GLOBAL EMERGING INNOVATION SUMMIT (GEIS-2021)

Editors:
Dharam Buddhi
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CONTENTS

FOREWORD

Research and Innovation are the prime factors for the creation of knowledge and entrepreneurship. Innovation also ensures the long-term sustainability of institutions. Innovation is a process of conversion from ideation to the creation of a new product or process by applying uniqueness & novelty.

Lovely Professional University organized a Global Emerging Innovation Summit 2021(GEIS-2021) on April 9-10, 2021 in collaboration with The National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA). GEIS-2021 was the most comprehensive conference focused on the various aspects of the Global Emerging Innovations. The Conference provided a platform to academic and industry professionals to discuss recent innovations in the area of Engineering and Sciences. The researchers from academia and industry as well as practitioners share ideas, problems, and solutions relating to the multifaceted aspects of Innovations. It also provided opportunities for the different research area delegates to exchange new ideas to establish research relations which may be able to mobilize future collaborations among academic institutions, industries and entrepreneurs globally.

Authors from academics, government agencies and industries, who contribute 189 papers truly make the conference a unique platform for a productive, interdisciplinary exchange of ideas. Out of 189 papers submitted, 59 manuscripts passed the peer review process and were presented during the conference. The success of this conference cannot be achieved without the involvement of number of individuals. I came to know that a good number of international keynote speakers and participants attended the summit.

I congratulate the GEIS organizers and editors for coming out with the proceedings of the summit, which will be an immense help to innovators.

Giacobbe Braccio
Head of Bioenergy, Biorefinery and Green Chemistry Division
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PREFACE

I am pleased to present you the Proceeding of the Global Emerging Innovation Summit (GEIS 2021) held on April 9th & 10th 2021. The conference was organized by Lovely Professional University (LPU) and supported by ENEA - the National Agency for New Technologies, Energy and Sustainable Economic Development with Publication partner Bentham Science.

GEIS-2021 is the most comprehensive conference focused on the various aspects of the Global Emerging Innovation Summit-2021 related areas. The Conference provides a platform for academic and industry professionals to discuss recent innovations in the area of engineering and Sciences. The goal of this conference is to bring together the researchers from academia and industry as well as practitioners to share ideas, problems, and solutions relating to the multifaceted aspects of Innovations in Engineering and Sciences. It provides opportunities for the different research area delegates to exchange new ideas to establish research relations to find global partners for future collaboration.

Authors from academics, government agencies and industries, who contribute 189 papers truly make the conference a unique platform for a productive, interdisciplinary exchange of ideas. Out of 189 papers submitted, 59 manuscripts are accepted and presented during the conference.

The success of this conference couldn't be achieved without the involvement of number of individuals. We would therefore, express our sincere gratitude to all of the organizing committees, keynote speakers, reviewers, session chairs, presenters, participants, and all contributors who have put their finest effort into making this conference a big success.

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CHAPTER 1

Power and Energy Density Analysis of Various Propulsion Systems

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Abstract: In this paper, the energy and power density of vehicles, energy-storing devices, and motors have been revisited. Hybrid propulsion systems like amphibious vehicles are considered along with normal propulsion modes. Power density reflects the amount of power delivered, and energy density reflects the range of systems. Power and energy densities of various transportation such as Electrically powered vehicles (EVs) Internal Combustion Engine (ICE) vehicles, Hybrid Vehicles (HVs), underwater vehicles, airplanes, ships, and hybrid mode transportation systems, are analyzed. The energy and power density of multi-mode propulsion are also calculated to explore the possibility of converting existing automobiles to multimode transportation systems as a part of retrofitting in the future. Power density matching for energy sources, ICE, motor, and coupling can lead to better operation of the propulsion system. This concept is parallel to the maximum power transfer theorem. Power density matching of all components associated with power flow can lead to better stability, lesser vibrations, and reduced maintenance of the system components. It reduces the need for frequent replacements of power components due to power stress. Energy density matching of all power flow components is equally important. A detailed study by considering various vehicles is presented in this paper.

Keywords: Amphibious Vehicles, Battery, Electric Vehicle, Energy density, Engine, Fuel Cell, Hybrid Vehicles, Motor, Power density, Retrofitting, Seaplanes, Submarines, Super-Capacitor, Ultra-Capacitor.

INTRODUCTION

The electric vehicle was first developed in the 1830s [1]. The principal benefits of these electrically powered vehicles are that these are pollution-free, easy to drive, have more smart features than internal combustion engines, *etc*. The adoption of these vehicles is very less due to the electricity problem. Also, the recharging time of these vehicles is more as compared to Internal Combustion Engine (ICE)

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

vehicles. The cost of these vehicles and range are not specific. Still, there are many confusions to select an Electric Vehicle's (EVs). Even though E-mobility is a cleaner alternative for the ICE vehicles, they are still not as good as in terms of power density and issues on refueling. The first batteries of lithium-ions were commercially produced by Sony in the early 1990s. These batteries were originally used specifically for small-scale consumer items such as cell phones, wall clocks, remotes, *etc* [2]. and with the new technologies and research. EV industries are taking bigger strides to become a common household commodity in the coming decades. There is a need to relook at the energy and power densities of newer propulsion systems. Gasoline is the abundantly used form of energy, mostly because of its transferability and ease of storage. Whereas the energy extracted from natural sources is not continuous and mainly relies on weather conditions and seasons, As renewable energy sources now become increasingly significant, there has been a growing curiosity among researchers to store this clean energy. Thus, different energy-storing devices are being developed; besides, their performance has also been enhanced extremely.

The Ragone plot named D.V. Ragone is a very famous guideline for energy storing devices [3]. The Ragone plot is commonly used for energy storing device's development for differentiating, blending, and anticipating future energy storing devices. The Ragone plot provides intuitive and systematic information of devices such as fuel cells, capacitors, *etc* [4]. The various EV brand manufacturers are providing battery packs that provide energy density of up to 200W-h/kg and the industry expects increasing electric density over to 500W-h/kg [5], but the power density of batteries still is around 500 W/kg [6]. Whereas the supercapacitors have an energy density of 20 W-h/kg and power density of 10 kW/kg. The ultracapacitors (super-capacitors) can withdraw very high power, but their energy-storing capacity is minimal. The energy density of petrol is to be 100 times greater than that of a battery, but do not reveal any implications that EVs will outweigh conventional vehicles to be able to run the same distance [7].In EV or Hybrid Electric Vehicles (HEVs) energy density and power density need to be investigated from a retrofitting point of view. Vehicle weight reduction also impacts the energy efficiency of a vehicle's configuration. In conventional ICE applications, a one-tenth weight reduction may result from a 6%–8% improvement in fuel economy. Both the conventionally powered vehicles and EVs vehicles are benefitting due to weight-optimization using new materials. Firstly, materials are often want to reduce the load of the vehicle, and secondly, materials can enable higher efficiency engines and power trains [8]. Energy density, power density mismatching in power train components, and energy storage devices need to be investigated. This is a major research gap found by the authors. Such analysis can give direction to society about the reuse of vehicles in different modes. This paper aims at discussing the Energy and Power density of

various automobiles, Eelectrical storage devices and Amphibious Vehicles and Seaplanes followed by concluding remarks.

Energy Density and Power Density of Various Automobiles

Heat engines convert thermal energy into a temperature gradient to produce mechanical work on a rotating shaft. Whereas electric motors use electrical energy to produce any mechanical work. The power to weight ratio or the power density in our case is used to measure the actual performance of any vehicle's engine. It is calculated to enable the comparison of the vehicle's performance with each other. If a system or a vehicle is said to have a high specific power, it means that it can withdraw a large amount of energy based on its volume or its weight. Since the energy is released in a small-time, a high-power density system can also recharge rapidly. The energy density can be calculated by using the enthalpy of the combustion of fuel. Table **1** contains the enthalpy of combustion of different fuels. This energy is calculated by multiply with the fuel capacity of a vehicle and thus taking its ratio with the weight of a vehicle. The higher the specific energy of a system, the greater will be the amount of energy stored in its body, and hence, the greater will be the range of the vehicle.

Table 1. Energy density of various fuels [9 - 11].

Fuel type	The energy density of fuel W-h/L)	The energy density of fuel (W-h/Kg)
Gasoline	**9,500**	**12,888**
CNG	**2,500**	**14,888**
Jet fuel	**9722.22**	**11944.44**
Diesel	**10,700**	**12,666**
Hydrogen Gas,1atm, 250C	**2.8**	**33,313**

Power density gives power swept per volume or brake horsepower per cm^3 (Fig. **1**). It is based on the internal energy capacity of the engine. Power to fuel capacity ratio is used to compare the efficiency of the vehicles based on their maximum distance covered in one full consumption cycle of the full fuel tank (Fig. **2**). This is the basic assumption for the comparison of various vehicles. For calculating parameters of various power densities of different kinds of two-wheelers, four-wheelers, heavy-duty motor cargos, and locomotive engines, aircraft, and watercraft, their engine displacements, maximum power, fuel capacity, and gross weight were collected [12].

CHAPTER 2

Classification of P2P-VoIP (Video) Traffic Using Heuristic-Based and Statistical-Based Technique

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Abstract: In recent years, VoIP technology has become very popular among internet users as it allows the users to transfer their voice & video over an IP network. Its advantage is that it is cost-effective, works over traditional telephone networks, and is also compatible with the public switched telephone network. It is based on P2P architecture and allows users to communicate with each other in real-time through audio or video conferencing over the network. It consumes a lot of network bandwidth. That is why, the classification of VoIP traffic is important from the viewpoint of monitoring, prioritizing, or blocking such traffic by the ISPs or network administrators. Traditional classification techniques such as port-based and payload-based are ineffective since modern VoIP applications make use of random port numbers, encryption, or proprietary protocol to obfuscate their traffic. In this paper, we focus on classifying VoIP (video) traffic by utilizing a 2-step classification process. The 1st step uses a packet-level process, where P2P-port based technique is utilized to classify VoIP traffic. The traffic which remains un-classified as VoIP is then fed to the 2nd step classification process (*i.e.* flow-level process), which combines proposed heuristic rules (with a unique packet size distribution of VoIP traffic) and statistical-based technique to classify VoIP traffic. The experiments have been conducted on real traffic traces using offline datasets and results show that the proposed technique not only achieves high classification accuracy of over 98.6% but also works with both TCP & UDP protocols and is not affected even if traffic is encrypted.

Keywords: Heuristic-Based Classification, Statistical-Based Classification, Traffic Classification, P2P Port-Based Classification, P2P-VoIP Traffic.

1. INTRODUCTION

Voice over Internet Protocol (VoIP) is an internet technology that provides the ability to transfer voice and media sessions over the IP networks. In recent years, Peer-to-Peer (P2P) Voice over Internet Protocol (VoIP) applications have become

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very popular among individuals and enterprises due to high bandwidth connectivity and low cost in comparison to traditional Public Switched Telephone networks (PSTN) [1]. With the evolution of such applications, it provides better quality of voice & video, free communication between users, and can circumvent the restrictive network environments such as NAT (Network Address Translation) and firewalls.

A VoIP infrastructure typically consists of VoIP clients and signaling servers for call establishment, authentication, and associated services. In addition to that, it may also include additional servers for accelerating media transport, achieving traversal of the media path, and interfacing with PSTN and mobile networks. Recently, there is tremendous growth in VoIP traffic as it is becoming a major communication service for individuals and enterprises [2]. Classifying VoIP traffic can help ISPs and enterprises to prioritize such type of traffic in the network and enforce policies for network monitoring, load balancing, flow control, managing network bandwidth, providing quality of service, enforcing intrusion detection & prevention services, and auditing.

There are several challenges in classifying VoIP traffic accurately since many applications such as Skype, Google-meet, *etc*., obfuscate/hide their traffic by making use of random port numbers, encryption, or proprietary protocol for communication. Conventional techniques include port-based and payload-based techniques for classifying network traffic. The port-based technique is the oldest & simplest technique to classify the traffic by using well-known port numbers ranging between 0-1023, which are assigned by IANA [3] to various protocols such as FTP, DNS, HTTP, *etc*. But, this technique is ineffective in classifying the traffic, which uses random or dynamic port numbers for communication. The payload-based technique (also known as Deep Packet Inspection) relies on packet payload and is the most accurate technique in classifying the traffic. It examines the packet payload to search for application-specific signatures and maps it with the database containing the signatures of previously stored application protocols. However, this technique also suffers from various limitations such as a) unable to deal with encrypted traffic, b) involves a lot of processing load and complexity, c) infeasible in high-speed networks, d) need to find application signatures every time as new application protocol emerges, e) leads to breach of some organization privacy policies by direct inspection of the packet payload, *etc.* [4, 6]. Therefore, traditional classification techniques *i.e*., port-based and payload-based techniques, are ineffective in classifying VoIP traffic, and since they are conventional techniques, so its related work is referred to in [7]. Currently, modern techniques (known as Classification in the Dark) are being employed to classify traffic which makes use of statistical/heuristic-based techniques. Statistical-based techniques classify traffic using statistical features calculated from the traffic, such as packet length, flow duration, the number of packets sent, number of packets received,

inter-arrival time of packets, *etc* [4]. On the other hand, the heuristic-based technique classifies traffic using a pre-defined set of rules by observing the behavioral patterns of the traffic; such as the number of out-going connections of a host, host acting as both client & server, number of ports used by a host, *etc*.

The main objective of this research work is to classify P2P-VoIP (video) traffic. Many modern VoIP applications have the functionality to make voice calls, video calls, file transfer, and chat, but we specifically focus on classifying video traffic which is generally used for video conferencing or conducting online meetings. For this purpose, we propose a 2-step hybrid classification approach which is categorized into packet-level and flow-level classification processes. Packet-level classification process uses of P2P-port based classification technique whereas flow-level classification process uses a combination of heuristic-based and statistical-based techniques for classifying VoIP (video) traffic. The experiments have been conducted on 3 popular VoIP applications, namely Skype, Zoom & Google-meet and the results show that the proposed technique not only achieves high classification accuracy (*i.e*. 98.6%) but also works with both TCP & UDP protocols and is not affected even if traffic is encrypted.

The remaining paper is organized as follows. Section 2 discusses the related work. Section 3 discusses the proposed methodology to classify VoIP (video) traffic. Section 4 discusses evaluation criteria and experimental results. Finally, Section 5 concludes the research work.

2. RELATED WORK

Jiang *et al.* [8] analyzed the network structure of Skype and conducted experiments to observe its new communication pattern after its acquisition by Microsoft. They designed a methodology to detect Skype users in real-time by analyzing the log-in & log-out phases of Skype in each traffic flow. The authors evaluated their technique using 11 hosts (where 8 hosts were running Skype) in an actual network environment and claimed that Skype users could be accurately & quickly identified using this approach. Yuan *et al.* [9] used an automated packet-sequence signature construction system to construct packet sequence signatures from the application payloads and discovered the sequence of signatures generated by Skype UDP flows. Their technique utilized the combination of login signal detection (to search for '0x02' string present in packet payloads during Skype login session) and destination IP-address lookup (which is one of the destination IP-address used for authentication purposes from the list of IP-addresses used by Skype servers) to identify Skype traffic. The experimental results achieved 98.93% precision and 99.54% recall, but their approach relied on a payload-based technique which has various limitations. Lee *et al.* [10] classified

CHAPTER 3

Comparative Study of FxLMS, Flann, PSO, and GA for Active Noise Controller

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Abstract: This paper presents a comparison between the different adaptive algorithms for designing a cost-effective Anti-Noise Control (ANC) system. Typically, the ANC systems use linear FIR-adaptive filter Filtered- Least Mean Square (FxLMS) configuration. FxLMS is straightforward in hardware implementation but, its efficiency substantially degrades in case time-varying and non-linear acoustic environment and the probability that it will converge to local minima. Meanwhile, the implementation of Trigonometric Functional-Linear Adaptive Neural Network (FLANN) enhances ANC performance for non-linear noise signals. However, at the same time, it increases the complexity of hardware implementation and is unable to solve the problem of local minima convergence. Whereas evolutionary algorithms -Genetic Algorithm (GA) and metaheuristic algorithm Particle Swarm Optimization (PSO) increase the robustness and stability in non-linear, and the time-varying acoustic environment with absolute zero probability to converge to local minima. This paper briefly discusses on implementation of FxLMS, FLANN, PSO, and GA-based ANC systems. Further, simulation compares Mean Square Error, BER, and PSNR to provide computational efficiency of these algorithms.

Keywords: Active Noise Control, Adaptive algorithm, Filtered-Least Square Method (FxLMS), Functional Link Adaptive Neural Network (FLANN), Genetic Algorithm (GA), MSE, Particle Swarm Optimization (PSO), PSNR, SNR.

INTRODUCTION

The enigma of eliminating undesired sound, commonly referred to as noise, generated by automobiles, airplanes, industries, giant constructions machinery, and other sources, is not only a prevalent research problem but also causing hearing impairment, stress, anxiety, and mental illness. Moreover, disturbance due to noise in the background damping focus and resulted in inefficiency in productivity. To diminish noise efficiently, the two predominant techniques are;

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

Passive Filters and Active Filters. Passive filters utilize the conventional method to use physical materials, which act as silencers, enclosers, and barriers to absorb and stop the undesired sound from reaching the eardrums. However, designing passive filters for a wide range of frequencies is expensive and ineffective to reduce low frequencies roughly below 500Hz. Consequently, active filter or Active Noise Controller (ANC) is cost-effective as well as efficient for low frequencies. It generates anti-noise sound of the identical amplitude and frequency but of an inverse phase of noise in an acoustic medium which results in destructive interference with noise and eliminating noise. Further, the active noise control system is a self-driven adaptive system that can adapt according to the continuously changing noise source and the acoustic environment on its own. The ANC system uses Adaptive Feedforward and Adaptive Feedback system configuration. The feedforward ANC [1] system comprises of reference microphone, anti-noise control system (usually adaptive filter), speaker, and error microphone. In the feedforward system, a reference microphone feeds the incoming noise to the controller to produce the desired anti-noise through the loudspeaker. The controller adapts to time-varying and non-stationary noise signals and acoustic mediums and drives the speaker to minimize acoustic pressure at the error microphone. Whereas, Feedback ANC configuration is built of an error microphone and adaptive controller [1, 2] The error microphone provides an error signal to a controller for updating its output and turns the speaker to generate anti-noise sound in an acoustic environment for diminishing noise [3].

This paper briefly discusses Active Noise Control algorithms in subsequent sections. Section II discusses details of Fx-LMS algorithms, FLANN algorithm., Particle Swarm Optimization (PSO), and Genetic Algorithm (GA) based adaptive algorithms in detail. Lastly, Section III presents the MATLAB Simulation results, comparison, and conclusion.

Section II: Algorithms

Filtered -Least Mean Square Algorithm (FxLMS)

In standard LMS, when electrical delay (time controller takes to compute anti-noise) is more significant than acoustic delay (time noise signal takes to reach speaker from reference microphone), it leads to non-casualty of system. Hence, performance sustainably degrades in diminishing broad-band noise; it can only reduce narrow-band/periodic noise [4]. The controller followed by the secondary path transfer function for compensating acoustic superposition of primary noise and anti-noise in the secondary path is a potential solution for the non-casualty problem [5]. However, this results in the non-alignment of the error signal with

the reference signal in time cause instability [6, 7]. Morgan *et al*. [8] proposed to use an inverse filter in series with a secondary-path transfer function or use an inverse filter with the reference signal for updating the weight of the LMS adaptive algorithm, which is also known as the Filtered-X-LMS (FxLMS) algorithm. Fig. (**1**) presents the block diagram of FxLMS.

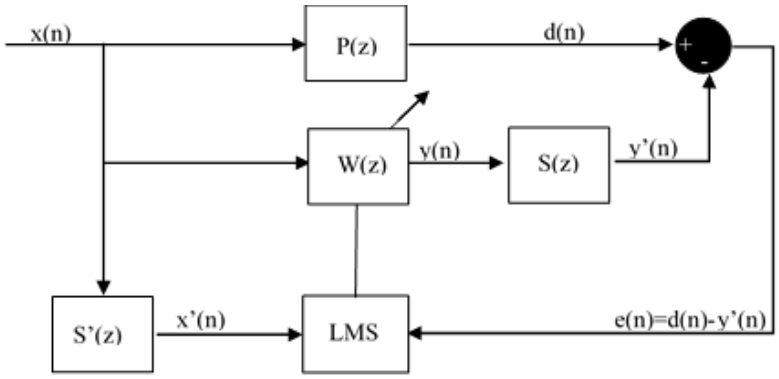

Fig. (1). Block diagram for FxLMS.

whereas, x(n)= Reference Signal; p(n)=impulse-response of primary path; s(n)=impulse-response of secondary path; w(n)=weight of the filter of length L $[w_0(1),w_1(2),\ldots\ldots\ldots\ldots w_{L-1}(n)]$ and $w^T(n)$ is transpose of w(n);

FxLMS algorithms first estimate the secondary path transfer function S'(z), which leads to divergence of the algorithm due to estimation error. Additionally, the secondary path is usually time-varying in nature, and gradient-based decent method of weight update led to convergence at local minima [8].

Functional Link Artificial Neural Network (FLANN)

The LMS and FxLMS have shown exceptional performance in the case of linear noise, but in non-linearity, both algorithms lose efficiency [9,10]. The non-recursive, and shift-invariant filters such as Volterra-filtered-x LMS (VFxLMS) [11], neural network-based controllers [12] and functional link artificial neural networks (FLANN) based filtered-s LMS (FsLMS) [13] are potential solution for non-linear input noise signal. The FLANN uses a trigonometric function to calculate the output. The expression is as follows:

$$y(n) = \sum_{i=0}^{N_a-1} a_i x(n-i) + \sum_{j=0}^{N_b-1} a_j y(n-j) + \sum_{j=0}^{N_e-1} e_j \cos[\pi y(n-j)] + \sum_{j=0}^{N_e-1} g_j \sin[\pi y(n-j)] \quad (2)$$

Particle Swarm Optimization

Particle Swarm Optimization is a meta-heuristic evolutionary algorithm and is

CHAPTER 4

Application of Computational Methods for Identification of Drugs against *Tropheryma Whipplei*

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Abstract: *Tropheryma whipplei* causes severe malady termed as Whipple's disease, a multisystemic lethal problem and we still require modified best regimens. To treat it successfully, 3 medications were distinguished in this investigation by using in-silico methods. 2-amino7fluoro5oxo5Hchromeno[2,3b]pyridine3carboxamide(2APC), Nicotinamide mononucleotide (NMN), and Riboflavin Monophosphate (RFMP) were seen as putative medications. 2APC and NMN restrain DNA Ligase catalytic activity for *Tropheryma whipplei* and compelling in impeding genomic copying and repairing mechanisms, RFMP shows the inhibitory impact on Chorismate synthase that drives hindrance in metabolic biosynthesis of amino acids. Our investigation used modern advanced in-silico assemblies. BLAST, CDART, CD-HIT were utilized to choose target catalytic biomolecules of a bacterium. Phyre2, dependent on HMM calculation, was applied to discover the best auxiliary models of chosen biocatalysts. AutoDock-Vina assembly was utilized for molecular docking and scoring restricting energies of these medications with catalytic proteins of the bacterium. 2 APC and NMN hindering DNA Ligase show - 8.3 and - 8.2 kcal/mol individually while RFMP represses Chorismate synthase - 7.3 kcal/mol binding energy. Sub-atomic re-enactment or simulative mechanistic analysis gives further approval to concluding 2APC as impeccable inhibitory medication having remedial activity against *T. whipplei*. This escalated and novel examination is simple, quick, and valuable in anticipating drugs by incorporating computational insights in medicinal sciences.

Keywords: Biomolecules, Computational approach, Drug Discovery, Molecular dynamics Simulation, *Tropheryma whipplei*.

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

INTRODUCTION

Whipple's malady is an uncommon multisystem disorder affecting the gastro-intestine and central nervous systems. *Tropheryma whipplei*, Gram **+ve** actinobacterium about which little is known. The total DNA arrangement of its genome consists of 925 938, not complete genes set with an absence for significant biosynthesis-pathways and a diminished limit concerning vitality in metabolic mechanisms [1]. T. whipplei normally contaminates sewage laborers in Caucasian populations and among little children under 7 years in poor unclean surroundings [2]. Still, no data about the transmission of this microscopic organism distinguishing that this bacterium is associated with Homo sapiens and transferred from other animals. T. whipplei make duplicates inside macrophages, living in mucous and monocytes of blood vasculature in patients. Like Mycobacterium tuberculosis, it gradually develops under culture. Currently, hydroxychloroquine, doxycycline, and trimethoprim/sulfamethoxazole drugs, and also an injection of ceftriaxone given to patients with *T. whipplei* but the problem with this medication approach was very long and time taking up to 2 to 3 years with lifetime follow up [3]. Modern computational approaches can be useful in predicting drugs for the rare bacterium that causes severe health effects like *T. whipplei* [4]. In this study, we used genomic and proteomic analysis along with molecular docking and simulation analysis to find out possible drugs. Evaluation of pharmacokinetic characteristics in computer-aided drug designing is integral for hit-to-lead improvements. Exceptional unpredictability of the present research design for medication search, scientists strongly sought molecular docking and simulation mechanistic models to characterize patterns in ADMET information to develop practical insights [5]. This investigation deployed ADMET analysis along with 2D and 3D interaction of drugs to biocatalysts and it was found to be very successful in drug predictions.

MATERIAL AND METHODS

Enzyme Selection Bias

Proteomic sequences of Tropheryma whipplei were retrieved from NCBI-Genbank for two significant compounds to be specific, DNA Ligase (AAO44511) and Chorismate synthase (WP_011096348), and these enzymatic edifices are engaged with DNA replication, biosynthesis of amino acids individually (Table **1**).The choice of these fundamental proteins depends on DEG (database of basic qualities) server investigation [6].

Table1. Selected proteins information for *Tropheryma whipplei*, that are found to be drug targets by screening NCBI- Genbank database and identification by KAAS (KEGGAutomatic annotation server) for pathway analysis of crucial genes.

NCBI-Genbank Accession no.	Identified Protein	KEGG Orthology Number	Functionality
AAO44511	DNA Ligase	K01972	Replicative and reparative Mechanisms of DeoxyriboNucleicAcids
WP_011096348	Chorismate synthase	K01736	Peptide and amino acid biosynthetic mechanisms

Protein Drug Analysis

After this CD-HIT server [7] was utilized to distinguish paralogs, it depends on a fast heuristic examination approach and accommodating in deciding likeness investigation between peptide stretches. Basic local search alignment was utilized for deciding homology [8] between considered proteins of Tropheryma whipplei and proteomic spaces of Homo sapiens. This gives more approval to the determination from escalated proteomic sets of the bacterium. To examine pharmacogenetics or medication capacity of considered proteins, a drug bank web-server (http://www.drugbank.ca/) was applied. To recognize the space homogeneity of protein groupings, 2 WebServers conserved-domain-architectu-e-retrieval-tool (CDART) & Pfam was utilized. KEGG automatic annotation server (KAAS) assisted in distinguish metabolic pathways for selected biocatalysts and here *T. whipplei*Twist and *T. whipplei*TW08/27 strains were browsed from the NCBIgenbank organisms list at the time of the investigation.

Structural Analysis: Docking & Simulation

The selected proteins, after intensive investigation and KEGG annotation, was exposed to homology displaying using Phyre2, it is a hidden Markov model-based server for structural predictions of catalytic enzymes. A quick overview of medications acting on chosen proteins and their 3D structure was acquired by utilizing Pubchem web server and RCSB- PDB databank. Sub-atomic docking was led using Autodock-vina assembly to examine the interaction energies of ligand-protein docked structures. SwissADME tool was deployed to examine biochemical properties like pharmo-kinetics, drug-likeness, and inhibitory action on cytochrome P450 isoforms, structural properties, bioavailability, and synthetic accessibility. Molecular simulation studies were performed for 40ns by using GROMACS ver.2019 simulation suite.

CHAPTER 5

Optimizing the Power Flow in Interconnected Systems Using Hybrid Flower Pollination Algorithm

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Abstract: To standardize the active power flow in the interlinked power systems, the controller must be crafted in such a way that it would improve the system's stability. With this objective, the paper is dedicated to the hybrid flower pollination algorithm: a metaheuristic optimization algorithm (hFPA) applicable to optimize the parameters of the PI and PID structure-controller incorporated in the two-area power systems. The projected algorithm is compared with the articles published where the PI and PID controller structure parameters upgraded with hFPA are compared with the enhanced strength Pareto differential evolution and grey wolf optimization algorithms to demonstrate its robustness for a vast span of system parameters and varying load situations. The superiority of the technique has been presented in respect of peak undershoot, settling time, peak overshoot, tie-line power, frequency divergence, *etc*.

Keywords: Automatic generation control , Hybrid flower pollination algorithm , PI controller , PID controller .

INTRODUCTION

Modernization in interconnected power systems takes the responsibility of providing uninterrupted power, which is economical, efficient, sustainable, and safe. The power system is subjected to short time and long-time disturbances such as imbalance, reduction in generated power concerning the consumer demand, internal and external losses, *etc*. In addition, the power exchange in the interconn-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

eted systems may result in frequency deviations, due to trouble inflow of active power, which needs to be addressed meticulously. The frequency variations in power generation and load side affect the overall power flow, stability, and performance of the system. However, the interconnected power systems have their separate controllers, which are synchronized to manage the frequency variations and load demand. While these conventional controllers with fixed gains or parameters are unable to adjust with the real-time situations, which may lead to system failure.

Therefore, to ensure continuous circulation of quality power, the system frequency must be controlled to a nominal operating range during random load perturbations. The interconnected power system with various uncertainties inactive power delivery, load variations, system modeling errors is studied by researchers. The control strategies that combine understanding, expertise and methodologies from several sources are presented in the literature [1]. However to cope up with the system nonlinearities and inconsistent behavior the net changes are required in the controller parameters according to the variations in consumer power demand.

In literature, several controller structures have been discussed for the interdependent power units in the power system [2]. Recently, the biologically inspired control optimization algorithms such as genetic algorithm [3] chaotic quantum genetic algorithm [4], artificial immune system algorithm [5], plant growth simulation algorithm [6], particle swarm algorithm [7], artificial bee colony algorithm [8], ant colony algorithm [9], grey wolf optimization (GWO) algorithm [10], Jaya algorithm [11], *etc*., have been developed for designing different controllers incorporated to several single and multi-area power systems.

In this article, an effort has been made to demonstrate the advantages of applying hybrid flower pollination algorithm (hFPA)for PI and PID controller structures over Enhanced strength Pareto differential evolution (ESPDE) [10] and GWO [10], in maintaining the system frequency under scheduled range.

An optimization problem is formulated using two thermal power systems and hFPA is commissioned to showcase the efficacy of the proffer technique with the considered controller structures for power flow control and system stability. The algorithm is providing superior damping characteristics when the system is put through the different variations discussed in this work. The proposed parameter control mechanism, can monitor the parameter deviations, take decisions and take action to minimize the variations, hold the system frequency within specified values and streamline the power distribution. The work is divided as; Section 2 illustrates the mathematical representation of interconnected thermal generation

system with controllers; Section 3 represents the proffer hFPA for controller parameter optimization and Section 4 explains the simulations and the results obtained followed by the conclusions, respectively.

POWER SYSTEM MODELLING

A dynamic model [10] of an interconnected system under investigation is shown in Fig. (**1**). In the figure, R_i (p.u. Hz) is the governor speed regulation variables; B_i is the frequency bias constants; ΔP_{Vi} are deviations in governor valve positions; ΔP_{Ti} are the variations in turbine power out-turn; K_{PSi} are the gains of the power system; T_{Gi} are the governor time constants; ΔF_i are frequency shifts; T_{Ti} is the turbine time constants; T_{PSi} are the system time constants; The nominal parameters taken for the simulations can be seen in [10].

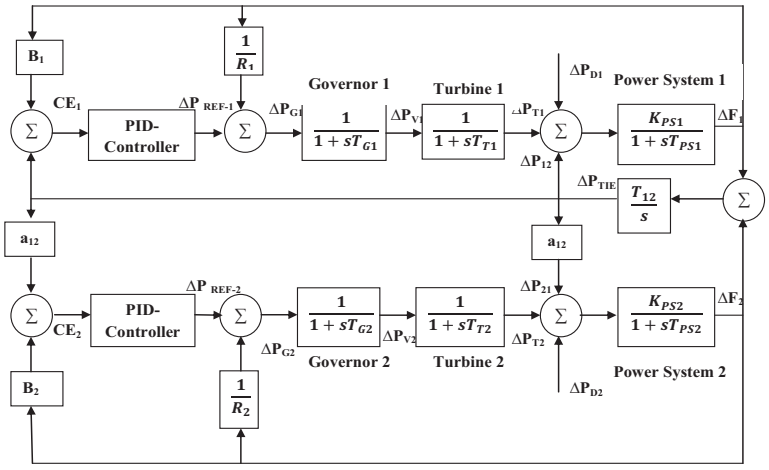

Fig. (1). Transfer function representation of 2-interdependent thermal systems.

An objective function is necessary to establish based on the required constraint, specifications and has to be selected for the optimization of the controller specifications. The function used in this work is integral time absolute error (ITAE) and can be described as:

$$ITAE = \int_0^{t_s} t\left(\sum_{i=1}^{2}\left|\Delta F_i\right| + \left|\Delta P_{TIE}\right|\right)dt \qquad \textbf{(1)}$$

PROPOSED ALGORITHM

Flower pollination algorithm (FPA) and its evolved forms are applicable in almost every field of engineering such as chemical, civil, electronics, and

CHAPTER 6

A Comparative Study on Various Data Mining Techniques for Early Prediction of Diabetes Mellitus

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Abstract: Diabetes mellitus is a deadly disease that affects people all over the globe. An early prediction of diabetes is very beneficial as it can be controlled before the onset of the disease. Various data mining classification techniques have proven fruitful in the early detection and prediction of multiple diseases like heart attack, depression, kidney-related diseases, and many more. This paper discusses and compares various data mining techniques for the prediction of Diabetes Mellitus. Also, three widely used data mining techniques *via* Artificial Neural Networks (ANN), K-nearest neighbor (K-NN), and Support Vector Machine (SVM) have been implemented in Matlab and the results are compared based on accuracy, recall, true negative rate, and precision.

KEYWORDS: ANN, Classification, Data Mining, Detection, Diabetes, KNN, Prediction, SVM.

1. INTRODUCTION

Among various types of Diabetes, diabetes mellitus is the most common type that affects humans around the globe. The main reason for the disease is a change in the lifestyle of the common man. It is a kind of metabolic disorder with hyperglycemia which means a high concentration of glucose found in the blood. The reason can be a defect in the insulin secretion or improper action of insulin in the body or both in some cases. Due to diabetes mellitus, the metabolism of the body is affected which causes a high level of sugar in the blood. Chronic hyperglycemia is dangerous as it may lead to the dysfunction of various organs and ultimately in organ failure. Neuropathy, Nephropathy, Retinopathy, Cardiac

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

Disorder, and Blood vessels compression are some of the main illnesses caused by this disease.

Long-lasting diabetes has been classified broadly into two major types: A) Type I diabetes B) Type II diabetes. The first one is the pathogenesis of TYPE I and is caused when the pancreas secretes damaged β-cells. The damaged β-cells prevent the pancreas to reduce glucose levels in the blood. The second type of diabetes mellitus is known as TYPE 2 or non-insulin-dependent diabetes mellitus that is caused due to resistance of insulin and deficiency in insulin secretion. This is one of the serious diseases that may result in death if not treated properly. To save the lives of people, the diagnosis of disease before its onset is the need of the hour. The use of DM (Data Mining) techniques in the early prediction and diagnosis of various deadly diseases like heart attack, breast cancer, Alzheimer's disease, *etc*. has proven useful for saving the lives of several people. These DM techniques may also be used to improve the prediction probability of diabetes mellitus so that it can be treated on time.

The medical dataset taken for the study of diabetes mellitus contains several attributes and the study of all the attributes is time consuming, inefficient, and cumbersome process. Therefore for the efficient, accurate, and correct prediction of diabetes mellitus, only significant features are selected that includes: (NTP) Number of Times Pregnant, (BDI) Body Mass Index, (2HSI) 2-Hr Serum Insulin, (TSFT) Triceps Skin Fold Thickness, Age and (DPF) Diabetic Pedigree Function and Class (Yes or No).

2. LITERATURE REVIEW

The researchers [1] develop five prediction models with 9 input and one output variable. They provide a comparative performance analysis of multiple classification methods for the prediction of diabetes mellitus by using vector measurements. The authors in [2] studied the data of 768 women and selected nine attributes for their study. They propose a model for the detection of diabetes mellitus using data mining classification algorithms using Clementine 12 software. The authors in [3] make use of invasive and non-invasive features to identify diabetes patients with high risk. They use the J48 decision tree with WEKA version 3.9.2 along with linear regression. Researchers in [4] studied various data mining algorithms for predicting diabetes mellitus using the dataset obtained from UCI Machine on WEKA software. The authors found decision tree records the highest prediction accuracy. The authors in [5] proposed a MADG algorithm using various mining techniques for the prediction of diabetes mellitus with three parameters viz Oral Glucose Tolerance Test, Body Mass Index, and Diastolic Blood Pressure for rule extraction. Researchers in [6] worked on a study

to check if sex, age, socio-economic status, parental education level, DKA at early diagnosis of type 1 diabetes mellitus, infection, psychological problems, poor metabolic control can be used for the prediction of DKA in type 1 diabetes mellitus patients. The authors in [7] form multiple data groups of various individuals and tested each group with K nearest algorithm, SVM, RF, NB, and ANN models and use negative prediction, sensitivity, specificity, and precision for assessing model performance. Authors in [8] studied the harmonization of biomarkers like immunoassays for the prediction of diabetes. Researchers in [9] studied various blood count parameters between healthy pregnant women and pregnant women suffering from Gestational Diabetes Mellitus to find the relation between the various blood count parameters and Gestational Diabetes Mellitus. The researchers studied [10] the role of interleukin-6 for early diagnosis of Gestational Diabetes Mellitus and found that assessment of serum interleukin 6 levels can be studied and used for early prediction of diabetes mellitus. Attempts to make an early prediction of diabetes more accurate and a novel model using D-M technique for the prediction of Type 2 diabetes was proposed by [11]. The researchers in [12] developed a technique for the diagnosis of gestational diabetes mellitus during the time of early pregnancy using the artificial neural network and decision tree. The metabonomics technique to see the changes of metabolites and metabolic trails pre and post-diabetes for the efficient and accurate treatment of diabetes was studied by [13]. The researchers studied [14] the possibility of various data mining classification techniques to classify persons suffering from diabetes based on various non-invasive and early collected clinical features. Authors in [15] studied 942446 U.S. persons without any sign of diabetes,>-3 RPG in baseline year and >-1 primary care visit/ year for the consecutive 5 years. The researchers in [16] studied the probability of heart attacks in patients with type 2 diabetes mellitus. The authors in [17] proposed a rule extraction algorithm enhanced STAD model in order to make accurate prediction of diabetes by developing accurate, interpretable and concise classification rules and then apply the rules on dataset for early diagnosis of diabetes mellitus. Researchers in [18] gave the comparison of various data mining classification algorithms based on experimental study along with the merits and demerits of each algorithm. Authors in [19] presented a review and explains the various challenges for diagnosis of gestational diabetes mellitus and identifies the various biomarkers that may help in the identification of gestational diabetes mellitus. Researchers in [20] studied five machine learning techniques for prediction of diabetes mellitus patients [21]. A study estimated diabetes using major characteristics and also gives the categorization of the relation between contradictory characteristics.

CHAPTER 7

Systematic Review of BYOD Cyber Forensic Ecosystem

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Abstract: Since the inception of Bring Your Own device (BYOD) a series of the study conducted in various segments of BYOD. The exponential growth of the adoption of BYOD technology increased the demand for research. As a result, academic researchers created a good amount of abstracts with new techniques and methods. This study article offers a systematic study of existing techniques and development on the BYOD cybersecurity ecosystem. The primary goal of this systematic review is to identify the existing research specifically on BYOD Cyber forensic ecosystem and grouping the techniques developed in various areas and summarized the findings. Post analyzing 8519 articles this study identifies the potential 18 research which contributes to enhancing the cybersecurity forensic ecosystem. Limitations of existing research are also identified which organizations need to mitigate to build a cyber secured Forensic BYOD environment. Finally concluded that BYOD Cyber secured ecosystem is indeed needed for the organization for enabling BYOD services so that due to the impact of cyberattacks in the BYOD environment business ecosystem does not get fragmented.

Keywords: BYOD, Cyberthreat, Cyber Crime, Cyber Security, Digital Forensic, Mobile Security.

1. INTRODUCTION

Periodic incremental research on Bring Your Device (BYOD) in various areas is conducted continuously. As BYOD becomes a fundamental need for the organization to enable an extended work environment. This is also witnessed that providing BYOD services to the employee increased productivity, business agility while employee satisfaction was a key requirement. While providing BYOD services to the employee for business growth and employee personal activities but this service becomes one of the major business disruption and survival reasons

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

due to the excessive cyber threat landscape [1]. Various secured authentication mechanisms [2] of providing BYOD access implemented and even also malicious traffic detection mechanism are framed [3] but limitations on authentication technique and threat detection model is always an important aspect.

Previous researchers have done lots of development in the area of security threats and systematic review was also performed. An advanced level of in-depth systematic review results are very unique and findings are very directive of existing research. As per this study where more than 100 indicative papers were grouped and analyzed and results are like security attack 32%, where research related to malware was 29%, data leakage focus was 14%, stolen device focused research was 12% and DDOS related research was 5% and unauthorized access and bandwidth related focused research was only 1% [4]. This advanced-level study indicates the demand for more abstract in providing a cyber secured BYOD environment.

The key goal of this review is to identify the available research technique in BYOD malicious traffic detection and protection mechanism to reduce cyber threats. Post identification of existing research, categorization, and finding out the gap and limitation in the existing research are key focused areas. Summarization of the existing studies and finding the development so far in the BYOD malicious traffic detection model and identifying the area of the development to reduce the cyber threat are key goals of this research.

To complete the systematic review rest of the papers are organized as follows

Section 2 described the Review Techniques and methods, Section 3 Review the Planning and conducting of the review, section 4 described the Result and Analysis, and finally, Section 5 include the Conclusion.

2. REVIEW TECHNIQUE

The outcome of the existing study in the BYOD threat detection model was the main target phenomena of this systematic review. Finding out the result, the Conclusion of the existing phenomena in the BYOD traffic threat detection model needs a robust exploration of the existing research in this area. Defining the process of how to conclude this was a tedious task, To finalize the process of Systematic review, key rationale mechanism, and process used during this research. A standard practice of Systematic Literature Review (SLR) was followed during this study. For structuring the process of this study standard defined strategies followed as per the study “Procedures for Performing Systematic Reviews” [5]. SLR protocols are defined as per the guideline of “A

Guide to Conducting a Systematic Literature Review of Information Systems Research" [6]. All the procedures are followed for the systematic review for Planning of the systematic assessment, performing the review, and reporting process. Major components of the systematic review which contain 6 subsections are covered. Finding the source of data, exploration strategy, review selection, review inclusion criteria and, review exclusion principles which are the key SLR questions.

SLR procedure's major 3 phases are considered as per the best practice during this review as mentioned in below Fig. (**1**).

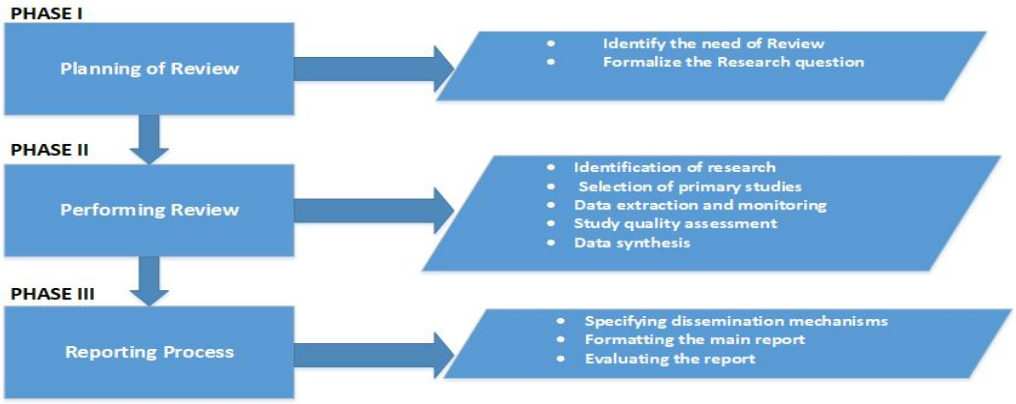

Fig. (1). Procedures followed for Performing Systematic Reviews are mentioned.

As shown in Fig. (**1**), this review was completed in 3 main phases. In phase 1, the Need for the review was identified then the research questions were formalized.

In phase 2 during conducting the research main goal was the identification of the research then selection of the primary studies followed by Data extraction and study quality assessment and at last data combination was done.

Finally, in phase 3 which is the Reporting process specification of distribution mechanism, the formatting of primary report and evaluation was done.

3. REVIEW PLANNING AND CONDUCTING LITERATURE REVIEW

Identify the Need for Research:

As already an advanced level in-depth analysis done from quality high impact factor journal that only 1% focus was towards unauthorized access [4], basis this, further incremental study conducted with the only key focused to cyber threat

CHAPTER 8

Dengue Viral Protein Interaction Study Derived Immune Epitope for *In-Silico* Vaccine Design

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Abstract: Dengue viral illness is communicated to humans through the bite of female Aedes aegypti mosquitoes. This disease may become lethal in numerous patients. The availability of an efficacious vaccine makes alarm for public healthcare. The dengue virus multiplied inside the host framework involved many host-viral protein interactions. This immunoinformatics study was designed for the prediction of immune epitopes for T cell-mediated immunity. The epitopes are anticipated from the most connecting viral protein with humans. We utilized a couple of epitope mapping tools for the determination of immunodominant epitope for vaccine design. The physical interaction between epitope ligand and receptor MHC class I alleles was analyzed in the molecular docking study. This study was concluded that two epitopes ('SRAIWYMWL' and 'FLEFEALGF') are suitable for the designing of an efficacious multi-epitope vaccine. The clinical validation is considered necessary for the final confirmation of vaccine potency.

Keywords: Conservancy, Dengue, Epitope, Host, Immunogenicity, Immunoinformatics, Protein-interaction, Vaccine, Virus.

INTRODUCTION

The female Aedes aegypti mosquitoes are the significant offender for the dengue viral illness. Asymptomatic, mild, or fatal dengue disorders are ordinarily announced in dengue patients [1]. All significant four serotypes of this infection show 65% closeness in their genome. The structural and non-structural proteins help infection endurance and increase [2]. This lethal infection has been causing social and financial weight in numerous (> 129) endemic nations [3]. The unavailability of an efficacious vaccine makes the circumstance more frenzy [4], [5]. Conventional vaccines may take long R&D processing time, safety concerns, and are also unaffordable for economically weaker nations. Most countries

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

investigate an option for alternative, affordable, efficacious, and safe vaccines [6]. Reverse vaccinology procedures may help for this excursion to design a peptide-based vaccine [7]. Highly interacting viral protein with human protein distinguished through human viral protein interaction network database. One viral serotype was chosen for protein sequence retrieval. From protein sequence database retrieved sequence and anticipated a couple of T cell epitopes. These epitopes were further analyzed for conservancy among the available four viral serotypes protein sequence. Immunogenic, low antigenic, and non-toxic epitopes chose for molecular docking prediction with respective MHC I- HLA allele. The perfectly docked epitopes are predicted as potent vaccine candidates.

METHODOLOGY

A. Dengue Virus-Host Protein Interaction Data Retrieval and Sequence Mapping

The protein-protein interactions (PPI) network study was performed by utilizing the DenvInt database. This tool was assisted with recognizing PPI between the dengue infection and its human host [8]. This data set investigation assisted with foreseeing the dengue protein which was indicating the greatest number of interactions with human protein and was chosen for additional examinations.

B. Strain identification and Non-structural Protein sequences retrieval

Dengue virus strain and protein sequences dataset was retrieved from the ViPR http://www.viprbrc.org/. The database is a useful resource for strain and sequence analysis [9]. The retrieved protein sequence was the input for epitope forecast.

Computation of MHC Class I Binding Epitopes

The protein sequence of Non-structural protein 5 was used for the MHC I presenting CD8 T cell epitopes. An integrated MHC class I binding epitopes established by the latest version of NetCTL artificial neural network. This tool was accurately evaluated binding affinity and proteasomal cleavage [10].

Epitope Analysis

We used the IEDB web tool for conservancy analysis of linear T cell epitopes. This web tool helps to calculate the epitope linear conservancy [11]. The conserved epitope peptide sequence was tested for immunogenicity score [12]. VaxiJen web tool version 2.0 predicted the antigenicity of epitopes. VaxiJen 2.0 server predicts antigenicity 70% to 89% accuracy [13]. ToxinPred is a

quantitative matrix peptide toxicity predictor [14]. This tool was predicted nontoxic epitopes from the antigenic epitope sequence dataset.

Prediction of Epitope 3D Structures and Molecular Docking Analysis

PEP-FOLD3 is a Hidden Markov Model-based *de novo* peptide structure forecast instrument that has been accounted for the capacity to discover 3D designs of 5-50 amino acids lengthen peptides [15]. The three-dimensional structure of the distinguished epitope anticipated the PEP-FOLD server from the amino acid sequences. The MHC-HLA allele three-dimensional structure was obtained from protein data bank (PDB) (https://www.rcsb.org). PatchDock webserver was utilized for molecular docking study of MHC- HLA receptor with an epitope peptide ligand. This tool was worked based on Shape complementarity principles [16]. Both the proteins were docked at 1.5 root-mean-square deviations (RMSD) for accurate output.

RESULTS AND DISCUSSIONS

Dengue Virus and Human Protein Interaction Network Study

The DenvInt data made known that NS5 dengue protein interacts with 169 human proteins with the highest interaction than other dengue viral proteins. This protein was selected for further analysis. Many flavivirus PPI and proteome studies were revealed that NS5 protein suppresses the stimulation of interferon [17].

Strain and Protein Sequence Data Retrieval

The DENV serotype type 1 strain particulars and Gen Bank accession number (AF311956) were retrieved from the ViPR database. The complete genome sequence with a length of 10735 base pairs was obtained. This strain was used for NS5 protein sequence retrieval. The functional and structural features of immune epitope locations in the NS5 protein sequence were also identified. The functional and structural variations in the NS1 protein sequence of the influenza virus are identified [18].

MHC I Presenting CD8 T Cell CTL Epitopes

The NetCTL 1.2 web tool was recognized MHC I presenting CD8 T cell CTL epitopes (n=179). These epitopes were identified from DENV -NS5 protein sequence. The MHC I -HLA supertypes, A3 (n= 52), A2 (n=26), A24 (n=54), B7 (22) and B44 (25) at threshold value 0.75 as prediction parameter. These epitope peptides were 9-mer long (9 amino acids). This webserver was utilized to identify five 2019-nCoV CTL T Cell epitopes for vaccine design [7].

CHAPTER 9

Significance of Dark Energy and Dark Matter in the Transformation of Cosmological Periods, Focusing on the Evolution of the Universe

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Abstract: In this paper, we review some detailed facts and information about dark energy & dark matter and try to examine their existence and nature. We also seek to extend their influence to understand various transformations of cosmological periods that have taken place, the evidence of which can be found in the chronology of the universe, along with the significance of dark energy and dark matter. We study the present-case scenario regarding the evolution of the universe concerning the Friedmann Equations, derived from Einstein's field equations, along with some important cosmological parameters. This analysis also underlines an effort to obtain a clear and crisp picture towards which the universe is heading with time. We also review the various cosmological eras found in the chronology of the universe, which was dominated by radiation, matter, and dark energy respectively, and derive a conclusion of what the universe might have to attain during its evolutionary course.

Keywords: Cosmic Microwave Background Radiation, Dark Energy, Dark Matter, De-Sitter Universe, Einstein's Cosmological Constant, FRW Metric, Λ-CDM Model.

INTRODUCTION

The universe and its law of cause and effect never fail to surprise us. But the most intriguing fact is what inspires us to unveil a bit more, of its greatest secrets. Recent years of our study about the universe have shown striking, yet significant evidence of the detection of Einstein's so-called cosmological constant (Λ), which was considered as his "Biggest Blunder". The observational study of type IA supernovae, presented possible evidence regarding the pace of the universe, which is speeding up. The discovery of the acceleration of the universe (which is

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

believed to be following Λ-term), is a huge milestone in our understanding of modern cosmology.

According to (Turner 2002), the mass/energy density of the visible constituents of the universe in terms of percentile is [1]:

Bright Stars: 0.5%

Baryons (total): 4% ± 1%

Neutrinos: at least 0.1% and possibly as large as 5%

From the given data, it can be inferred that, Ωstars=0.005 and Ωbaryons=0.04. Although the value of Ωbaryons is much higher in comparison to the value of Ωstars, the total density of the universe comes close to 1. (Varun Sahni 2004) raised a question about what else can be out there in the universe, contributing to the total density as follows [2]:

$$\Omega_{total} - \Omega_{baryons} = ? \quad \textbf{(1)}$$

Therefore, it was quite clear about an unknown essential component(s) present in the universe, apart from ordinary matter and energy. Until recent years, scientists and astronomers thought that the entire universe was comprised entirely of "baryonic matter" (matter comprising mainly of protons and neutrons). But the results of observational data portrayed that there is something else in the universe also, which is not visible, contributing to the total density, as in the fore mentioned question, and a reason for the non-linear rate of expansion of cosmos.

Cosmic acceleration, and its deep-rooted origin, remains a big mystery. Speaking by the general relativity, if the universe would have been made only of ordinary matter and radiation, then the gravitational force would have slowed down the rate of expansion, that expansion which was set by a powerful explosion, known as the "Big Bang". But, if we observe the chronology of the universe, after the advent of cosmic inflation, the universe still expands at an accelerating rate. Hence, the hypothetical terms "Dark Energy" and "Dark Matter" came into the picture, which was associated with Einstein's cosmological constant, explaining the unrealistic expansion and evolution of the universe.

DARK ENERGY AND DARK MATTER

Dark Energy can be defined as a hypothetical and unknown form of energy, proposed to explain the accelerating rate of expansion of the universe, at the largest scale. It is thought to affect quite opposite to gravity, and similar to

repulsion. But, if that's the only reason sufficient, what could have been the reason for the formation of the large-scale structures found in the cosmos? Gravity, being the weakest fundamental force of the universe, couldn't have alone played the role. Therefore, a hypothetical form of matter, known as "Dark Matter" was introduced. Dark Matter could be defined as a hypothetical form of matter, which is believed to interact with visible matter *via* gravitational force. It is referred to be dark because there is no evidence of interaction with electromagnetic radiation, which makes it almost undetectable with current scientific instruments. Hence, the origin of dark forces from the present epoch of the Big Bang was known.

Assuming the standard cosmological model to be correct, and according to observational data procured by (Bolotin *et al.* 2014), the relative densities of main constituents making up the universe, such as dark energy, dark matter, baryonic matter, and radiation are as follows [3]:

$\Omega_{de} = 73\% \pm 4\%$ (dark energy)

$\Omega_{dm} = 23\% \pm 4\%$ (dark matter)

$\Omega_{b} = 4\% \pm 0.4\%$ (baryonic matter)

$\Omega_{r} = 5 \times 10^{-5}$ (radiation)

In the currently accepted model in modern cosmology as discussed by (Peebles and Ratra 2003), the universe is spatially flat, since it's known that [4]:

$$\Omega_{M0} + \Omega_{R0} + \Omega_{\Lambda 0} + \Omega_{K0} = 1 \quad \textbf{(2)}$$

where, (Ω_{M0}) is the mean mass density of main baryons and non-baryonic dark matter, (Ω_{R0}) is the measure of present mass in 3-K cosmic microwave background radiation accompanying low-mass neutrinos, ($\Omega_{\Lambda 0}$) is the measure of equivalent dark energy, and (Ω_{K0}) is the measure of the curvature of space.

Therefore, we can say that the fate and face of the universe are tied to the nature of dark energy and dark matter and their respective roles. They must have had a significant role in shaping the universe in certain dominations, leading the universe to its current state.

CHAPTER 10

Magnetic Field in the Solar System – a Brief Review

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Abstract: The following review is concerned with the working and development of the magnetic field around the solar system. It combines the various theoretical facts that have been extracted to date emphasizing how the magnetic field is present in the solar system and how it plays a crucial role in protecting it as well as other constituents of the solar system comprising planets. Since the magnetic field is all-pervasive throughout the universe, it can be considered to be a crucial element for the development of any planet or cluster or other celestial and intergalactic entities as well. Through this theoretical review, we will be able to discern the role of the magnetic field in a solar body, whereas through observational data we will be able to understand the practical orientation of the respective magnetic field in different planets throughout the solar system.

Keywords: Dynamo Effect, Heat Flux, Magnetic Field, Magnetosphere, Plasma, Solar Wind.

INTRODUCTION

There have been a lot of speculations regarding the origin, working, and importance of the magnetic field. The magnetic field is not limited to a particular domain. The following review is concerned with the magnetic field of the solar system and its respective planetary bodies. Most of the bodies in and exceeding the solar system possess a magnetic field that acts as a protective shield around their respective atmospheres. Sometimes heavenly bodies like galaxies act as giant magnets. In general, the magnetic fields in-universe are weak. However, in some compact objects, these might be assumed to be of extraordinarily large values. These fields are produced by the gravitational disintegration of massive magnetized bodies. According to [1] it is generally presumed that the magnetic fields in the astronomical structure having different sizes, from the stars R~ 10^{11}

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

centimeters to the galactic clusters R~10^{24} centimeters are generated by the amplification of the preceding weaker magnetic field seed *via* different dynamo. The magnetic fields are often measured with μ, Gauss strength which is abbre*via*ted as G or Gs is the CGS unit for measuring magnetic flux density or magnetic induction or magnetic field [2]. Revealed that the evolution of the magnetic- field is governed by the magnetic-induction equation which is derived by combining both the Maxwell equation while neglecting the current due to displacement as well as a simple form of the ohms law.

The planetary magnetic fields are produced by the interaction between the convection of the molten core and the planet's rotation. Not every planet has a measurable magnetic field. Mercury has a weak magnetic field because of its slow rotation. Venus also doesn't have a measurable field as there is very little convection in its molten core. Earth has a moderately strong field of magnetism which protects it from solar winds as well as facilitates navigation. Mars lost its magnetic field because of the solidification of its interior. Jupiter has an enormous magnetic field for which its core is responsible. Saturn's magnetic field is slowed down as it moves through the ring of particles that litter the orbit of Enceladus. The field of magnetism on Uranus varies from place to place, in the southern hemisphere, its field is only 1/3rd strong as that of earth's while Neptune has a turbulent magnetic field being 27 times powerful to that of earth's and resides at an angle on the planet, varying chaotically as it comes in contact with the solar winds. Comparing with planets, the galaxies have a weak magnetic field. The magnetic field of our Milky Way galaxy is 100 times weaker as compared to that of earth. The fields of magnetism are an important factor in the interstellar medium of barred, irregular, spiral, and other dwarf galaxies as well as in the formation of stars by enabling the removal of angular momentum.

MAGNETISM IN THE SOLAR SYSTEM

Around the Sun

It has been more than 10 decades since magnetic fields have been first measured around the sun. The sun has a quite large and complex field of magnetism [3]. Found that the structural dynamics of the Sun are mainly dominated by the intense field of magnetism which is created by the turbulent plasma present in the convective zone (solar dynamo). The sun's magnetic field is estimated to be twice as strong as that of Earth. The magnetic domain of the Sun, in reality, expands far into space, even beyond Pluto (the farthest planet), and this extension of the Sun's field of magnetism is known as Inter-planetary Magnetic Field or IMF. It is often stated that the sun is a magnetic star itself. It can be understood as a thermo-nuclear furnace burning at 15 million degrees with an excessively heated core that churns the electrically conductive plasma in the exterior third of the sun just like a heated stove that churns the boiling water. The visible disk of the Sun called

photosphere contains dark earth-sized sunspots which are the provinces of intensely magnetic domains [4]. explained through this research that numerous missions have been executed for understanding the ejections of coronal mass, their intensity, nature, and extent of the magnetic fields of solar origin taking into concern the 11 years solar activity cycle.

Exploring Mercury

There have been various speculations on the genesis of the magnetic fields in Mercury. The intrinsic field of magnetism in Mercury might be a result of a dynamo effect in a liquefied core, despite the obtuse rotation rate of the planet. The core of mercury is partially in the liquid phase. According to earlier observations, Mercury seems to have an intrinsic dipolar-magnetic domain having a moment of 5×10^{12} Tesla cubic meter. It was conferred that the observations received through a space probe studying magnetosphere-type region around mercury might have been an outcome of reciprocity with the winds of solar origin [5]. Explained the concept of radius and the core-density while there have been variations due to consideration of present conditions and availability of data. Since, Mercury is the only planet to have a notable field of magnetism (revealed by Mariner 10 in 1974-1975) other than Earth, having a field 1% to that of Earth's. It has been a tough task to model the presently observed magnetic field of Mercury in terms of crustal magnetization, while the theoretical studies confer that if the dynamo effect works similarly on Mercury as it does on Earth, then the field of magnetism around it should be ~30% of its terrestrial equivalence.

Exploring Venus

Venus is a rare exception among planets. It cannot be wrong to state that it is a world that doesn't have a magnetic field at all. This exquisite exception in planetary science forces us to speculate that how a planet with no magnetic field can is sustaining itself through the universe. The solar wind may sometimes interact with the atmosphere of the planet without any resistance as there is no magnetic field. However, through recent observations, it has been found that Venus has an induced magnetic domain that protects it, partially though. According to [6] the highest heat flux that can be derived from the core without thermal convection and is given by

$$R_c = k\,\alpha\,a\,t/c_p \qquad \textbf{(1)}$$

Where α and k are the thermal-conductivity and thermal-expansivity, a is the gravitational acceleration, t is the core-temperature, and c_p is the specific heat

CHAPTER 11

Comparative Study on Identification and Classification of Plant Diseases with Deep Learning Techniques

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Abstract: Proper development and growth of crops had always been a major concern and challenge in Agriculture. Proper crop development assures good quality of crops and also bumper harvest. Humans may not always identity all plant diseases accurately at all stages having an automated system for crop disease identification and detection can be a great help for a tiller. This thought inspired me to perform the proposed research work. VGG-16 based learning model achieved an accuracy of 98.74%, ResNet-50 based transfer achieved an accuracy of 98.84%, and ResNet-50 v2 based transfer learning model achieved an accuracy of 98.21%.

Keywords: CNN Achitecture, ResNet, ResNet50-v2, Transfer Learning, VGG.

1. INTRODUCTION

Development from an infant to a fully developed crop is a tedious process that requires close monitoring. Framers depend completely on the crop yield for their living. The plant needs a lot of care in its development process. One of such risks involved includes disease. There are various types of diseases of which a plant can get affected. Crop failure due to disease can have a grave impact not only on farmer's economic status but can also impact the national economy. Automated early detection and identification of plant disease can be a great help to farmers. It has a benefit over the traditional method of making an expert guess based on what farmers perceive from their eyes. Early detection of disease is important to provide scientific manuring.

With the amelioration of artificial intelligence, techniques of plant disease detection with help of leaf images are an emerging research area. The deep

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learning technique has been proved to be a powerful tool to perform such image classification techniques. In this aspect, deep learning techniques play an indispensable role in form of Convolutional Neural Network techniques. Convolutional neural network feature extraction plays a vital role in model performance.

CNN-based models are broadly classified into two categories: 1) Customized models: made by the developer according to the problem statement. 2) Standard models: These are pre-developed models whose efficiency had already been proved.

In the real world, when plant images are captured in farms the image contains green background, along with the infected leaf. A series of image processing steps need to be performed like image pre-processing, image segmentation, feature extraction. Based on the extracted features models are trained. And disease mapping is done for classification purposes. CNN provides a pre-built architecture for the majority of phase, whereas if one is using a machine learning algorithm need to develop all these phases.

The proposed research focuses on the following key points:

- An experiment is carried on multiple plant datasets to validate the result and avoid overfitting and underfitting conditions.
- Transfer learning techniques helped to achieve a higher result accuracy.

2. RELATED WORK

Konstantinos (2018) [1] presented a convolution neural network model to identify various plant diseases. Images of various plant leaves which include both the infected and healthy leaves images are used to train the model. In this proposed research work, an accuracy of 97% is achieved. The CNN architectures used in the proposed framework include AlexNet, AlexNetOWTBn, GoogLeNet.

Golhani *et al*. (2018) made a detailed review of various deep learning algorithms along with their advantages and disadvantages also their optimization techniques. A comparison has also been made for these techniques about the related work [2].

Sardogan *et al*. in (2018) [3] proposed a model that is a combination of convolution neural network and Linear vector quantization algorithm. The dataset used included 500 images of tomato leaves.

Wallelign *et al*. in 2018 [4] presented a model that was implemented using LeNet

one of the efficient and standard CNN architectures for the classification of soybean leaves. The dataset includes 12,763 images. This proposed model gained an accuracy of 99.32%.

Zahid Ullah *et al.*, (2020) [5], in this paper author has explained a detailed methodology for image enhancement. There are various scenarios where some amount of useful information of the image is damaged, distorted, or lost. So, at first, the author has advised filtering the image. A median filter is passed through the image to remove some amount of noise. A good contrast of the image is required for good analysis. Good contrast makes all image object visible. In this paper, the author has suggested a very effective methodology by limiting contrast in histogram equitization. This method is better than the histogram equalization method because it removes the over-amplification issue. And then it is good to do the wavelet transform process. 2D discrete wavelet transform is an efficient tool to do image enhancement.

Pantazi *et al.*, (2019) [6] provides a detailed study of each step of the proposed algorithm. Grabcut algorithm for image segmentation. LBP algorithm for thresholding. One Class Classification method and its hybridization with the SVM algorithm for conflict resolution. Sankaran *et al*. (2010) [7] this paper shows one of the early works in plant disease detection technology. This paper does a comparative analysis of disease prediction in plants with the help of molecular techniques, imaging and spectroscopic techniques, and also volatile organic compound profile study.

Fuentes *et al*. in 2017 [8] provided a framework that needed stage-wise implementation. First meta architectures: Faster RCNN, R-FCN, and SSD are combined to form a single meta-architecture. Then standard CNN architectures like VGG-16, ResNet-50 are used to extract features and train the model.Sharma *et al*., 2019 [9] in this paper the author has addressed a major problem about the success of the model in the real world. Most of the algorithms proposed work efficiently on training data but fail to achieve the desired output in a real-world scenario. The author made a change in training a convolutional neural network. Instead of training the convolutional neural network with a full image the author trained the model with the help of a segmented image and got a very efficient output. Arivazhagan *et al.*, 2018 [10] proposed a framework to identify the disease with leaf images of mango plat with an accuracy of 96.97%. Oppenheim *et al*., (2017) [11] proposed a framework using CNN for potato plants from a dataset of size 2465. Tammina (2019) [12], the author has proposed a framework for the use and implementation of the transfer learning model and how to extract necessary data from pre-trained models. Khirade, *et al.*, (2015) [13] proposed a methodology

CHAPTER 12

Analysis of Heat Sink Consideration Based on their Size

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Abstract: Light-emitting diodes have become very popular in general lighting due to their various advantages over other luminaires. Power consumption and LED size also play an important part in their selection over CFL's. LEDs are compact and brighter and can be modelled according to the requirement. Due to the compact size of high-power LEDs, the temperature or heat produced by the LEDs will be more, so some efficient cooling methods must be employed. This paper compares heat dissipation through heat sinks of different sizes. This paper claims that the temperature of high-power LEDs cannot be lowered after reaching a certain point, as a result, an increase in the size of the heat sink at that particular level is useless.

Keywords: Fin Thickness, Heat Dissipation, High-Power LED (Light Emitting Diode), Heat Sink, Thermal Behavior.

INTRODUCTION

The ordinary LEDs consume almost about 0.05W of power and the operating current is equal to 20mA. Whereas high-power LEDs can be of 1W, 2W or maybe up to 100W, and operating current is several hundred milliamperes. The main disadvantage concerned with the LEDs is low light lumen that only 10~20% power transforms into the light which gives rise to the expansion of high-power LEDs. A high-power LED requires that with the stable input voltage, the constant current and the operating temperature below 60ºC, can the long-life expectancy of the LED lighting system be achieved. Using a high-power LED, the temperature can be increased to more than 60ºC without any cooling system. If the temperature keeps on increasing LED can be burnt.

As we know heat sinks are mechanical devices generally used to dissipate the heat of electronic devices. In an electronic device, the heat increases due to the rise of

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

temperature of electronic components with an applied voltage which leads to a rise in device temperature. Consequently, high power devices are vulnerable to high temperatures. The heat sink attached to the device helps to spread the heat away from the device to the environment which eventually reduces the device temperature [1, 2].

The heat sinks available in the market are of different shapes and sizes [3]. The construction of a heat sink depends upon the various parameters like a component to be cooled and the size of the device. There are two kinds of heat sinks called active heat sinks and passive heat sinks.

A. An active heat sink uses an electronic device's power supply to connect a fan to dissipate the heat to the environment from the heat sink to make it cooler. Active heat sinks are always employed with passive heat sinks [4].
B. Whereas, passive heat sinks have no mechanical parts hence, making them easy to install within electronics [5]. The generally used material for heat sink design is aluminium because it is economical compared to copper. But the thermal conductivity of copper is more than that of aluminium. Passive heat sinks can spread heat fast through its fins design which allows air to circulate, hence making it cool down faster [6]. Thus, the fins help to spread heat away from the heat sink without employing any active cooling device.

This paper compares the heat dissipated by passive heat sinks. This experiment comprised of two heat sinks of different sizes with no moving parts and the third heat sink with fins is used here without any fan. The first heat sink volume (L x W x H) is of size 5cm x 5cm x 5cm, the second fixed heat sink volume (L x W x H) of 15cm x 15cm x 15cm is used and the third heat sink with fins is of size (L x W) 7.8cm x 7cm with fin height of 4.2cm and fin thickness of 0.19cm is employed. Experiments have been performed over high-power LEDs and with two different wattages. The first LED chosen was around 5 watt and the other one is around 10 watts. The heat dissipation behaviour of all three heat sinks is analysed.

There are several parameters like thermal resistance, the component temperature that is cooled, mass, reliability, application area, size, acquisition and process cost, designated cooling process, and electronic performance that need to be taken into account while choosing a cooling method for high power LEDs [7].

EXPERIMENTAL SET-UP

Here, initially for the first-round measurements were performed for three demonstrations as shown in Fig. (**1**) power LED of 5watts is mounted on the heat sink of size 5cm x 5cm x 5cm which is used to manage the heat dissipated by the high-power LED. 2) the same high-power LED of 5watts is mounted on the other heat sink of different sizes 15cm x 15cm x 15cm. 3) the same high-power LED of

5watts is mounted on the other heat sink with fins of size (L x W) 7.8cm x 7cm with fin height of 4.2cm and fin thickness of 0.19cm.

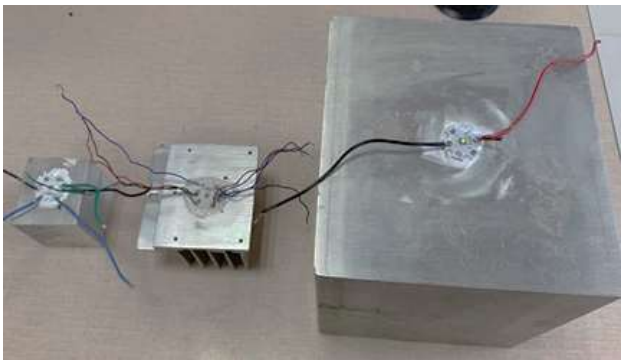

Fig. (1). Different sized heat sinks used in the experiment.

In the second round, measurements were performed for the next three demonstrations: 1) power LED of 10watts is mounted on the heat sink of size 5cm x 5cm x 5cm as shown in Fig. (**2**) . which is used to manage the heat dissipated by the high-power LED. 2) the same high-power LED of 10watts is mounted on the other heat sink of different sizes 15cm x 15cm x 15cm as shown in Fig. (**3**) the same high-power LED of 10watts is mounted on the other heat sink with fins of size (L x W) 7.8cm x 7cm with fin height of 4.2cm and fin thickness of 0.19cm as shown in Fig. (**4**) . The diameter of the LED chip is around 20mm.

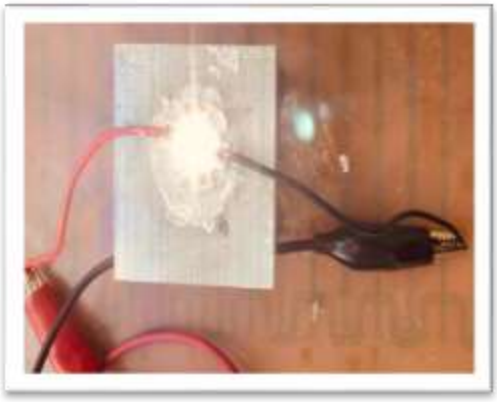

Fig. (2). Heat sink of size 5cm x 5cm.

CHAPTER 13

A Comparative Study on Various Machine Learning Techniques for Brain Tumor Detection Using MRI

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Abstract: The brain is the central controlling system in the human body. If the structure of the brain changes due to the enlargement of the brain cells, it is diagnosed as a brain tumor, which can lead to fatality. The techniques such as medical imaging provide evidence of whether a patient has a brain tumor or not. This paper discusses various machine learning techniques for brain tumor detection using MRI and provides a performance analysis of such methods based on the state-of-the-art. A comparison of ANN and CNN-based models have also been given after implementing the techniques in Tensorflow to understand the potential benefits of using deep learning-based techniques.

Keywords: ANN, Brain Tumor, CNN, Deep Learning, Machine learning, MRI.

INTRODUCTION

Images obtained from MRI-Magnetic resonance imaging are utilized to obtain the complete information of internal brain tissues. During the process of brain tumor [1] investigation, detection of the tumor core location is the key task to get the size and shape of the brain tumor. Segmentation techniques are vital in the detection process of tumors in the brain. To obtain complete knowledge of brain tissues like gray matter, cerebral spinal fluid, white matter, *etc*., segmentation methods are applied. Segmentation can be done in two ways either automatically or manually. Manual segmentation takes more time and requires expert knowledge and experience but brings down computational efficiency while Automatic segmentation works with histograms based on pixel intensities. The assessment of lesions , using MRI image segmentation, in the brain of a patient

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helps in providing significant data that in turn could help provide insights into the evaluation and detection of various brain pathologies which could help in the proper planning and monitoring of treatment. The segmentation incorporated with human intervention can prove very beneficial in terms of accuracy but it is a very cumbersome and expensive task that is also a time-consuming task. So, an efficient and automated segmentation-based detection technique is the need of the hour that may provide outcomes that could be significantly used for the quantitative evaluation of tumors.

In neurological sciences, MRI segmentation of the brain is the key basic step and has applications in functional imaging, operational planning, and quantitative analysis [2]. Although the brain's internal structure is accurately described by MRI-imaging, the segmentation of medical images is a tedious task as a result of various issues like noise, weakly defined boundaries, poor or weak spatial resolution, inhomogeneity, low contrast, partial volume, variations in the shape of objects, acquisition artifacts present in the f*etc*hed data and deficiency of anatomy models that completely give details about the deformations of the internal structures [2 - 4]. These issues can be solved by the implementation of some simple techniques which are presented in [4 - 7]. As a result of issues like tumor heterogeneity, instability in shape, size, tumor recurrence it is very complicated to formulate the best efficacious segmentation technique [3].

Hybrid techniques are utilized to obtain gainful and reliable results in the segmentation process by integrating more than one method, by utilizing their pros and rejecting their cons. Parveen [8] proposed a hybrid technique in which both SVM and FCM techniques are merged to obtain the correct classification of the brain tumor region. For segmentation of affected brain core region, FCM is utilized and in the process of classification, features are extracted using Gray level run length matrix which is then utilized by SVM for the process of classification. Region-based ACMs integrated with Machine learning are applied for fruitful segmentation results by utilizing their pros and rejecting their cons. Intensity homogeneities are dealt with by machine learning while issues of misclassified and weakly defined boundaries are handled by region-based ACMs.

Many researchers have used supervised methods for brain tumor segmentation technique that includes; Support Vector Machines (SVMs), Random Forests and K-Means, *etc*. All these methods are known to use hand-crafted feature extraction techniques which are constrained computationally as compare to any deep learning-based methods. Many researchers have used different methods of segmentation for Brain tumor detection. In the following sections, an overview of different techniques of segmentation with current literature has been discussed.

LITERATURE REVIEW

In this paper [9], a tumor classification technique based on wavelet features and DNN is used. The authors have used OFPA which stands for oppositional flower pollination algorithm, for the feature selection and Deep Neural Networks have been used to classify the tumor. Finally, a possibilistic fuzzy c-means clustering (PFCM) based technique has been used to extract the tumor-affected area. In the study, the accuracy rate of 92%is achieved with a specificity of 91% and sensitivity of 86%. Nazir *et al.* [10] proposed a segmentation method for brain tumors is used that works in various stages. In the first stage, feature extraction from input brain images is done using the Discrete Wavelet Transform technique. Decomposition of an image takes place which results in multiple wavelet sub-bands, then the bands with the highest energy are selected and divided into multiple blocks. In the second stage, from every single block high variance features are chosen using discrete cosine transformation technique and for classification transferred to neural networks. In the last stage, segmentation is achieved by k-means clustering. Shivhare *et al*. [11] provide a complete model which is based on two constituents.

- For partitioning input images into various clustered images Parameter –free clustering algorithm is used.
- Hole filling operations proceeded by morphological dilation are used to get to the core region of the tumor.

Sazzad *et al.* [12] use gray-scale images obtained from the MRI technique. The filter operation method is incorporated to eliminate undesirable noise and this results in better segmentation. OTSU segmentation technique based upon thrush hold is used to replace color segmentation. Feature information provided by pathologists is finally used for the identification of the tumor core region.

Khalil *et al.* [13] proposed the segmentation method applied for brain tumor identification involves three levels. Pre-processing for the quality improvement of the image by eliminating undesirable noise like discrepancies and inhomogeneity from the image. The technique based on two-step clustering is applied to obtain the exact basic contour points for the level set segmentation method. Dragonfly algorithm is integrated with k-means in the process of clustering. Level set segmentation helps in the speedy extraction of tumor edges

In this paper [14], the core area of the tumor is detected using four major modules. For pre-processing FNLM technique is applied for enhancement. For segmentation, the OTSU technique is applied. For extraction of various features like HOG, GEO and LBP are incorporated into one feature vector which is further

CHAPTER 14

A Review on Health Monitoring of Electronic Passive Components

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Abstract: The development of Technology in the field of electronic devices is going very rapidly. Factors such as cost, performance, complexity, and portability are contemplated over and over again. Nowadays low cost and better performance captivate the interest of a wide range of public. To meet these demands of the public various components are integrated onto a single chip. As this integration increases, the complexity of the devices increases which leads to increased chances of faults and failures in a device. It is not that today's urban human is using the electronics keeping hi-tech gadgets in hand, but today's mechanical transport means are also driven by daily changing and improved electronics devices. So many times, there are recalls of sold components or devices by leading electronics giants due to post prediction of their failure. This happens because the companies are using traditional techniques for condition monitoring and reliability testing. Even big automobile giants have to recall their cars for defects occurring in the later stage. One of the examples of recalling of TATA public transport buses sold to DTC in Delhi, India, as those automobiles are getting caught in the fire in many cases. Traditionally, to analyze electronic components reliability and condition monitoring, three techniques are used, viz., using empirical methods including standard handbooks MILHDBK-217, BELLCORE, and PRISM; analyzing using life testing experiments; collect maintenance and operating data and perform statistical analysis.

Keywords: Failure Prediction, Failure Rate, Faults, Reliability.

INTRODUCTION

Manufacturers across the globe are focusing on improving the reliability of their existing components. This is because most of the sold components received bad feedback because of low quality or fault which eventually leads to big losses even to successful companies. After some careful analysis it is concluded that the cause of this situation is ignoring the need for Reliability Calculation and fault analysis using a traditional approach in calculating RUL remaining useful life is consider-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

ed a cause now the struggle of the manufacturer's is to increase component performance at a normal cost this eventually reduces their time to market the component the automobile industry is no less many big automobile manufacturers had to call back their products [1 - 18].

PREDICTION OF RELIABILITY AND FAILURE

Reliability is defined as the consistent performance of any component in electronic devices. It can help solve issues related to the failure. It helps to prevent failures. Fig. (**1**) shows the Bath-tub curve. Reliability plays a key role in measuring failure rates as it defines the probability of occurrence of the failures in the system with preference. Some major reasons these failures occur are:

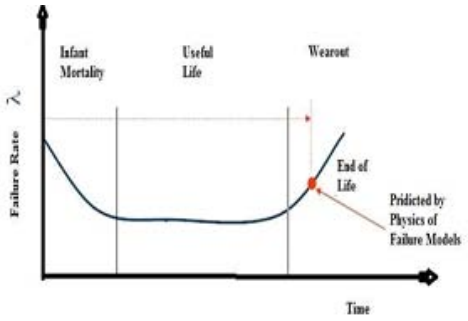

Fig. (1). Bath-tub curve [3].

1) Using components above their stress level.

2) Quality of product and weakness inherited.

3) Degradation of the component with its age and usage.

4) Failure of a component affecting others

A Bath-tub curve is used to analyze the rate of electronic devices along with time. The failures shown in infant mortality are the failures due to manufacturing. These show up at the initial stages of component usage. So, the failure rate gradually decreases as age increases. The failure rate in the useful life stage remains constant as failures occur like a randomly occurring event. Due to exposure of components to environmental stress and overloaded electrical parameters the failure rate increases as age increases. This is called the Wear out stage.

LITERATURE REVIEW

1. Zhao *et al*. (2018) [18], given the characteristics as current operational age and corresponding degradation state, conditional reliability can be estimated by using assessment method for devices that are subject to condition monitoring(CM). The degradation process is specified by a continuous-time Markov chain. Cox's proportional hazards model is used to determine the hazard rate failure time in this process. The majority of Degradation states and the transition of generation deteriorating mechanism are two main that are encountered in the health assessment. They can be properly addressed by a proposed method.

2. Vasan *et al*. (2018), we can observe degradation in a component with the change in an initial value of an electrical parameter of a component. Low performance of circuits and failure are the results of using such components. Detecting the component level errors in the circuit by deviation calculation of every parameter in the present-day process. A prognostic method that exploits the features extracted from the responses of the circuit, which consists of components that have parametric called as discussed to solve the issue.

3. Bhargava *et al*. (2018) [3], ocuses on a parameter thermal stress or high temperature the main reason for the failure of the capacitor under the high-temperature value of ESR and C change rapidly as electrolyte inside the capacitor start to evaporate. This eventually reduces the capacitor size. The constant charging and discharging of the capacitor lead to capacitor breakdown. The paper also analyses the humidity factor that enhances the capacitor's degradation cycle. Summing up the accuracy in predicting the life of capacitor increases from 55% to 90%.

4.Yao (2017) [17], an online non-invasive monitoring system was advised to inspect the dependability and life of Electrolytic capacitors as they were crucially accountable for the collapse of power electronic devices. Using capacitance and continuous analysis of Equivalent series resistance (ESR), this monitoring system is capable of yielding the electrolytic capacitors output by using an additional trigger that acts as an amplifier and amplifies the output and to analyze output voltages switching through continuous monitoring of capacitors. Offline monitoring, online monitoring are the types of monitoring. The device needed to be switched off before analyzing which was a crucial pitfall and online monitoring and quasi online monitoring played a vital role in overcoming it.

5. Chigurupati *et al.* [7], Machine learning made it easier to predict the component failure. The past behavior is used to learn and analyze *i.e*., to train the algorithm. Then we can predict the future behavior of components more accurately. Machine learning helps in predicting the behavior before failure

CHAPTER 15

Edge Gateway and Zigbee Based SHM of Bridge Using AI

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Abstract: SHM of the bridge is the major issue for finding the condition and life span of the bridge. Recently many bridges have collapsed due to floods and environmental conditions. The up and coming age of extension SHM innovation needs to persistently screen conditions also, issue early alerts before an exorbitant fix or disastrous disappointments. With the assistance of the Internet of Things (IoT), the SHM can be transformed into a real-time monitoring system and the monitoring can be processed from any remote location through the internet. At present cloud computing is integrated with IoT for storing, monitoring, and performing analytics on the data received from the sensor node. In this study, we have proposed the Edge gateway and ZigBeecommunication-based SHM of the bridge. In the case of a bridge, the decision needs to be taken immediately for avoiding the demolition of the bridge. For immediate decisions, we have employed edge computing at the gateway node that performs analytics immediately and gives the necessary action to be undertaken. In this study, we have embedded the Zigbee module in the sensor mote for sensing the distinct parameters of the bridge and communicate them to the edge gateway. Edge gateway performs analytics by applying artificial intelligence techniques for predicting the damage and condition of the bridge and sends the alerts to the cloud server *via* a Wi-Fi module. From the cloud server, the authorities can access through the web application and mobile application.

Keywords: AI techniques, Edge gateway, IoT, Sensor mote Zigbee module.

INTRODUCTION

For better transportation in the world, bridges play a major role in interconnecting the roads between rivers, hills, canals, *etc*. In the USA about 66,405 bridge infrastructures *i.e*. more than 11 percent of bridges are in bad conditions to know the status of the bridge the SHM of the bridge is necessary [1]. Structural Health Monitoring (SHM) is characterized as a method that aims to obtain information over time on a structure's condition and behavior [2]. The stability of vital infra-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

structures (VIs) such as energy grids, oil and gas systems, nuclear power plants, or transport networks is an important technique for monitoring [3]. The process of monitoring consists of the continuous compilation of the most representative parameters that indicate a structure's state and the choice of these parameters depends on a variety of factors, such as the form of structure, its function, the materials used for construction, and environmental conditions [4]. Based on the normal method, parameters are in different forms like stress, displacement, deformation, temperature, humidity temperature, pH, and oxidation of metal [5]. Three important components are included in a regular, wired SHM system: a sensor system, data collection, and transmission system, and a health evaluation system from the sensory information [6]. Here IoT is an emerging technology that is capable of real-time monitoring the physical things from any remote location *via* Internet Protocol (IP) [7]. The integration of cloud computing and IoT establishes a real-time platform for storing sensory data and applying analytics for getting understandable data. However, in the case of SHM of the bridge, the response time for detecting the damage of the bridge should be high as the bridge locates in the location where the connectivity issues also arise. With the advantage of edge computing technology, we are proposing edge gateway and Zigbee communication-based architecture for monitoring and prediction of the damage using AI techniques. Zigbee-based sensor mote is deployed to the bridge at a different point for sensing the dynamic parameters of the bridge. Zigbee communication transmits the sensory data to the IoT-based edge gateway and as the gateway is based on edge computing it performs the analytics using AI. The gateway can give understandable metadata of the health of the bridge. The gateway is also embedded with the wi-fi module, so it can transmit the data to the cloud server.

RELATED WORKS

The present approach in SHM of the bridge depends on visual assessments, which are tedious and emotional and are impossible to analyze regularly for all bridges.SHM of the bridge scour is very precise for evaluating bridges under scouring dangers, deterministic models dependent on designing decisions have been actualized throughout the long term utilizing subjective appraisal techniques [8]. Sensor-based approaches used for checking frameworks have been proposed to computerize and enhance the visual examination measure. One methodology is to introduce a variety of various sensors, for example, strain gauges and accelerometers are mounted on the bridge. The disadvantage is that such sensors require a refined and costly electronic framework with the establishment, upkeep and force uphold [9]. In the remote structural health monitoring of the bridge, GSM/GPRS wireless protocol is used for transmitting the data to a long range

[10]. Wi-Fi module is also used for transmitting and receiving the data from sensor nodes for SHM of the bridge which is an IEEE 802.11b/g/n standard with a 2.4 GHz band [11]. Wireless Global Bridge Evaluation and Monitoring System are one of the wireless communication networks which have a 902 to 928 MHz frequency band which is used in sensor nodes for collecting and processing the data [12]. Due to high power consumption and prepaid network, the GSM/GPRS should be replaced free licensed network. Zigbee communication module works on the ISM (industrial, scientific & medical) band and it is open access licensed band where the transmission of data can be sent with low power consumption a low cost based sensor and NB-IoT communication-based system is proposed for displacement monitoring of the bridge and cloud server is integrated for storing the displacement data [13]. An IoT-based flexible platform is implemented with accelerometer sensors for remote health monitoring of the bridge [14]. Applying machine learning (ML) technique from sensory data of SHM of the bridge which includes a training algorithm for characterizing the structural condition of the bridge. Based on the data analysis through algorithms, we can predict the damage and preventive measures would be taken [15].

PROPOSED ARCHITECTURE

Edge computing technology where data collected from IoT devices is computed directly at edge networks instead of transmitting to the local server [16]. By using this technology data is analyzed at the edge devices and also provides a quick response for any emergency when compared to cloud computing. In this study, an edge gateway and Zigbee-based architecture are proposed for SHM of the bridge and it is shown in Fig. (**1**). Zigbee-based sensor mote will be deployed at the distinct points of the bridge for monitoring the condition of the bridge. In the sensor mote, Acoustic Emission, ultrasonic sensors, and Accelerometer sensors are used for sensing the dynamic parameters of the bridge.

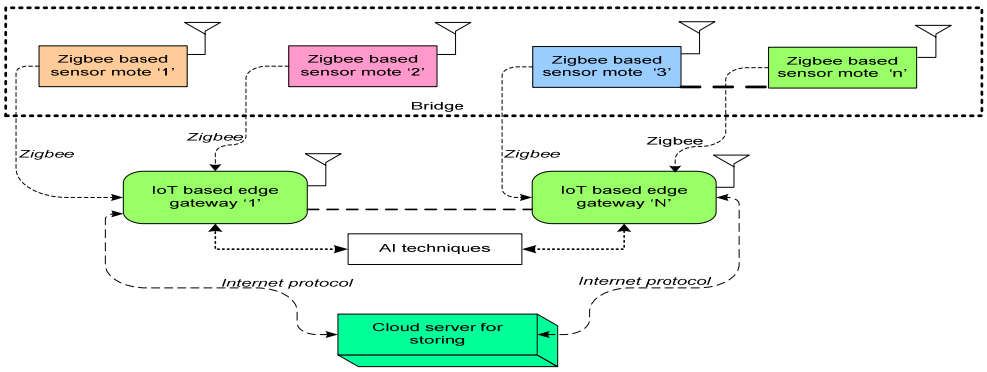

Fig. (1). Edge gateway-based architecture for SHM monitoring of bridge.

CHAPTER 16

Deep Learning Based Edge Device for Diabetic Retinopathy Detection

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Abstract: Diabetic Retinopathy is the major problem in Diabetic affected people, as it causes blindness to the people who are affected by this particular disease. Recently many people are being affected by Diabetes due to changes in food habits and the quality of food people take. Early and continuous testing of the eye in regular intervals leads to the identification of this disease by which the blindness problem can be overcome, but due to lack of availability of resources like optholomists and the machinery for monitoring the eyes the early detection is not that easy. The early machines and methods adopted will not provide good results in any cases because of many constraints, As the technology is advancing, with the help of neural networks and Edge Devices regular monitoring the diabetic people can be done easily and effectively in any part of the globe with much ease. At present image processing techniques are being used. In this study, we propose Deep Learning algorithms that process the date very accurately in very less time because of which we could good results in performance evaluation. In this study we have also proposed Edge Device which are end term devices, where these devices perform analytics on images of the eye and predict the condition of the eye and also it gives the information of stages of Diabetic Retinopathy, we can also store the data which is processed by edge device on cloud servers *via* wifi, From the cloud server the concerned people can obtain the records of that person who is affected with Diabetic Retinopathy.

Keywords: Convolution Neural Networks(CNN), Diabetic Retinopathy, Edge Device, Neural Networks.

1. INTRODUCTION

Diabetic Retinopathy (DR) is a disease of the eye [1] which is caused because of increased glucose levels in the body, as the body cannot produce enough insulin. This increased glucose level affects the blood vessels which are present in the eye will be swelling which in turn leads to leakage in the retina. A person who is Diabetic is subjected to failure of the Kidney, Blindness, Bleeding in teeth, nerve

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

failures, and so on. The maximum increase in glucose levels in blood leads to oozing of blood from the eye, because of which the human visual system will be damaged.

i. Diabetic Retinopathy can be classified into two types namely

ii. Non-Proliferative Diabetic Retinopathy (NPDR)

iii. Proliferative Diabetic Retinopathy (PDR)

The classification of DR is shown in Fig. **(1)**.

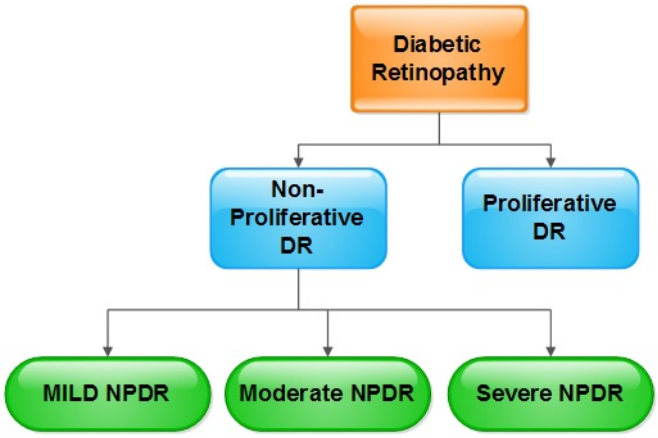

Fig. (1). Classification of Diabetic Retinopathy.

The images of NPDR and PDR are shown in Fig. (**2**).

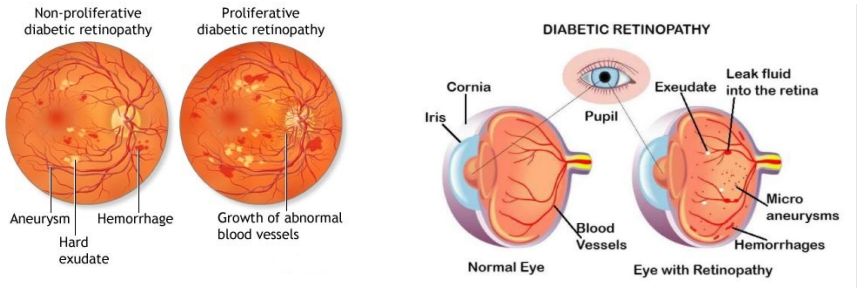

Fig. (2). Images of NPDR, PDR, and difference between normal eye and eye with retinopathy.

The aim to obtain information on various elements of the eye retina is important to identify the DR problem. The process of monitoring the eye retina consists of

the continuous examination of Micro aneurysms (MA) [2], Exudates (EX), Hemorrhages (HM) which are internal elements of the eye whose properties are going to vary if it is affected. The difference between normal eye to DR is shown in Fig. (**2**).

MA represents the internal enlargements of the retinal capillaries. EX represents Internal Bleeding. HM represents inflammation in Blood vessels because of which blood flow is restricted and causes tissue damage. Parameters like MA, EX, HM are to regularly monitor and should be identified if there are any changes but with the help of existing methods that use image processing techniques will not produce a better result. The major drawback is time consumption and Performance evaluation.

The adoption of Neural Networks in Medical applications for various monitoring applications will improve the medical examination outputs concerning time consumption, ease of access. We can adopt the latest like Deep Learning techniques which could provide good results [3 - 12].

The integration of Neural Network algorithms with high-end devices like Edge Device would provide a great opportunity to provide Health Monitoring in a real-time platform by acquiring the retinal data (fundus images) and applying the analytics for getting understandable data. However, with the advent of edge computing technology, computing can perform at edge devices. With the advantage of the edge computing technology, we are proposing Edge Device and Deep Learning Algorithms which gives good results.

2. RELATED WORKS

The present approach in DR detection depends on manual assessments of patients, which is highly not possible because of an insufficient number of Optholomigists and machinery needed.

Jiawei *et al*., (2018) proposed a method that involves two different forms from the view of MAs turnover and pathological risk factors. It is used to diagnose the DR. To get MA's turnover there are 7 other methods and pathological features. Using statistical analysis and technique of pattern classification an unchanged and new MA's can be resolved [11].

Pedro *et al*., (2018), have proposed a method that is joint optimization of the instance encoding and the image classification stages. To get pathological images mid-level representation (MLR) is used [13].

Xianglong *et al*. (2019), have proposed a novel CNN model with Siamese-like

CHAPTER 17

Plant Disease Detection: A Survey

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Abstract: The actual framework will improve seed or plantation growth by increasing their production, efficiency, and economic benefit. It also allows one to serve nature by overseeing plant growth by balancing the climate. Many methods have shown an important role in the variety of uses, such as medical, security, *etc.* Farming, remote sensing, market research, *etc.* The use of automated simulation tools to mimic human visual capacities has proved a dynamic function of smart or precision agriculture. This principle has allowed for the automated control and observation of seeds, planting, disease control, water conservation, *etc.* to improve seed production and efficiency. In this paper, we reviewed several publications that follow the principle of machine learning, deep learning, soft computing and digital image processing (DIP) approaches for the detection and classification of plant diseases.

Keywords: Deep learning, Digital image processing, Machine learning, Plant diseases, Soft computing.

INTRODUCTION

One of the big problems for farmers has always been planting and seed disorders. It may pose a substantial danger to the production potential of agriculture. However, diagnosing the true cause of the issue with the proper or reliable diagnosis can be a large benefit in the field of agriculture [1].

It is well said that it is very straightforward to recall and evaluate the items or objects humans imagine. The eyes act as a capturing system that absorbs and converts light into a signal then transmitted to the brain. The brain then covers this to greater learning. The idea of technology for visually analyzing and recognizing real-time details using computer systems or computers. This device facsimiles to some degree the understanding capacity of living things, like humans [2]. With the assistance of a camera serving as an eye for the device, data in the information of signal and photographs are developed and handled with the help of a digital

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

system to extract any valuable information from it. It is understood that DIP is the technique of transferring a picture from a signal to a digital form. Since it is not easy to understand details obtained in the signal type, it has been translated into 0's and 1's to well understand the results.

Many artificial intelligence techniques are commonly used for the classification and detection of diseases in the plant. The popular techniques are decision tree, logistic regression, SVM, KNN, and Deep CNN. To optimize attribute extraction, these techniques are paired with separate image pre-processing processes.

K-NN is a basic classification algorithm based on memory that takes data based on a calculation of similarity.

METHODOLOGY

The farmers are concerned about the plant which are been destroy by many diseases. Plant pathology is the process that recognizes the development of the plant. Sometimes it is referred to as Phytopathology, originating from the Greek phrases where Phyto means plant, diseases mean path, and information means emblem. The study is about plant disease and disorder affected by variables such as biological factors, nutritional shortages, temperature, and microorganisms. The classification of pathogens is shown in Fig. (**1**).

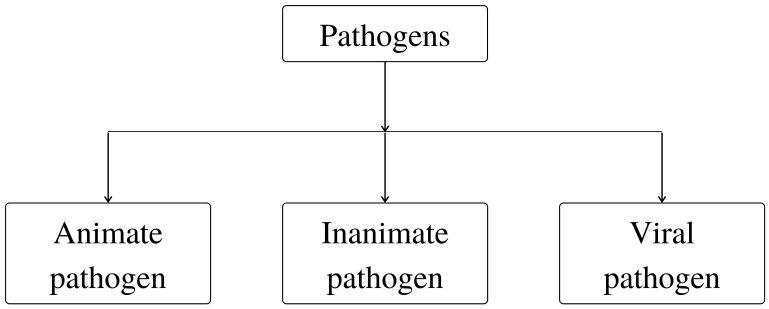

Fig. (1). Classification of pathogen.

Two types of plant diseases are there:

• Non-infectious diseases – These types of diseases aren't always connected with any animated or infectious pathogen, so they cannot be spread from an infectious agent to a healthy plant. It is mainly caused by low/high temperatures, inappropriate oxygen levels, uncertain water levels, hail, storm, air quality toxicity, *etc.*

• Infectious diseases – These are an infection caused by infectious species of bacteria in a series of environmental conditions. Microorganisms, fungus, viruses, microbes, and more bacterial infections will damage the plant.

The methodology is based on machine learning technologies to identify infectious and non-infectious diseases. The flow diagram of it is shown in Fig. (**2**), where the dataset is taken then the data augmentation process is done to add more new data and to reduce the overfitting of models, then the classification of diseases is been done by applying models like SVM, k-NN. After this, different results is been predicted for the diseases.

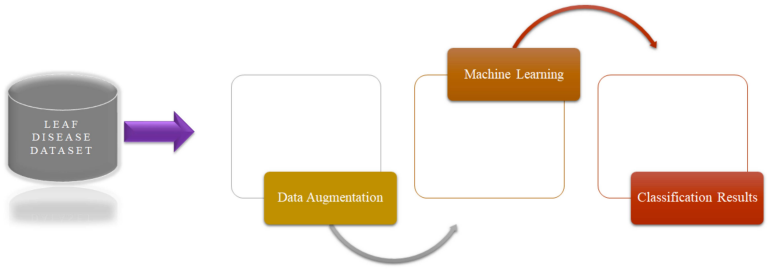

Fig. (2). Flow diagrams of classification of plant disease.

Plant diseases may be infectious or non-infectious agents, such as viruses or viroid, that cause diseases or disorders. Abiotic variables are environmental factors, such as temperature, precipitation, humidity, nutritional deficiency, *etc.* that cause sickness or disease. Table **1** shows the commonly occurring diseases and some are listed below:

Table 1. Commonly occurring diseases.

Disease's name	Caused from	Symptoms	Plant harmed
Rusts	Fungal	Orange-red, reddish, or yellow	Woody and herbaceous plant
Gall	insects	Knobs and lumps	Seen on the oak tree
Molds	Fungal	Small white grey color patches on the leaf	Mostly found on tomato plant
Curl of leaf	Virus	The leaves become thick that cause wrinkles	Mostly on peach tree
Virus	Red dwarf, mosaic, the plague of buds	Twisting, leaf discoloration	Tobacco, potatoes, soybeans, cucumbers.

CHAPTER 18

Automated Indoor Farming System with Remote Monitoring

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Abstract: India is one of the largest agricultural producing countries in the world where about 58% of its population's livelihood is dependent on it. The traditional method of agriculture requires a lot of human effort but then also we cannot assure the maximum yield from the crops due to various environmental factors. With the help of the Internet of Things - IoT we can modernize the traditional methods of farming and control the environmental factors. This not only helps the plants to get the maximum yield but also reduces a lot of human effort. This proposed system mainly depends on the information which is retrieved from the sensors as an automatic watering system waters the plant according to the data retrieved from the temperature and moisture sensor of the system and can be helped in reducing the water wastage.

Keywords: Agriculture Automation, Blynk, Farming, Indoor Farming, IoT, Remote Monitoring.

INTRODUCTION

For the past few years, the demand for building automation systems soars up, especially in offices and households. The term automation which is referred to the automation system that can mix household activities which include sensors to read the input condition and centralized the control of electrical appliances.

LITERATURE REVIEW

Arul Jai Singh explained the close relationship between innovations in embedded systems and how they help to farm, it doesn't have remote monitoring [1].

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

Chin and Audah implemented cloud agriculture monitoring and they also included a wide range of sensors, the drawback here is it doesn't have humidity monitoring and an automatic water controlling system [2].

Saraswathi developed software to use in an Android mobile, it requires a Wi-Fi connection to centralize the server. But the drawback here is the system lacks cloud Services [3].

Latha developed a "cooperative communication-based Wireless SensorNetwork", she monitored all the parameters like Temperature, Humidity, CO_2. But the system was only limited to smart agriculture, not for zone-wise farming [4].

Ayaz *et al*., made a perfect system which was named "Making Fields Talk" which had all the sensors related to Temperature, Humidity, Soilmoisture, *etc*. But the system was unable to determine air inflow and cannot control light for the plants [5].

Balachander *et al*., proposed some advanced technologies to improve the efficiency in agriculture and some vast improvements to be made in the system, But there was no chance to implement the IoT in agriculture [6].

Sambath *et al*., made a system that measures the temperature, soil moisture and controls the water inflow to the plants. It doesn't have humidity monitoring and air inflow control [7].

Sahu and Verma made an automated watering system by taking measures like the availability of water in some regions. This system mainly projects the automatic sprinkler system in agriculture [8].

METHODOLOGY

A quantitative approach was chosen for the design of the system by analyzing farming techniques and projects. Firstly, related websites, research papers, ideas, and podcasts on this topic from the last 15 years were reviewed. This gave many views on how the system can be designed. Next, the hardware used on these techniques has been assessed, and the cost and the scalability of the hardware have been reviewed.

EXPERIMENTATION

Raspberry Pi

Raspberry Pi, is often the center of the project, Collecting data from all the sensors and analyzing it in line with the program given to that and transmitting the

info to the farmer. All the sensors and peripherals used here are connected through GPIO pins on the board and programmed using python, which advances because of the fundamental artificial language for Raspberry Pi. Fig. (**1**) shows the Raspberry pi 3b+ which we used in this project.

Fig. (1). Raspberry Pi 3b+.

Soil Moisture Sensor and Water Dispenser

Almost 70 percent of the freshwater existing today is employed for agriculture. Fig. (**2**) is A soil moisture sensor is employed to detect the moisture level of the soil and therefore the water dispenser drips just barely enough water for the crop.

Fig. (2). Soil moisture sensor.

Lights

Lighting is one of the most issues in Indoor farming. a lightweight device is employed to calculate the intensity of the sunshine the plant is receiving and is monitored exploitation Raspberry pi. Fig. (**3**) showing how lighting is provided to plants.

Fig. (3). Lighting for indoor plants.

Temperature and Humidity

CHAPTER 19

An Improved Method for Diabetes Prediction through the Application of Neural Network

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Abstract: A common disease that is affecting the whole world is diabetes, and is also known as a silent killer. Diabetes affects the nervous system, retina of the eyes, kidney, heart and affects the entire system of the body. Diabetes boosts the other diseases also whenever patients suffer from them otherwise it remains in sleep mode. The foremost reason for boosting diabetes is the lifestyle of today's generation. In this paper, we have tried to predict diabetes at the primary stage by making use of a neural network *i.e*., multilayer perceptron. We have made use of the PIMA Indians diabetes dataset in our article and the experiments were performed using the Weka tool. After applying the proposed algorithm, the experimental result shows an increase in accuracy by 3% which is far better for predicting diabetes.

Keywords: Accuracy, Diabetes, Neural Network, Performance.

INTRODUCTION

One of the prolonged illnesses that research has shown in medical science is diabetes. Diabetes is a continuing ailment and is instigated due to a large amount of sugar present in the human blood. It is also called a silent killer. It generally remains in dormant mode but boosts other diseases such as kidney disease, cardiac problems, retina problems. When the amount of insulin is deficient in the human body, diabetes occurs. When there is improper digestion of blood glucose in the body *i.e*., it does not get metabolized properly. The main source of energy in the human body is blood glucose. Insulin is the hormone that is created by the pancreas to help body cells in absorbing glucose that human beings get from food. If enough insulin is not produced, glucose remains in the blood and causes diabetes. Diabetic people have to take care of the whole of their lifespan by maintaining a healthy lifestyle and can remain healthy throughout their whole life.

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

Diabetes is of three types: In type 1 diabetes, the pancreas is being attacked by body cells with antibodies that damage the organ, and enough insulin is not produced and the blood glucose remains unabsorbed. It is also known as insulin-dependent diabetes. In type 2 diabetes, an insufficient amount of insulin is being produced by the pancreas, thus increasing the sugar levels in the blood. This type of diabetes is also known as insulin-independent diabetes. Type 3 diabetes is gestational diabetes that occurs in expecting mothers. There is a condition known as a pre-diabetic condition where the amount of blood sugar is on the borderline and the absence of physical exercise and excess weight gain could be the reason for the pre-diabetic condition.

In this research article, the neural network is used to make predictions for diabetes at an early stage. A neural network is one of the machine learning techniques which learns from the data and builds the algorithm around the data. It is also known as multilayer perceptron.

RELATED WORK

Many researchers in the past have given strategies to detect diabetes using multilayer perceptron. Kaur *et al.* [1] have used an artificial neural network, linear support vector machines, kernel-based radial function and have classified the dataset into diabetic and non-diabetic people. Perveen *et al.* [2] discuss the ensemble of Adaboost and bagging by making use of J48 decision trees for diabetes classification after performing extensive experiments, Adaboost machine learning outperforms as compared to bagging as well as J48 technique. Robustness was enlarged by advancing techniques in diabetes prediction. K-nearest neighbor and Logistic Regression were used by the Selvakumar *et al*. [3] for detection of diabetes and classification of patients. By Maniruzzaman *et al*. [4], gaussian process-based classification technique is used by making use of linear, polynomial, and radial-basis kernel and a comparison was drawn against linear discriminant analysis, quadratic discriminant analysis, and naïve Bayes. Rigorous tests were supported out to find the best working cross-validation protocol. Their experiments revealed that Gaussian process-based classifier along with a 10-fold cross-validation protocol is the superlative classification technique for predicting diabetes. Mohapatra *et al.* [5] have made use of a Neural network and done testing on the divided dataset. Division of the dataset has been done into training and testing dataset and has proved that test data gives the classification accuracy of 77.5% when being divided.

The organization of the remaining paper is as follows: Materials and Methods section represents materials and methods, including dataset description, tool description, prediction algorithms, and classifiers evaluation. Results Section

represents the consequences of all classifiers applied before feature selection and enhancement in the exactness of the classifiers after feature selection. The conclusion discusses the summary of current work and future work.

MATERIALS AND METHODS

Dataset and Tools

In this research paper, we have made use of the PIMA Indians diabetes dataset which contains 8 feature attributes and 1 class attribute. Eight attributes are several times a woman is pregnant, diastolic blood pressure, diabetes pedigree function, plasma glucose concentration, two-hour serum insulin, age of the patient, triceps skinfold thickness, and last but not the least body mass index. The description of the dataset is shown in Table **1**. We have made use of weka to categorize the expecting ladies into diabetic and non-diabetic one.

Table 1. Description of PIMA Indian diabetes Dataset.

Attributes Mean	Standard Deviation	Min/Max Value
No. of times pregnant 3.8	3.4	1/17
Plasma glucose concentration 120.9	32	56/197
Diastolic Blood Pressure 69.1	19.4	24/110
Triceps skinfold thickness(mm) 20.5	16	7/52
2-hour serum insulin 79.8	115.2	15/846
Body mass index(kg/m2) 32	7.9	18.2/57.3
Diabetes pedigree function 0.5	0.3	0.0850/2.32
Age 33.2	11.8	21/81
Class	Tested Positive:	Diabetic
	Tested Negative:	Non-Diabetic

METHODOLOGY

Multilayer Perceptron: Multilayer perceptron is a feed-forward neural network [6] and it consisted of three layers. The name of the three layers is the input layer from which input is fed forward to the network, the output layer and few layers are present between the input layer and output layer which is known as the hidden layer. Input to the next coat is produced by an input layer with a linear activation function. Linearly separable problems can be solved with the help of a single-layer perceptron network [7], but the intricate complications that are linearly inseparable can't be solved with a single-layer perceptron network, to solve these

CHAPTER 20

Enhanced Study on Security Major Issues and Challenges in the Vehicular Area Network

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Abstract: Ad-hoc network is a kind of temporary network used to establish connections for a temporary purpose. The ad hoc network is a kind of wireless network. This is not an infrastructure-based network. Mobile ad-hoc networks and Vehicular ad-hoc networks are two popular areas of ad-hoc networks. VANET is the most popular network nowadays. VANET is the network on wheels *i.e*. Vehicle is considered as a node; there is no issue of power management in this network, unlike MANET networks. Further to increasing the efficiency at such high speed, various issues and challenges occur in the path of this self-organized network. VANETs present the largest real-time application but lack security, scalability, efficient routing, and clustering protocols. The main aim of the study is to focus on various issues and challenges related to security requirements in VANET, which will allow researchers to work in this field for increasing the reliability of the network. Also, various attacks are focused which show the threats in the vehicular networks because of their dynamic topology.

Keywords: Intelligent Transport Network (ITN), MANET, VANET, V2I, V2V.

INTRODUCTION

Over the most recent couple of years Vehicular specially appointed systems (VANETs) have been an intriguing issue for analysts. VANETs [1, 2] draw in such a great amount of consideration of both the scholarly world and industry because of their one-of-a-kind attributes, for example, high unique topology and unsurprising versatility [1, 2]. Vehicular ad-hoc networks (VANET) are a special case of ad-hoc networks, where the vehicle's speed is dynamic and generally considered to be a fast topology varying network so sometimes it’s difficult to maintain the communication between the vehicular nodes. So VANET protocols are defined which are not similar to Mobile ad-hoc networks (MANET). VANET is different from MANET in various cases like power limitation, topology changes or protocol implementation, *etc.* So VANET is a popular technique that

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will change the future of Car communication, as to date, the vehicle mode is more mechanical, which needs to be improvised more towards software credibility. This network works more towards the communication of the vehicles and takes all the advantage of wireless communication [3, 4] between vehicle to vehicle (V2V) and Vehicle to Infrastructure (V2I). Roadside Units (RSU) also help vehicles to forward the information to another vehicle or node.

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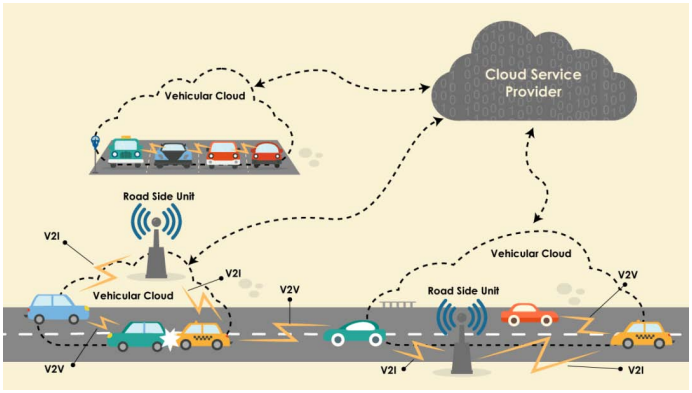

Fig. (1). VANET architecture.

Vehicular correspondence is given by the VANET which satisfies the necessities of the wellbeing as it is as creating system. The principle goal of this system is to improve well-being by trading messages between the vehicles by using remote correspondences. The state of streets, activity and diverse viewpoints which are urgent to security is an alarm by utilizing this system for the direction of vehicle stream. The transmission of data is happening in an open-access condition. The driver choice is affected by the aggressor by sending false movement cautioning

messages. This assault prompts wastage of time of the driver, vehicles fuel and even prompts car crashes.

MAJOR ISSUES IN VANET

Issues are termed as the drawbacks of the VANET network but the drawbacks are useful for further research which opens the new schemes. Some issues are related to VANET. These issues are as follows:

High Mobility

Due to high mobility [6, 7] all the nodes in the network are not able to communicate properly with each other because of the rapid movement of the vehicles. Due to mobility vehicle changes its topology and the vehicle which is selected for communication purposes will leave the network. The link between the vehicle and RSU will break and the whole network is not able to communicate under high mobility. It also decreases the efficiency of the system. In the DSMC treatment, boundary interactions are treated as collisions of either purely specular reflection type, purely diffuse reflection type, or a combination of specular and diffuse reflections, with a specific description of the energy and momentum transfer using accommodation coefficients of the reflection behavior along the tangential and the normal directions to the walls. Fig. (**2**) shows mobility in VANET.

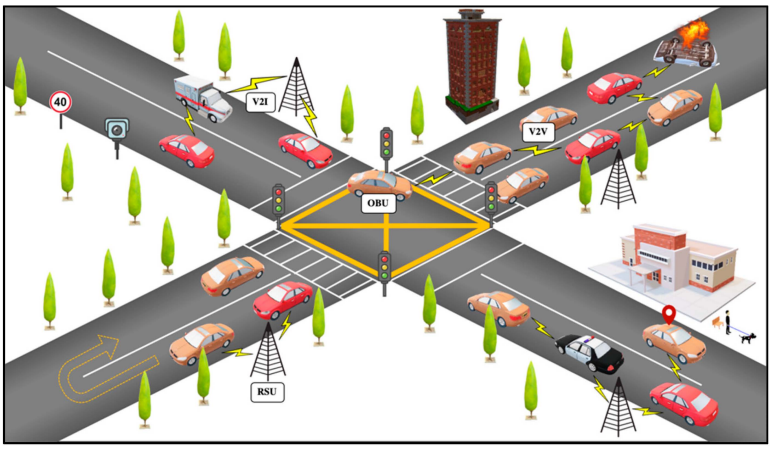

Fig. (2). Mobility in VANET [8].

Time Constraint

VANET is used for safety message delivery in case of road accidents, alternate routes, congestion, and much more. So the exact delivery time for the transmission of the information from one node to another node is difficult under

CHAPTER 21

Face Recognition Using Deep Neural Network

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Abstract: Abstract: There is rapid development in the field of image processing. Now, there are a lot of models for face recognition in the whole world. In the field of image recognition, the arrival of deep learning theory has evolved drastically. In today's world, biometric is used everywhere and the expectations from the system are that it provides positive results in any kind of situation as the quality, alignment, facial expression, and reflection of the picture make it difficult for the machine to validate it. Thus, there is an alternative model to the traditional neural network model which is Convolutional Neural Network (CNN) models which are deep learning models. This model includes the process in which at first the machine is trained with the data set and then the validation is done.

Keywords: Convolutional Neural Network, Deep Learning, Face Recognition, Machine Learning, Microsoft Azure.

INTRODUCTION

Image Processing has a significant stage named Image Segmentation [1]. As we know today's scenario, there are various projects/guides developed on face recognition using Artificial Intelligence and deep learning. Hence, Deep Learning is based widely on training and database collection [2]. Face Recognition is a difficult issue in the field of vision and biometric recognition because of different changes such as present varieties and outward appearances in face recognition the key issue is face extraction [3]. Also, it is quite unpredictable but deep learning makes it easier. Deep Learning makes facial information much accurate and improves the technology. So, a better result is achieved [3]. Also, CNN (Convolutional Neural Network) in the era of Deep Learning has been improved compared to the traditional ones based on precision, capacity, and speed of identification, clarification. To identify the face properly one first needs to be" clear the picture" in a sense to remove the blurriness. Hence, the equation to the motion blurring problem is generated [4]. CNN concentrates on highlight data of

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

the image, which can successfully lessen the element of image information, and don't have to diminish the element image information independently [5]. Computer vision-based deep learning techniques are used to recognize human facial expressions [6]. An enormous technique of figuring out the gender classification, the iris recognition, the lip, the mouth, *etc*. have been examined. Therefore, the difference between the male and female is generated through the researches [7]. In the following paper, we have discussed the following methods using Microsoft Azure, whereas the first step is collecting a database whereas for example for a single human face we collected pictures in a way that every angle and feature is visible and then the next step is the model preparation using Microsoft Azure Machine Learning software and the accuracy of the model is observed. Feature extraction is one of the major factors that is considered as a major factor as the model accuracy depends on them. Also, a histogram is prepared to check and stick to the accuracy of the extracted feature of the human faces.

LITERATURE REVIEW

The work based on CNN was used and the realization on the face was divided into two parts which are network training and implementation. Whereas the recognition speed and accuracy are specified by 99.4% [2]. The program and implementation of each feature of the face are taken by the algorithm that is prepared, the database, and the implementation done by the common face database, but the result is not always improving [3]. DNN training system, which takes a favorable position of both the SoftMax misfortune and triplet misfortune capacities, has been proposed for productive face recognition. The viability of the proposed DNN preparing structure on the LFW dataset and four distinctive face datasets [4]. Also, the designs of both DNN and CNN were compared based on the performance and the quality in terms of the recognition rates. The face is being recognized in a way that it was taken in the real-time facial expression with emotions *etc*. and hence the recognition rate was specified [6]. The classifier determines the Euclidean distance between datasets using the K-Nearest Neighbor algorithm [8]. The local features are used to recognize the objects [9].

METHODOLOGY

Azure Machine Learning Studio (AMLS) is an Azure-based software. Azure is Microsoft's Cloud service. In 2015 Microsoft introduced AMLS, which is too new a technology. With AMLS, machine authorization models are exploited, verified, and used. Some identical technologies are Google Cloud Machine Learning Engine and Amazon Sage Maker. Getting started with the use of AMLS, one

needs to have a Microsoft Account. You can create and analyze all types of non-Azure models subscriptions.

Model Description

Creating what is called a prepared data is a tedious process. Specific modules of preprocessing data are added to the raw data. It takes a long time to create prepared data from raw data. It may take a long time to select the raw data. The algorithm of the machine to run is selected by the data scientist. It also decides on the data aspects being prepared for use, and ultimately examines the outcome. The ultimate aim is to evaluate the composition of the algorithm of machine learning and trained data that provide the most valuable results. Fig. (**1**) represents the process of Model building and execution.

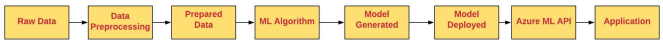

Fig. (1). Process of model building and execution.

For the creation of the model. Following steps must be taken and are shown in Fig. (**2**).

Fig. (2). Block diagram of the process.

Import Data

The feature excel sheet that is generated is provided to the model as input. In the paper, the features are taken from the image analyzer tool in MATLAB.

Selection of Columns in the Dataset

The features that should be taken from the excel sheet is sorted out and are then processed further.

Split Data

The data and the features that are selected from the above set are then split for the training and testing of the model. Further, the datasets are divided into train, test, and validate the model.

CHAPTER 22

A Review on Implementation of Cloud Security in the Aadhar Card Project

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Abstract: Demands of Cloud computing have been increasing these days and becoming more prevalent in the field of Information Technology. It has been able to provide solutions to various markets in the IT sector. In this paper, we will discuss a cloud computing case study on Aadhar cards that were to be provided to all the citizens of India. This major project included cloud computing technology and due to handling of confidential data, the security needed to play a vital role. Though the cloud is a secure platform there are still some challenges that need to be encountered for the data to be saved from external and unethical attacks. So this paper discusses some solutions to the given problem of handling security on the cloud and how to overcome challenges and issues faced on the cloud.

Keywords: Aadhar Card, Cloud Security, Cryptography, Data Security.

INTRODUCTION

Cloud computing is a very fast-growing technology and will be covering around the maximum of the growing market. As cloud computing is becoming the demand of the market, security follows automatically. The only question that comes with the cloud is whether the data is secure on the cloud or not. Cloud security is a major concern of all and therefore some security measures are being adopted these days. Cloud is basically of three types namely public, private, hybrid [1]. All three types of clouds have different security issues and challenges. Further, the cloud is known to provide three types of services namely IaaS, PaaS, SaaS [1]. These three types of the environment being provided by the cloud service providers have different security issues. IaaS is known to have multi-tenancy issues, SaaS is known to have password issues, and PaaS is known to have encryption issues. Further, the major issues faced by cloud computing tech-

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nology these days are confidentiality, integrity, availability, and Privacy. Confidentiality is maintaining privacy. Privacy in the sense of how secure the data is from attacks, breaches, or in a simple way, no unauthorized person gets access to the data in any way, let it be by any internal or external to the organization. Integrity demonstrates there should be no change in the data like if one sends the message ABC then it should not be received as ABX. This is how integrity gets affected. Availability shows whenever the data is required it should be available in a proper format as it is. Like if I need any data kept on server A then also if server A does not respond, the data should be available and as you know the cloud is known for its backup and recovery due to large data centers situated worldwide, it is also known for high availability. Many centralized data centers are known to store data but it is costly and sometimes if it fails the data becomes unavailable and this may pose a threat to security. This is solved by the high availability feature provided by cloud computing [2]. Multi-Tenancy issues are sharing the same space/infra by different customers [3]. For example- there is a flat system, in a flat, every family is given a different home but the security, water, electricity is provided by the same source. Privacy is very different from confidentiality, as any data may be personal and can't be shared with others. This is privacy in which one needs to keep all the information private.

LITERATURE REVIEW

Aadhar card in India has been a major project that requires a large amount of data to be handled. Aadhar card is known to give the complete details about the citizen, so it contains highly confidential data [4]. Moreover providing Aadhar cards to all the citizens of India has been a major and challenging task. So cloud computing has always been a solution to such a wide task. Due to the linking of bank accounts of people(Number of adult Indians with bank accounts rises to 80% of the population known to have bank accounts in India) [5] and other applications, the task has become more challenging. This will have also led to the opening of more bank accounts in rural India. For managing all the tasks, there has been a requirement of cloud computing. Due to the data being confidential, cloud security is of utmost importance. Along with the implementation of cloud-based environments for storage and security, a lot of tasks become easier. For example. counting of votes [6], linking of common data with the help of the Aadhar card-based approach. The cloud environment is also known to have some challenges. Due to these challenges the cloud security may not be reliable. Though the cloud itself is known to be a highly reliable technology there may be some challenges that may alter its features and the clients might not find the data on the cloud to be secure.

Fig. (**1**) depicts the three deployment models -Public cloud, private cloud, hybrid

cloud, and community-based cloud. Along with the deployment models, service models are also depicted- Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). Above the layer of service models, it shows the essential characteristics of cloud computing like Broad Network Access, Rapid Elasticity, Measured Service, On-Demand Self-Service and Resource Pooling.

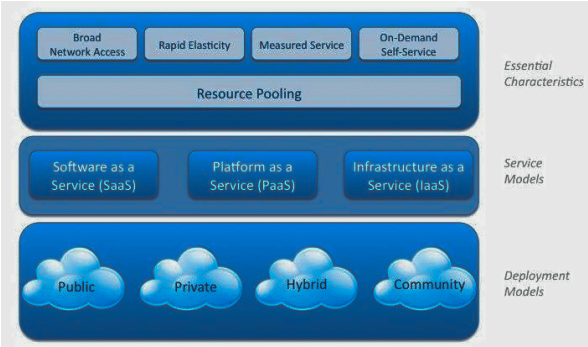

Fig. (1). Visual model of cloud computing platforms with services and characteristics [7].

Isolation failure is also one of the concerns wherein sharing of resources in a multi-tenancy cloud environment is a problem while implementing cloud for highly confidential data. Other issues may be related to guest hopping attacks [3].

Aadhar is known to link all the details from your bank account, your pan card, your fingerprints, your retina prints, so it contains a lot of private data where maintaining confidentiality is very important.

Data privacy and data protection have been a right of every citizen of the country provided by law [8]. Therefore maintaining data privacy is very important in the case of Aadhar.

METHODOLOGY

There can be many solutions to the issues discussed above, but some of them are mentioned below. The most important solution of all is to always choose a trusted cloud provider. Trust is a very important aspect where one should never compromise. Backup should always be kept for ensuring the availability of data. Whenever data may not be available there should be a backup plan to recover all the data. At the end of everything, data is of utmost priority to any organization as well as any person who is an Aadhar cardholder. The data should always be stored and transferred in encrypted form. These days many cryptographic algorithms are being developed to ensure the privacy of data. PKI (public key infrastructure) is a very common technology that uses a concept of a key pair. The pair are known to

CHAPTER 23

Early Detection and Classification of Breast Cancer Using Mammograms by Machine Learning

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Abstract: Machine learning-based classification of breast cancer and its detection is possible without toxic therapy by a well-trained model. The machine learning model detects features and patterns form the data sets that used when training model which is useful for detecting tumor and classify whether it is a benign or malignant and this process simplifies the cancer detection and gives results accurately at a faster rate when compared to the other traditional methods like Magnetic resonance imaging (MRI), Coronary artery disease (CAD), Modalities using ultrasound, *etc*. Here I am proposing a new technique through which breast cancer can be easily detected by a proper training model with the help of few classifying algorithms in this research a good set of data is used for training classifier machine algorithms in Microsoft azure by comparing all those five algorithms accuracy and working these are the five algorithm models are 2-class Support vector machine, 2-class Neural Networks, 2-class Boosting Tree, 2-Class Logistic Regression, 2-Class Bayes Point and acquired better results which can lead and helpful for detecting cancer in future by using machine learning and deep learning techniques.

Keywords: Benign, Deep Neural Networks, Malignant, Modality, Simple Neural Networks, Tumor.

INTRODUCTION

A machine learning model learns by identifying patterns which is a very important and crucial phase while creating a model by which the system is faster and accurate. The selection of features and detecting patterns is done by the known training dataset. In this paper, the model is trained by various machine learning algorithms to compare their accuracy and proposing the best algorithms which are used for predicting tumors for better results. The model is capable of predicting breast cancer at an early stage by using mammograms deep neural networks, simple neural networks, automating breast cancer detection, *etc*. The

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research is focused on improving breast cancer screening by using the best techniques from the pool of the comparative analysis to find an efficient way to increase the accuracy rate of breast cancer detection keeping in mind that only limited datasets are available.

PREVIOUS WORK

The mammography is the essential test used for screening and early recognition, and its assurance and preparing the advisers for improve bosom disease discovery. In 5593 females age thirty to sixty-nine years observed from 1995 through 2005, 896 event invasive breast cancers were recognized. 50 years is the average age at diagnosis [1]. Based on Relative Ricks from the Black Women Health Study model, the predicted risks for the calculation of fair risks are 0.73 of women who are around the age group of forty-nine a long time and 0.70 for ladies age 50 to 69 years [1]. Additionally serves as an effective examination of computerized mammograms reliant on surface division for the analysis of beginning time tumors, There changed into desirable arrangement among anticipated and decided number of bosom tumors fundamental (anticipated to-found proportion, 0.96; 95% CI, zero.88 to one.05) and in most peril segment classes. Oppressive exactness turns out to be better for females whose age is 50 years (zone beneath the bend [AUC], 0.62; 95% CI, 0.58 to0.65) than for women age ≥ 50 years (AUC, 0.56; ninety-five% CI, 0.53 to 0.59). Utilizing a 5-yr expected threat of 1. 66% or extra as a cut point, 2.8% of ladies younger than 50 years of age and 32.2% of women ≥ 50 years of age were sorted as being at raised danger of obtrusive bosom most cancers [2]. Bhupendra Gupta and Anuj Kumar Singh displayed the recognition stage pursued by the division of the tumor locale in a mammogram picture by using fundamental picture preparing strategies, for example, averaging and edge techniques [3]. The proposed strategy is basic and quick as a result of utilizing not many picture preparing strategies and is additionally be useful in other clinical imaging applications, design coordinating, highlight extraction [4] in comparison to past investigations that utilized SVM characterization that utilization basic first-request measurements highlights. Then again, with Neural Network-based classifiers, past examinations showed that computationally more costly highlights give similar outcomes to what we arrived at. Future adding the miniature calcifications (MCs) and utilizing the modern classifiers, like ANN and RBFNN, a Max-Mean and Least-Variance method for tumor recognition is moreover given by [5]. The Euclidean distance between datasets is computed by using KNN [6]. The features extracted from the image involve object recognition, registration, and recognizing parameters [7].

METHODOLOGY

To upgrade bosom disease deduction and endurance, early location is fundamental, which incorporates two early discovery methodologies for bosom malignancy: early finding and screening. Early analysis centers around giving ideal admittance to disease treatment by identifying mass (benevolent or threatening) through screening instruments like mammography. There are various markers of bosom malignant growth, like twisting of the state of the bosom disease, yet these are less demonstrative. There are two head groupings of mass. One is alluded to as benevolent (gentle) and the other as dangerous (compromising). A kind-hearted tumor is a tumor that doesn't assault it's including tissue or spread around the body, it is round or oval. A dangerous tumor is a tumor that may assault its enveloping tissue or spread around the body; it has irregular boundaries and is partially round in shape. Also, malignant tumor emerges whiter than neighboring tissues. It is the 2nd most driven reason for deaths among women, globally. It is a kind of cancer that forms in the breast tissue with the main observable symptom that is a lump that feels irregular from the remaining tissues.

In Fig. (**1**) there is a pie chat which shows the ratio between the deaths which are caused by all other cancers *i.e*.87% of deaths are caused by other cancers whereas 13% of deaths are caused by Breast Cancer.

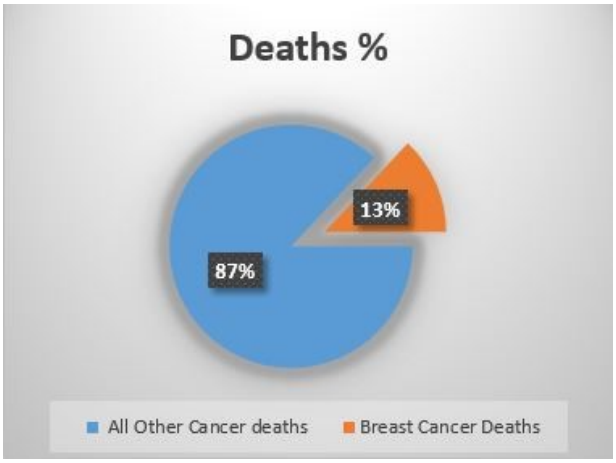

Fig. (1). The deaths ratio due to other cancer and breast cancer.

In the past years, research in breast cancer diagnosis has chiefly centered on the advancement of the computer-aided system (CAD) to help radiologists in the analysis. Conventionally, mammography depended closely on hand-engineered components of CAD system which indicated bounded accuracy in complex

CHAPTER 24

Face Emotion Recognition by Machine Learning

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Abstract: Detection of Facial expressions and emotions is always an easy task for humans but to achieve the same task using different computer-based algorithms is a challenging task. It is possible to detect emotions from images using various machine learning algorithms as there is a huge advancement in computer vision and machine learning over the years. Programmed face appearance acknowledgment is an effectively arising research in Emotion Recognition. In this paper, the Convolutional Neural Network (CNN) which is a subset of AI is rehearsed as a way to deal with outward appearance acknowledgment tasks. Thus, the proposed method is found to be more effective than other methods and has an accuracy of 92. Face appearances are the vital qualities of non-verbal correspondence. Non-verbal explanations are imparted through outward appearances. Face looks are the delicate indications of the greater correspondence. Nonverbal correspondence implies correspondence among people and animals through the eye to eye association, signals, outward appearances, non-verbal correspondence, and paralanguage. Human facial expressions can be recognized by using deep learning.

Keywords: Convolutional Neural Networks, Deep learning, Z Face Emotion, Machine Learning, Recognition.

INTRODUCTION

Facial inclination affirmation is the route toward distinguishing human sentiments from outward appearances. The human cerebrum sees sentiments normally, and programming has now been developed that can see emotions. Facial feeling acknowledgment is an assignment in artificial intelligence (AI). This issue has grown as a fascinating subject of exploration concerning late occasions. Facial feelings are a sort of non-verbal method of correspondence which passes on the temperament of any individual. There are numerous kinds of facial feelings like cheerful, dismal, outrage, disappointment, dreadful. It has numerous applications in different fields, for example, advanced mechanics, drugs, driving help frameworks, lie finder tests. Face discovery and Recognition can be utilized to

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improve access and security. The application of Convolutional Neural Networks (CNN) for facial feeling acknowledgment. CNN is generally utilized for picture grouping and gives the best result among all the strategies.

PREVIOUS WORK

The Facial Action Coding Systems (FACS) being among the generally utilized techniques). This technique assembles one classifier for every conceivable gathering of impediments [1]. Entropy-based element determination technique applied to 3D facial element separations is introduced for an outward appearance acknowledgment framework characterizing the looks into 6 essential classes dependent on 3-Dimensional (3D) face calculation [2]. This facial express acknowledgment framework is fabricated utilizing the Facial Landmark to get the demeanor highlight [3]. A proposed technique that breaks down the neighborhood highlights of outward appearance removed by Gabor wavelet change and plays out the different dimensional decrease on the issue of highlight excess, which adjusts the element measurement and the commitment pace of the component [4]. To begin with, in the base level, the facial element focuses on every facial segment, *i.e*., eyebrow, mouth, and so on, catch the nitty-gritty face shape data. Second, in the middle level, facial action units, portrayed in the facial activity coding structure, address the pressing factor of a particular approach of facial muscles, *i.e*., top tightener, eyebrow-raiser, and so on. Finally, at the undeniable level, six prototypical outward appearances address the overall facial muscle improvement and are usually used to depict the human inclination states [5]. Programmed examination of human facial expressions is one of the difficult issues in insightful frameworks and social sign handling. The calculation plots a face model chart dependent on outward appearance muscles in each edge and concentrates highlights by estimating facial diagram edges' size and point varieties [6]. For outward appearance acknowledgment, the local binary point highlight is a significant method of the surface component, yet ordinarily, the entire picture is taken as removing territory, overlooking to separate the key territories of outward appearance [7]. The local features also play an important role during image recognition [8]. It is also observed that a convolutional neural network is better in terms of producing better accuracy [9].

METHODOLOGY

The first and the premier advance in the undertaking is to gather the example pictures to prepare the model. The dataset comprised pictures of the apparent multitude of seven feelings that are glad, miserable, irate, impartial, energized, appall, and dread. The dataset being utilized is Yale Face Database B that contains 16128 pictures of 28 human subjects under 9 postures and 64 brightening

conditions. The information configuration of this information base is equivalent to the Yale Face Dataset B. The features are extracted from the images using MATLAB. The samples are transformed from RGB to grayscale and from grayscale to binary during feature extraction. The seven unique features are stored for further processing using Microsoft Azure. This paper proposes a visual interface-based AI model for the prediction of human outward appearances acknowledgment. The preparation dataset comprises the zone, significant pivot length, minor hub length, border, unconventionality, Euler number, direction, and equal breadth. Most importantly, the preparation datasets are transferred to the model. The data which were missing in arranged datasets is substituted with the mean worth. The datasets are essential for two segments: one for the preparation and the second for the testing. For preparing, 70% of datasets are used, and the leftover 30% were utilized for the approval and testing of the model. Fig. **(1)** represents the proposed technique. It includes essentially three significant advances: creating a new model, model testing, and built-up for the new model

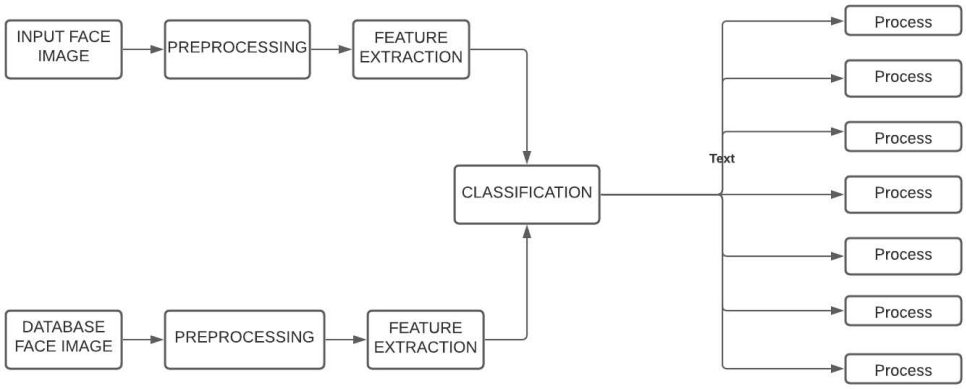

Fig. (1). Proposed method.

From providing our sample data to our output extraction there are four steps in between which are shown in Fig. **(2)**. The data is preprocessed then features are extracted from it then the machine learning algorithm and azure machine learning API work on it and then we finally get our output. shows a sample image taken from our dataset. The image is of angry emotion. Similar images of different types and emotions are used to train our model. The advancement of deep learning, a branch of machine learning has aroused interest in its application to fuel the accuracy of cancer screening of medical imaging problems. Fig. **(3)** shows the sample images of experiments from datasets. Research reveals that most practiced physicians can determine malignancy with 77 percent exactness while 92 percent

CHAPTER 25

A Review on Nanogrid Technology and Prospects

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Abstract: Global energy demand is expected to climb about 25% by 2040. This will be a challenge for the national power grid. Distance between generating stations and consumers is also another concern that may lead to more line losses and reducing the efficiency of the power system. This increasing demand leads to complexities in a national grid with increased demand for reliability, security, and environmental concern. The solution to the above challenges and requirements is the new structure of the power system known as the "Nano grid". A nanogrid can be considered as an electrical generation and distribution system, which is a building block of small loads, two or more distributed generations (DGs), and the ability to connect or disconnect from the utility grid. In this article, an overview of Nano grid technology with its advancement and the prospect has been presented.

Keywords: Distributed Generation (DG), Nano Grid, Power Grid, Renewable Energy (RE).

1. INTRODUCTION

Due to exponentially increasing demand from consumers, the national power grid is facing several challenges. This is not a single challenge in front of the centralized power grid. Distance between generating stations and consumers is also another concern that may lead to more line losses and reducing the efficiency of the power system. Environmental conditions like heavy rain, wind, *etc* may lead to a power system failure and hence the power outages. Centralized grid generating stations are dependent on fossil fuels which are responsible for the degradation of the atmosphere. In addition to the above, power supply to remote areas is one of the big tasks. To respond to 21st centuries electricity demand, it is

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required to design a new structure of power system which will reduce the burden on the national power grid. Distributed generation is one of the solutions to the above problems, which can generate power close to its point of consumers [1]. Photovoltaic, wind power these renewable energies (RE) sources which are omnipresent with the advantage of low carbon footprints and wide distribution comes under the DGs. One of the problems associated with renewable energy sources is their intermittent nature [2]. Output power developed by the photovoltaic module or the wind turbine is dependent on the availability of sunlight and wind respectively. Hence output power will be fluctuating and the power system has to deal with uncontrollable generation and demand. Consumers demands uninterrupted power supply and due to this intermittent nature consumers have less attention in investing into RE. Another problem associated with RE sources are high installation cost and the different energy policies related with RE [3]. To overcome these inadequacies and to bring consumers' attention towards investment in RE, a control structure is to be developed for balancing between the production and consumers' demand. In recent years such a new structure in the field of research is microgrid (MG). It is a low-voltage distribution power system, which is composed of small generating units, which may be renewable energy sources, other distributed generators, and battery energy storage systems are connected to fulfill the load demand [4]. MG can be integrated with the main grid or can be operated in off-grid mode. Another structure that is further developed and small version of the microgrid is known as the “Nano grid”. Hence Nano grid is lower power and has fewer complexes than the microgrid. A Nano grid can be considered as an electrical generation and distribution system, which is a building block of small loads, two or more distributed generations (DGs), and the potential to connect or disconnect from the national power grid [5]. Nano grid is the important cornerstone of the future smart grid.

Nano grid is a recent topic in the field of research and research is going on in various areas like nanogrid control, nanogrid hardware, power quality, future development of nanogrid, *etc*. This paper will discuss an overview of the Nano grid concept, types of Nano grid Technologies, and their structure. It will also discuss new technologies and research in the Nano grid and the future scope of research.

2. NANO GRID CONCEPTS

It is difficult to define the electrical power system due to changes in opinions and structures. According to [6 - 8] Nano grid is similar to that of the microgrid. So we will start our discussion with similarities between nanogrid and microgrid. Not only microgrid but also nanogrid is a power distribution network. Another

analogous point is both can operate as AC, DC, or in hybrid mode. A microgrid can operate in off-grid mode and grid-connected mode which is again true in the case of the Nano grid. To differentiate nanogrid from microgrid one should focus on the load which is to be connected. The concept of nanogrid is limited to a single house or building while microgrid extends to interconnections of multiple nano grids.

2.1. Nano Grid

By taking the reference of information given above nanogrid can be defined as A nanogrid is the distribution network of the power system for a single house or a building for load up to 20kW, with the potential to connect and disconnect from the national grid [5].

2.2. Structure of Nano Grid

The fundamental structure of nanogrid is shown in Fig. (**1**). It includes the following building blocks:

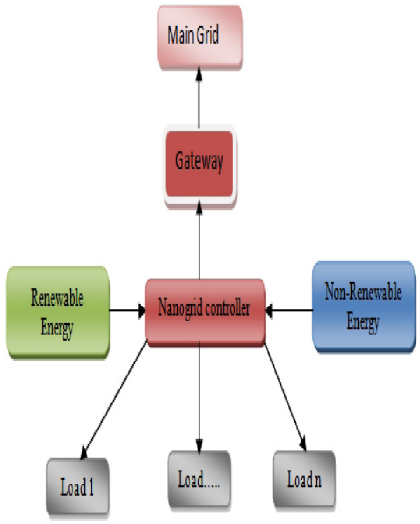

Fig. (1). Nano grid block diagram.

2.3. Distributed Generators

In the case of the nanogrid it is possible to generate the power close to the point of consumers which is known as Distributed Generation (DG) [9, 10]. It consists of both renewable and nonrenewable energy sources. Renewable energy sources are

CHAPTER 26

Dual Factor Authentication Bank Locker Security System

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Abstract: The foundation aim of these Projects is to increase the storage security of bank lockers based on fingerprint Sensors and Shocking mechanisms with the help of a One-time password. These systems may help the bank to attract more customers by the use of high security and smart locker system. In this framework, there is a requirement to verify individuals to recuperate the reports or cash from the storage spaces. In this security framework, unique finger impression and OTP are utilized. The first individual's fingerprint and mobile number are registered with the system. After that whenever a user will scan their finger with the system, it matches the stored print with the print received after scanning. In case the print matches at that point four-digit code will be sent on approved individual versatile to open. So biometric and OTP security are points of interest than other frameworks. This system will have an attached vibration sensor, to detect in case someone tries to hammer or break the locker. On detection of any such activity alert, there will auto-generated messages will send to high authority persons on individual's number. Also, the system goes to freeze mode and is activated only when a valid finger is scanned.

Keywords: Finger Print Sensor, GSM, Microcontroller, Motor Driver, Vibration Sensor.

INTRODUCTION

In the present scenario, well-being and safety have turned into a fundamental issue for the vast majority of individuals, particularly in the provincial and metropolitan territories. A minority of people attempt to betray or take over the property that can imperil the protection of the bank's cash, house, and office. To overcome the safety threat, the majority of individuals will propose a bundle of locks or caution framework. A variety of alert systems are accessible from the market which uses diverse sensors. These sensors can determine the changes occ-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

urring nearby and the development is controlled by an alarm according to pre-set worth. Over time, this framework might not be used continuously. In this research article, we emerged security of cash in bank's locker, house or office by employing biometric and GSM technology which is much cautious than other systems. In Ref. [1] biometric frameworks utilize an individual's actual qualities (like fingerprints, irises, or veins), or social qualities (like voice, penmanship, or composing musicality) to decide their character or to affirm that they are who they guarantee to be. In Ref. [2] biometric information is exceptionally novel to every person. Talking about fingers prints they are one of the numerous extraordinary biometric marks which we can use to distinguish individuals precisely. In Ref. [3] However, holding someone's hand and gazing at their fingers aren't useful as we are bad at this. Be that as it may, PCs are acceptable at perceiving and coordinating examples exceptionally quickly and precisely. Before we can handle a unique finger impression design with a PC, we should "catch" it. There exist numerous strategies to digitize fingerprints; from legal techniques to ultrasound examining. R307 is an image-based mark scanner element from the R30X arrangement delivered by Hangzhou Grow Technology Co. Ltd, a Chinese merchant. Multiple types of sensors in this arrangement are capacitive sensors *viz.,* R300, R301T, R302, R303, R303T, R305, R306, R308, and R311.

Background Work

In these, we briefly introduce the previous works carried out by various researchers. Few papers in the market already worked on smart lockers Systems. S.V Tejasvi work in the smart security system by the use of fingerprint OTP by using AT89S52 microcontroller in our work we have used ATMEGA2560 and also add to more security like we are also adding one shocking mechanism where if anyone tries to harm the main door the vibration sensor senses the vibration and shocking mechanism get enable with these 220v voltages will directly give to the door so if anyone tries to touch the door they get shocked and also we add one freeze system with these if anyone tries to breach our security system our system get freeze [3]. For example, Some non-User try to enter the locker without permission the system will freeze by itself and the system will get unfreeze by the only person it can be the security head or Branch manager. These things will make add more sacristy to our bank security system. After System gets unfreeze the shock mechanism will get low command and the Shock mechanism will get disable. Our system will get back to the normal smart security locker.

Proposed Work and Methodology

The Dual factor authentication bank locker security System consists of database enrollment, data scan, data Delete, and verification. First, the client will enlist his

client Name and his portable number in the framework data set through framework programming then the individual will put a finger on the unique mark module finger impression will be output and store with a finger id. In this manner, the client enrolment cycle will be finished [4, 5]. At that point client will perform login activity during login activity client will initially scan his impression and in case it, then OTP will be sent on a versatile number of the client which entered during enrolment through GSM. Then the client will punch the code through the keypad if the code gets coordinated, the storage will open and LCD will show access conceded. In case the fingerprint doesn't match an alert message will be sent to the client's number saying "someone trying to open the locker", thus alerting the client. Also, the vibration sensor attached will sense any kind of hammering or attempt to break the locker and notify it to nearby police station and client. Also, it will freeze the system functionality until a valid finger is scanned.

Enrolling: In these first, the user will get enrolled in our system by adding their fingerprint and contact number. All the details and data are saved by our system which will future use when the user will coming to open their locker.

Delete Our old users which will discontinuous our services these will help to erase their data like fingerprint and contact number from our system for their security purpose. And also help to increase the efficiency of the system so in future they don't try to breach our security.

Scan: This is the very first step toward the locker system where the user will put their finger in the figure print scanner and our system will scan the user figure if the user is a registered user then they will get access to the second step which is OTP system. If the user will not register our system will show that you are a non-user Please get enrolled your id in our system to get access the locker.

Related Work

In this section related work is discussed below and it is shown in Fig. (**1**), first, the client will enlist his client Name and his portable number in the framework data set through framework programming then the individual will put his finger on the unique mark module finger impression will be output and store with finger id. In this manner, the client enrolment cycle will be finished. At that point client will perform login activity during login activity client will initially scan his impression and in case it, then OTP will be sent on a versatile number of the client which entered during enrolment through GSM [6]. Then the client will punch the code through the keypad if the code gets coordinated, the storage will open and LCD will show access conceded. In case the fingerprint doesn't match an alert message will be sent to the client's number saying "someone trying to open the locker",

CHAPTER 27

In Silico Identification, Analysis, and Prediction Algorithm for Plant Gene Cluster

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Abstract: The concept/phenomenon of operons, which are organized genes that work in a coordinated way in microbes, is well established. Recent developments in genetics, biochemistry, and bioinformatics have unraveled similar gene arrangements in plants. Here we aim to develop an algorithm/tool which would help us detect and identify biosynthetic gene clusters (BGCs) from any input plant genome. Through this tool, we intend to match or supersede the performance of pre-existing sting tools for BGC prediction, like the popular plantiSMASH. The predictions models were developed using the machine learning tool WEKA using the physicochemical properties as data set to classify between terpene synthases and non-terpene synthases. A set of ten physicochemical properties were selected and their values were predicted for each of the 159 proteins (terpene synthases and non-terpene synthases) Employing the random forest and SMO classifiers, we were able to obtain significantly promising accuracy of over 90 percent with 66 percent percentage split testing. Accurate prediction of BGCs in the plants, especially the major food crops like rice, wheat, and corn revolutionize farming and nutrition for the better.

Keywords: Algorithm, BGC, Mining, PlantiSMASH, Random forest, SMO WEKA.

INTRODUCTION

Metabolite gene cluster discovery techniques are improving at exponential rates which have opened up avenues of endless possibilities in the field of plant biology and natural product discovery. Improved farming (allelopathic interactions), drug discovery, better nutrition, and synthetic biology are only a few of the promising areas [1]. With over 20 wild varieties cultivated around the world, rice(Oryza *Sativa),* a member of the family Poaceae and genus Oryza, is one of the most

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

popular and staple food crops in the world. *Oryza sativa* and *Oryzaglaberrima*are the most cultivated out of all the rice varieties. Sativa variety is a global favorite while glabberima has been around for over 3500 years, originating in West Africa. Rice species could be diploid or triploid with n=12 and *Oryza sativa* or *Oryzaglaberrima* L. are diploid species (2n = 24). Complete sequencing of the Asian cultivated rice genome has been performed and it was the first food crop to be the whole genome sequenced [2, 3]. A group of genes in the DNA of a particular organism is called a gene cluster when they collectively work in the production of protein or enzyme [4]. These genes are usually regulated by the same promoter region. BGCs produce two types of enzymes in general, signature enzymes produced by the signature genes of the BGC and tailoring enzymes produced by the tailoring genes of the BGC. Tailoring enzymes get produced first which in turn enter a cascade of reactions accelerating and catalyzing the production of the signature enzymes, which is the bigger, complex. In some gene clusters where there is the formation of enzymes. There are steps in which the formation of enzyme takes place. First, there is the synthesis of enzymes known as tailoring enzymes which helps in catalyzing as well as accelerating the processes to form the main enzyme which is a bigger and more complex molecule known as the Signature enzyme [5]. In this project, we are aiming to develop a universal cluster prediction algorithm using terpene synthase gene clusters as the reference and classifying genes into Terpene synthases and non-terpene synthases based on the distribution of selected unique physicochemical properties. Random forest and Sequential minimal optimization (SMO) [6, 7] classifiers were employed for the development of the machine learning model in the WEKA tool.

METHODOLOGY

Collection of Data

We have collected FASTA [8] sequences of Terpene synthases and non-terpene synthases (negative control), across the plant kingdom. UniProtKB database was used for the retrieval of the relevant data. Around 80 terpene synthases and non-terpene synthases each were gathered for this study. Fig. (**1**) shows the flow chart.

Selection and Prediction of Features

A total of 10 physicochemical properties were selected. They were Length, Molecular weight, Isoelectric point, Instability index, Aliphatic index, Hydropathicity Charge at pH 7, TMindex, Solubility, Extinction coefficient. Following web servers were utilized for the prediction of these features where the FASTA sequences of the proteins were fed as input.

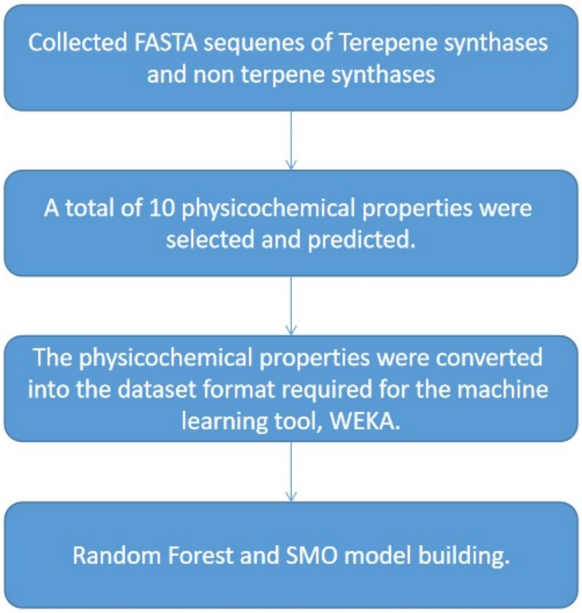

Fig. (1). Flow chart.

- ProtParam by Expasy: Chain length, molecular weight, PI, instability index, aliphatic index, GRAVY (Hydropathicity) https://web.expasy.org/protparam/ [9].
- PROTEIN CALCULATOR v3.4: Charge at pH7 http://protcalc.sourceforge.net/
- TM predictor: TMindex http://tm. life.nthu.edu.tw/
- Protein-sol: Solubility https://protein-sol.manchester.ac.uk/ [10].
- PepCalc.com-Peptide property calculator by INNOVAGEN: Extinction coefficient https://pepcalc.com/

Preparation of Data Set

The physicochemical properties were converted into the dataset format required for the machine learning tool, WEKA [11], which was used in this project, where classes were terpene or non terpene. The data set was saved in .arff format and explored through the WEKA tool for model building.

Model Building

Loaded with several algorithms such as Bayesian Network, SVMLib, Artificial Neural Network (ANN), Nearest Neighbor (IBk), Random Forest, *etc*, Weka is a convenient machine learning tool. For this study, we developed Random forest

CHAPTER 28

Papaya Seeds: Treasure of Nutrients and a Promising Preservative

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Abstract: Papaya is broadly known for its taste and medical advantages yet very few individuals know about the massively helpful Papaya seeds that are by-products of fruit and are generally discarded. These small round black seeds are edible and useful for our wellbeing whenever taken in a restricted amount. Their reuse will be useful not only for the economy and environment rather; it will prove to be a ray of hope for the food industries engaged in the search for plant-based food ingredients to enhance the nutritional status of functional foods. In this review, we have discussed the composition, medicinal properties, its utilization as a nutritive agent, and a promising preservative.

Keywords: Bio-Actives, Fruit Waste, Functional Foods, Papaya Seeds, Value-Added Products.

1. INTRODUCTION

Papaya is one of the affordable, nutritionally, and medicinally important fruit which belongs to the Caricaceae family. It is the third globally cultivated plant that grows wild in the Torrid Zone and excels on almost every kind of soil in the tropical rain forest. It was originated in southern Mexico and Costa Rica but now it is cultivated in many other countries [1]. It is low in calories and loaded with phytochemicals that help in keeping our bodies healthy. It is a rich source of various sorts of enzymes. Papain, vegetable pepsin present in the fruit helps to reduce digestive problems [2]. In this way, it is nothing unexpected that the high consumption of this fruit for various health benefits generates a large number of wastes. Papaya's major byproducts are peel (PP) and seeds (PSs) and these wastes consist of approximately 20-25% of total the weight of the whole fruit. PSs are not waste as they consist of many valuable bioactive such as crude protein, fatty

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

acids, crude fiber, carpaine, caricine, papaya oil, glucotropacolin, and an enzyme myrosin. Despite having so many benefits, they are dumped in garbage cans. As they are high in moisture and microbes, their improper disposal can cause serious environmental problems [3, 4]. However, these nutritionally important seeds should be reused as food additives so that their recovery could be beneficial for health, economy, and environment. Therefore, there is a need to think of processes that will empower us to reuse seeds to produce commercially successful products. In this review, we are going to discuss a portion of those researches, featuring utilization of these losses as an important food ingredient and a promising preservative.

2. PAPAYA SEEDS AS FOOD ADULTERANT

PSs have been used to add bulk in black pepper for many years. To identify and separate it from black pepper, many studies have been done, in which researchers have emerged victorious [5]. However, papaya seeds are not only food adulterant but it is also a treasure of nutritious elements in itself which we will study in the upcoming sections of this review.

3. PHYSICOCHEMICAL COMPOSITION OF PAPAYA SEEDS

To get the most out of it and make maximum use of PSs, it is vital to have total information about its chemical composition. Tang *et al*. (1978) published one paper on the composition of PSs; in this research defatted PSs were taken for observation. Results showed that PSs contain 32.97% oil content, 40% crude protein, 48.9% crude fiber, 6.86% ash content, 1.11% fatty acids and minerals such as P, K, Ca, Mg, S, Mn, Fe, and Cu. A major fatty acid present in abundance was oleic acid with 71% and some toxins were also detected. The amount of benzyl-ITC content present in seed oil and benzyl glucosinolate present in seed meal was 0.56% and 1.86% respectively [6]. In another study conducted by Marfo *et al*. (1986), both defatted and undefatted PSs were taken for observation. The result showed the approximate composition of PSs in which defatted PSs contain 44.4% of crude protein, 31.8% of crude fiber, 4.48% ash content, and undefatted PSs contain 27.8% crude protein, 28.3% lipids, 22.6% crude fiber, and 3.5% ash content. Other bioactive components were 0.94% fatty acids and minerals such as P, K, Ca, Mg, S, Mn, Fe, Cu, Ni, Co, and Na. A major fatty acid in abundance was oleic acid with 79.1% and in toxins, benzyl glucosinolate (10%) was present in the highest proportion. This study revealed that carotene and monosaccharide were also present but in trace amounts and out of all sugars, sucrose was present in the highest proportion [7]. In another study of papaya seed oil (PSO) composition done by Malacrida *et al*. (2011) revealed that PSO contains a high

amount of monounsaturated fats, a low amount of Tocopherols, and a substantial amount of Carotenoids and total Phenolic. Major fatty acids present in oil were oleic, palmitic, linolenic, and stearic acid, major tocopherols present were α- and δ-tocopherol, and β-cryptoxanthin were major carotenoids [8]. Thus, based on these researches, it would not be wrong to say that PSs are a potential source of crude protein, carbohydrates, fatty acids, lipids, fibers, calcium-phosphorus with some toxins.

4. MEDICINAL PROPERTIES OF PAPAYA SEEDS

PSs are successfully utilized in the treatment of viral infections such as dengue fever. They are anti-bacterial, anti-inflammatory, anti-amoebic, anti-ulcer, anti-diabetic, anti-obesity, and anti-parasitic agents, and wound healing agents. Its water extract is not at all toxic and even helpful for the protection against oxidative stress. Flavonoids are rich in water extract of PSs act as an anticancer agent. PSs are Nephroprotective as guarantees the smooth working of our kidneys and rich source of monounsaturated fatty acids and various antioxidants, so they maintain our cardiovascular health by lowering blood pressure and cholesterol level [9 - 12].

5. VALUE-ADDED FOOD INGREDIENT & A PROMISING PRESERVATIVE

The brief information about the purpose of adding PSs in various functional foods is given in Table **1** and year wise explanation is also mentioned below:

Table 1. Utilization of PSs to add value in various functional foods.

S. no.	Author	Year	Utilized In	Act As	Ref.
1.	Azevedo *et al*.	2014	Hamburger	Nutritive agent	[13]
2.	Sofi *et al*.	2015	Indian mackerel	Preservative	[14]
3.	Castro-Vargas *et al*.	2016	Edible oil	Preservative	[15]
4.	Kugo *et al*.	2018	Porridge	Deworming agent	[16]
5.	Veronezi and Jorge	2018	Soybean oil	Preservative	[17]
6.	Senrayan and Venkatachalam	2018	Papaya seed oil	Edible oil	[18]
7.	Bhosale and Udachan	2018	Functional Cookies	Nutritive agent	[19]
8.	Subandi and Nurowidah	2019	Coffee powder	Anti-obesity agent	[20]
9.	Cruz *et al*.	2019	Papaya jam	Anti-fungal agent	[21]
10.	Avila *et al*.	2020	Porridge	Nutritive agent and Preservative	[22]

CHAPTER 29

Cryptocurrency Price Prediction Using FB Prophet Model

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Abstract: A new method encountered for securing cryptocurrency *i.e* cryptographic algorithms for example Secure Hash Algorithm (SHA-2) and Message Digest (MD5). It uses Blockchain technology to make the transactions secure, transparent, traceable, and immutable. This is the reason cryptocurrencies have gained popularity in almost all sectors, especially in the financial sector. Cryptocurrency price prediction has become a trending research topic globally. Many Machine Learning algorithms have been developed such as Linear Regression, SVM, Random forest, and Facebook Prophet. Facebook Prophet is a time-series forecasting model for predicting the future price of bitcoins. In this paper, Facebook prophet Model is used, and two cryptocurrencies are considered, namely Bitcoin and Litecoin. The result depicts that FB prophet Model accurately predicts the prices of bitcoin cryptocurrencies. We considered the data from yahoofinace.com for BTC-USD and LTC-USD.

Keywords: Bitcoin, Cryptocurrency Price Prediction, Facebook Prophet Model, Hash Algorithm, Litecoin, Machine Learning, Time-series Forecasting Model.

INTRODUCTION

One of the common new financial assets is crypto-currencies. Even though their exchange rates and market capitalization have experienced many drastic ups and downs over the last decade, following the appearance of the first cryptocurrency, namely Bitcoin [1].

At the beginning of 2017, the overall market capitalization of Crypto-currencies amounted to $15.6 billion; it was nearly $230 billion at the beginning of 2020 and the maximum market cap hit almost $860 billion in mid-2018.

A contentious and debatable issue is the role and place of Crypto-currencies in the global financial market. Large fluctuations in their rates and the legal complexity

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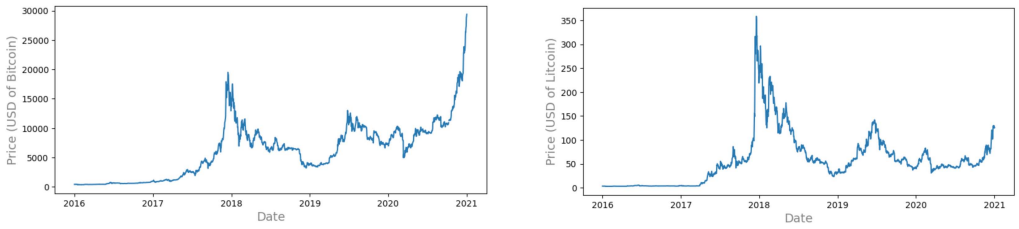
Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

of the deals made for them in the majority of countries are creating significant uncertainty and, as a consequence, a high risk of the money being spent. Prediction of prices for cryptocurrencies, but they concentrated only on small but popular cryptocurrencies such as Monero and Ethereum. But other coins can be broadly accepted by financial institutions, such as Litecoin, Bitcoin, and Stellar. In the top 10 currencies, Litecoin is located [1]. They have the potential to be broadly embraced by financial institutions. The price history of bitcoin and litecoin are shown in Fig. (**1**).



(A) (B)

Fig. (1). Price History of (a) Bitcoin (b) Litecoin [1].

Due to its non-traceable and analytical transactions, the coin is branded as a privacy measure. Because of this property, their demand is very likely to grow in the future. This paper is designed to attack these cryptocurrencies and provide a suitable market prediction scheme [1, 2].

RELATED WORK

We prepared a comparative analysis of papers as shown in Table **1**.

Table 1. Comparative Analysis of Papers [3 - 12].

Study	Features	Finding
Applied of feed-forward neural network and FB Prophet Model for train passengers forecasting [3]	Data collected on Java Island from January 2006 to August 2019 are the data collected every month by train passengers.	Accurately predict the number of passengers
Using the Facebook model of air temperature estimates and long-term memory [4]	Five-year daily Bandung air temperature forecast	Prophet improves at the highest air temperature and LSTM improves at the lowest air temperature.
Models are used for price prediction and analysis [5]	Focused on a popular cryptocurrency for example Bitcoin	Two series of deep learning approaches and demonstrated their effectiveness in predicting bitcoin prices.

(Table 1) cont.....

Study	Features	Finding
GRU Prediction scheme [6]	Used the mean root squared error to study and compared various approaches (RMSE).	Model GRU with repeated dropout is better than established common models
Bitcoin Price Prediction using Machine Learning [7]	Forecasts 30 days ahead	Compare three separate neural networks: the FNN, the Exogenous Input Network, and the Nonlinear Autoregressive Neural Network (NARX), by obtaining the expected results of each model.
Evidence from a quantile cross-spectral approach [8]	Formulates and bond markets between 2011 and 2019	Support the idea that in some return quantiles Bitcoin will have financial diversification
Improving Stock Price Prediction with GAN-based Data Augmentation [9]	The prediction of price series stock data using GAN produced increased time-series data	24.47% of AMZN and 30.27% of lower RMSE, 15.84% of B, and 13,88% of lower RMSE and MAE.AMZN data collection
Prediction of Bitcoin prices with machine learning methods using time-series data [10]	For different window lengths filters with different weight coefficients are used.	A 10-fold cross-validation approach is used for building a model during testing.
Crypto-Currency price prediction using Decision Tree and Regression techniques [11]	Until the present date, the dataset is taken with open, high, low, and close Bitcoin value price information.	Compared the accuracy of the Bitcoin prediction with various ML algorithms.
Bitcoin Price Prediction Using Machine Learning Methods [12]	Kaggle Bitcoin Dataset 2010-2019 data set	Accuracy rates are 97.2%.

MATERIALS AND METHODS

This research will be based on the Fb prophet which is an open-source library provided by Facebook. The architecture of the Fb Prophet is shown in Fig. (**2**). It is used for Machine Learning Model. It is a Model which has opened for additivity, primarily in the Time series. Users use Prophet to forecast revenue and buy-back prices. The prophet is a method that has been using for Time-series Data.

It is open-source software released by Facebook's Core Data Science Team.

DATASET USED

Dataset Description and Preprocessing of Data: The data used for the analysis was collected by Yahoofinance.com. It is an online forum for analyzing and providing global financial market statistics. Data have been collected for the two cryptocurrencies Litecoin and Bitcoin. The regular opening price, highest price,

CHAPTER 30

Study on An Evolutionary Feature of Canine Circovirus Genome: Nucleotide Composition and Codon Usage Bias in Canine Circovirus

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Abstract: Canine Circovirus (CaCV) or Dog Circovirus (DogCV) causes hemorrhagic gastroenteritis, thrombocytopenia, vasculitis, hemorrhages, and neutropenia and is usually found as co-infection with other canine infectious agents like Parvovirus and Distemper virus in dogs including wild canines (wolf, fox, badger). To know the evolutionary feature of the viruses, nucleotide composition and Codon usage bias (CUB) have been used which further ascertain their adaptability towards the suitable host. In the present study CUB and Nucleotide composition of both cap & rep gene of around 88 CaCV strains were compared. Nucleotide composition of CDSs at 3rd codon position (G3% A3% T3% C3%) together with overall AT% and GC%, GC12, and GC3 were analyzed. using codon W 1.4.2 and CAIcal server, Aromo, and Gravy values, effective no of codons and relative synonymous codon usage values were also analyzed. The results show that CaCV has an AT-rich genome and codons ending with A/T have to preference over GC ending codons. Nc-GC3 plot of CanineCV reveals that selection pressure was dominant over mutation pressure. Correlation analysis between Gravy, Aroma, and CAI indicate natural selection over mutational pressure. The RSCU values of Cap & Rep genes were analyzed to find out overrepresented codons.

Keywords: CaCV, Canine Circovirus, Codon usage bias, Dog Circovirus, RSCU.

INTRODUCTION

Canine Circovirus (CanineCV) [1] or Dog Circovirus (Dog CV) belongs to the genus Circovirus within the family Circoviridae. Canine CV has been isolated in 2012 as a part of the genetic screening of canine samples for a new virus [2]. Since then various strains of CanineCV have been isolated in different parts of the world including the USA, Italy, UK, Croatia, China, Thailand, and Argentina. Canine CV is small, naked, icosahedrons, with circular, monomeric, ambisence, covalently closed, single-stranded DNA (ssDNA) genome ≈2000bp in size. They

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

are the tiniest known self-replicating animal pathogen, encoding capsid protein. The genome comprising of 2 units encoding 2 open reading frames, Rep and Cap proteins [3]. Using a double-stranded replicative form DNA intermediate, Canine CV replicates their genomes [4]. A few studies on synonymous codon usage characteristics were done earlier on PorcineCV, PigeonCV, and DuckCV [5]. This study is going to be the first effort in evaluating the codon usage pattern of CanineCV. No earlier attempt to evaluate factors (Mutational Pressure/Natural selection) responsible for the host-specific adaptation of CanineCV. There is no vaccine against CanineCV. No earlier attempt for development of vaccine using codon usage bias manipulation strategy in CanineCV.

METHODOLOGY

Codon Usage Bias Analysis

(a) *Analysis of Nucleotide Composition*

Using coding sequences of CanineCV genomes, we intend to determine: (a) GC content (b) nucleotide's frequency (A%, G%, U%, and C %) (c) Nucleotide's frequency at 3rd position of synonymous codons (U3S%, A3S%, G3S%, and C3S %) (d) Nucleotide's frequency (G + C) at 3rd synonymous codon positions (GC3S %) (e) Nucleotide's frequency (G + C) at 3rd codon position (GC3) and mean frequency of both G + C at the 1st and 2nd position (GC12). 5 codons UGG and AUG (Tryptophan and Methionine) and UAG, UAA, and UGA (termination codons) will be excluded from the analysis. Using CodonW/EMBOSS/DAMBE/BioEdit/CAIcal Server, the composition of Nucleotide will be calculated.

(b) *Relative Synonymous Codon Usage*

Distinct as the ratio of the observed frequency of **codons** to expected frequency given that all synonymous **codons** for the same amino acids are used equally. RSCU will be calculated using the software CodonW/CAIcal Server.

(c) *An Effective Number of Codons (ENC)*

The degree of codon usage bias can be determined using ENC and is calculated using CodonW.

(d) *Codon Dinucleotide Frequency Analysis*

DAMBE software is used to calculate the dinucleotide frequencies.

(e) ***Gravy and Aroma Statistics***

The Gravy value indicates protein hydrophobicity on codon usage bias. The effect of aromatic hydrocarbon proteins on codon usage bias can be measured by Aroma value. Both of these statistics are calculated using CodonW.

EFFECT OF NATURAL SELECTION AND MUTATIONAL PRESSURE ON CUB

(a) Enc-plot analysis: To reveal factors driving CUB, ENC value against GC3s value will be used. Points will lie on a standard curve in case of mutational pressure.

(b) ***Parity rule 2 analysis:*** Used to measure the effect of natural selection and mutational pressure.

(c) ***Neutrality analysis:*** To determine the dominant factor affecting CUB, values of GC12s against GC3s will be used using EMBOSS CUSP /CodonW.

STUDY OF HOST-SPECIFIC ADAPTATION

(a) ***Codon Adaptation Index (CAI)*****:** Among highly expressed genes, CAI determines the preference for codon usage of a gene. It also represents virus adaptation to the host. Its value lies between 0 and 1. Higher the CAI stronger is the adaptation to the host. CAI is calculated using CAIcal Server

(b) ***Relative Codon Deoptimization Index (RCDI):*** Codon deoptimization of virus to its hosts is measured by RCDI. It is calculated using RCDI/eRCDI Server

(c) ***Correspondence Analysis (CoA):*** Usage patterns among viruses coding sequences are determined by CoA. It is determined using CodonW.

(d) ***Statistical Analysis:*** SPSS22.0/SPSS26.0 software is used to determine the factors influencing synonymous codon usage patterns.

All step-wise methodology is represented in Table **1**. It represents all the In-Silico tools used in codon bias analysis.

CHAPTER 31

Evaluation of Thoracic Mobility in Different Stages of Chronic Obstructive Pulmonary Disease: A Pilot Study

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Abstract: Patients suffering from COPD have decreased thoracic mobility which affects the functioning of the respiratory muscles. As the literature on thoracic mobility in COPD patients is scarce the present study focuses on assessing thoracic mobility in different grades of COPD with the help of a digital inclinometer. A total of 59 subjects were included in the present study (37 COPD and 22 Controls) and subcategorized into 4 groups according to the severity (GOLD's Classification). Thoracic mobility on the left and right sides, both were found to be less in the COPD group as compared to the controls. There was a statistically significant difference for the left side thoracic mobility (p=0.00) between both groups with the mean value of 35.38 ± 6.92 for the COPD group and 44.49 ± 3.92 for control. There was a statistically significant difference for right side thoracic mobility between both groups (p =0.01) with the mean values of 40.08 ± 9.28 in the COPD group and 44.43 ± 4.22 for the control. The right and left thoracic mobility was found to be decreasing with increasing severity but the difference was not statistically significant. There is an alteration in the respiratory mechanic and shoulder girdle kinematics which alters the thoracic mobility. In the present study, the sample size for each subgroup of COPD was less. The mild and severe COPD subgroup had a limited sample and hence more studies should be conducted to understand the changes that happen in thoracic mobility due to an increase in severity. The thoracic mobility is affected in COPD patients and with increasing severity of COPD, the thoracic mobility decreases in this population.

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

Keywords: COPD, Digital Inclinometer, Left Thoracic Mobility, Right Thoracic Mobility, Thoracic Excursion.

INTRODUCTION

Chronic respiratory disease (CRD) is a disease of the airway and other structures of the lung. Some of the most common are Chronic Obstructive Pulmonary Disease (COPD), asthma, occupational lung disease, and pulmonary hypertension. Estimates suggested that COPD and asthma are the most common [1]. The mortality rate of chronic respiratory disease increased by 18% from 1990 to 2017. In 2017, deaths due to COPD comprises 81.7% of the total number of deaths from chronic respiratory diseases. COPD related death in 2017 was 23% more than in 1990 [2]. A review of the published reports revealed 384 million cases of COPD in 2010 which is 11.7% globally [3].

COPD brings changes in chest wall configuration [4]. Patients with COPD develop hyperinflated chest which impairs their chest mobility. 12 thoracic vertebrae are connected to 12 pairs of ribs. Additionally, it provides muscle attachments and allows those muscles to function as muscles of ventilation. Therefore, it is necessary to focus on thoracic mobility. Thorax and thoracic vertebrae are part of the upper body quadrant [5]. Postural re-alignment and mobility of the upper body quadrant have been recommended as part of pulmonary rehabilitation.

To document the stability, evaluation, and progression of chest function; a physical therapist measures chest mobility. Chest mobility can be measured by measuring the chest circumference during breathing using an inch-tape [5]. It is a simple and inexpensive method in clinical practice but defined reference values are absent. With the development of time, there is more equipment available to assess chest mobility. Debrunner kyphometer, digital inclinometer, bubble inclinometer, are some of them.

Movement available in the thoracic region is rotation so by assessing thoracic rotation to left and to the right we can easily know the thoracic mobility. Our study evaluates thoracic mobility by using a digital inclinometer (DI) which is a valid and reliable method [6]. To the best of our knowledge no such study was done which assesses thoracic mobility in different stages of COPD. For better understanding, we took healthy controls to compare the data. This study found a new opportunity of using a digital inclinometer as a tool to assess the severity of COPD in different stages.

MATERIAL AND METHODS

All COPD patients were recruited from the medical department of HAHC hospital, Delhi. After explaining the study protocol, interesting subjects signed the informed consent form. A total of fifty-nine (59) subjects were enrolled in the present study of which, thirty-seven (37) were diagnosed with COPD and labeled as group A. Twenty-two (22) were non-COPD patients and labeled as group B. Present study is a quantitative descriptive cross-sectional study.

Clinically stable patients and those who don't require oxygen supplementation were included in the COPD group. History of smoking was taken and both smokers and non-smokers were recruited in both the groups. Patients with recent exacerbation in the past 3 months, unable to cooperate and understand the protocol, and with comorbidities were excluded from the study. Thoracic mobility was assessed by using a digital inclinometer. Subjects were instructed to adopt heel sit position (Fig. **1**) and time was provided to them so that they could get familiarize with the movement of thoracic rotation in the heel-sit position but no formal warm-up was done to reflect clinical practice. The Digital Inclinometer was calibrated before data collection according to the manufacturers' guidelines.

Fig. (1). (a) Starting heel sit position, (b) Left side rotation, (c) Right side rotation.

The device was placed over the C7– T1 interspinous space perpendicular to the spine, which can be located by palpating the subject's cervical spine. Subjects were instructed to place their ipsilateral upper extremity at the side of the body in full elbow flexion, keep the head aligned with the thoracic spine in the horizontal plane, and maintain the kneeling position. Compensatory patterns of movement were observed. We took three measurements by using Digital Inclinometer in the starting position (Fig. **1a**) and then at the end-range left- and right-rotation positions (Figs. **1b** and **1c**). The mean of the 3 measurements was calculated for each left- and right-rotation position [6].

Sample size was calculated by using n = [DEFF*N*p*q]/ [(d2 /Z2 1- α/2*(N-1) +p*q] formula [7, 8]. Data were analyzed by using the SPSS Statistics software

CHAPTER 32

Wearable Antennas-An Overview

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Abstract: The most popular antenna for portable devices in current communication technologies is the wearable antenna due to its compactness and flexibility; demand was rapidly growing and can communicate through signals with the human body and the wearable devices. The advantages of wearable antennas are flexible, hidden, low profile, and no harm to humans. The key benefit of this antenna is that it is placed on the human body or included in clothing, effortlessly transmits, and receives signals through clothes or on-body. These antennas play a vital role in the number of applications, viz. navigation (118MHz to 137MHz), medicine (750MHz to 2.6GHz), military (225MHz to 400MHz), RFID (433MHz to 5.4GHz), physical training, tracking, and health monitoring, *etc*. This paper discussed the important aspects of wearable antennas, which include materials used, substrate, and fabrication techniques. Next, discussed a clear overview of wearable antennas existing and design aspects, their advantages, and drawbacks.

Keywords: Fabrication Technique, Flexible Antennas, ISM Band, Substrate Integrated Waveguide, Textile Antennas, Wearable Antennas.

1. INTRODUCTION

It has been seen that during the last decade of years, portable devices play a proximity role in human life those are mobiles and tablets. The technology is rapidly changing year by year and the size of the device, visibility decreases. In forthcoming days, sensors are used to control human activities; further devices are used to monitor the different requirements of the human including medical

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

conditions. These devices and sensors play a crucial role, communicate with each other and stuffs outside. In real-world communications, all these advancements are possible only because of wearable devices and antennas [1].

Generally, Wearable devices are carried by the person within the body or on-body and are capable of communicating among them *via* cellular connectivity. The devices used in these types of communications would include other components such as like sensors, antennas, and batteries. One of the most important components in the wearable device is antennas and they contribute overall efficiency of a wearable wireless link [2 - 4]. The wearable antennas must be light in weight, conformal design, low cost, easy system integrable, *etc*. and the design ought to be specified which is not deteriorated even if they are bent [5].

In our life, Wearables play a significant role and are found to be used in many portable devices used for Security and Entertainment like fitness bands, wristwatches, reality glasses, and cover a lot of medical applications and rescue operations [6]. In the field of health monitoring, wearable devices are used to monitor the patient's health conditions who are in the critical stage like, the sugar level of the patient, glucose level of the patient, Blood pressure, inner intestinal system, body temperature, *etc*. of the patient minute to minute. Wearables are also used in rescue operations as well as entertainment. The Table **1** describes the field involved in wearable antennas with their applications.

Table 1. Applications of Wearable devices in different fields [7].

Field	Applications
Health Monitoring	Glucose Level Monitoring / Oximetry/ Endoscopy / GPS tractor / Wearable Doppler unit
Entertainment	Smartwatches / LED dress / Music Jackets / Intelligent
Rescue and security	Helmet / Tractors / E-shoes / Fitness-bands / Life jackets/ Raincoat

In day-to-day life, Wearable antennas are integrated into humans wearing gadgets like shoes, jackets, helmets, lenses, cooling glasses, raincoats, *etc*., and numerous aspects to be considered while designing wearable antennas as they need to be flexible, hidden, unobtrusive, low profile and should not be considerable degradation in proximity to the human body [8].

This paper discusses the overview of wearable antennas and mainly about on-body as well as textile-based antennas. Section II describes important aspects involved in wearable antennas and section III involved the discussion about the design of substrate integrated waveguides. Section IV is about the existing different wearable antennas and ended with concluding remarks.

2. IMPORTANT ASPECTS IN WEARABLE ANTENNAS

This section discusses important aspects of wearable antennas and includes a discussion about materials, the substrate as well as fabrication techniques.

2.1. Materials

The different kinds of dielectric, conductive materials are used to implement Wearable antennas, and these can be carefully chosen to prevent mechanical bending, mechanical wrapping at different weather conditions for the protection of EM radiation [9]. Table **2** reports the flexible conductive materials with their Thickness and conductivity.

Table 2. Thickness and conductivity of Flexible conductive materials.

Materials for Conductor	Thickness (mm)	Conductivity
Egain Liquid fillet [9]	0.08	250K
Ployleurethene nanoparticle composite sheet [10]	0.0065	1.1M
Zoflex plus copper [11]	0.175	193K
Copper coated taffeta [12]	0.15	3.4M
Sliver flakes plus fluorine rubber [13]	NA	85K
PANI/ CCo composite [14]	0.075	7.3K

2.2. Substrates

The dielectric substrate plays a very dominant role in the design of wearable antennas. The standard substrates like Rogers, Teflon, RT-Duriod, and silicon have been not preferred in the case of textile antennas due to bending, str*etc*hing, and rotating capabilities [15 - 18]. This needs to invent flexible conductive materials and some of the materials which having loss tangent, dielectric constant as revealed in Table **3** .

Table 3. Flexible materials (Dielectric constant and loss tangent).

Conductive Material	Dielectric Constant (εr)	Loss Tangent (Tan δ)
Polydimethylsiloxane [13]	3.2	0.01
Polydimethylsiloxane -ceramic composite [14]	6.25	0.02
Ethylene Vinyl Acetate [15]	2.8	0.002

CHAPTER 33

A Novel Energy-Efficient Routing Algorithm for Reduction of Data Traveling Time in Wireless Sensor Networks

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Abstract: Wireless Sensor Network Lifetime improvement is very well demonstrated using sink mobility effectively in the literature. The challenge taken up in the past research was to identify the shortest route that avoids obstacles and delivers the mobile sinks at the designated nodes. In this paper, we present a cluster-based approach for collecting the data and a heuristic algorithm for a well-planned work. The routing protocols may differ from application to application, due to a large number of sensor nodes the algorithm should be studied in a novel way. In this method, the nodes known as cluster heads collect information from different cluster points and sends data to the mobile sink following this clustering process. We also propose an energy-efficient data gathering algorithm for the collection of mobile sinks. Simulations were conducted using NS2 software to verify the efficiency of the proposed algorithm.

Keywords: Clusters, Energy efficiency Algorithms, Heuristic tour plan algorithm, Mobile Sinks, Wireless sensor Networks.

INTRODUCTION

Wireless sensor networks are a source of many applications in a range of aspects, including medicine, disaster management, and environment, safety, and surveillance [1, 2]. in parallel with the Internet of things. As Power consumption is the main drawback in many applications, Wireless sensor networks designed for energy efficiency can be also avoided. However, in WSNs with limited power consumption, we use effective sensors, whereby the nodes near sinks are still responsible for the transmission of data to topless photos far away from sinks. While there is space for further energy consumption. Due to the failure of these

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

kinds of nodes at the sinks, the entire network gets disconnected and this is a situation that causes worry and keeps the lifetime of the network in doubt. Therefore, this is also a challenging task to increases the lifetime of the network by reducing the power consumption at these kinds of sensor nodes. The important limitation of this node is also the energy supplied and the bandwidth allocated. Scaling of voltage dynamically, the hardware used in the radio communication system, partitioning of the communication systems, issues that arise due to small duty cycles are some of the areas where the utilization of energy is concentrated such that it is effective in the literature.

This paper focused on using a routing algorithm that is applied exclusively in multiple paths at a cross-layered geographical node [3]. Instead of using the static nodes, this paper employed mobile nodes with the interest of increasing the network lifetime. With the use of mobile nodes installed on mobile vehicles which move across the sensing fields, the network will tend to collect data from all the static nodes. Mobile nodes can adopt single hopping or multiple hopping mechanisms.

In this work, we identify the mobile nodes as mobile sinks which can reduce the overhead on various sensor nodes, both of which are located nearer as well as farther from the mobile sinks. By processing the movement of the mobile nodes, the network lifetime can be increased.

As the physical atmosphere includes many more difficulties, the sensing field is reorganized by finding the shortest routing path which can avoid obstacles and the mobile sink can move all over the network. This paper also proposes an algorithm for finding such a routing path.

Also, the mobile sink should consider the effective performance of energy among the nodes when passing through the sensing field at the same time. This was done with a cluster-based approach [4]. The sensors in the network are known as the cluster heads and the cluster members in two categories (Sensor nodes). Cluster members collect the environmental data and thereby collect the data from them by the cluster heads and send it to the mobile sinks. The mobile sinks start this process from an initial point and return to this beginning point after collection. Fig. (**1**) shows a Cluster-based approach.

When the path of this mobile sink is designed well to avoid the obstacles, then there is every chance to utilize the power effectively and thereby contribute to the overall energy efficiency.

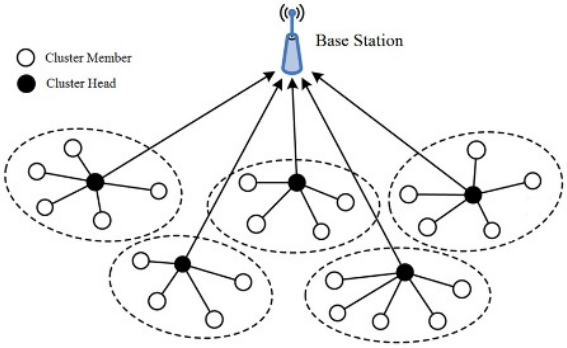

Fig. (1). Cluster-based approach (CH- Cluster Head).

When a problem is considered, a regularized grid-based approach is used to design the mobile sink network, in which the whole sensor field is described uniformly in a two-Dimensional plane, using grids of similar sizes. These grid cells now cover the entire sensing field, which may also consist of obstacles. A grid is considered an obstacle when a particular obstacle falls in a grid cell region. These grid cells are also regularised and a spanning graph is also constructed. This spanning graph makes the scheduling of the mobile sink easy by identifying the grid cells with and without obstacles which helps us in identifying the shortest route which avoids obstacles.

The rest of the paper is organized in different sections covering the different algorithms proposed followed by the simulated experimental results.

A HEURISTIC APPROACH BASED OBSTACLE AVOIDING ALGORITHM

This section presents a heuristic approach Obstacle that eliminates the shortest algorithm for the mobile sink. It involves various steps which are discussed below.

- A minimum Spanning tree is used for finding the shortest route as that of it is used in comparison to the traveling salesman problem. The spanning graph which is the set of edges is obtained by connecting the obstacle corners with the terminals. This graph reduces the infinite possible sites into finite sets.
- The spanning graph for the physical environments cannot be directly obtained as discussed above, as the shapes of the obstacles are quite irregular. Therefore, a grid-based technique [5 - 9] is used as a solution to the problem of scheduling the mobile sink path effectively. The region of the sensor is divided into units of the

CHAPTER 34

Covid-19 X-Ray Image Classification Using Deep Learning Models

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Abstract: Coronavirus (COVID-19) disease is spreading rapidly and is becoming increasingly common every day. This study can be helpful in the basic steps for doctors to diagnose the diseases and treat the patient accordingly. We used 1200 images of COVID-19,1300 Normal images and 1345 Viral Pneumonia images for the research work. We compared three popular deep learning methods which were CNN, VGG19, and Resnet-18 Model. We found that the Resnet-18 model with different useful parameters outperforms all the other proposed models. The accuracy we got was 97% when 50 images from each category were being tested.

Keywords: CNN, CORONAVIRUS, COVID-19 Radiography Dataset, Normal, Resnet-18, VGG19, Viral Pneumonia.

INTRODUCTION

In the field of research, image classification has played a vital role in the case of medical images classification as it reduces the efforts made by doctors to detect the disease. Due to high computation power, we can achieve many tasks in a few minutes. Researchers are always working on different algorithms and models for getting more accurate results and to make the work easier [1].

Image classification generally has two basic steps which are classification and labeling. If an image belongs to class A, it must be classified as a class A image and it must be labeled as a class A image by the model. Whenever a researcher is working on a particular algorithm, the output must be better and efficient to make the process easy [2].

There are different deep learning models which can be used to solve various image classification problems. Each model has different parameters, and based on

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

different steps one can find the actual accuracy after performing the training and testing part. Researchers are working on hybrid models so that more accurate results can be generated in a shorter span [3].

The dataset contains viral pneumonia as some symptoms of it matched with the COVID-19 symptoms [4]. The three categories are shown in Fig. (**1**) .

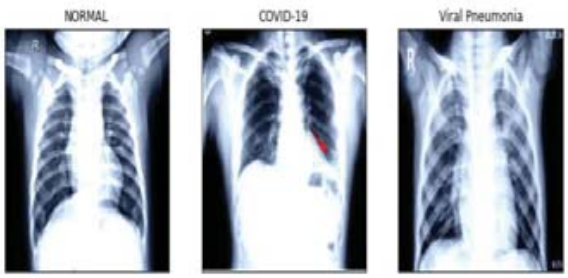

Fig. (1). The three classes used from the COVID-19 radiography database.

In the current conditions, the adverse effects of COVID-19 can be very close to viral pneumonia, as medical clinics are crowded, and not stopped to treat patients. As a result, COVID-19 would misrepresent non-COVID Viral Pneumonia, thereby postponing a cure procedure [5].

RELATED WORK

Asif *et al*. [5] used the deep learning model Inception V3 to classify the images and proposed a model that outperformed all the stated models in the paper, the results were promising and the dataset used consists of more than 3000 images.Toraman *et al*. [6] used the Capsnet model in their research work and compared the model with terms of accuracy for binary as well as multiclass classification. Das *et al*. [7] used the architecture of the extreme Inception model in their research work and did a literature review of different papers. Shaban *et al*. [8] proposed a methodology in their research work that was based on fuzzy inference engine and Deep Neural Network. They proposed a hybrid model to get more accurate results. Ly [9] compared various factors of the ANFIS (Adaptive Nuero-Fuzzy Inference System). Sahlol *et al*. [10] used the different CNN models for their research work. Singh *et al*. [11] proposed a new CNN approach that was being compared with the state of art models and it also outperformed them by various accuracy parameters. Khan *et al*. [12] proposed a CTNet model and compared it with 9 deep learning models in their research. . Apostolopoulos and Mpesiana [13] proposed a CNN model with transfer learning and compared it with other state-of-the-art deep learning models.Yadav [14] proposed SVR based

model and stated the number of cases along with the number of deaths.

DATASET USED

The dataset was rendered in a Kaggle repository. It contains three classes of x-rays that have been stored: COVID-19, pneumonia, and normal [4, 5]. The comparative analysis of papers showed that CNN types were widely used in the image classification process as shown in Table **1** .

Table 1. Comparative Analysis of Different Papers [5 - 14].

Paper No.	Deep Learning Models Used, Accuracy%
[5]	Inception V3, Classification Accuracy more than 98%
[6]	Capsnet Model, More than 90% in binary and More than 80% in multiclass classification.
[7]	Inception V3, More than 95% Accuracy
[8]	Fuzzy Inference engine and Deep Neural Network (DNN), More than 95% Accuracy
[9]	ANFIS 1 to 12, Training Error, Validation Error, and Testing Error was calculated
[10]	CNN types, More than 98% Accuracy
[11]	CNN,F-measure:1.9789%
[12]	CTNet,Accuracy:99%
[13]	Transfer Learning with CNN,Accuracy:96%
[14]	Method of SVR, Compared the correlation

RESULTS AND DISCUSSION

We took all the images and labeled them to the category to which they belong for comparison purposes with our prediction as shown in Fig. (**2**). We compared three popular models which are Resnet-18, CNN, and VGG19. We used 50 images from each category for the testing part. Batch size was 10 [15 - 17]. We used 20 epochs and trained and tested all three models and plotted the accuracy using graphs. In the case of the Resnet-18 model, steps were considered [18, 19].

We took 20 epochs for the training accuracy and the models we used were Resnet18, CNN, and VGG19. When we compared these three best models we got the results as shown in Fig. (**3**) [19]. CNN is a basic model that has approximately 2Lakh parameters, whereas VGG19 has 144 Million and Resnet-18 has 11 Million Parameters [19]. We compared the models and predicted the images and labeled them according to the class they belong to as shown in Fig. (**4**) .

CHAPTER 35

Design and Analysis of Triangular MIMO Antenna with a Truncated Edge for IoT Devices

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Abstract: The Internet of Things (IoT) is a developing system of articles, gadgets, and types of machinery each ready to interconnect with the other utilizing a remote system to get to the Internet. These frameworks permit users to achieve further mechanization, examination, and integration inside a structure. IoT gadgets have an adaptable scope of both wired and remote availability choices. IoT conventions generally use Industrial Scientific & Medical (ISM) band 915 MHz, 2.4 GHz (Zigbee), 5GHz. Right now, a short review of IoT highlights has been given in the paper. Likewise, a triangular MIMO reception apparatus (antenna) with a truncated edge has been intended to work at the frequency of 2.4 GHz (Zigbee). The proposed reception apparatus has been structured utilizing FR4 material having a dielectric constant of 4.4 and loss tangent 0.002. The thickness of the substrate is taken 1 mm. The proposed reception apparatus is reverberating at 2.4 GHz, which is reasonable to be utilized at Zigbee. The simulated Gain of the proposed antenna is 1.18 dB, its radiation efficiency is approximately 30%. All the simulated parameters such as multiplexing efficiency (ME), envelop correlation coefficient (ECC), and mean effective gain (MEG) is fulfilling the requirement to be used as MIMO antenna for IoT applications.

Keywords: IoT, Microstrip Antenna, MIMO Antenna, Truncated Antenna, Zigbee.

INTRODUCTION

An IoT device is a remote associating device to the established network to transmit information. As the adaptable increment in the IoT devices in the current world, because of this effect, such a large number of organizations had recognized this IoT innovation and executing the miniaturized and integrated communication

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systems and modules. They improve the range of areas and their accuracy. IoT gadgets are a piece of a situation wherein each gadget bury relate with each other gadget in a domain to the programmed world and convey an ever-increasing number of usable information to clients, specific frameworks for the information projections, and so forth [1].

IoT Technology

IoT predominantly exploits standard agreements and system administration advances. Notwithstanding, the major authorizing developments and protocols of IoT are near-field communication (NFC), low power Bluetooth, RFID, low-power wireless, LTE-A, and WiFi-Direct. The double antenna design framework is very much followed in the current innovation because the use of double antenna builds the exhibition of the framework and the transmission of information is increasingly solid [2]. The MIMO innovation is successful in the multipath moderating circumstances and afterward it is executing in the ongoing advancements, for example, various modules. This paper proposes a triangular MIMO antenna with a truncated edge, which involves two scaled-down triangular antennas that work under the ISM band for the IoT devices with the resonance frequency of 2.4 GHz as well as for the Bluetooth, Wi-Fi, and WLAN. It utilizes for the system devices, for example, WLAN and Bluetooth conventions for the information transmission [3 - 4].

IoT-Key Features

Artificial Intelligence, sensors, network, and small device usage are the absolute most significant highlights of IoT. It makes essentially anything “keen”, which means it advancements each portion of presence with strength of information collection, AI algorithms, and networks.

IoT-Pros & Cons

The advantages of IoT range over each section of the way of life and occupational, it incorporates Technology Optimization Improved Customer Assignation, Concentrated Waste, Enhanced Data Collection and so forth. A portion of the key difficulties incorporates Security, Privacy, Complexity, Flexibility, and Compliance.

Hardware Utilization

The apparatus used in IoT structures integrates devices for a distant dashboard, sensors, devices for control, and servers. These devices comprise strength elements, sensing modules, and RF modules. IoT may incorporate Accelerometer

Temperature Sensor, Auditory Sensor, Gas RFID sensor Pressure Sensor, Humidity Sensor, Microflow sensor, Proximity Sensor, *etc*.

DESIGN OF MIMO ANTENNA FOR IOT DEVICES

The proposed antenna has been designed to work for Zigbee so it should resonate at 2.4 GHz. This frequency has been considered as the design frequency. Also, it has been reported earlier that an inset fed formation is the common method to advance the impedance band of microstrip patch antennas (MPA) because of its simplicity. Therefore to feed the proposed antenna inset feed is used. According to the cavity model, the resonance input impedance of an MPA is given by the following expression:

$$R_{in} = R_0 Cos^2\left(2\pi \frac{d}{\lambda}\right) \quad \textbf{(1)}$$

Where R_0 is the input resistance when the patch is fed at the edge, d is the feed distance (or inset depth) from the edge, and λ is the guided wavelength at the resonance frequency. For a triangular MPA, the resonance frequency for any TM_{mn} mode is given by [4]:

$$f_r = \frac{2c}{3a\sqrt{\varepsilon_r}}\sqrt{m^2 + mn + n^2} \quad \textbf{(2)}$$

Where m and n are several modes, c is the speed of light, a is the side length of triangle, ε_r is the Dielectric constant of the substrate. The calculation of the patch can be made using the effective length, a_e of the patch as in the equation below:

$$f_{10} = \frac{2c}{3a_e\sqrt{\varepsilon_r}} \quad \textbf{(3)}$$

a_e is the effective side length of the triangle and it is given by:

$$a_e = a\left[1 + 2.199\frac{h}{a} - 12.853\frac{h}{a\sqrt{\varepsilon_r}} + 6.182\left(\frac{h}{a}\right)^2 - 9.802\frac{1}{\sqrt{\varepsilon_r}}\left(\frac{h}{a}\right)^2\right] \quad \textbf{(4)}$$

The technique of changing feed depth can be used efficiently to properly match antenna using microstrip line feed, whose characteristic impedance is given by [4]:

CHAPTER 36

A Forest Fire Detection and Reporting System Using a Wireless Sensor Network

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Abstract: Forest fires are a great threat to ecologically healthy grown forests and the protection of the environment. The root cause is due to the lack of a scalable network to monitor the physical conditions over vast forest areas. To overcome this, we used the NRF24L01+ module configured in mesh network mode interfaced with Arduino along with DHT22, MQ2 sensors, powered by Lithium-ion batteries which can be recharged with solar panel, this allows the node to reconnect to the network automatically in case of any damage to its parent node.

Keywords: Arduino, DHT22, MQ2, Mesh Network, NRF24L01+, Raspberry Pi, Wireless Network.

INTRODUCTION

Ever since the life of humans progresses, we have changed the land cover of the earth gradually. In Consequence, one of the most alerting issues today is the conservation of forests. Forest protection is a branch of forestry that is concerned with the preservation or improvement of a forest and prevention and control of damage to the forest by natural or man-made causes like forest fires, plant pests, and adverse climatic conditions (Global warming). Conservation of forests is the practice of planning and maintaining forested areas for the benefit and sustainability of future generations. Forest conservation involves the upkeep of the natural resources within a forest that is beneficial for both humans and the ecosystem. In these recent years, we have experienced many major incidents of forest fires in many parts of the world. Fig. (**1**) shows the number of forest fires that occurred worldwide in 13 years [1].

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

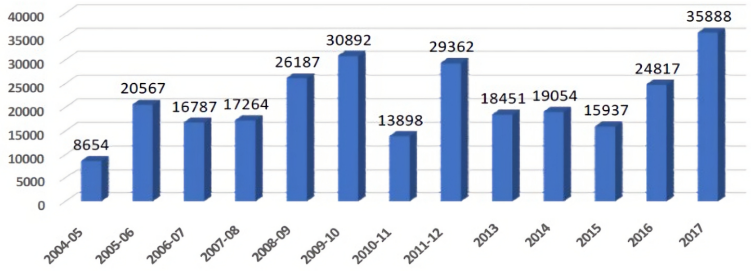

Fig. (1). Total forest fires in 13 years. Adapted from [1].

When a forest fire occurs, there are many disadvantages for both humankind and the ecosystem. The major disadvantages are air pollution, soil damage, animal habitats will be burnt which will cause unbalance in the ecosystem, *etc*.

In 2018, the annual rainfall measured in India was over 1020 millimeters. This was a decrease from 2017 where around 1127 millimeters of rainfall was recorded. The basic steps in preventing forest fires are reducing both the risk and hazard of the situation. The next question that always comes to mind is how to prevent or how to detect the fire in the forest. Because the fire is still at its origins, how do let the authorities know and reach the place on time. These days we can see a huge leap in the development of technologies from year to year but why can't we still solve this problem. One of the main reasons will be the connectivity issues that we face in the forests. The improper network is a major problem that delays the information reaching the authorities on time. Now the question is how can we face this major issue and fix the problem. The solution is to design a network that will help the transmitters to transmit signals or data out from the forests so that they can reach the authorities on time. Hence, we need devices that can send the data or the information out of the forest. we will be using NRF24L01+ as a trans-receiver in our project.

Related Work

Alexander A. Khamukhin and Silvano Bertoldo determined the type of forest fire in WSNs by analyzing the noise power spectrum of forest fires [2].

With the use of unmanned aerial vehicles (UAVs) with specialized cameras and Lora WAN sensor networks Georgi Hristov; Jordan Raychev and the rest of the authors worked on early fire detection [3].

Adnan; A. Ejah Umraeni Salam and the rest of the authors showed Forest Fire Detection using LoRa Wireless Mesh Topology [4].

Similarly, in [5,6], and [7] different methods are used but using nrf24l01+ saves cost as well as we can get more optimized location and higher data transfer rates.

System Architecture

Mesh Network

Mesh Network is a network topology where nodes connect directly and dynamically to other nodes and transmit information efficiently using different routing techniques [8]. Fig. (**2**) shows an example of a mesh network [8].

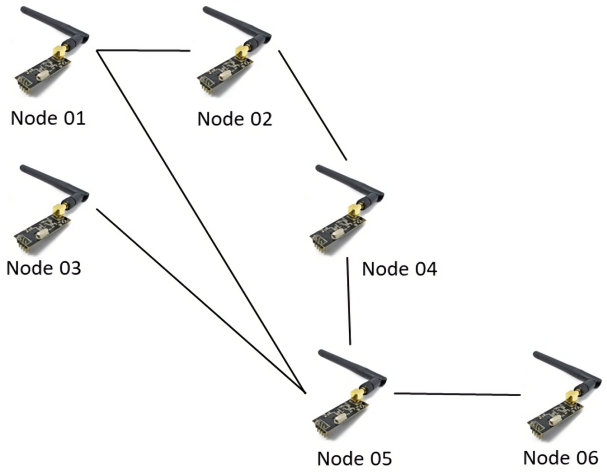

Fig. (2). Mesh network. Adapted from [8].

Sensor Node and Gateway Node

In this project, we are using Arduino Nano/Mini as a sensor node interfaced with DHT22 for temperature and humidity data and an MQ2 sensor for smoke data. The information is transmitted using low-cost NRF24l01+module. In Ref [9] other available methods are discussed. The location of each node is manually fixed in the database after placing the node in the forest so that there is no need for a GPS module which cuts down cost. Fig. (**3**) represents a sensor node with basic interfacing.

CHAPTER 37

Bioremediation of Textile Dyes for Safer Waters

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Abstract: The earth holds several natural resources in itself. Water is the most crucial resource among them. However, anthropogenic activities in the proximity of water bodies are leading to water pollution. The primary concern is the textile industry, where water consumption and environmental risk are significant. The manner the water reaches into the water body is of primary concern as no proper treatment is done in many cases. The review mainly focuses on the use of microorganisms for degrading textile dyes in water through bioremediation. Among the different methods being explored for dye degradation, bioremediation is one of the most promising. It is easy to alter and more economical when applied to a commercial scale. Bioremediation is also a sustainable solution that can be harnessed at a large scale and for several generations. However, microbes with specific new biotechnological applications such as nanobiotechnology can give better results. Still, significantly less literature is available on this subject matter. Microbes are a powerful alternative for dye degradation as several bacteria and fungi can degrade many acidic and basic dyes in short periods. The effluent obtained at the end of the process does not have a tertiary effect, making these microbes an efficient choice for dye degradation.

Keywords: Biomagnification, Bioremediation, Dyes, Microbes, Nanobiotechnology.

INTRODUCTION

The textile industry is a big player when it comes to economic aspects. After agriculture, it is the second biggest industry in terms of employment generation. Per the current statistics, this industry globally has emerged as a trillion-dollar

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industry [1]. One of the WHO (World Health Organization) reports states that residues from the textile industries alone contribute nearly 18 to 20% of the water population. The reason is the use of several synthetic dyes, which are available at a lower cost [2]. However, from an environmental point of view and concern, they possess no benefit or potential as sustainable or even eco-friendly compounds. Various synthetic dyes nowadays are readily available in the market and fit in the pocket of industries. Some of them are toluidine blue, neutral red, safranine O, eosin yellowish, coomassie brilliant blue, methyl violet, malachite green, methyl green. These dyes, when released either untreated or undertreated, are a cause of great environmental concern. Such dyes are insoluble in water and tend to enter the aquatic fauna's living system as suspended particles, responsible for tumor formation [3]. The bioaccumulation of such toxic compounds in water can have potential threats and be hazardous not for aquatic species but for humans and other animals indirectly linked to water bodies. Bioremediation is one of the most suitable methods for overcoming this problem [4]. Specific improvements in this method with the incorporation of new technology can make this technique reach its optimum potential, providing relief from water pollution [4].

MICROBES USED FOR DYE DEGRADATION

There are several classes of microbes that are used for the degradation of dyes. The focus is primarily on microbes, which are economical, easy to culture, and do not produce any secondary or tertiary by-products after the reaction with the dyes. Bacteria like *Brevibacillus* are effective in degrading toluidine blue. The identity of the bacterial species is routinely confirmed using 16S rRNA sequencing in conjunction with morphological identification and biochemical characterization [5]. Studies show that the textile industrial effluents removed by microbial use have low-enough BOD levels to meet the standard criteria [6]. The BOD parameter fit for commercial and environmental concerns is generally set at 10-30mg/L. With the help of these bacteria, the target of the standard can be easily achieved. It is often seen that natural dyes can provide an alternative to harsh synthetic dyes.

BIOREMEDIATION OF TEXTILE DYES

The textile industry is a big industry with a market capitalization of billions. In our country, too, it holds a significant economic role. The use of hazardous chemicals in the form of dyes can be an actual theft to the environment. Microbes are a significant alternative to chemicals when it comes to dye degradation. As compared to the general practice where one microbe is used, the use of more than one microbe or even a consortium is a more promising protocol, especially when it comes to azo dyes degradation. For degrading congo red, bacterial strains like

Bacillus thuringiensis RUN1 are popularly used. This is a decolorizing dye bacterium. However, this bacterium can degrade some other dyes as well, namely Reactive blue 13, Reactive red 58, and reactive yellow 42 [7]. The bacteria produce necessary enzymes for the biodegradation of dyes, which include *azoreductases, laccases*, among others. Bacteria like *Providencia* sp and *Pseudomonas aeruginosa* can degrade other highly reactive dyes like the species Red HE3B [8]. Untreated effluents of textile industries are one of the major pollutants of the water. In the case of dyes, the azo dye class dominates the segment. Being the largest class, it has various compounds that are highly soluble in water and can easily escape treatment systems, which is when they cause the most problems. One of the most commonly used and effective methods is bioremediation. The use of microorganisms is economical and practical, just as it is of a drawback that minor literature is available for the same. Microbes from class bacteria, fungi, yeast can clean the effluent water. In fungus, species like *Phaerochaete chrysoporium* are competent to metabolize several xenobiotics compounds. Another widely usable microbial strain is *Pseudomonas aeruginosa ETL-1*. This bacterial species is capable of decolorizing triarylmethane dyes (Maulin, Kavita, *et al.*). For the same dye, another bacterial strain, namely *Aeromonas hydrophila,* is also effective. The operational parameters are generally the decolorization efficiency of the bacterium [9]. When it comes to azo dyes, the degradation becomes even more challenging. One of the novel fungal strains used for dye-degradation is *Aspergillus oryzae* [10]. It is observed that this fungus can decolorize and remove the toxicity of reactive textile dyes like PR-HE7B and PV-H3R. However, better productivity is achieved when the fungus is in pellet form or is having dead biomass. *Aspergillus* is capable of removing metals like copper and chromium from mixed wastewater streams. It is essential to consider metal waste as most textile industry effluents had residual metal and dye in waste effluents [11]. For metal degradation *A. lentulus* and *A, terreus* are popular. This fungus shows high productivity even in the presence of mixed pollutants. Mixed pollutants are generally known to exhibit high toxicity [11]. Several new techniques, such as bioremediation, are emerging for the current scenario. Several industrial effluents are treated with nanoparticles like Fe, Au, Sn, Ag, *etc*. Like ZnO nanoparticles effectively degrade Rhodamine B, a colorant [12]. Several sulfate-reducing bacteria (SRB) are found to be effective in azo dye degradation. They are also beneficial in the mineralization of intermediates when given anaerobic conditions [13]. The fungal strain *Trichoderma harzianum* in a semisolid medium can also degrade dyes, which is identified by decolorization. Fungal mycelium exhibits color, confirming the presence of dyes [14]. Another fungal species, *Aspergillus flavus,* is reported to degrade bromophenol blue [15].

CHAPTER 38

Advancements of Transdermal Patches in Psychiatric Disorders

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Abstract: Non-adherence and non-compliance to the course of psychiatric medications affect the standard treatment plan of a patient. Inability to monitor the correct time and dosage also results in lesser efficiency of the drug and its action mechanism. Factors that may cause instability and non-compliance with the treatment plan are the possible side effects of drugs or the ease of use. With technological advancements in the field of drug delivery, transdermal patches, while Being non-invasive, ensure proper dosage and delivery of drugs through the skin, minimizing the first-pass metabolism. This review examines the existing literature, working mechanism, preclinical studies, and advancements in the application of transdermal patches in psychotropic drugs and de-addiction while evaluating various psychiatric disorders and comparing their efficacy and remission rate concerning standard oral treatment. It also addresses the challenges, drawbacks, and strategies required to increase its efficiency in clinical use.

Keywords: Affective Disorders, Transdermal Drug Delivery Systems, Schizophrenia, Substance Abuse Disorders, Sumatriptan Iontophoretic patch.

INTRODUCTION

Over the past century, psychiatric care has mostly been given in form of oral medication or through brain-stimulating techniques such as electroconvulsive therapy. With recent advancements in drug delivery systems, psychiatric care has widened its sphere of influence by providing alternatives like patches that are self-administered and not patient depended. However, compliance to medication and optimization of dose can get hampered by various psychological as well as physiological factors such as dose routine, route of administration, personal beliefs, and nature of the illness [1]. To counter these, transdermal patches are non-invasive with each patch having a period of 1 to 7 days of sustained drug

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

release and hence have paved a way for an alternative route of drug administration.

Advantages of Transdermal patches include the drug delivery through the skin avoids hepatic first-pass metabolism and gastrointestinal incompatibility without vexatious experiences of injections or rectal applications [2], and steady and sustained drug levels in the body [3]. With recent advancements, applications of Transdermal patches has widely increased in the field of Neuropsychopharmacology, specifically in psychotropic drugs which alter mood, behavior, and thoughts through drug delivered *via* skin. Examples of these include medicines for Attention Deficit Hyperactivity Disorder (ADHD) and For Major Depressive Disorders (MDD) [4] which would be discussed in the coming sections

TRANSDERMAL THERAPEUTIC SYSTEMS

Transdermal Patches, also known as transdermal therapeutic systems, consist of three structures: an adhesive, a pharmacologic agent, and an enhancing agent. Further, they are of three main types: reservoir, matrix, and iontophoretic patches. Originally, the patches were made of a liquid reservoir system where they consisted of a drug reservoir, a backing material (which functioned as adhesive and protective), and a release membrane. On the other hand, the liquid-reservoir design has been used to develop patches of testosterone, scopolamine, estrogen, *etc* [4]. An updated configuration, the adhesive matrix system consists of only three layers and the drug and the adhesive layer are combined into one, leaving only the backing layer and protective layer which is removed before applying on the skin. This design is much more popular and is used to deliver new drugs except for the ones mentioned above.

Another approved patch, the sumatriptan iontophoretic transdermal system makes use of a low voltage current to transfer the drug through the stratum corneum. Iontophoresis entails the movement of charged molecules through electrophoresis whereas the weak and uncharged molecules move through electro-osmotic force [5]. The advantage of this design is as it uses the application of electric current, the system can be controlled through a microprocessor and in this case, the patient itself.

MECHANISM OF TRANSDERMAL DRUG DELIVERY

To simplify the mechanism, drugs are transferred *via* three main pathways: through the sweat ducts, through hair follicles and sebaceous glands (collectively called shunts), or directly through the stratum corneum. In the passive reservoir or matrix configuration, the drug diffuses into the stratum corneum through

intercellular lipids. Drugs administered Transdermally need to have low molecular weight and lipophilicity, which corresponds to penetration through the skin and efficient solubility. Apart from this, drugs having a low melting point and which are more volatile can be easily composed into a Transdermal patch as they tend to permeate through the skin effectively [5].

APPLICATION OF TRANSDERMAL PATCHES IN CLINICAL PSYCHOPHARMACOLOGY

With recent advancements in the field of drug delivery and especially in neuro-psychiatry, new patches have been made available for transporting psychopharmacological drugs to treat neuropsychiatric disorders such as ADHD, Depression, Dementia, Obsessive-Compulsive Disorder, and addictions such as Nicotine and Opioid. Examples of such patches are Buprenorphine, Clonidine, Fentanyl, Methylphenidate, Nicoderm, Rivastigmine, Selegiline, *etc*. However, Scopolamine, a Transdermal patch used for the treatment of motion sickness has been found to induce toxic psychosis within a short period [6]. This is one of the side effects which would be discussed in the coming sections.

Dementia

Patients receiving drug therapy for Dementia for a greater period have shown its effects of cognitive decline which has reduced patient admission into in-patient wards. This has led to increased requirement of prolonged wear Transdermal patches [7] since a complicated dosing schedule can lead to patients taking sub-therapeutic doses [8], making the treatment less effective.

Rivastigmine has evolved as the first transdermal patch for Alzheimer's and Parkinson's disease dementia and its efficacy level reaching as high as standard oral dosage, making it a sustained drug through Transdermal transport [3]. Rivastigmine, a cholinesterase inhibitor that is administered Transdermally avoids the central cholinergic gastrointestinal side effects [9] which in the titration phase, is believed to cause a rapid increase in acetylcholine levels in the brain after inhibition of targeted enzymes. This drug instead provides sustained levels, reducing fluctuations in plasma concentrations. These properties are responsible for reducing the probable side effects of oral medication [10].

In a study by Winblad and colleagues [11], they concluded that the Transdermal Rivastigmine patch of $10cm^2$ showed improvement likewise as oral administration of the drug but with lesser side effects. Additionally, they also found that patch of $20cm^2$ showed better and superior cognitive scores as compared to standard $10cm^2$.

CHAPTER 39

Review of Intangible Urban Planning Aspects for Sustainable Brick & Mortar Retail Markets

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Abstract: Undeniably, public precincts are the stage that unfolds urban life every day, they foster social & economic bonds, bringing people together. Brick & Mortar retail market along streets is one of major mode for retail shopping in a city, in addition, these places play a pivotal role for connecting people with the physical environment and this is not a recent phenomenon but B & M retail market along streets have played this role since the origin of towns and cities. But, in recent past, rather than pedestrian there have been more flow of private vehicles in these public precincts. The position is deteriorating day by day as private vehicles are growing drastically, due to which on one hand quality of life is degraded and on other hands the aspects of public spaces had undermined in several cities. Thus, there is an immediate demand to give attention to all users at these places, so that they can stroll, communicate, shop, and comply with other social acts that are important for sustaining socio-culture aspects of cities. Along with tangible, intangible characteristics also play a pivotal role in maintaining the social & culture of any area, and as retail depicts one of the important elements of urban development so these non-physical characteristics should be incorporated in retail planning. This paper will provide insights to make planning parameters that can revive footfall in B & M stores and increase user satisfaction while physical shopping. It will also help in addressing sustainable social and cultural aspects of the city and its impact on users.

Keywords: B&M Retail, Intangible Aspects, Planning, Social & Cultural Aspects, Sustainable, Tangible Elements.

1. INTRODUCTION

Undoubtedly, in process of the retail sector, like others also changed with the advancement in technology and urban development. Each change does not eliminate the previous process but if considered appropriately they can comple-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

ment each other. For example, Omnichannel was described by Rigby [1], as "an integrated sales experience that melds the advantages of physical stores with the implementation of rich experience of online". Rigby heads the firm global innovation practice and in the article "The future of shopping" discussed that every 50 years retailing undergo interference in the process, but these changes will not eliminate the previous process, but planners and retailers need to pick up the pace of changes and reshape the process in such way that customer expectations are fulfilled. Change in customer behavior is the main reason for organized retail growth in India, is claimed by Vij [2], "The study and the analysis: an impact of organized Retail on unorganized retail in India" recommended that organized and unorganized retail sectors in India can co-exist and flourish side by side but both sectors need to keep customer satisfaction on top. Obviously, along with advancements in m-commerce & e-commerce which are providing comfort and convenient platforms to attract customers, another reason for the decline of footfall in B&M markets is increased vehicles that are not safe, especially for pedestrian shoppers. In addition, another reason for user dissatisfaction while physical shopping in present B &M markets is missing basic amenities and infrastructure.

Thus, it is time to strictly consider both tangible and intangible elements as an integral part of planning, as they play a pivotal role regarding all B & M retail markets. In the Smart city proposal, retrofitting of retail markets is one of the area-based projects in many proposals so while planning these areas emphasis should be given to the need of all users. In addition, intangible characteristics also play a pivotal role in maintaining the social & culture of any area, and as retail depicts one of the important elements of urban development so these non-physical characteristics should be incorporated in retail planning.

2. LITERATURE REVIEW

This review is to understand and analyze the need of all users while shopping in the existing B&M retail market and the impact of tangible and intangible characteristics on user satisfaction. This review also aims to compare various retail modes over decades and how it is affecting people of the city in terms of sustainability, socio-economic aspects, social life opportunities and aspirations of people.

2.1. Tangible and Intangible Measures in a Retail Environment

Irreversibly, considering retail store image, a fusion of tangible and intangible measures, and decisive customer relationship with retailers is accepted for its

success in terms of profit as well it adds value to store. Burt and Carralero-Encinas [3], "The role of store image in retail internationalization" by taking an example in the UK and Spain explained connection and contrast in customer perception of store image attribute both tangible and intangible, which must be handled carefully to have a consistent position in host market by international retail companies.

Kaltcheva [4], "When Should a Retailer Create an Exciting Store Environment?" recommended that the consumer motivational orientation controls the effect of the arousal produced by a store environment. They elaborated task and recreational motivational orientation, on one hand, task-oriented customers focus on output rather than process so high arousal decreases pleasantness & harms shopping behavior. On other hand, for recreational-oriented consumers, high arousal enhances their shopping experience & increases intentions to visit and positively make purchases.

Diallo *et al*. [5], "Factors influencing consumer behavior towards store brands: evidence from the French market" explored virtue of consumer image factors and store acquaintance on store brand purchase style. By sampling three French towns they found various factors like value awareness, store image impression and price-image have a significant impact on store brand purchase style.

Mullick [6], "A Study of Shopping Experience in Selected Retail Centres in NCR.," interprets the shopping experience in Delhi retail stores. He claims that along with shopping the ambiance should be created in such a way that customers can relish the space with their family, eventually, it will increase the reliability in customers and motivate them to visit the store again.

2.2. Urban Planning / Inclusive Approach

Gert-Jan Hospers [7], "Lynch's The Image of the City after 50 Years: City Marketing Lessons from an Urban Planning Classic" claimed that even after fifty years of publication, still the study of the perception of the image by the user in making city image in their mind, is applicable and up to date. Importantly it is not only relevant for urban planners, but psychologists, geographers, and today's city marketers can also take advantage of highlighting the city concerning five elements: - paths, edges, districts, nodes, landmarks.

Reardon [8], "The Death and Life of Great American Cities" by Jane Jacobs comments that, in her book, through the hymn, she argues in fighting for planning from street- level perspective, having mixed-use of building types is accepted, but

CHAPTER 40

Design of Arduino and Ultrasonic Based Smart Shoe

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Abstract: With the increase in population, usage of vehicles is also increasing at an alarming rate. People working round the clock and earning handsome amounts usually prefer four-wheelers to ease their journey from one location to another location. But this ease has now created a lot of problems as now more traffic jams can be seen than before and traveling time is again increasing for people bound with deadlines. So, now people have moved from four-wheelers to either two-wheelers or by foot. Also, while traveling to unknown places and roads, GPS is a must nowadays. But on two-wheelers, it is tough to use GPS on mobile phones. Moreover, the shoe is the necessity of life and when it comes to a blind person shoes can help to protect from pebbles and roads but obstacles cannot be avoided. So, we are trying to make it more convenient for blind people as well, so that with the help of sensors in front of shoes he/she will be indicated with vibrations to avoid the obstacles in the path. we are trying to make it more efficient by using new technology *i.e*., Smart shoe where information of path is retrieved from Google navigation database, and accordingly, the instructions are sent to the sensors installed in the shoes to take turns (*i.e*., U-Turn, left, right, *etc*.). All this can be achieved by interfacing the Bluetooth sensor placed in shoes and it would give signals to 4 sensors placed in four directions in shoes and when to take any specific turn it would vibrate. Also, this signal is provided to the Bluetooth sensor from a mobile application which will be connected to the Google navigation database.

Keywords: Bluetooth, Microcontroller, Navigation Database, Sensors, Smart Shoe, Ultrasonic Sensor, Vibration Motor.

INTRODUCTION

With the fast-moving world, technology is also growing faster to ease the life of human beings. Multiple options are already available for tracking routes but they sometimes lack fulfillment in certain circumstances. Also, when it comes

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

to handicapped people there is no efficient and affordable technology available. So, we are coming up with the idea of smart shoes which will be able to track the location and accordingly give direction to the person without actually holding his/her smartphone in hand. Also, if a blind person is wearing it he/she can feel comfortable as it will be notified with the help of vibrations against any obstacles in the path.

This Mobile phone plays a major role as we are concentrating on the Bluetooth module. So, for handicapped people, this is the best advantage. Therefore, a Mobile phone with Bluetooth acts as a port between Smart Shoe and GPS. Concentrating on GPS which acronyms for Global Positioning System is also in trend. People nowadays rely on it when exploring new routes or when distance measuring. GPS has been enabled and introduced in a way to detect the exact endpoint of geographical locations by military officers for the main operations and also by the civil users. This is based on the use of satellites that transfer particulars in earth orbit which allow computing the distance between the user and the satellites. Now, in the smart shoes with the accumulation of these both technologies *i.e*. GPS and Sensors, we can make the life of humans more comfortable. Now with the use of these smart shoes if a person is holding his/her Mobile phone which should be connected to shoes then with the 4-way sensors he can move along that path even if he/she is holding the phone. And for the blind also his/her life can be much more.

BACKGROUND WORK

In this project, our work will be concentrated on making a complete design for the prototype for the shoe with all the components inside it, and to be perfectly distributed in the shoe without affecting the feet. On the other side, we have a serious challenge which is to make the circuit small and to choose the smallest components as possible as we can to fit in the shoe as a primitive prototype design made by our hands, and in the long term to be abroad manufactured.

Proposed Work and Methodology

Many other solutions are available for tracking paths which are very useful in places of pilgrims and tracking on mountains and others. The techniques used in these already available systems will be discussed in this section. Global Processing System Navigation algorithm, mainly designed and introduced for hearing and sight-impaired people [1]. It consists of a GPS device with Bluetooth which interfaces with mobile. But this technology has its limitations as it does not capture all areas of markets [2]. The main keywords and Necessary information required for GPS Navigation functionality are GPS status, GPS Provider, Speed, HDOP, VDOP, longitudinal, GPS Dispatcher as shown in Fig. (**1**) [3].

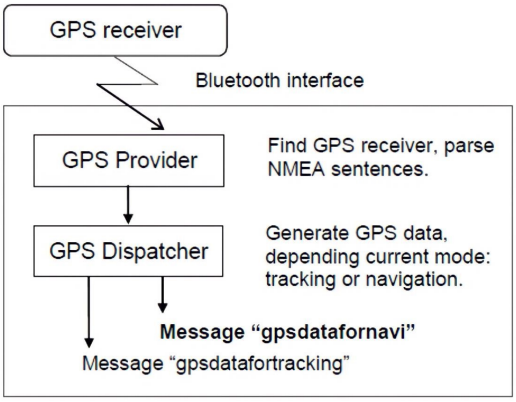

Fig. (1). Obtaining the necessary GPS data.

GPS Receiver: This communication uses GPS Provider. This mainly helps to carry through search and communication with GPS receivers by interfacing with Bluetooth. This process of connection and search is done without any human interaction [4].

GPS Provider: Find GPS receiver, parse NMEA sentences.

GPS Dispatcher: The use of class GPS Dispatcher, which helps in implementing and interfacing GPS Listener, speed modules, and filters GPS position for the availability of new data [5].

Analyzing GPGGA NMEA-0183 and CPGGA Sentences, Smooth processing of GPS information are obtained: They are Direction HDOP and VDOP, Latitude speed, Latitude, Status, Longitude approach to the GPS data, GPS Listener and Generates mainly Global Positioning System Information, depending on current mode tracking or navigation [6].

Mailbox: This is used for communication between classes. The dispatcher class generates new message "GPS data for NAVI" [7]. Whenever there is any new message, this message is generated in 1.5 to 10 seconds determined on the path of fast filtered speed.

Purpose

Our project mainly concentrating on the idea of pairing smartphones using Bluetooth with smart shoe prototypes and help the person to give necessary navigational data to those who are using it.

CHAPTER 41

Myxobacterial Metabolites: A Promising Resource for Big Pharma

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Abstract: Abstract: The lives of people have been better since the discovery of medicines. Experts were able to discover a cure for even a few chronic diseases like cancer. Scientific studies from multiple areas, including biology, chemistry, and biotechnology, have created a diverse array of solutions to the issues faced by humans in health and medicine. The usage of microorganisms to make valuable products that are important to treat various diseases and improve people's lives by using it in many industrial levels like food, pharmaceutical, and agricultural sectors has made microbial species that include bacteria and fungus, *etc*., ever-demanding. Research studies from the past few decades proved that many bacteria, including myxobacteria, have been used as a potent source for deriving lots of compounds that could be useful for humans like antibacterial, antifungal, anticancer agents, and enzymes that can degrade cellulose, protein, *etc*. Since it's a proteobacterium commonly found in organic dwells and swamps, it would be feasible to cultivate this bacterial species to produce chemical compounds with more incredible industrial applications. This review will explain why myxobacterium is considered a potential source for the production of industrially important enzymes and many other beneficial secondary metabolites. Also, this review will shed light on various ways to screen and characterize the myxobacterial population to produce cellulolytic enzymes.

Keywords: Cellulase, Enzyme, Myxobacteria, Proteobacteria, Secondary Metabolites.

INTRODUCTION

Myxobacteria are one of the widely distributed microbes ubiquitously found in aquatic and terrestrial ecosystems. A German botanist H.F. Link was the first scientist to discover the myxobacterium strain *P. vitellinium* in 1809. *Stigmatella aurantica* and *Chandromyces crocatus* were the other two genera discovered by M.J. Berkeley in 1857. These species were identified as myxobacteria for the first

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

time in the year 1982 by R. Thaxter. Since the beginning of the 20th century, several studies have been made on myxobacteria. *Myxobacteria Xanthus* became an essential research tool of myxobactrial species [1]. Reichenbach and Coworkers by discovering a new field of biologically active secondary metabolites. Molecular biology, developmental biology, taxonomy, and especially biotechnology are the main focus nowadays in myxobacterial research. Following are some of the myxobacterial genera: *Sg. Stigmatella*, *H. Haploangium*, *Na. Nannocystis*, *Cc. Corallococcus, Cm. Chondromyces, M. Melittangium, Mx. Myxococcus, So. Sorangium* [1].

Two different types of myxobacterial cells are usually seen:

Cell type I: They have flexible rod-like structures usually slender 1 μm in diameter and belong to suborder: Cystobacterinae.

Cell type II: They have a cylindrical road-like structure, usually rigid one μm wide and belongs to suborder; Sorangineae.

Vegetative cells and myxospores have such a unique shape, which becomes a characteristic of the order Myxococcales. Fimbriae are involved in intercellular cohesion as well as in social behavior [2]. Myxobacteria show social behavior, which is characterized by their property of up-taking of food and cooperative motility [3]. They show gliding movement on surfaces made up of solid. This movement is accompanied by the secretion of slime and the bending of cells. 10–60 μm/min is their gliding speed. Flagella, an extracellular motility organelle are lacking [4].

Swarming behavior is a characteristic trait of myxobacterial colonies [5]. An increase in the colony diameter indicates swarming. The movement of myxobacteria is affected by many factors such as the density of cells, availability of nutrients, and temperature. Extracellular enzymes help in the digestion of food and increases feeding efficiency.

ISOLATION AND CULTIVATION OF MYXOBACTERIA

Isolation of myxobacteria is a process because myxobacteria grow slower than other bacteria present in the soil. The different methods for isolation of myxobacteria are [6];

- Baiting with dung pellets
- Baiting with *Escherichia coli* streaks
- Inoculation of filter paper with soil

Cultivation of isolated strains is equally difficult. Many different kinds of media like PDCY media, VY/2 media have been tried, but the best results were shown by CYE Media (in grams per liter): casitone at 28–32°C [1].

The isolation technique by rabbit dung pellets method mainly applies for isolation of *Myxococus Xanthus, Myxococus fulvus, Cystobacter fuscus*, and *Archangium gephyra, Cystobacter ferruginous, Stigmatella erecta, Corallococcus coralloides*. Saline-rich soil is completely unsuitable for myxobacterial growth, owing to which myxobacteria grow in a habitat that is rich in the organic matter having a pH of 6-8. Moreover, terrestrial habitat-specific myxobacteria cannot grow in an environment having above 1% salinity [7].

The soil property also plays a major role in the existence of myxobacteria. So they are mostly found in the soil, such as brown and black soil rich in nutrients, whereas sandy soil and decomposed rock soil lack myxobacteria [8,9].

Secondary Metabolites

Myxobacteria have become the most significant source of secondary metabolites. Many molecules are biologically active with antifungal, antibiotic, and anti-tumor. Chances for medical application have been found in many structures (Reichenbach and Holfle, 1990**)**. Ambrucitin was the first chemical structure of a myxobacterial antibiotic. Then Myxothiazol formed by *M. fulvus* was found. Some essential secondary metabolites of myxobacteria are Corallophyronin C, Myxohiazol, Stigmatellin, Myxoniescin, Salranycine, Sorangicin, Aurachin E, Ambruticin, Nannochellin, Soraphen [10,11].

Epothilone

Epothilone was isolated from *S. cellulosum* epothilone in 1987, which acts upon the eukaryotic cytoskeleton (Jahn E,1911). The action spectrum of epothilone is narrow: rarely bacteria and fungi are affected. It treats cancer cells. Mainly it stops the growth of cancer cells in humans, *e.g*., breast cancer, ovarian cancers. It is used for cancer treatment in clinical applications [12]. Epothilone has been FDA-approved as an anticancer drug. The structure of epothilone is shown in Fig. (**1**).

Geosmin

Geosmin is another secondary metabolite formed from streptomycetes and is mainly responsible for the typical odor of soil. Geosmin is formed from Nannocystisexedens [13]. The structure of geosmin is shown in Fig. (**2**).

CHAPTER 42

Modern Overtures in Biomaterials for Bone Tissue Engineering and its Applications

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Abstract: Bone tissue engineering is a stimulating way to directly repair and engineer the defected/damaged bone tissue by omitting the less efficient techniques used in conventional practices. Biomaterial plays a cardinal role in providing support and extracellular environment for cell proliferation, differentiation and enhances tissue regeneration. The traditionally used bone graft has been substituted by the tissue engineering technique, due to their minimal pathogen transmission property. As there have been some challenges and restrictions, bone tissue engineering has not been a hot topic in clinical practices. The aims and objective of this paper are to review the current approaches in the developing field of Bone tissue engineering and find a better substitute as an implant device for the welfare of society.

Keywords: Biomaterial, Bone Graft, Bone Tissue Engineering.

INTRODUCTION

The aspiration behind bone tissue engineering is to improve the current approaches for bone tissue regeneration. Bone being one of the significant issues that provide a structural backup for various organs in the human body also plays a vital role in mineral metabolism and provides a site for hematopoiesis [1]. There are chances of immune rejection and pathogen transmission during allograft an autogenous graft, so as a substitute to these bone grafts, metal and ceramics are being used [2]. Biomaterials are utilized for repair or replacement, treatment, augmentation, evaluation of tissue or specific parts of the human body. Scaffolds consist of biomaterials that act as a carrier of cells and signals playing a vital role in bone tissue engineering [3]. Then the bone tissue engineering started focusing on different alternative treatments which will overcome the current situation and issues for treatments available like immune rejection, donor site morbidity, and pathogen transfer [4]. Bone grafts performed each year cost $1.6 million [5].

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

BONE TISSUE ENGINEERING

Bone tissue engineering is affined with the making of implantable bone exchange replacing defective critical skeletal which cannot heal on its own. In this scenario, priority is given to transplantation. The donor organ/tissue must be compatible with the recipient or it may result in graft rejection [6]. Nowadays, there have been many challenges in front of us related to preclinical, model business challenges; these issues have hampered clinical versions [7]. The technique involved in the making of a new substitute that can replace the damaged or lost bone tissues in a living body is referred to as bone tissue engineering [8]. Bone offers structure-designed formation, muscles binding place, tendons, and ligaments, and also the shield of vital tissues [9]. Some of the painful diseases regarded as musculoskeletal diseases include osteoporosis by losing bone mass, rheumatoid arthritis causing joint inflammation, and osteoarthritis affecting the joints in our body [10].

HISTORY OF BONE TISSUE ENGINEERING

Bone tissue restoration and replacement are bound to a significant amount of limitations and the need for quality life in the aging population have driven the field of bone tissue engineering at a demanding pace [11].

It all started with the introduction of limb transplants by Damien along with Saint Cosmos. Although the innovative idea was a result of mythology, science came from behind to prove this theory successfully. Soon, artificial analogs were used to replace the tissue and limbs and the tissue replacement concept became notable [12].

A small experiment performed in early 1970 by W. T. Green made it evident that future technologies could create biomaterials with great biocompatibility factors. His aim was to implant a mouse with chondrocytes in its bone spicules. The expected results were to form new cartilage. Although the experiment did not turn out as expected it invoked hope for future technologies [13].

BIOMATERIALS AND THEIR CLASSIFICATION

Any substance that can be engineered biologically into some material that posses therapeutic benefit and interact with biological systems which could also be utilized to repair or replace a specific portion of a living organism is termed as a biomaterial. The biomaterial chosen must have these three important properties bioinert, bioresorbable, and bioactive. In the present era, damaged tissues are either replaced or reconstructed. Both of these techniques require immense practice and compatibility. Though replacement or transplantations have aided a

lot of people, it also has its setbacks [14].

Classification of Biomaterials

Metallic Biomaterial

The biomaterials falling under this category can be used as a support material for the biological tissues and are being used currently minute amounts. These can be used as fracture plates but usually, metals are susceptible to corrosion inside the body of an organism [15]. Metals being highly corrosive cannot be implanted for long inside the human body and this property limits the use of metallic biomaterials. Majorly, there are 3 sub-categories of metallic biomaterials as shown in Table **1** [16].

Table 1. Types of Metallic Biomaterial.

Metallic biomaterial	Implementation
Stainless steel	Screws, plates, nails, hip prosthesis
Co-based alloys	Joint prosthesis, dental fillings
Ti-based alloys	Cup for hip prosthesis, pacemakers

Ceramic Biomaterials

These can be used as an alternative to metal biomaterials as they are capable of strongly binding to the bone. Generally, bio-ceramics like alumina and zirconia are bio-inert which does not harm the living organism by causing the reaction [17]. Synthetic hydroxyapatite is remarkably one of the best biomaterials possessing great osteoinductive properties and accelerates mineralization for the rapid proliferation of bone tissues [23].

Polymeric Biomaterial

Polymer can be molded to the desired shape and is comparatively economical [8]. Apart from this, the fibrous feature of polymers allows manipulation at the time of scaffold fabrication so that the porosity and structure of scaffolds can be controlled [18].

Natural Polymer

Collagen, chitosan.

CHAPTER 43

A Review of Hybrid Effort Estimation Model for Agile Based Projects

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Abstract: Software effort estimation is an important part of the software development process as it strives to determine the success or failure of the project. The success of the project is entirely based on the prediction accuracy of the software effort estimation. There has been a major challenge in agile methodology adoption which is effort estimation but the conventional means of estimating the effort mainly results in inaccurate estimates so we need to follow an appropriate model approach. This paper is reviewed to focus on effort estimation in agile projects which is related to story points that help to prioritize user stories for faster deployment of the project and to review different hybrid models that are used to predict the effort. We reviewed the accuracy parameters based on three popular agile datasets and found that the Deep Belief Network-Ant Lion Optimizer (DBN-ALO) model works efficiently for all the datasets and outperforms all the other proposed hybrid models. Different techniques can be used for minimizing the effort estimation so that the tasks can be done efficiently.

Keywords: Agile Methodology, Ant Lion Optimizer, Deep Belief Network, Effort Estimation, Story Points.

INTRODUCTION

The software effort estimation is currently an important aspect of the software industry as the success or failure of a project depends upon how accurate an effort prediction of the software is. Various techniques are being used over the years for estimating the effort in both agile and non-agile environments [1]. In agile projects, two very commonly used metrics influence the project's growth efforts, one that defines the size and complexity of the project called the story points, and the other that defines the total number of story points that can be conveyed by the team in a sprint called the project team's velocity [2, 3].

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

We can estimate efforts that are required by the software project using the agile approach efficiently based on the two factors- story points and team velocity. This paper provides an overview of the hybrid software estimation techniques being used recently. The effort estimation process for user stories in the backlog is discussed in a sprint planning meeting, after which, the product owner prioritizes the item effectively based on the team's velocity. A very important factor in this process is to reduce any kind of influence on the team and to successfully practice the exercise [4, 5]. Different accuracy parameters can be used in effort estimation like MMRE, MdMRE, PRED which shows the difference between actual and the estimated effort [6, 7].

HYBRID ALGORITHMS USED IN AGILE-BASED PROJECTS

FLANN-WOA – FLANN-WOA – It is a hybrid algorithm that combines the FLANN (Functional Link Artificial Neural Network) which consists of three layers that are first, middle, and finally the last layer for getting the nodes, and then those nodes are being multiplied by the calculated weight vector by combining WOA (Whale Optimization Algorithm) [8].

RBFN-WOA- RBFN (Radial Bias Function Network) has 3 layers just like the FLANN algorithm. The first layer of RBFN has input neurons that provide input data whereas the Gaussian radial basis function generates the middle layer. The necessary output is then obtained by extracting the weighted sum which is calculated by WOA and then multiplied by the nodes of the middle layer [8].

DBN-ALO - The number of knots in the proposed DBN-ALO architecture has five RBM's for traditional inputs whereas 3 for agile inputs. Just one node is available to attempt the output layer. The input is linked and evaluated according to the training algorithm in the visible DBN layer. Three Restricted Boltzmann Machine (RBM) stacks were relocated. The effort is calculated as a linear amount of the final RBM output at the output layer [9].

SVR-RBF-The Support Vector Regression (SVR) has been designed to address regression problems. Oliveira initially investigated the application of SVR to estimate the cost of software projects. Kernel Learning algorithm uses a popular kernel function in machine learning called the radial base function which is also used for the classification of vector machines [9].

ABC-PSO - A novel method was proposed for the calculation of the commitment in agile development projects focused on velocity and the story points. A mixed variant of Artificial Bee Colony (ABC) and Particle Swarm Optimization (PSO) algorithms had been implemented as well for getting better results [11].

REVIEW METHOD

Based on the review method, two research questions were prepared and have been answered accordingly.

Below are the Research questions that were analyzed according to the review:

RQ1: What methods have been used to estimate effort or size in Agile Software Development (ASD)?

RQ2: What accuracy parameters and effort predictors are used in effort estimation for ASD?

RELATED WORK

Jørgensen *et al.* [8] presented a new method that was collaborated and applied to the software cost estimate model and it is being efficiently tested on the tera-PROMISE datasets. Kaushik *et al.* [9] proposed a DBN-ALO method. A prediction interval of effort to deal with uncertainty in estimation was also provided in the research work. Khan *et al.* [10] explored the characteristics of user stories that can influence the estimation of effort in ASD, which is useful for improving the effectiveness of the current techniques for estimation. Khuat [11] introduced a new technique that was based on the team velocity and story point factors. The parameters of these were then optimized by employing swarm optimization algorithms. Onkar Malgonde and Chari [12] took seven algorithms to predict the efforts of a story. They also carry out computer experiments to demonstrate that the ensemble-based in comparison with other ensemble-based benchmarking performed better. Mirjalili [13] proposed the algorithm was benchmarked in three stages. The ALO algorithm was initially compared in the first two test phases with a variety of algorithms that were from their literature survey. Nassif [14] initially performed the regression analysis. Results showed that model performance was affected by data heteroscedasticity. Ezghari and Zahi [15] proposed a strengthening of the FASEE, by imposing criteria of consistency to deal with the aforementioned disadvantages. Aditi Panda [16] improved the prediction accuracy of the agile-based software effort estimation. Different kinds of neural types for doing this were used. Pandey and Litoriya [17] proposed an analysis involving the use of five different estimates. They mapped the values of the correlation into fuzzy through linguistic values. Such fuzzy numbers state vector and adjacency are then used to represent the matrix. In recommending a software estimation method, they obtained a probability of success equal to 70%. Srikrishna *et al*. [18] introduced the Evolutionary Cost-Sensitive Deep Belief Network (ECS- DBN) model in this paper for the prediction of effort in any agile techniques. Rao and Rao [19] used seven machine learning-based classifiers for

CHAPTER 44

Accident and Theft Detection Using Arduino and Machine Learning

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Abstract: Every human wants to be safe and secure health while driving. Here the big role comes for technology. Technology needs to improve a lot because we can't take risks in life. The life of human beings is very precious. The main reason for death during driving is attention. During driving, we all should be more careful and should be alert every time. The reason behind making this project is to rescue the people when they are in an emergency and to give them a medical rescue team *via* sensors and GPS, GSM, MPU6050 consists of gyroscope and accelerometer. Here Machine learning part is used for theft detection using accessing a local camera. And also this project will help to find our lost or stolen vehicles in India.

Keywords: Accident Detection, Emergency Services, Vehicle Tracking, Vehicle Theft Detection by accessing camera using machine learning coding.

INTRODUCTION

The use of vehicles has increased traffic congestion and thus led to an increase in road accidents. Lives are at stake, simply because of the urgent need for emergency supplies. Automatic microcontroller systems auto accident detection using GPS has received attention because it helps in an emergency. In this project, there is an Arduino microcontroller system that will detect the accident of a vehicle also detects the theft *via* Buzzer and Ultrasonic sensors. Hence we are introducing accident and theft detection using Arduino, Ultrasonic sensors, and Buzzers. With the help of GPS and GSM toolkit, we can find our lost and stolen vehicles also. This project can save the life of human beings from unplanned happenings. When we start the car engine a caution message is sent to the holder's

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

cell phone. When theft happens, the owner will be able to identify the theft and will be able for emergency services shortages *via* an app [1]. At last, the paper contains as follows. Section I Methodology. In Section II, we discuss the literature survey and block diagram. In Section III Block diagram of the GSM system for mobile communication work. In Section IV Block diagram of GPS working in accident and theft detection. In Section VI working of code with the camera using machine learning code. In Section V working on this project. At last, the conclusion of this project.

SECTION I: METHODOLOGY

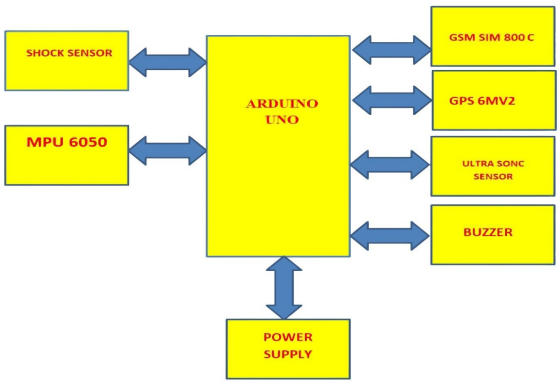

Fig. (1). Block diagram of this project [1].

Step 1: According to the Block diagram we have added a shock sensor, MPU 6050 that consists of an accelerometer and piezoelectric sensor, GSM, GPS, Ultrasonic sensor, and a buzzer.

Step 2: Firstly, a piezoelectric sensor will detect the accident, and the code written for MPU 6050 will be intimated.

Step 3: Latitudes and longitudes will be detecting on GPS and messages will be sent to nearby people with the help

of Buzzer and *via* GSM SIM800C.

Step 4: A message will receive that is a google maps IP number, that is prestored in Arduino Uno.

Step 5: If there is any false message an OFF switch is also provided (Fig. **1**).

SECTION II: LITERATURE SURVEY AND CIRCUIT DIAGRAM OF THE PROPOSED PROJECT

From the past circumstances, we come to know the Drawbacks that have been noted down

1. Detection of vehicle accidents plays a significant process in system projects.

2. After an unplanned accident, medical attention cannot be given to the needed person immediately.

After considering the drawbacks we have mapped out a proposed system that produce all the mentioned drawbacks.

1. A computerized system will be used once when an unplanned accident has happened.

2. This computerized system gives perfect output information about latitudes and longitudes in a system when any unplanned accident occurred in an area without taking any delays.

3. We can save human life using this computerized system when any accident happened.

4. This machine gives us attention when the theft happened.

Hardware Description

Arduino is a microcontroller device and is based on an open-source electronic platform prototyping board that can be easily programmed. In this project GSM accident detection, MPU6050 that consists of an accelerometer and gyroscope is used to detect or sense the posture of motion (Fig. **2**) [2]. A gyroscope sensor is a device that senses an angular velocity. In simple words, angular velocity is a change in rotational angle per unit of time. This computerized system is used to pitch of vehicle and because when any person is cross from an accident event, the vehicle tends to fall off to down, and the pitch angle is usually small (Fig. **3**) [3]. The work of receiving the pitch angle of the car also be executed by using a gyroscope that will provide the angular acceleration details of the GSM. Moreover, the tilt of pitch angle of the car is evaluated by using MPU6050 and in tie-up with the accelerometer. Gyroscope is used to help in computing the pitch angle which uses to help in executing the present algorithm (Fig. **4**) [4].

Arduino is a microcontroller device and it is based on an open-source electronic platform prototyping board that can be easily programmed.

CHAPTER 45

Review on Phyto-Remedy to Manage Diabetes Mellitus

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Abstract: Diabetes Mellitus is a heterogeneous metabolic disorder with various aetiologies that are characterized by chronic hyperglycemia. DM is a consequence of defective metabolism in the body was either cells fail to secrete insulin or insulin *per se* is inactive. Insulin is a pancreatic hormone responsible for glucose uptake and utilization by cells for energy production. Thus, insulin deficiency renders the cells unable to uptake and utilize glucose for metabolism. DM is majorly categorized into two conditions: Type 1, In this case, there is no enough insulin production by the pancreatic cells (Insulin-dependent). In type II, despite insulin production, the cells fail to respond to the hormone (Insulin Independent), the reason behind the former is not yet clear, but the latter is studied to be a result of obesity or inactivity. Thus, as a consequence of an error in glucose metabolism, it leads to comorbidities, with high glucose concentration in the blood causing damage to the circulatory and excretory system. This condition becomes life-threatening without proper medical care. Type 1 can be treated with an external source of insulin provided to the body. Type II is treated with hypoglycaemic drugs. Along with medicine, other options include an improved lifestyle with proper nutrition and exercise. The number of diabetes patients has been increased today. In the present review article, we have discussed the research reported to show medicinally important plants and plant-derived compounds which have been shown to affect insulin production and glucose intake and utilization in type 2 diabetes patients.

Keywords: Antidiabetic, Diabetes, Hyperglycemia, Medicinal Plants, Natural Treatment.

INTRODUCTION

Diabetes mellitus, a heterogeneous metabolic disorder, characterized by hyperglycemia condition because of the absence of insulin, and its decrement in concentration and its action mechanism. Hyperglycemia with chronic diabetes is related to several long-term microvascular complications affecting kidneys, ner-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

ves, and damaging of the retina which is the subject of diagnostic criteria too for diabetes. In macrovascular, it is caused a high risk of cardiovascular disease (CVD) and tissue and organ damage [1]. Overall, it affected the patient's style and reduce the survival rate and increase the burden of diseases and cost of treatment. Conventional medicine and treatment are being utilized to suppress the diabetes effect but they have their side effect if used in long term. Plants and their products are natural and have many diverse chemicals which have been utilized for many purposes and one of them has medicinal potential. Antidiabetic medicinal property has already been observed in many plants and exploring in other plants too. Here, the information of some phyto-remedy is mentioned which can fight with type 2 diabetes to suppress and defeat diabetes with fewer side effects and better efficacy [2 - 4].

CLASSIFICATION AND DIAGNOSIS OF DIABETES

Long-time persisting hyperglycaemic condition is responsible to cause diabetes which may arise due to lack of insulin production responsible for type 1, insulin insensitivity, or resistance responsible for type 2, and during pregnancy cause gestational diabetes [5].

Epidemiology

Diabetes mellitus is no longer an international concept for the global community; it is increasingly prevailing in all countries [6], regardless of the volume of revenue. According to recent estimates, 629 million individuals are expected to suffer from DM by 2049 [7]. In children, T1DM is more predominant, especially in those going from birth to 14 years old, yet it can cause in people of all ages, with a man abundance found in youthful grown-ups [8]. Adults or obese individuals, on the other hand, are frequently affected by T2DM, but this can also occur in adolescents, according to the latest studies. T2DM is sometimes pointed to as the biggest donor to the diabetes community as a whole [9].

TREATMENTS

From ancient literature and to the present-day research, the use of plant varieties to extract medicinal valuable compounds for the treatment of several human diseases has been reported. In the present study, we have reported research demonstrating medicinally valuable plants and their products which have shown a positive effect in response to diabetes mellitus.

Plant Remedies in the Management of DM

From its roots on earth, civilization has used plants to cure illnesses and to

promote general health. Plants have been the world's most important natural resource since ancient times [10,11]. The knowledge base concerning the therapeutics properties of herbs was primarily given by tribes and these plants are in high demand in both created and non-industrial nations. The World Health Organisation reports that 80% of the total populace relies on herbal drugs, most of which use plant remedies, to fulfill their primary health care needs. The current pharmacopeia also includes at least 25% of plant-inferred drugs and many others that are semisynthetic, because of plant-confined model mixtures. Recent studies indicate that among diverse cultures and nations, more than 9000 herbs have known medicinal uses [12].

Achyranthes Aspera

This herb belongs to the family *Amaranthaceae,* widely grown in India and called Chirchitta, Chirchira (Hindi). In indigenous medicine, *Achyranthes Aspera* is respected a great deal. *Achyranthes Aspera* ethanolic extract was tested for in-vitro anti-diabetic action against diabetic mice caused by alloxan. A substantial decrease in blood glucose levels was found observed after the treatment from the extract in diabetic mice [13].

***Bael (Aegle marmelos*)**

Bael, a common name in Hindi, belongs to the genus of Rutaceae identified as a medicinal plant to cure various diseases [14]. The numerous bio-chemicals that are contained in the leaves of *A. marmelos* are alkaloids, heart glycosides, saponins, terpenoids, tannins, steroids, and flavonoids, *etc* even its fruit is also utilized for medicinal purposes [4] Ethanolic extract that contains *A. marmelos* has shown that diminishes blood sugar in alloxan-induced diabetic rodents. After continuous extract organization, glucose drops could be seen from the seventh day and sugar levels were discovered to be diminished by 54% on the 28th day. Alloxan-induced oxidative stress was observed to be greatly diminished when *A. marmelos* extract was administered. The Histopathological examination uncovered the recovery of β-cells in both the concentrate and glibenclamide treatment classes. The concentrate of ethanol given by the leaves of *A. marmelos* is a diabetic enemy of alloxan-incited rodents with promising antidiabetic action [15].

***Aloe Vera (Aloe barbadensis Miller*)**

Aloe vera, a common name in Hindi, is being utilized globally due to its uncommon medicinal properties. It contains more than 70 active ingredients, including nutrients, minerals, proteins, amino acids, polysaccharides, and phenolic compounds [16]. The therapeutic effects of A. vera gel include, but are not limited

CHAPTER 46

Biometric Smart Card

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Abstract: It is a common saying in the security industry that the "S" in RFID stands for "Secure". An RFID Tag/Card dumps all the information it contains when brought close to the RFID Reader. The RFID Card is therefore considered unsuitable for storing sensitive data. Our project aims to find a way of adding a layer of security to the RFID Card using biometric authentication, which would widen the scope for the use of RFID technology in areas where they couldn't have been used before, such as contactless payments.

KEYWORDS: Biometric ATM Card, Biometric Authentication, Biometric Contactless Payment, Biometric Smart Card, Contactless Payment, RFID, Smart Card.

1. INTRODUCTION

The modern world is headed towards digitization at a pace that has never been seen before. It is therefore important for us to contribute towards this progress by doing our part in improving the technology that already exists and come up with innovative solutions to problems that haven't yet been solved.

The age of digitization has brought with it numerous ways which significantly reduce human effort. Technologies such as self-driving cars, which reduce the effort put in by the driver while driving. Online banking, which has eliminated the need for the customer to go to the bank for making a withdrawal/deposit. Home automation, which manages all the small and laborious tasks in a house, such as a temperature control, automatic motor control, gas leak detection, intruder alert system, *etc*. These are among the few examples of the part technology plays in improving the daily lives of people by eliminating the small tasks there by giving

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

them more time to focus on improving their lives and spending time on the things that matter. As with every new technology introduced, there are several benefits and also certain drawbacks, the most significant of which is security. As smart devices make life more convenient for the user, the job of those who exploit these devices for personal gain also becomes easier.

One such example is contactless payment technology. It works by bringing the contactless payment-enabled card within 2cms of the post terminal and any amount within the predefined limit (Rs.2000) can be debited without requiring any form of authentication (PIN) from the user. This no doubt speeds up the payment process, but as is quite evident, it has the potential to be misused, and getting a refund from the bank would be quite a hectic and drawn-out process if at all the bank agrees to refund the amount. Hence, the need arises for a mode of authentication that is just as fluid and fast as the process of tapping the card on the POS terminal without entering the PIN. One of the solutions for this problem is adding a biometric authentication method to the card itself so that the contactless payment is disabled until a fingerprint sensor reads and authenticates the fingerprint of the cardholder. In this method, the cardholder would only have to hold the card by the fingerprint sensor to activate contactless payment and then tap the card on the POS terminal for the payment to go through. This method provides an additional layer of security, thereby drastically reducing the risks associated with contactless payments.

2. RESEARCH METHODOLOGY

The project that we aim to make different from any of those which are already available in the present market and are being taken into use by people in their day to day lives *e.g*., contactless payment system using RFID technology is already available and is being readily used by the vast majority of people like at the toll plaza. A biometric attendance system is present in the market for a long time now and is very efficient and is used by people in several places like offices, institutes, universities just a name of a few. ATM cards with tap and go facilities are also readily available and are being by people everywhere around the globe. The project that we are making is a blend of all technologies mentioned above, just smarter, more reliable, more secure, portable, and efficient. Because in our project we plan to use RFID to store the concerned person's data who is supposed to use that particular card, like the fingerprint. We are also using a fingerprint scanner module to store the digital fingerprint and then later verify that it is being used by the same person which adds up additional safety. While all the above-mentioned systems are designed for a specific application, this smartcard is multifunctional and can also store important documents such as the ID card or the Driver’s

License. It can be used for cashless payments just like a regular ATM card or as a contactless card with enhanced security.

3. OVERVIEW OF THE CURRENT BANKING SYSTEM

Many people from across the globe have turned towards contactless payments and the number just keeps on increasing. Especially in India, statistics show that the number of card payments has increased rapidly after the arrival of 4G refer (Fig. **1**)) in 2016. Contactless payments are widely accepted by people and are also a preference in places where less time is required for the purchase. Instead of entering a pin that one tends to forget, one may simply prefer to "tap and go" [1]. Since the early 2000's many renowned companies from across the globe have launched their payment methods to make contactless payments, each one having its methodology to ensure that it will do the job without any security issue, as the only thing people were concerned about was "security" [2]. After that others also took part and launched their payment systems for their user base so that their users don't have to rely on somebody else's payment system to make payments [3]. Mobile payments increased rapidly across the globe and have proved to be very effective [4]. Some regions are not only accepting contactless payments but are also shifting towards cryptocurrencies, many countries have also opened banks just to support contactless payments [5], many people find it effective and have been saying that it is a much faster mode of payment than the conventional payment methods [7]. Places, where people tend to carry less amount of cash, are being dominated by contactless technology [8]. This technology is being supported and backed not only to make faster and safer payments but also to make the transition towards a cashless society [9].

Fig. (1). Value of card payments in india from financial year 2014 – 2020 [6].

CHAPTER 47

Bamboo Infoline in Himachal Pradesh-Analyzing the Current Status of the Furniture Industry and Artisans

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Abstract: India is famous for its cultural legacy and its artisans and artistic heritage. Himachal Pradesh has always been known worldwide for its culture, styles, and workmanship. Bamboo is the most versatile and sprightly growing perennial grass. It is the fastest-growing resource that is getting recognition in all the states of India but has shown a very low pace in Himachal Pradesh. The state which is a hub of artists and bamboo resources is not able to utilize the resources and meet consumer demand. The prominent concerns in Himachal Pradesh are inadequate technological know-how & facilities; lack of awareness amongst artisans regarding the latest trend of bamboo furniture and design; lack of promotion of bamboo craft and furniture. The artisans and craftsmen are facing many challenges due to these impediments. Bamboo is an exciting design resource and has many positive attributes such as rapid growth, high strength, and ease of manipulation using simple tools with low investment and can act as a supportive measure to enhance the current status of the artisans in Himachal Pradesh. The removal of poverty and social tensions which Himachali craftsmen are facing, bamboo furniture development and productions can play a major stroke to protect the heritage legacy [1]. The focus of this paper is to find the current status of the bamboo handicraft and furniture industry in this highly tourist-oriented state of Himachal Pradesh, the gaps and challenges faced by all the stakeholders in the industry, and the development policies which are needed to produce a better source of handicraft and furniture to meet consumer demand.

Keywords: Bamboo, Bamboo Artisans, Craftsman, Furniture, Handicraft, Himachal Pradesh.

1. INTRODUCTION

The Indian bamboo and handicraft sector has significant importance in the economy-boosting. Besides promoting the cultural heritage and design of the state

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

it is also generating an inflow of foreign exchange and interest in the foreign market.

The bamboo furniture and handicraft sector have been of importance since 1950 in promoting the creative skills and heritage of India. Himachal Pradesh is the main contributor to this development, it is a state with a geographical boundary of 55673 km^2. The ancient history described this state as the "Abode of Gods" located in the Northern part of India and boundaries by Jammu & Kashmir, Punjab, Uttar Pradesh, Haryana, and Tibet shown in Fig. (**1**). The state extended on 30^0 22' to 33^{0}12'north latitude and 75^0 45' and 79^0 45'. Being a part of the Himalayan region, the state AMSL [average mean sea level] is 350 to 7000 meters [2].

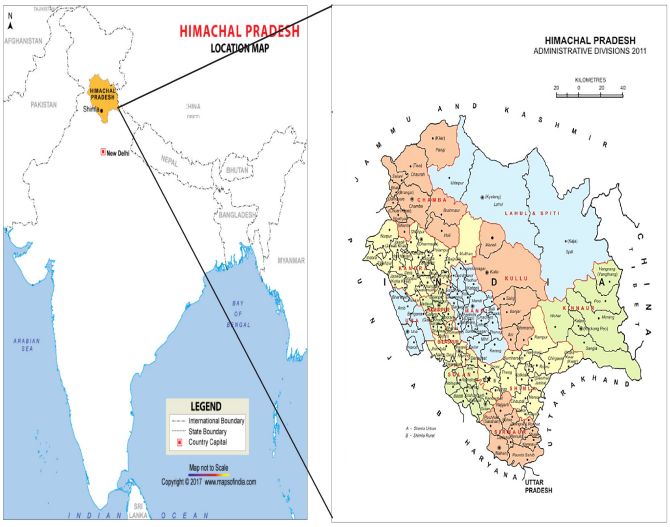

Fig. (1). Map showing location of study.

India is a very important supplier of bamboo in the world market. Since independence, with the legacy of Gandhian philosophy, the small-scale sector played an important role in boosting the Indian economy. It has been estimated that 40% of the total industrial output and 35% of the total direct export is been originated from the small-scale sector [3]. The bamboo and handicraft industry in the industry is highly labor-intensive. It is spread all over the rural and urban sectors of the country and provides a wide scale of employment to millions of artisan and large-scale women from the rural sector. The bamboo and furniture and handicrafts sector have been given importance since 1950, many policies were made to support the sector but policy implementation is facing lots of gaps and challenges. Our Rural and urban artisan and workers have given hefty

contributions to the economy of the country. Bamboo, popularly been referred to as "poor man's timber" has been an integral part of life in the hilly states. Fig. (**1**) shows Map location of the Study.

The small scale industry of Himachal Pradesh which includes bamboo furniture industry and sawmills are less capital intensive compared to the other industry like paper, plywood, and other boards products. For centuries the local community is been using bamboo from food to construction. The paper is focusing on finding the current status of the bamboo handicraft and furniture industry in this highly tourist-oriented state, the gaps, and challenges faced by the industry and the artisans, and development policies that are needed to produce a better source of handicraft and furniture

2. BAMBOO CLUSTER HISTORY

The history of bamboo furniture and crafts has no specific records but it can be traced back to the 2nd century AD. During the ancient days, bamboo cutting was forbidden by natives because of its religious significance and auspicious value but the origin of bamboo crafts can be traced from the time when man started cultivating food crops thousands of years ago. The bamboo crafts and furniture industry is been one of the oldest cottage industries because of its versatility, strength, and easy workability with simply hand-handled tools [5]. The people of the state [Himachal Pradesh] are highly involved in the bamboo-related industry from making baskets to mats and this industry is highly contributing to the alleviation of rural poverty and women empowerment. These craftsmen are known by different names in different districts like Dumnas, Reharas, Bararas, Banjaras, Kolis, and Chamangas [6]. This industry is providing earning opportunities to many rural women and was majorly contributing to making them more financially independent. Most importantly this industry is playing a major role in environmental rejuvenation as bamboo absorbs 12 metric tonnes of carbon dioxide per hectare and produces 45% of more beneficial oxygen than other plants moreover bamboo needs less water than many other species which helps in maintaining soil stability. The industry was earlier confined to the household level but later it grew due to various central government policies. Many artisans were experts in the production of bamboo furniture and handicrafts. The cluster of bamboo working was practiced in many districts like Kangara, Pathankot, Dharamshala, Mandi, Kullu, and Baijnath [4].

CHAPTER 48

Nutritional and Therapeutic Properties of Button Mushroom (*Agaricus Bisporus*)

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Abstract: Medicinal plants have great importance these days and the better way to provide medicines is to give them as food. Mushrooms are one of the good sources of food that has good nutritional and therapeutic value. They are the constituents of a good diet which boosts up the immune system and helps to fight diseases like cancer. From ancient times people of China believed that the mushrooms have anti-aging properties and they had been consuming mushrooms as their important diet. Along with the anticancer and anti-aging properties, they increase brain activity. One major advantage of mushrooms over other vegetables is their growth period, *i.e*., they can grow around the year while many vegetable plants are seasonal. The present review article is focused on the nutritional and therapeutic properties of button mushrooms in more detail, which will help the researchers working in this area to design further experiments and explore more on this plant.

Keywords: Anticancer Activity, Anti-Diabetic Activity, Button Mushroom, Nutritional Properties, Therapeutic Value.

INTRODUCTION

Mushrooms are the part of Basidiomycetes family and are used both as food and medicines. They are edible and poisonous too. The edible part of the Basidiomycetes family is known as “Mushrooms” while the non-edible part is “Toadstool” as they are poisonous. Unlike other plants, they do not perform photosynthesis as they have no chlorophyll in them and reproduce with the help of vegetative propagation. During the process of vegetative propagation, the mycelia of the mushroom secret the enzymes which are responsible for the breakdown of

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

the compounds that are present in the substrate such as cellulose and lignin. The compounds that are degraded are again absorbed by the hyphae and allow mycelia to grow. Usually, mycelia grow in a lateral form but in some cases, the diameter enlarges [1].

NUTRITIONAL CONTENT IN *AGARICUS BISPORUS*

Proteins

A. bisporus is a protein-rich vegetable. The crude protein present in *A. bisporus* comes next to the protein content of animal meat but is superior as compared to milk protein [2]. *A. bisporus* contains most of the essential amino acids that can only be consumed from non-vegetarian products. *A. bisporus* contains many types of amino acids that are essential like histidine, leucine, valine, threonine, isoleucine, arginine, lysine, methionine, *etc*. The amount of amino acids is balanced in *A. bisporus*. Cysteine and threonine are limiting amino acids. *A. bisporus* is considered the best source of threonine, isoleucine, and tryptophan. In frozen and preserved white button mushrooms, there is an abundant amount of exogenous amino acids. The amount of aspartic acid, glutamic acid, and arginine is 8.1g, 6.2g, and 8.0g per 100g of the total amount of protein. By using various types of substrate, during the cultivation, protein content can be increased as various types of the substrate can provide nutrients to the fruiting body [3].

Carbohydrates and Dietary Fibers

Carbohydrates provide us with energy to do work. The carbohydrates content that we get from *A. bisporus* is not considered a major energy source for human beings. It was observed that based on dry matter percentage of carbohydrates present are mannitol (8.56), glycogen (5.34), reducing sugars (2.48), and hexuronic acid (0.32). Two forms of carbohydrates present are digestible carbohydrates, which are present in a small amount like glycogen that is 5-10% daily values whereas non-digestible carbohydrates which include non-starch polysaccharides like chitin, mannans which constitute major carbohydrate content in *A. bisporus*. Mannitol is the most abundant sugar in mushrooms as there is 80% mannitol out of total free sugars present in white button mushrooms [4]. Research shows that carbohydrate content is 3.26g per 100g of *A. bisporus* Dietary fibers consists of constituents of fungal cell wall like hemicelluloses, beta-glucan, *etc* which adds to the nutritional content of *A. bisporus* [5]. Dietary fibers are estimated to be 1g per 100g of *A. bisporus*.

Minerals

Mineral content vary according to diameter, type of substratum of fruiting body,

and species of mushroom. *A. bisporus* is rich in Fe, K, Cu, Zn, Na, Co, Se, Ca, Cd and Mn [6]. Research shows that there is more amount of different types of minerals in the cap than they are in the stem but calcium and iron are more in an amount in the stem than in the cap. Phosphorous (10,400-11,230mg/kg) and potassium (38000-39500mg/kg) is present in maximum amount in *A. bisporus*. Mushrooms are grown on substrates rich in zinc, selenium, and copper. 56-70% of total ash content is produced by minerals like K, Na, Mg, and P whereas 45% of total ash is formed by potassium alone. *A. bisporus* is considered a poor source of selenium with a concentration of 1 microgram per gram on a dry basis.

Vitamins

A. bisporus contains a variety of vitamins like folate, pantothenic acid, riboflavin, thiamin, niacin, *etc*. It is reported that white button mushrooms are rich in vitamin B complexes [7]. *A. bisporus* is not usually rich in vitamin C and vitamin D. They are deficient in vitamin D because they are cultivated in a dark environment. There is a technique used to fix this deficient nature of vitamin D. When fruiting bodies are treated with ultraviolet rays. Perhaps this exposure leads to the production of vitamin D2 [8]. Ergosterol which is one of the constituents of the fungal cell wall is also a precursor of vitamin D2 [9]. Ergosterol from white as well as from brown button mushrooms. The antioxidant activities of both types of mushrooms are correlated with the ergosterol level of fruiting bodies [10].

THERAPEUTIC PROPERTIES OF BUTTON MUSHROOMS

Anticancer Activity

Lectin from the common mushroom *A. bisporus*, a popular edible species in western countries, has potent anti-inflammatory effects on human epithelial cancer cells, in addition to the apparent cytotoxicity. Lectin from *A. bisporus* has anti-inflammatory effects on various cell types. Selenium is an important chemical element in humans and animals. Selenium helps in the prevention of cancer. Selenium has a potential role in cancer protection by protecting antioxidants and/or increasing immune function [11]. The intervention trials also showed the benefits of selenium in reducing cancer, especially within the liver, prostate, colon, and lung, with excellent benefits for those with low selenium status. Aromatase is an enzyme that converts androgen into estrogen. Increased exposure of aromatase to breast tissue is considered a risk factor for carcinoma Ergothioneine, lectin, and beta-glucan found in white-buttoned mushrooms act as an antioxidant for breast cancer.

CHAPTER 49

Phytochemical and Therapeutic Properties of Indian Bay Leaf (*Cinnamomum Tamala*) Plant: A Review

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Abstract: The Indian bay leaf (*Cinnamomum Tamala*) plant is found in high altitudes along the tropical and subtropical regions of India. This plant is very useful to be used as a food ingredient and as a medicine for centuries to treat several ailments. The leaves are traditionally used in the Indian household as a spice in food and even as a mouth freshener and deodorant. This is because the leaves have a pepper-like aroma which is caused due to the essential oils present in the leaves and the bark. It is rich in alkaloids, flavonoids, terpenoids, polyphenols, *etc*. These phytochemicals are responsible for their aroma, flavor, and medicinal properties. The plant has therapeutic properties against various types of diseases. Due to its antimicrobial properties, it has been used as a preservative in the food industry. The present review discusses in detail the phytochemical and therapeutic properties of *C. Tamala,* along with its tremendous potential to be used as a medicine.

Keywords: Alkaloids, Bay Leaf Plant, Phytochemicals, Secondary Metabolites, Therapeutic Property.

INTRODUCTION

Nature is a treasure trove and it contains various treasures which help humanity grow and evolve. One of the most important and interesting treasures that can be found in it is plants, which provide us with minerals, vitamins, and even act as medicines. For thousands of years, humans have used plants not only as a source of food but also as a source of medicine for various ailments and disorders [1 - 3]. The advancement of technology prompted us to understand the therapeutic properties of various plants at a molecular level. The medicinal plants are rich in

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

phytochemicals which play a vital role in the treatment of different ailments. The phytochemicals are constitutive metabolites in plants that act with other nutrients and fibers to fight against diseases [4]. These chemicals on intake create a certain physiological action, suppress the growth of pathogens without causing any adverse effect to it, and have anti-mutagenic, anti-carcinogenic, and several other various attributes [5].

C. tamala is known as Indian bay leaf is a plant that belongs to the genus Cinnamomum under the family Lauraceae. In India, it is commonly known by names such as Tejpat, Tejpatta, and many more. Up to 350 species of this plant can be found worldwide [6, 7] and there are such species. In India, we can find around 20 such species. It is found in the states of Sikkim, Assam, Mizoram, Meghalaya, and on the North-Western parts of the Himalaya among its tropical and subtropical regions at an altitude of 900 -2500 m and is found mostly in shady and ravine slopes [8, 9]. The plant *C. tamala* is a medium-sized evergreen plant. Its trunk is grey-brown and its bark is soft and wrinkled in texture with abundant leaves present [6, 7]. The plant extract contains various phytochemicals used for various ailments such as diabetes, cardiac disorders, arthritis rheumatism, hyperlipidemia, inflammation, bladder disorders, hepatotoxicity, vomiting, diarrhea, and many more [10]. It is also used in the food industry as an ingredient for food items such as pickles, baked goods, sauces, some drinks, and many more, it is also used as a preservative for pineapple juice [8]. This review study focuses on the phytochemical and therapeutic properties of this plant.

Chemicals Found in *C. Tamala*

The frequently used part of *Cinnamomum Tamala* is its leaf, it has many components but the major component of bay leaf is the essential oils which consist of furanogermenone (59.5%), β- caryophyllene (6.6%), sabinene (4.8%), germacrene D (4.6%) and curcumenol (2.3%). It has other components such as eugenol, cinnamaldehyde which is present in the barks, it is responsible for the aroma [11]. The medicinal use of the oil is anti-flatulent, diuretic, and carminative properties [12]. The extract from Cinnamomum Tamala has terpenoids, alkaloids, phenol /polyphenols in extract fractions. The spice plant has phytochemicals that are used to develop antibacterial agents [13].

Phytochemical Properties of *C. Tamala*

Phytochemicals can be divided into seven different types which are polyphenols, alkaloids, tannins, terpenoid, phytosterols, saponins, and flavonoids [14].

Polyphenols

They are the secondary metabolites involved in the process of defending against UV rays and pathogens, plant polyphenol consumption in the diet prevents cancer formation, heart diseases, diabetes, and bone disorder, it has other properties like tests, aroma, smell, and against oxidative damage in food [15]. It is beneficial in reducing the adverse effect of aging on the brain or the nervous system.

Alkaloids

They are naturally occurring nitrogen-containing organic compounds. Alkaloids have complex chemical structures, it has been used for more than 3000 years and has various medicinal uses such as been used as purgative sedative and antitussive for fever, snakebite, and insanity. Alkaloids are known to have pharmacological effects, due to which it has been widely used in pharmaceuticals, such as stimulants and narcotics, but many alkaloids are toxic to different organisms so these are used as poisons [16, 17].

Flavonoids

It is a group of polyphenolic compounds that are classified into four groups, flavones, flavanones, anthocyanins, and catechins, and are mostly found in fruits, nuts, seeds, vegetables, stem, flower, honey, wine, tea, and propolis, and are known to have biochemical and pharmacological effects. antioxidant properties prevent cell damage, showing anti-tumor properties, improve blood circulation and decrease blood pressure [17].

Tannins

It is the most important secondary metabolite, tannins are described as the phenolic compound of high molecular weights, found mostly in plant leaves, barks, woods rots, *etc*. These provide the defense mechanism against insects, fungi, pathogens, herbivores, and help in regulating growth. Tannins have the ability to bound to proteins that form soluble or insoluble complexes, which gives the ability to form a complex with nucleic acid, alkaloids, saponins, polysaccharides, and steroids [18, 19].

Saponins

Saponins are secondary metabolites present in barks, stems, leaves, flowers, and roots. It has medicinal properties such as anti-inflammatory, antimicrobial, anti-tumor, anti-ulcer, hepatoprotective, decreases blood cholesterol level, and is used as an adjuvant in vaccines. It is used in the preparation of soaps, detergents, shampoos, beer, cosmetics, and fire extinguishers. Drugs based on Steroidal

CHAPTER 50

A Survey on FANET: Flying Ad-hoc Network (Situations & Model Functionality)

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Abstract: Perhaps the contact that is key to coordination and interaction across UAVs (Un-named Aerial vehicle) has been some of the main marketing difficulties regarding mega-UAV (Interplanetary aerospace aircraft) platforms. If any of the UAVs were daisy-chained with the node or maybe a land base network, the UAV may interact *via* the infrastructure. Moreover, the mega-UAV device functions are limited by such a network-dependent interaction design. The issues of a completely infrastructural UAV system could be solved using ad-hoc networking within UAVs. The following study discusses flying ad hoc networks (FANET), an ad hoc network that links UAVs.

Keywords: Asymmetric key, Group key management, Key management, MANET, Routing protocols, Symmetric key.

INTRODUCTION

Owing to just the exponential developments throughout the development of electrical, detector, and connectivity capabilities, unmanned aerial vehicle (UAV) devices may be developed that would operate automatically or globally requiring management. Thanks to the range, mobility, simplicity of deployment and fairly low operational cost, the adoption of UAVs offers different opportunities for intelligence and defensive purposes including scan as well as kill operations [1], border monitoring [2], and the control of wildfires [3] when second-UAV structures are used for years, there are several benefits of a community of smaller UAVs, rather than designing and running a big UAV. Mega-UAV structures have special functions, and connectivity is the most critical architecture concern [4]. Flying Ad-Hoc Network (FANET) is a new program group that is effectively an ad hoc network for UAVs.

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The variations in the MANET, VANET, and FANET ad hoc cell tower are discussed and the key FANET implementation problems are identified [5] the FANET station's major technical problems. In addition to the advancement in microcontrollers as well as the move towards battery technology in hybrid propulsion machines, tiny or tiny UAVs were developed at a reasonable cost [6]. The potential of a specific UAV is therefore constrained. Different UAVs may be synchronized and combined in a framework that is above one UAV alone [7]. That effect of mega-UAV structures might be formulated as fare, ascendable, perseverance, discharge, micro transversal satellites. UAVs may also be connected to land or a drone in a mega-UAV network as in a standard UAV network. Components of such a policy cantered on star topology can exist [8]. Although only a UAV portion of soil bases or satellites may interact, all UAVs create an ad hoc web. It allows the UAVs to interact between the surfaces towards the other.

Good communication and communication with UAVs, FANET often requires third-party-to-peer communications. This also provides information either from the area, as is the case for embedded detector systems. FANET will also promote peer group-to-peer networking and simultaneously integrate recast congestion flow. There is a significantly greater standard disparity among the FANET networks than during the MANETs. MANET, VANET, FANET are displayed in Fig. (**1**). In the new section, we provided many FANET implementation situations and FANET interface features.

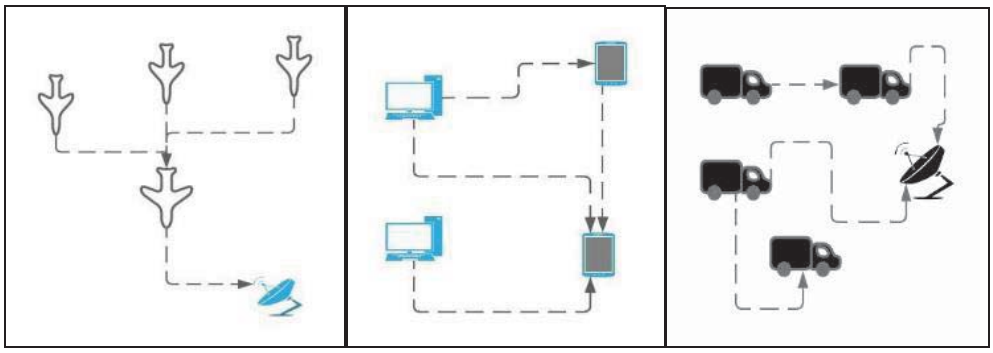

Fig. (1). View of FANET, MANET, VANET.

RELATED WORK

Ad hoc flying networks (FANETs) were discussed in their reports, an ad hoc structure linking UAVs [9]. Secondly, cellular informal channel differences between FANET and VANET are clarified, followed by significant impediments

for the production of FANETs [10]. In keeping with both the new FANET protocol, the issues of research required are often dealt with [11]. They have essentially provided in this article a review of several FANET agility designs. Survivability is among FANET's several intractable problems [12]. The disparity among FANET as well as other ad hoc networks has been spoken about. As just an upcoming piece of research, they like to contrast such models with one route configuration pick the best with FANET [13]. A quest and destruction operation is carried out in a restricted area by several UAVs. The UAVs get a narrow band of sensors and are capable of carrying minimal assets to minimize demand. The UAVs do a job of finding objectives [14].

SITUATION WITH FANET

Extended Mega-UAV Operating Optimization

When a Mega-UAV transmission platform is installed on technology including a transmitter or a foundation, the field of service is restricted to architecture's connectivity range. Rather than UAV-to-footing connections, FANET is focused on the UAV-to-UAV ground stations, which can expand the service scope. (Fig. **2**) shows an example.

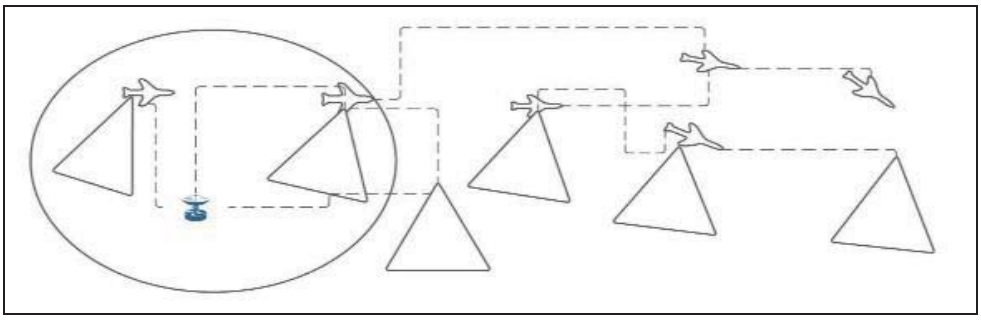

Fig. (2). A FANET circumstance to improve mega-UAV virtualization.

Many FANET architectures have been established to increase mega-UAV technologies interoperability. This was noted that perhaps the creation of a UAV connection string may stretch the operating range through mega-hop communications. FANET will also lead to the operation of mega-UAV systems under the hurdles and thus can improve underpinning.

Trustworthy Coordination for Mega-UAVs

Quad-UAV structures in many other situations are running in an extremely

CHAPTER 51

Design and Implementation of Automated Electro-Mechanical Liquid Filling System

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Abstract: Automation hypothesis and strategies has increased global productivity in the last few years of worldwide competition. It influenced a great variety of enterprises on the manufacturing side through the decline of production time, superior system performance, and process control. The main purpose of today's manufacturing system is to upgrade productivity. The universe is full of technologies that pressure an elevated amount of production, particularly in industries where automation is needed. To proceed towards automation, the recent trends in all the industries are required to cope up with new technologies. The same vision is applied in water bottle filling plants, to meet the customer demands and to speed up the filling of bottles. Now the process of filling bottles is conducted by PLC in a large number of production units. Due to the high cost of the PLC machine, a filling is yet performed manually in small manufacturing units. The manual filling usually leads to imperfection in the operation of filling and spikes up the cost of labor. The prime purpose of our project is to design and develop an automated electro-mechanical bottle filling system, that can reduce the cost for small-scale en6terprises and assist them to build up an automated factory. The project proposes aspects of computer, electronics, and mechanical *i.e*., designing and modeling, schematic circuit prototyping and programming, sensor and actuator application, project planning, and presentation skills.

Keywords: Arduino, Automation, Bottle Filling, Microcontroller, PLC.

INTRODUCTION

Overview

In evolving states, an advancement in liquid handling industries has been seen in the past years, as the production of beverages, milk, mineral water, cooking oil, and pharmaceutical liquid dosage forms are the main provision of the entire economy. Over the past years, industries have evolved in automation to adopt

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large-scale manufacturing and procedures. Mainly in large-scale industries Programmable Logic Controllers (PLC) are used to automate the process. PLC's found in the market are high initial cost that needs multifaceted changes for configuring the program and hardware [1]. The prime purpose of this project is to design and develop an automated electro-mechanical liquid filling system, that is low initial cost, small in size, easy to learn, and compatible with small and medium enterprises. A microcontroller is the brain of the system which controls the entire process and performs the concrete work in the process. Such microcontrollers are 8051, AVR microcontrollers, and Atmega328 [2].

Background

In the 19th century, the demand for bottled water refinement and beverage plants were fully-fledged and rapidly increased, due to the adulterated water supplied by the municipal corporation. Somalia is one of the evolving states that have seen burgeoning in the arena of liquid handling industries. Since 1999 the bottled water industries are promptly increasing in Somalia as the capital manufacturing machines and raw materials have been gradually imported. The number of small to medium enterprises (SMEs) has leveled up to around the capital city of Somalia, Mogadishu [3]. The prominent bottled water manufactures in Mogadishu are Caafi, Saafi, Zam-Zam, Jimmy, and Coca-Cola [4].

LITERATURE REVIEW

Kurkute *et al*. (2016) designed and developed an automatic liquid mixing and bottle filling using PLC and SCADA system. They proposed a mixing and filling management system for industries that are completely application of automation. They proposed a system that consists of three microcontrollers that controls all the various sections in the system [5]. Katre and Hora (2016), the researchers developed and designed a microcontroller-based automated solution filling module in which is used to fill a fixed amount or level that can reduce the manual filling or the imperfection in the operation of filling, which is a common problem in the manual filling [6]. Prajapati *et al*. (2019) developed a project of automatic bottle filling and capping system using PLC, it has high percentage output with minimum power consumption and high accuracy. It is capable to meet the requirements of the industries which can save time and increase productivity [7]. Darji and Parmar (2018) have designed and implemented an automatic bottle filling plant using the Geneva mechanism, they mainly focused on designing and develop a system that is easy to use, economically friendly to a Meghdev beverages plant located in Surendranagar, Gujrat, India [4]. Kumar *et al*. (2017), they simply developed an automatic bottle filling system using PLC, that follows

a proposed methodology of sensing the bottle, dispensing the desired amount of liquid, and unloading the bottles [8].

PROPOSED WORKING METHODOLOGY

PLC and SCADA had a major role to play in an automated liquid filling system as a processing unit of handling and controlling the system. Mainly the automatic bottled water industries have been developed by using a microcontroller or Arduino nano based on Atmega328. The microcontroller-based system delivers acceptable performance with insignificant percentage error. The methodological approach to follow in the system is defined completely from loading the bottle to unloading the bottle in the below Fig. (**1**) that summarizes the procedure and entire flow chart of the system [9]. It would be carried out through system specification requirements that are concept studies related to the topic. Subsequently, we will come to the project planning *i.e.*, hardware specification requirements, software implementation, and system design. After taking different essential evaluation parameters, we will draw the block diagram and flow chart in Smart draw online software. Then the schematic diagram and PCB designing will be done by using Easyeda online software or proteus software. In the end, Arduino IDE will be utilized to write the program [10].

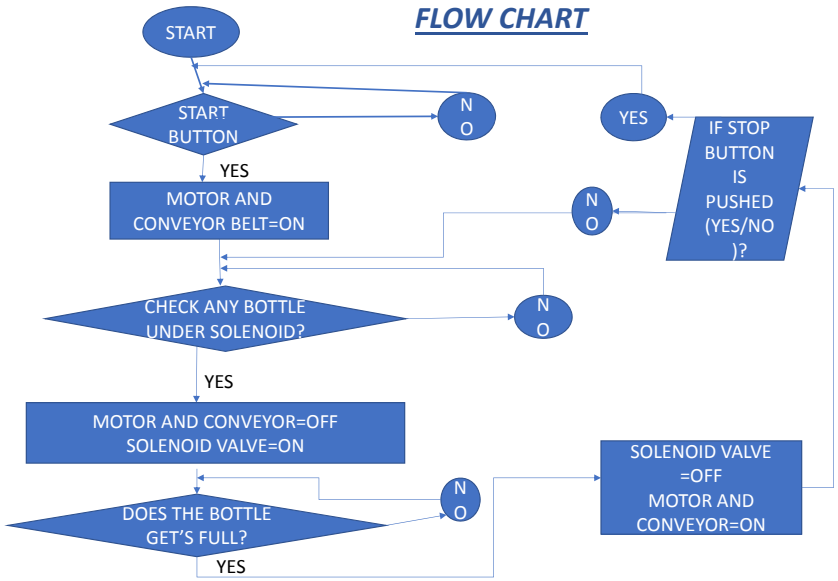

Fig. (1). Program flow chart of bottle filling system.

CHAPTER 52

Review of Mobile Ad-hoc Networks - Architecture, Usage, and Applications

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Abstract: Advanced internet technology contributes to several new apps due to wireless communication technology. Mobile Ad-hoc networks are one of the most productive areas of wireless internet technology development. The cellular ad-hoc channels have now become one of the most competitive and successful communications and connections as their usage has increased considerably over the last few years. A remote ad hoc channel is an independent set of portable devices that interact through wireless networks and collaborate in a decentralized way, in the absence of fixed facilities, in an attempt to provide the communication capabilities required. This article addresses a summary of MANET and its use in devices. This article provides a brief analysis of the styles and benefits of MANET implementations in wireless transmission channels. This kind of network, which acts as an isolated channel or one or more places linked to cellular networks or the Internet, paves the way for various exciting new technologies. This article also gives an overview of the possible applications of ad hoc channels, complex assaults, and addresses the technical problems facing procedure architects and channel designers.

Keywords: Cellular Networks, Link Capacity, VANET, Wireless Transmission Channels.

INTRODUCTION

MANET is an ad hoc channel, where packet headers among two nodes require no engineering support. MANET is an ad hoc mobile network or known simply as an ad hoc cellular network which is also an active, self-ordained, and infrastructure-free network extender of portable devices [1]. Every machine or device in MANET design means that every system is both a router and an end-user. The MANET design's modules or machines are usually independent [2].

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Every mobile phone is independent in a network [3]. Mobile phones can be carelessly moved and randomly arranged as shown in Fig. (**1**). Many implementations have been developed by MANET, such as strategic systems, wireless detector channels, cellular networks, computer networks, *etc* [4]. There are still some development difficulties and difficulties to address in many implementations. The main aim of ad hoc cellular networks is to broaden movement into the field of separate, mobile, remote territories, where adapters and users can be needed to create an ad hoc networking infrastructure [5]. Much exploitable vulnerability has been found in a mobile climate, such as MANET, and curb-measures have also been suggested. Nonetheless, only a handful of them gives a guarantee that solves the crucial safety issue [6].

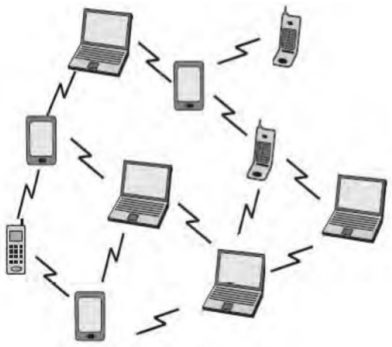

Fig. (1). Mobile Ad hoc Network.

Keeping this in mind, the key goal of wireless ad hoc communication is to promote the reliable and efficient operation of mobile networks through the implementation of routing capabilities in mobile channels. These networks are meant to have complex multi-hop and random routing protocols that often shift quickly, and generally consist of wireless links fairly restricted to throughput [7].

RELATED WORK

In this paper, the authors have given an insight into the possible implementations of ad hoc systems, various threats, and addresses software architects and system builders' face engineering challenges [8]. The author takes stock of the forms and strengths and drawbacks of MANET systems in conjunction with wireless transmission networks. MANET is an acronym for cellular ad hoc networks, also known as wireless ad hoc networks; it is an uncontrolled ego-configuring, an infrastructure-free channel of portable devices linked without the need for cables [9]. In this document, we will talk about the different main leadership systems for

MANETs. This academic research introduces a novel method for protected ethnicity-based data encryption using cryptographic and Knowledge Theoretical Technology [10]. The authors addressed the efficiency of some intrusion prevention devices in the MANET framework in this paper. It is suggested that SAODV be expanded to provide intrusion prevention mechanisms and a judge-based framework to foster cooperation between the cooperative nodes and severely punish the greedy nodes. Tests of the simulations were conducted to demonstrate the efficacy of their proposal as opposed to AODV and SAODV [11].

FEATURES OF MANET

In this section we aimed to give a general concept of some of the features of MANET although it has many characteristics, some of which are mentioned below and the given Fig. (**2**) gives a generalized idea of it:

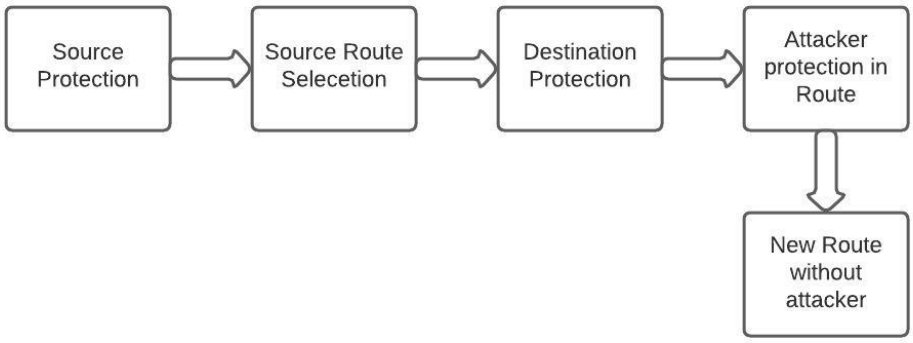

Fig. (2). Routing of MANET.

Multi-Hop Routing

Multi-hop networking is a type of wireless data communication in which the network link is wider than the ray range of the computing nodes. The node can use other clusters as relays to hit some endpoint.

Dynamic Network Topology

The channel is modeled, similar to the fixed scenario, as an unsupervised connected path, in which each node knows the peers but knows nothing more about the algorithm [12].

CHAPTER 53

Face Expression Emoji as Avatar Creation and Detection

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Abstract: One of the latest emerging trends, the flexible way of communication in an entertainment manner is through emoji (smile emoji, sad emoji, etc), many top companies like Facebook, Snapchat, Instagram, and many more are using this type of trend but now also they are in progress of this trend for the creation of avatar for the virtual world. Therefore we will discuss the backend of this type of work creation, different technologies used for the implementation, all the set of algorithms, and past, present, and future of the Face emoji creation (FEC) and Face emoji detection (FED) with the review in avatar formation. We get to know different advantages and the disadvantages related to the above technology. One of the interesting things for everyone is the avatar of their face. So, we get to know the concepts of AC (avatar creation) with expression oriented and how it is going to be related with the virtual world, which is going to be experienced by the future generation.

Keywords: Avatar, Computer Vision, Convolutional Neural Networks, Face Emoji Creation, Face Emoji Detection.

1. INTRODUCTION

Social media would be boring, WhatsApp had been irritating, Snapchat could have blast our minds and many more without the implementation of emoji (or the set of emotions in a form of an image), different expression-based emojis are smile, anger, disgust, fear, etc. Expression/Emotions are often mediate and then facilitate the interactions among the different human beings that is why it had been annotated in a few Wordnets [1]. Thus, capturing the emotions although brings content to seeming bizarre ate and difficult social platform related communication. For the complex expressions, there is a mixture of different emotions that could be used for descriptors. Computer vision has grown at a large

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scale and all the commercial products are using the benefits of a high speed image processing and machine learning to obtain useful details from the visual world to generate the virtual world, every company is in the race for the innovation as mentioned above one of the fastest-growing technology [2, 3]. Fig. (**1**) shows Convolutional neural network (CNN).

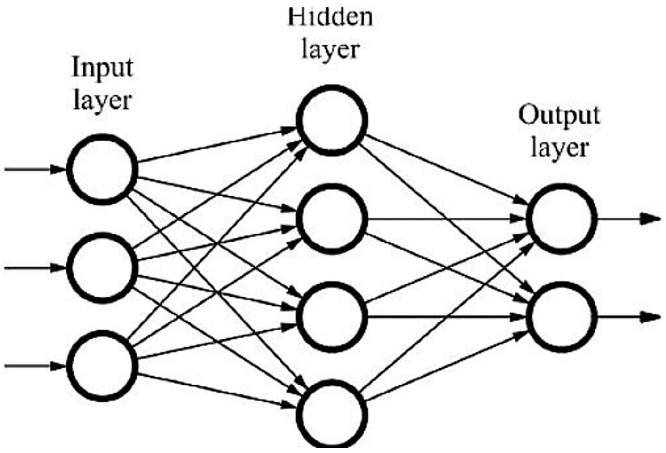

Fig. (1). Convolutional neural network (CNN) [1].

The emoji will be more interesting when it will be with the avatar of your face which would play a most interactive communication in social media and virtual space (from the real world to the virtual world). Avatar is represented in a set form like "switches" (parameters) which selected the different parts and modify it, as an instance, the shape of the nostril, the color of the attention, and the fashion of hair; all are taken from a predefined set of alternatives created *via* artists. Thus, we discuss all this with pros and cons. One of the important tasks is the detection of the face. After that expressions in the face then the creation of the required model like emoji or avatar. For these different techniques are there are fisher faces, eigenfaces, viola jones object detection framework, Hausdorff distance, etc. Many of the survey papers are there among which one of the papers by [4] provides a superb overview of the different states of computer work research as it directs to emotion detection from different primary sources are mentioned in this.

2. FACIAL ACTION CODING SYSTEM (FACS)

Ekman and Friesen had identified the facial muscles which are important in defining emotions and compiled finding to a system of 46 action units (AUs). These are for inner eyebrow and the raising of the outer eyebrow were immensely important in quantifying human expressions. It is important to note that automated

detecting facial AUs is a difficult task, especially because some AUs are only visible from a certain point of angle [5, 6].

2.1. Facial Action Parameters (FAPs)

Ekman's Facial movement coding device became observed to be extremely comprehensive as researchers can identify over 7000 different combinations of the 46 atomic AUs [7, 8] however it is critical to note that real-life expressions are dynamic and there is more to them than still images of contracted muscles. The Motion Pictures Expert Group (MPEG) introduced a well-thought-out set of facial animation parameters (FAPs) This system develops a neutral face and a set of 84 different key facial characteristic points [9 - 11].

2.2. Emotion Detection from Frontal Facial Image

This segmentation of faces from the rest of the image is done by a skin color model to avoid noise [12]. Facial parts like the eye and lip and nose region are extracted from the image by the viola-jones algorithm. Emotion detection is then done by analyzing the position of the mouth and eyes in each of the test images.

3. NOVEL APPROACH TO FACE ANALYSIS

In this technique, image extraction is done from video. Image is segmented to different points of interest such as nose, eyes, mouth. Texture analysis is done on bass of cheek and forehead activity. Facial characteristic points are changes in the gradient, which is the vector sum of color differences in the neighborhood of a pixel. The texture is the brightness difference, color difference, shape, and smoothing factors. Now more techniques for the avatar improvement are pyramid histogram of gradients (PHOG) [13], AU conscious facial capabilities [14], boosted LBR descriptors [15], and RNNs [16]. The context for static pix all used deep CNNs, generating up to 62% test accuracy [17, 18].

(Discrepancy distance): Suppose 'Cap' be a category of capabilities from X1 to X2 and allow ℓ: B × B → R+ to be a loss feature over B. The discrepancy distance discC between distributions Dist1 and Dist2 is above the A is defined as:

discC(Dist1, Dist2) = supcap1,cap2∈ Cap |RDist1 [cap1, cap2] − RDist2 [cap1, cap2]|,

where, RDist [cap1, cap2] = Ex~Dist [ℓ(cap1(x), cap2(x))]

We do not put into effect fashion losses in our technique as more substantially; the problem that we remedy differs. The literature of face comic strips

CHAPTER 54

Slice Isolation Through Classification: A New Dimension for 5G Network Slicing Security

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Abstract: Connectivity over the internet is drastically increasing which is the main factor for developing different generations in the mobile network. Earlier, the usage of the internet was primarily through smartphones but now with the invention of IoT devices, the shift has been changed into different sectors like healthcare, agriculture, infrastructures, and vehicles using this internet. With this shift the demand for bandwidth, connectivity has been increased. And can be resolved through 5G network slicing. In this paper, we proposed a slice isolation model for the security of 5G network slicing also it will help users utilize the characteristics of network slicing to the fullest. Our proposed model uses a Machine learning algorithm to perform slice isolation.

Keywords: Decision Tree, eMBB, k-Nearest Neighbor, Support Vector Machine, mMTC, Random Forest, uRLLC.

INTRODUCTION

Mobile devices, specifically smartphones, are increasingly computing and processed so that they overtake laptops and just become a leisure activity. Smartphones are increasingly used for everyday activities, such as shopping, reservation, transportation, and banking. All modern uses are establishing tremendous needs for mass communication. Mobile networks can play a central role in evolution and creativity to meet the dramatically rising needs of consumers and stuff about access and network availability. This results in the next generation of mobile devices, coined as "5G." 5G allows a new form of network to bring nearly all, including devices, objects, and appliances, together. Wireless 5G connectivity is expected to offer higher data rates of Multi Gbps, incredibly low latency, better reliability, vast network capability, greater availability, and much

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greater user experience for more devices [1]. The below Fig. (**1**) represents the requirement of 5G.

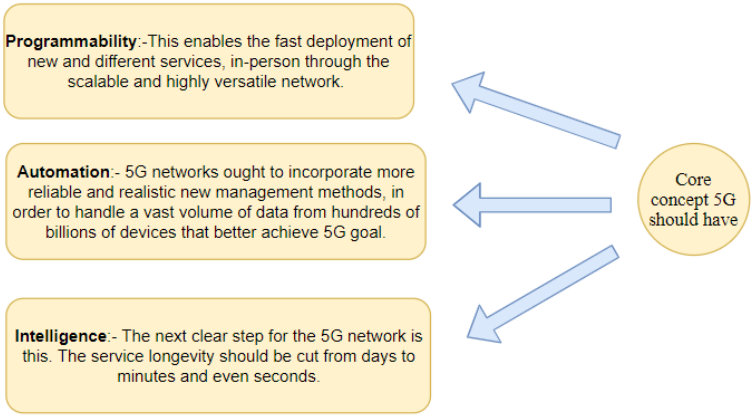

Fig. (1). 5G must have a concept.

5G will have a real effect on all sectors, rendering safe transport, remotely monitored health care, agriculture of precision, digital logistics, and so on. These challenging and ambitious goals must be met with the "one-fit-all" model [2]. This is why, in contrast with every previous transformation, the transition into 5G is even more sudden, meaningful, and demanding. To do this, 5G should have three core concepts [3]. The core concept underlying 5G is perhaps a single network, which is versatile enough to deal with a range of applications [4]. In 5G, network slicing is mainly of three types of slices as shown in Fig. (**2**), also known as "5G triangle" or "5G use-cases" [5, 6].

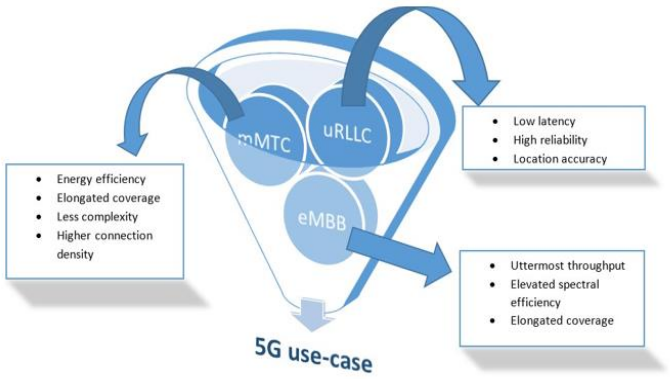

Fig. (2). 5G use-cases.

uRLLC

In additament to the improved mobile broadband implementations, the five-generation mobile networks are anticipated to provide essential URLLC services. URLLC covers a whole new case family of technologies by promoting new vertical market demands like autonomous driving, eHealth remote surgery, and industry 4.0 along with cloud robotics [7]. All the technologies clamor enhanced latency, reliability along with uttermost security and availability.

eMBB

The focus is on propping up an ever-expanding user rate as well as system capacity for enhanced mobile broadband (eMBB). eMBB unveils two significant technology improvements to meet these requirements:

- Scope shift with cmWave and mmWave to achieve significantly higher allocations for bandwidth.
- A state-of-the-art antenna array with ten or perhaps even thousands of TX/RX antenna arrays to encourage MIMO and beamforming.

The eMBB is a service extension allowed *via* 4G LTE networks first, in simplistic words, that allows the maximum data rate over a large coverage area [8]. For massive gatherings and end-users on the move, the EMBB would have the expanded capability to accommodate peak data rates.

mMTC

Concerning minimal cost and lengthy battery life, it embraces the huge density of devices including long-range transmission that makes it suitable for the Internet of Things. Without overburdening the network, mMTC aims at the cost-effective yet robust connection of thousands of devices [9]. Critical factors for performance involve -coverage, cost-effectiveness, reduced power usage, long-term availability. mMTC main focused is on IoT devices.

The below section deals with the research work of various scholars and researchers and their findings along with results is mentioned in Table **1**.

CHAPTER 55

Analyses of CSMA/CA Protocol Without Using Virtual Channel Sensing in DCF Mode

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Abstract: QoS is an important component of any operation, but it is particularly important in wireless transmission systems. To improve network strength and data transmission, we need to use a network that can provide the most benefits to its end users. This paper detail simulates the CSMA/CA protocol in DCF mode without using virtual channel sensing (*i.e.*, RTS/CTS frames). In this article, a comparison of the performance of an IEEE 802.11e network is made, and the results are compared to improve the network's efficiency.

Keywords: CSMA, CTS, CSMA, DCF, EDCF, LAN, RTS.

INTRODUCTION

In recent years, wireless networks have piqued people's attention. They are easy to set up and use. IEEE802.11 is the most well-known and commonly used WLAN protocol. Collisions can occur in wireless LANs, just as they can in wired networks when multiple stations communicate at the same time over a common transmission medium. In wireless LANs, the air is, of course, the shared medium [1] The medium access methods in the MAC layer are specified by the IEEE802.11 standard. The distributed coordination function (DCF) and the point coordination function (PCF) are their two primary functions (PCF). In the norm, DCF is needed, while PCF is not. Only DCF functionality is discussed in this study.

MAC LAYER

This is the most critical layer of the data link layer, and it is responsible for data transmission. It deals with the medium and gives it power over data access and transmission from the sender to the receiver. In multipoint transmission, this device makes use of an access control mechanism to provide a complete duplex

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structure [2]. This layer or channel may interact with each other in a single or dual direction.

DCF is the most widely used tool in IEEE 802.11 as shown in Fig. (**1**). It works on a transmission agenda with a first in first out algorithm and is based on the CSMA. It reallocates and integrates mac functionality and channel availability. If the channel is available or not. If the channel is busy, the MAC must ensure that the channel is free before transmitting the data. DCF uses CSMA/CA, which stands for carrier sense multiple access with collision avoidance. CSMA/CD (carrier sense multiple access with collision detection) [3] is not the same as this. Since wireless stations are incapable of transmitting and receiving at the same time, they are unable to detect collisions. Instead of detecting collisions, CSMA/CA attempted to stop them. The receiver can send a signal and collect data at the same time. This message is sent *via* SIFS, a smaller file system than DIFS. When SIFS is less than DIFS, the data is automatically shielded from other stations and transmitted, as shown in Fig. (**1**). If the CW file size is too small, the data will be lost. The backoff algorithm will be tested and analyzed if the size is doubled.

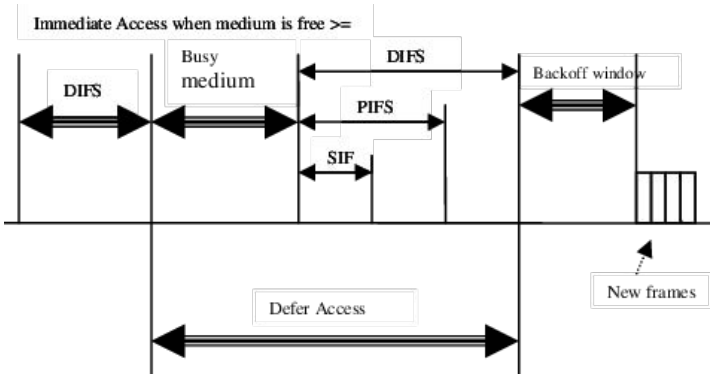

Fig. (1). Timing relationship for DCF.

It employs the “listen before speaking” mechanism, which requires each station to sense the medium for potential transmission [4]. The station transmits the packet if the medium has been idle for a certain amount of time. Otherwise, the station would delay transmission until the medium is free. After that, the backoff algorithm is invoked [5].

The CSMA/CA protocol has been documented in the literature for quite some time. Many articles have been published that address the protocol's performance problems and recommend various methods for improving it [6]. A lot of research has been done to improve the backoff procedure of the CSMA/CA protocol by

changing the contention window adaptively [7, 8]. The backoff algorithm has a major effect on CSMA/CA efficiency because it specifies how long stations must wait before transmitting when the medium is sensed busy. As a result, if there are significant delays without a direct benefit, the channel will be underutilized, and bandwidth will be wasted. On the other hand, if the time between retransmission trials is quite short, there will be a growing number of collisions, resulting in low channel usage and bandwidth waste [9].

The work proposes a two-stage algorithm to improve the efficiency of the CSMA/CA protocol's backoff algorithm, and thus the IEEE802.11 WLAN's performance. This algorithm functions in the same way as the norm [10]. When a station has a collision, it raises the contention window, and when a station has a good transmission, it reduces it [11].

With the support of increasing DCF, EDCF is used to track and coordinate QOS in Fig. (**2**). To gain access to the access group [12, 13] the system will use the FIFO process, which will aid in the transmission of information to the stations. IEEE 802.1d [14] will be used for this. Various types of operations, such as video conferencing, online mail, and traffic, will be routed through a special AC [15, 16].

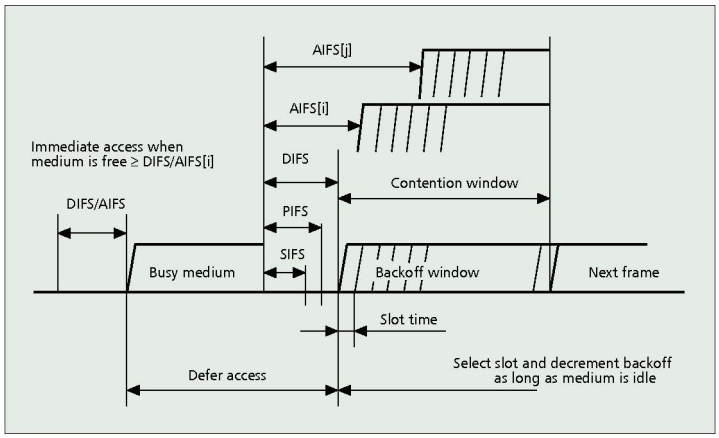

Fig. (2). Timing relationship for EDCF.

RESULTS AND DISCUSSIONS

Various simulator approaches will be explored in this report, and the network simulator will be used alongside other research operating devices as shown in Table **1**. The main goal is to test the system using a contention-based window whose size and variance are dependent on the Bit error rate and the number of users in the channel or medium. In this article, various comparisons were made

CHAPTER 56

Sanjay: A Remote Vulnerability Scanning Framework

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Abstract: Many techniques are laid out that try to protect the web application from unauthorized access with the growing concern for web security. To uncover the possible inconsistencies that can damage the application, new approaches have been introduced. Vulnerability scanning is the most widely used technique. By the term vulnerability, we meant the possible device flaws that make it vulnerable to attack. Scanning these vulnerabilities in the system provides a means of identifying and developing new strategies to protect the system from the risk of damage.

This paper focuses on the use of a remote vulnerability scanning framework- "SANJAY" which completely and comprehensively scans the given target most effectively and easily with the help of integrated tools like SLACK and VPS.

Keywords: Framework, SANJAY, Slack, VPS, Vulnerability Scanning, Web Security.

INTRODUCTION

Vulnerability is programming flaws or configuration issues that allow an attacker to achieve unauthorized access [1]. Vulnerability in a computer system can entail everything from a router's poor password to an unpatched programming defect in an exposed network service.

A vulnerability is a kind of technological error that makes a device or service vulnerable. Vulnerability is a warning sign, the more vulnerabilities associated with a device, the less secure it is. As per the Open Web Application Security Project (OWASP) [2], a list of the top vulnerabilities is been published based on the risk factor and threat level called OWASP TOP 10. These flaws possess a sig-

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

nificant risk to the web application and may result in significant harm. Under the name OWASP Mobile Security Project, OWASP also announces a list for Mobile Vulnerability. In 2017, OWASP updated its list of the top vulnerabilities, illustrated in Table **1**.

Table 1. Shows the list of OWASP TOP 10 Vulnerabilities in 2017.

RANK	Vulnerability Name
1	Injection
2	Broken Authentication
3	Sensitive Data Exposure
4	XML External Entities (XXE)
5	Broken Access Control
6	Security Misconfiguration
7	Cross-Site Scripting (XSS)
8	Insecure Deserialization
9	Using Components with Known Vulnerabilities
10	Insufficient Logging & Monitoring

Some of the Web Application vulnerabilities are enlisted below [3].

Remote Code Execution (RCE)

Remote Code Execution occurs when an attacker can execute server commands on a remote server [4].

Cross-Site Scripting (XSS)

Cross-Site Scripting enables an intruder to insert untrusted javascript code into a web application with no authentication. When the victim enters the website, this script is executed, resulting in serious exploitation [5].

Cross-Site Request Forgery (CSRF)

In CSRF attackers can create forged HTTP requests by using CSRF. Using a forged HTTP message, the intruder attempts to trick the user to compromise his/her data [6].

Server-Side Request Forgery (SSRF)

It is a web security flaw that allows an attacker to force the server-side program to send HTTP requests to any domain of the attacker's choice [7].

Insecure Direct Object Reference (IDOR)

IDOR is essentially a defect in a web application in which specific database documents or directories are not fully secured and are readily exposed [8].

Injections

SQL Injection is a typical injection-based vulnerability found in database-driven web applications. An intruder sends basic text-based requests that take advantage of the syntax of the specific interpreter [9].

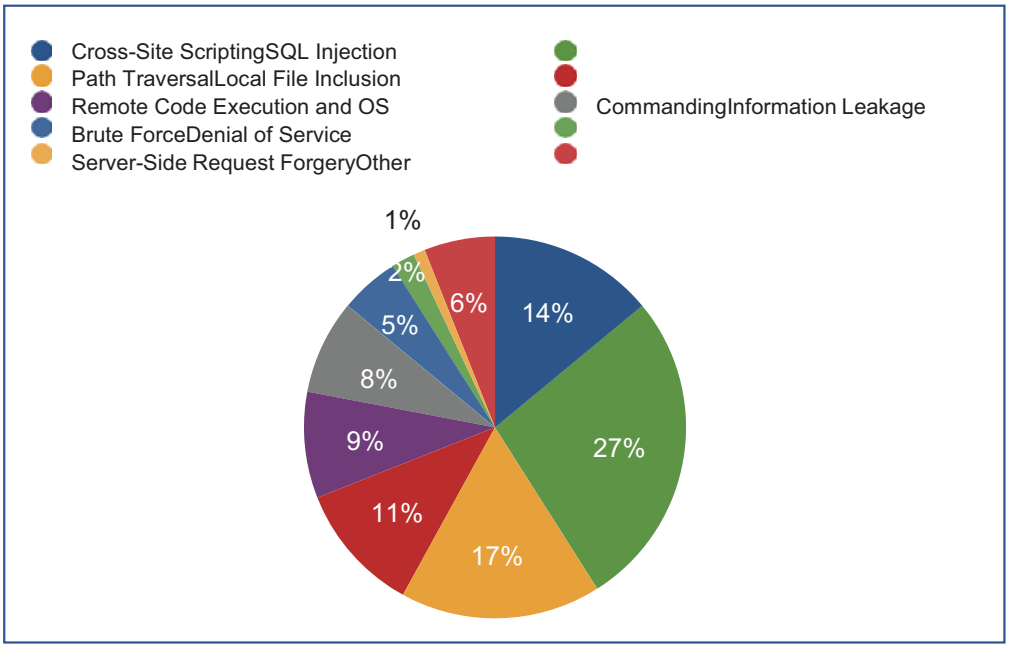

Fig. (1). Web application vulnerabilities.

Fig. (**1**) illustrated shows the round of percentage of Web Application based Vulnerabilities in the year 2019 in which 27 percent is of SQL Injection followed by Path Traversal having 17 percent and Cross-Site Scripting with 14 percent [10].

In this paper, we have proposed a comprehensive scanning framework called "SANJAY" which will make scanning and identifying the vulnerability in a system and make it more accessible to everyone.

In this framework, we have developed remotely accessible technology integrated

CHAPTER 57

A Study of CRM Solution Using Salesforce

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Abstract: Customer Relationship Management (CRM) is a cloud-based technology that helps businesses to interact with their customers and potential customers. CRM makes easy access to shared computing resources with less management effort. Salesforce is an advanced and efficient CRM Solution. In this paper, we are discussing cloud computing, features of a good CRM tool, Salesforce as a CRM solution, analysis of Salesforce growth with other CRM providers, and the Salesforce CRM in COVID 19 insight. This paper aims to provide an extensive study of CRM using Salesforce and to substantiate the efficiency of Salesforce with other CRM providers like Adobe, Microsoft, and Oracle, *etc*.

Keywords: Cloud Computing, COVID 19, Customer Relationship Management, Good CRM Tool, Market Share, Salesforce.

INTRODUCTION

Traditional approaches to developing business applications, such as order and inventory management, software project management, and enterprise resource planning, are prohibitively expensive, complex, and time-consuming. To design, configure, install, test, run, and update such applications with traditional approaches, more resources and expertise are required. Managing all of these on a company's premises [1] can become a very time-consuming task. Because organizations need to set up on-premise infrastructures like data centers, servers and, hardware tools [2]. This required high investment and business risks in operation and maintenance. High infrastructure maintenance cost is an extra burden on these organizations. But over the last few decades, IT infrastructure has been evolving. From the measure of traditional hardware with high maintenance,

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

the IT industry has evolved to a point where infrastructure maintenance and operation are easily manageable. One solution in that journey has been the cloud, which alle*via*ted IT maintenance issues by handling core infrastructure requirements over the network. It provides on-demand shared resources [3] to the client. These resources include tools and services like storing data, access to databases and servers, networking and analytics, data security, and customer support [4]. The cloud services to individuals or companies are provided by cloud service providers.

Many technology and software services are directly deployed on the cloud. Out of these, one technology is CRM (Customer Relationship Management) [5]. It is used to manage and build customer relationships to increase sales, improve customer services and increase profitability. To grow a business at a good pace with up-to-date and reliable information on business progress, there is a need for CRM technology to get a clear view of customers. CRM systems offer several strategic advantages to companies. In the age of digitization, the scope and market of CRM are widening every day. Businesses are in a time of transition, as a technological shift has occurred from offline to online operations. To keep up with market changes, technology has been steadily improving the way businesses and their customers are managed. One of the most effective CRM technology is Saleforce.com. Salesforce is a cloud platform [6] that adheres to strict security requirements, allowing users to work in a secure environment. Salesforce CRM provides everything for users to grow their businesses. Users, for example, have no idea which CRM software is best for their applications. We compare and contrast Salesforce CRM with other CRM providers in this paper (like Adobe, Oracle, Microsoft, *etc*).

CLOUD COMPUTING

Cloud computing has become very prevalent and in high demand in businesses for several reasons, which include minimal cost, high productivity, high speed and efficiency, great performance, and maximum security. The main services provided on cloud computing include email, data storage, and backup, retrieval of data, creating and testing apps prototypes, streaming of audio and video, delivering software on demand, and also analyzing generated digital data [7]. To achieve consistency and cost advantages, cloud computing relies on resource sharing. Cloud computing has evolved as a result of the availability of good capacity networks, minimal cost computers and storage devices, as well as the global acceptance of hardware virtualization, utility, and autonomic computing, and service-oriented architecture [8, 9].

Fig. (**1**) illustrated shows the generalized cloud computing architecture. Cloud has deployment models which include public clouds, private clouds, hybrid clouds, and community clouds [10]. The public clouds deliver their services on servers and storage on the Internet. The private clouds deliver their services on a private network for a specific client such as an organization. The hybrid clouds are the blend of both public and private. One or more community groups, a third party, or a combination of them own, administer, and run the community cloud.

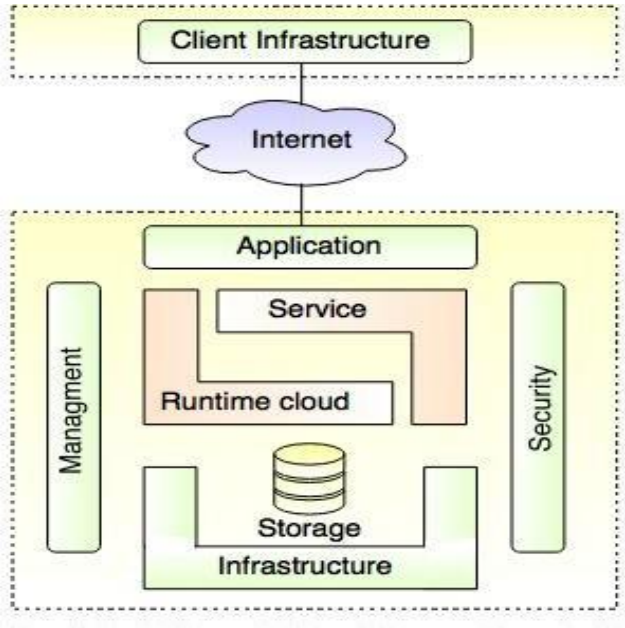

Fig. (1). Generalize cloud computing architecture [11].

Cloud providers offer their services through three basic models *i.e*. Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) [12]. IaaS is a cloud computing service in which businesses rent or lease servers in the cloud for computing and storage. Cloud providers provide a computing platform in PaaS models, which usually includes an operating system, programming-language execution environment, database, and web server. Cloud providers install and run application software in the cloud, and cloud users access the software through cloud clients in the SaaS model [13].

OVERVIEW OF CRM

Customer Relationship Management (CRM) is a technology that helps in managing the relationship with customers and potential customers. It gathers and maintains a large volume of customer data. These data are processed for a better

CHAPTER 58

Using Renewable Electricity, Energy Storage, and Renewable Fuel to Produce Carbon-Neutral Process Heat and Power

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Abstract: In the pursuit of lower and more stable energy expenses coupled with lower carbon emissions, the industry is moving towards the integration of low-cost renewables. This can be achieved through a range of technologies and/or mechanisms, each with its own set of advantages and disadvantages. One potential solution to achieve low-cost, predictable, and low-carbon process heat and power is the coupling of renewable electricity with thermal energy storage backed up by renewable fuel. This combination takes advantage of the low-cost but variable renewable generation coupled with the dispatchability of thermal energy storage with robustness added by utilizing a higher cost but low volume renewable fuel. With this approach, a lower overall cost, dispatchable, robust, and carbon-neutral solution to process heat and power is realized. Therefore, in the current study, several combinations of renewable technologies coupled with electrically charged thermal storage (ECTES) and renewable fuel were designed and simulated to meet the process heat needs of two hypothetical scenarios. The solutions were then evaluated based on their economic (levelised cost of heat and power) and environmental (carbon emission avoided) merits to determine feasible solutions. Of the two studied cases, replacing diesel for heating at a mine site with solar PV, wind, ECTES, and renewable diesel delivered significant financial and environmental benefits. Unfortunately, at today's prices replacing natural gas heating with solar PV, ECTES, and biomethane is not economically feasible without further cost reductions and/or a carbon tax.

Keywords: Biofuels, Carbon-Neutral, Process Heat, Renewable Integration, Thermal Storage.

1. INTRODUCTION

Traditionally, commercial and industrial (C&I) heat has been generated using

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

low-cost gas or coal. While the cost of coal continues to be erratic but largely unchanged for the last decade [1], companies are becoming increasingly aware of their carbon footprint and are starting to move away from coal. While a large number of companies were already using natural gas, the move to lower-carbon gas (over coal) encouraged more uptake. This was previously not an issue as domestic energy prices were low (around $5/GJ), however, since 2016 the domestic price of pipeline gas has doubled or tripled from this cost [2], while off-grid users are paying 3-5 times that cost in the form of LPG and/or diesel, putting pressure on companies' margins. Additionally, while gas as a heat source has a lower carbon intensity when compared to coal, it remains significantly higher than what is required to meet the Paris Accord targets. This has led to a growing number of consumer/end user calls for environmental accountability. For example, Woolworths (Australia) has announced their plan to go 100% green electricity by 2025 while requiring 100% of their 'own brand' products to be sustainable [3]. Similarly, the New South Wales government in Australia has recently launched a $750M fund to help decarbonise the process industry [4] highlighting the importance of decarbonising this sector.

Conversely, during this same time, the cost of generation from renewables (with limited carbon intensity) has sharply declined. This paradigm has led the way for companies to seek renewable electricity generation as a way of reducing their energy costs and carbon intensity. However, most renewable generation is variable; something most C&I processes are ill-adapted to cope with. Therefore, storage is needed to fill in these gaps. One such option is to use cheap renewable electricity to generate heat and store it thermally to be used when needed. There are a growing number of companies [5, 6] and demonstrations [7 - 9] highlighting the potential of electrically charged thermal energy storage (ECTES) as a means to provide heat and/or commercial and industrial power. These systems are designed to use excess and/or curtailed renewable electricity (and in some cases waste heat) to generate heat and store it thermally. When required the heat can be recovered and used directly and/or reconverted to electricity. These systems are ideally suited to process heat applications as long storage and usage durations make these systems significantly cheaper than chemical storage. Additionally, these systems deliver heat as air or steam and can be integrated into existing equipment, further saving costs. A non-exhaustive list of ECTES companies and demonstrations is given below highlighting the expanding market for ECTES (Table **1**).

Table 1. Planned or demonstrated ECTES technologies.

Company	System Configuration	Type	Media	Region
Siemens	Packed Bed	Sensible	Volcanic rock	Europe

(Table 1) cont.....

Company	System Configuration	Type	Media	Region
RWE	2-tank	Sensible	Molten Salt	Europe
SaltX	Reactor	Thermochemical	Calcium Oxide	Europe
Lumenion	Packed Bed	Sensible	Steel	Europe
Storasol	Packed Bed	Sensible	Rocks	Europe
Malta	2-tank	Sensible	Molten Salt	North America
Brenmiller Energy	Coil-in-tank	Sensible	Crushed rocks	North America
EPRI	Coil-in-tank	Sensible	Concrete	North America
1414	Coil-in-tank	Latent	Silicon	Australia
CCT	Coil-in-tank	Latent	Silicon	Australia
Seas-NVE	Coil-in-tank	Sensible	Rocks	Europe
Energy Nest	Coil-in-tank	Sensible	Heatcrete	Europe
Eco-tech	Packed Bed	Sensible	Ceramic/waste	Europe
Azelio	Coil-in-tank	Latent	Metal PCM	Europe
Enesoon	2-tank	Sensible	Molten Salt	Asia
Moltex	Coil-in-tank	Sensible	Molten Salt	Europe
MGA	Coil-in-tank	Latent	Miscibility gap alloys	Australia
Graphite Energy/Solastor	Coil-in-tank	Sensible	Graphite	Australia
Kraftblock	Coil-in-tank/ Packed Bed	Sensible	Ceramic	Europe
Pebble Heater	Packed Bed	Sensible	Rocks	Europe
Team Solid	Iron Powder Reactor	Thermochemical	Iron Oxide	Europe

However, while it has been noted that variable renewable generation coupled with storage can have significant economic and environmental benefits, the amount of over-capitalization of generation and/or storage prevents this approach from effectively reaching 100% carbon neutrality and therefore a green fuel backup is required. For example [10], identified the least cost 100% renewable electricity grid for Australia resulted in 66% of the energy provided by variable renewable energy followed by 27% dispatchable renewable energy with the remaining 6% delivered using a renewable fuel. This result is consistent with recent 100% renewable energy studies for Germany such as those by [11] and [12] which focussed on the oversupply of variable renewable generation firmed up by energy storage with green fuel as the backup. Regarding green fuels, there are several options available such as green hydrogen, green diesel, and green methane. Green diesel or hydrotreated vegetable oil (HVO) diesel is made from vegetable oils, used cooking oil, or animal fats and is a direct drop-in diesel [13]. It possesses a

CHAPTER 59

Techno-Economic Analysis of Thermal Energy Storage for Sensible and Latent Heat Systems as a Heat Source for CSP

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Abstract: With the advent of modern technologies in concentrated solar power(CSP), research focus has moved to cost reduction to make CSP a competitive alternative to the conventional heat source for power generation. One way to achieve this is by increasing the storage temperature so that size of thermal storage is lower which leads to reduced engineering and maintenance costs. To incorporate the CSP into power generation, one way to reduce the cost is to employ the higher temperature to improve the efficiency of the supercritical carbon dioxide Brayton power cycle. In the current study, a variety of phase change materials (PCMs) and graphite and their combination were assessed. For efficient heat transfer between PCM and heat transfer fluid, a shell and tube configuration was assessed as a suitable arrangement. The storage mediums can be contained in four indirect shell-and-tube configurations, including 3-PCM and 5-PCM cascade storage, PCM-graphite-PCM hybrid storage, and a single graphite storage tank. The sizing and design of the TES systems were performed by using a dynamic cycling methodology based on a transient 2D numerical model. The cost of these TES designs configurations was determined by using an economic model. This work also investigates the impact of some geometric parameters and cost assumptions on the techno-economic performance of the TES system. The analysis suggests a scenario exists whereby a low efficient storage system with less tube or lesser storage material could be more cost-effective. Overall, the cost of hybrid TES is the lowest among all studied systems, \$26.96/kWh$_t$ and \$21.49/kWh$_t$ for charging temperatures of 720 °C and 750 °C, respectively, followed by the 5-PCM storage of \$28.06/kWh$_t$ and \$21.82/kWh$_t$.

Keywords: Concentrated Solar Power, Design, Economic Analysis, latent heat, Sensible heat, PCM Cascade Storage, PCM Graphite Hybrid, TES Thermal Energy Storage.

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Dharam Buddhi, Rajesh Singh and Anita Gehlot (Eds.)

1. INTRODUCTION

With the current advancement in renewable energy, the electricity market is evolving towards a carbon-free generation. The authors expect that this trend will continue to gather pace. However, some jurisdictions in the world are becoming constrained by where and what type of technology can be employed due to system strength or capacity issues [1 - 3]. Researchers are assessing ways to ensure how renewable technologies can deliver future electricity on demand. One such technology that can meet these requirements is concentrated solar power (CSP) with thermal energy storage (TES). However, CSP had limited success so far in fulfilling its potential as an on-demand energy producer [4]. CSP plant and cost per kWh are still seen as the biggest hurdle relative to solar photovoltaics and wind [5].

To make CSP competitive, its balance of plant, materials cost needs to be competitive. One way to reduce the cost of CSP is by higher temperature which helps to reduce the quantity of material and components sizes. This is especially prevalent for the receiver and two-tank sensible TES as the traditional heat transfer fluid (HTF) and storage material is a nitrate-based molten salt (60/40 wt% $NaNO_3/KNO_3$) which is limited to use in applications below 600°C [6, 7]. To take advantage of higher efficiency, the desired temperature of 700°C and above should be targeted [8, 9] as it will help to make the system more efficient. All this requires low-cost supercritical carbon dioxide (sCO_2) turbines, a new HTF, storage medium, and storage technology. One of the suitable high-temperature HTF fluids is liquid sodium. Liquid sodium has been heavily studied in past and a vast amount of research and data is available which may help in rapid development. The liquid sodium offers a low freezing point, high thermal stability, and high thermal conductivity, these properties can improve the performance and reduces the cost of the CSP receiver [10, 11]. Meanwhile, alternate high-temperature storage materials include solid and liquid sensible materials [12, 13], latent heat/phase change materials (PCMs) [14 - 19], or thermochemical materials [20, 21]. The techno-economic challenges associated with different TES technologies for use in CSP were addressed by Stekli, *et al*. [22]. This study focuses on sensible and latent TES technologies, which are currently viewed as the most deployable technologies.

The thermal performance and efficiency of the TES system are critical to determining the cost of the whole CSP plant. The PCM cascade system can achieve higher energy and exergy efficiencies compared to the single PCM system [23 - 25]. Mostafavi Tehrani, *et al*. [26] demonstrated that the hybrid storage of PCM-concrete-PCM provided the highest annual electricity output

among the forty-five TES designs in a shell-and-tube configuration. Similar latent-sensible hybrid storage was studied by Jacob, *et al*. [27] in a high-temperature process heat application and hybrid storage was found to achieve the lowest storage cost. Both PCM cascade and latent-sensible hybrid TES were investigated in this study and graphite is of great interest as the sensible storage material due to its superior thermal conductive characteristics. A conventional and most-studied shell-and-tube configuration [28] was selected with PCM or graphite filling in the shell space.

For TES to be successfully adapted to CSP technology, TES must provide a technically viable and lower-cost economic solution. The TES capital cost of the current two-tank sensible system is \$27/kWh$_t$ [29]. However, the U.S Department of Energy SunShot targeted cost for TES is \$15/kWh$_t$ with a minimum discharge period of 6 h. Nithyanandam and Pitchumani [30] numerically evaluated the cost and performance of a CSP power tower with integrated encapsulated PCM packed-bed, PCM embedded with heat pipes, and two-tank sensible TES system. The effects of several storage system design parameters on the various performance metrics were analyzed and feasible operating regimes and design conditions were identified to meet the SunShot target of \$15/kWh$_t$. The study of two-PCM cascade storage systems consists of 75 vol.% of high melting-temperature PCM and 25 vol.% of low melting-temperature PCM connected in series. Except for the height/length of the tank, all the other design parameters in both PCM systems are the same. It is believed by the authors in this study that there is still potential to optimize this cascade storage system. However, due to a large number of parameters, the design and optimization of cascade PCM and latent-sensible hybrid TES systems for CSP are more complicated than that of a direct sensible TES system.

It has been addressed in several studies [30 - 32] that the performance of a TES system needs to be evaluated annually in a CSP system model including power block and solar receiver considering the local climate conditions. The net annual electricity production is critical in examining the cost and efficiency of the CSP plant with TES at a geological location. However, the methodology of optimizing the cascade PCM and latent-sensible hybrid TES in system-level modeling has not been established. It is primarily due to a large number of parameters and the extremely intensive computing load required. Therefore, to improve the simulation speed, most previous system models employed a 1D model [31, 33] to predict the performance of the TES system. But it can be argued that the simplified 1D model has lower accuracy to capture the heat transfer in the PCM [34, 35].

This study suggests the design and optimization of the TES system can be carried

SUBJECT INDEX

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

Z

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He has published thirty two books in the area of Embedded Systems and the Internet of Things with reputed international publishers.

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