INTELLIGENT TECHNOLOGIES FOR RESEARCH AND ENGINEERING

Editors:
S. Kannadhasan
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Advanced Technologies for Science and Engineering

(Volume 3)

Intelligent Technologies for Research and Engineering

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PREFACE

The book on Intelligent Technologies for Research and Engineering covers new research findings from academics. The book contains research from active researchers who are involved in the cooperation between businesses and a variety of intelligent technologies, such as those that may be used in the production and distribution of industrial goods, factory automation, and other fields. The theory, design, development, testing, and evaluation of all intelligent technologies relevant to different areas of industry and its infrastructure are the main topics of this book. All computational intelligence techniques applicable to industry, intelligent data science techniques applicable to business and management, intelligent network systems applicable to industrial production, intelligent technologies applicable to smart agriculture, and intelligent information systems for agriculture are some of the topics covered. Significant advancements in intelligent systems have occurred as a result of the exponential growth of modern technologies. As a result, there is more potential for advancements and new uses.

A vital source of academic content on the creation, deployment, and integration of intelligent applications across several sectors is the journal, Developments and Trends in Intelligent Technologies and Smart Systems. This book is ideally suited for researchers, engineers, computer scientists, academics, students, and professionals interested in the most recent applications of intelligent technologies, highlighting a variety of cutting-edge topics like enterprise modelling, remote patient monitoring, and service-oriented architecture. Moreover, The latest advances in the field of solidification research and the problems posed by the community in the 21st century in terms of processing and analysis have been discussed.

On behalf of the editors, we would like to offer our appreciation to everyone who took part. First and foremost, the authors, whose excellent work is at the core of the book, and we gratefully congratulate all those involved and wish them great success. We would like to take this time to thank our family and friends for their support and encouragement while we worked on this book. First and foremost, we offer all credit and respect to our almighty Lord for his bountiful grace, which enabled me to finish this book successfully. We would like to express our gratitude to the writers for their contributions to this edited book. We would also like to thank Bentham Science Publishers and its whole team for facilitating the work and providing us the opportunity to be a part of this work.

The content of this book is summarized as follows:

In Chapter 1, it has been discussed that adding a new wireless access point, especially in a busy user environment does not always boost Wi-Fi performance. There are situations where, even with Access Points (AP) in every classroom, students still have to cope with slow download speeds. These common Wi-Fi complications are caused by co-channel interference. Wi-Fi communication is a bit like a conversation. A good communicator not only depends on the ability to speak but also on how well he or she listens. The conversational confusion is compounded when two speakers are using a similar tone. The same holds true for Wi-Fi transmission. Two or more neighboring APs operating on the same channel can increase interference and drag down performance. This paper proposes a smart antenna technology, when a smart antenna AP detects a neighboring AP signal, it will automatically change its pattern to reduce interference and show fast and reliable transmission. It is just like cupping our hands around our mouths or ears to let ourselves shout more loudly or listen more clearly. The normal methods for signal detection for WLAN nodes have many false positives. Therefore, this study proposes a BPNN model that uses a PFMDMM system for signal

classification to identify the best signal for a WLAN node. The experimental results show that this Decision-Making Model using a Parameterized Fuzzy Measures Decision-Making Model Based on Preference Leveled Evaluation Functions for signal classification can better predict the best signal for a WLAN node. It was found that the estimated results and the signal detection accuracy are almost the same as in actual ground measurements. The test team simulated co-channel interference just like we would encounter in a school, office, hotel or airport where many APs operate on the same channel. The proposed smart antenna AP consistently delivered the best throughput outperforming other aps by an average of 75% superior coverage and unbeatable performance.

In Chapter 2, the fundamental point of this paper is to give staggered validation in biometric frameworks. Multimodal validation gives more degree of confirmation than unimodal biometrics, which utilizes only one biometric information, for example, unique finger impression or face or palm print. In this paper, we are utilizing a unique finger impression of an individual as a watermark which is installed in the chosen surface areas of the face picture of that individual which is caught utilizing a camera. A strategy called Discrete Wavelet Transform (DWT) is utilized for this reason. There is a serious level of visual relationship among unique and watermarked face pictures. The exhibition of the proposed watermarking strategy has been assessed and contrasted with procedures like Peak Signal-with Noise Ratio (PSNR) and Mean Squared Error (MSE).

In Chapter 3, Today, underwater communication has become a hot issue in research on both undersea and deep-sea navigation, as well as in autonomous underwater vehicle management, and acoustic communication has been accounted for due to its flexibility and lower degree of attenuation. However, owing to influencing elements such as channel time changing circumstances, bandwidth measurements, delay longer propagations, and the greatest degree of Doppler spread, pressure conditions, and salinity level, establishing acoustic communication in real-time is much more difficult. With a new monitoring era of global physical entities and based on the efficient energy-efficient awareness and depth, a new agent-based multipath routing protocol has been proposed in this work including underwater sensor nodes and underwater gateways with an autonomous underwater vehicle (AUV). The clustering head in the impacted region of sensor nodes will gather and aggregate data using mobile agent-initiated routing algorithms for identifying numerous pathways, as well as parameters including hope counting, delay propagation, nodal energy, and channel quality. In this paper, an agent-based dynamic AUV traversal method is developed to increase the network's dependability and connection while reorienting the AUV's movement direction

In Chapter 4, the number of people using face masks has increased on public transportation, retail outlets, and the workplace. All municipal entrances, workplaces, malls, schools, and hospital gates must have temperature and mask checks in order for people to enter such places. The paper's goal is to find someone who is not wearing a face mask in order to control COVID-19. Conv Net may be used to recognize and classify images. The model depends on Conv Net to assess whether or not someone is wearing a mask. It is possible to identify an image's face by utilizing a face identification algorithm. These faces are then processed using Conv Net face mask detection. If the model is able to extract patterns and characteristics from photographs, it will be categorized as either “Mask” or “No Mask”. With an accuracy rate of 99.85 percent, Mobile Net V2 is the most accurate when it comes to training data. MobilenetV2 correctly identifies the mask in “Mask” or “No Mask” video transmissions.

In Chapter 5, PH plays an important role in determining product quality in industries like various chemical, petrochemical, and petroleum refineries, fertilizer, pharmaceutical, and food industries, effluent treatment, and many other organic and inorganic plants. For instance,

in any industrial wastewater treatment plant, the PH is monitored and controlled by manipulating the acid or base stream, which is a strong acid or strong base. Modern treatment plant involves physical and chemical precipitation/flocculation along with biological treatment in-aerators/trickle filters, membranes, *etc*, where the control of PH is the key factor for efficient treatment. In chemistry, PH is a measure of the acidity or basicity of an aqueous solution. Pure water is said to be neutral, with apH close to 7.0 at 25 degree Celsius. Solutions with a PH less than 7 are said to be acidic and solutions with a PH greater than 7 are basic or alkaline. PH measurements are important in medicine, biology, chemistry, agriculture, forestry, etc. By PH control, we mean to maintain the PH value during continuous operation at a specific desired value by manipulating the alkaline flow rate. Usually in most industrial applications, the desired value is chosen to be around 7. This is the safest value for portable water, utility water used in industry, or waste-disposed water.

In Chapter 6, **Aedes albopictus** is considered the primary threatening vector for affecting public health. The process of identifying specific transcripts in enhancing the growth factor in **Aedes albopictus** is the initiation towards the development of a therapeutic marker. It implicates the identification of a particular antagonist. The approach was on the reference-based analysis of the whole transcriptome to reveal the differentially expressed pattern of transcripts. Further research requires the mathematical modeling of gene regulation and differential expression.

In Chapter 7, the objective of the study was to identify a potential inhibitor for a bifunctional protein in Microcystisaeruginosa. The in-silico modeling of the Protein using the “TBM” module of “Galaxy Seok Lab” extended the execution of virtual screening using MTi open screen. Finally, the protein-ligand interaction was studied using LIGPLOT software for “Bifunctional Protein” in “Microcystis aeruginosa.” The virtual screening revealed 7176 compounds from the drug library, and the “best fit” screening resulted in 1500 compounds. Among the 1500 compounds, the molecule MK-3207 showed a better affinity towards the bifunctional Protein with -11.3Kcal/mol binding energy.

In Chapter 8, the focal point of this study is to recreate and plan a hybrid system consisting of solar photo-voltaic, battery, and diesel generator and; to determine its optimized configuration into an off-grid hybrid structure to meet the electricity demand of an institutional area situated in Jaipur, Rajasthan, India. Various configurations have different specifications that are obtained to meet the load demand based on input parameters which are obtained from the pilot survey and main survey as well at a particular location. Various costing parameters such as per unit of cost and net present cost are estimated with the condition of meeting the maximum load demand. The HOMER (Hybrid Optimization Model for Electric Renewable) software is used for different simulation processes and finally, it has been found that the solar PV-battery-diesel generator hybrid system is an economical system to meet the electricity demand in which the cost of energy is obtained as 13.83 and Net Present Cost is 9.78 M with initial capital and operating costs of 4.20 M and 646,319 per year, respectively. The diesel fuel cost is obtained as 5,09,288 per year. Meanwhile, the electricity production and consumption are also estimated to be 1,09,040 kWh/year and 81,939 kWh/year with an unmet load of 1.77% only, respectively.

In Chapter 9, one of the most important issues in Wireless Multimedia Sensor Networks is the energy efficiency of object detection and image transmission. In-node object detection and tracking algorithms have been proposed in recent WMSN approaches. However, with a little effort, the WMSN will able to detect the presence and absence of objects in images. For the WMSN, a new approach for the above technique is suggested in this research. Instead of sending a whole image, this technique sends image parts. It ensures energy saving inside the

node and minimum picture content which is transferred to the sink node. On the basis of in-node reconstructed and energy consumption picture PSNR, it is suggested that the technique is evaluated using (PSNR). In comparison to existing state-of-the-art methodologies, simulation results demonstrate that the suggested methodology saves 95 percent of node energy with a received picture PSNR of 46 dB.

In Chapter 10, the purpose of this study is to discover anomalies and malicious traffic in the Internet of Things (IoT) network, which is critical for IoT security, as well as to keep a watch on and stop the undesired traffic flows in the IoT network. For this objective, a number of researchers have developed several machine learning (ML) approach models to limit fraudulent traffic flows in the Internet of Things network. On the other side, due to poor feature selection, some machine learning algorithms are prone to misclassifying mostly damaging traffic flows. Nonetheless, further study is needed into the vital problem of how to choose helpful attributes for accurate malicious traffic identification in the Internet of Things network. As a solution to the problem, an Artificial Neural Network (ANN) model is proposed. The Area under Curve (AUC) metric is used to employ the cross-entropy approach to effectively filter features using the confusion matrix and identify effective features for the chosen Machine Learning algorithm.

In Chapter 11, a mixed signal quadrature demodulator was suggested in this study. In 90 nm CMOS technology, to get the desired frequency range, a quadrature VCO is employed. The fast speed is achieved with a three-bit ADC. Unused ADC construction components have been removed to conserve energy and space. Outputs obtained are used to meet the power needed in the mixed signal demodulator designed for multi-gigabit applications. QVCO, baseband AGC, frequency synthesizers, and IQ mixers are all part of the demodulator. This displays the highest level of integration while using the least amount of electricity. To sample the symbols at optimal SNR, the baseband modem included a mixed signal timing recovery loop based on the Gardner timing error detector.

In Chapter 12, this paper focuses on wire length reduction throughout the 3D floor layout stage. The 3D cell layout stage is part of the floor planning process. Previously, it was expected that an entire module would be placed on a single device layer. They do not consider how a module's cells may be dispersed across many device levels to reduce cable length. Each of the device layers is assigned to one of the cells that make up a module (a 2D module is converted into 3D module). To place cells in three dimensions, several constraints are used. The placement-aware constraints are a set of constraints that determine whether a 2D module may be turned into a 3D module. The vertical alignment of identical sub-modules owing to the same planar placement requirement is referred to as vertical constraint. The size of the solution will be reduced as a result of this. A 3D floor design module packing method is proposed by the author. Calculating the wire length and taking into consideration the feasibility requirement for a smaller solution area, 3D cells are arranged in an initial set of floor layouts. After finding the best floor design, the modules are packed using a packing algorithm, and the technique is finished. A placement-aware 3D floor design method is the name of the approach, which is developed in C++ and operates on Fedora Linux.

In Chapter 13, the design and fabrication of biomimetic underwater robotic fish are covered. A robot fish is a type of bionic robot that looks and moves like a real fish. Two motors, an Arduino microcontroller, Bluetooth, and a pump are required to complete the underwater robotic fish project. Motors are employed for quick forward and rotating motion, and the pump assembly aids in deep-water diving. In addition, sensors assist the robot in making intelligent judgments such as obstacle detection, direction shift, and so forth. Additionally, essential information such as live streaming, pressure, and temperature are provided. The

innovative performance of the robot helps achieve the real motion of the fish, making the robot competent for the aquatic-based design that helps to reduce the complex structure without applications such as underwater exploration, oceanic supervision, pollution level detection, and military detection. This project is also beneficial.

In Chapter 14, it has been discussed that agriculture is one of the backbones of Indian economy. India is primarily an agricultural country. It plays an important role in the development of our nation. This project proposes an automatic irrigation; it maintains the moisture content present in the soil by an automatic irrigation system. This setup uses a capacitive soil moisture sensor v1.2 that measures the exact amount of soil moisture. It monitors soil properties such as temperature, humidity, soil moisture, and motor status. These parameters are measured using a soil moisture sensor, a DHT11 sensor, which is controlled by a NodeMCU that acts both as a microprocessor and as a server. It is possible to remotely control many farm operations from any part of the world through IoT.

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CHAPTER 1

A Fuzzy Based High-Performance Decision-Making Model for Signal Detection in Smart Antenna Through Preference Leveled Evaluation Functions

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Abstract: In a densely populated area with many users, adding a new wireless access point may not necessarily improve Wi-Fi performance. There are times when students must deal with poor download rates even with Access Points (AP) in every classroom. Cochannel interference is the root cause of several typical Wi-Fi issues. A discussion may be compared to Wi-Fi communication. The capacity to communicate and listen properly are both essential for effective communication. When two speakers are speaking in a similar tone, the conversational uncertainty is exacerbated. Wi-Fi broadcasts are the same way. The interference and drag performance might be worsened by two or more nearby APs using the same channel. This study suggests a smart antenna technology. When a smart antenna AP finds a nearby AP signal, it will automatically alter its pattern to minimise interference and provide quick and reliable transmission. The same principle applies when we cup our hands over our lips or ears to enable us to yell or listen more clearly. There are a lot of false positives in the typical approaches for WLAN node signal recognition. The optimal signal for a WLAN node is therefore identified using this study's proposed BPNN model, which uses the PFMDMM system for signal classification. This Decision-Making Model Using Parameterized Fuzzy Measures has been shown *via* experiments. A WLAN node's optimal signal may be more accurately predicted using a decision-making model based on preference-leveled evaluation functions. The precision of the signal identification and the anticipated findings were found to be almost identical to those obtained from real ground measurements. The test team mimicked cochannel interference, which would occur in a setting with plenty of APs, such as a workplace, hotel, or airport. The suggested smart antenna AP regularly outperformed other apps by an average of 75% greater coverage and unmatched performance.

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Keywords: BPNN, Decision making model, Deep learning model, Preference leveled evaluation functions, Received signal strength, Reconstruction, Signal detection, Smart antenna.

INTRODUCTION

Antenna Engineering

An antenna has a source for its input and output. Essentially, the input is an electrical transmission. Essentially, the output is an electromagnetic free-space signal. These inputs and outputs are of diverse kinds [6]. The signal's electrical character is present at the input. The electromagnetic signal's wave nature, which is nothing more than waves in empty space, is present at the output. An antenna is simply a device that transforms an electrical signal into an electromagnetic wave that travels across open space. It creates a wave out of an electrical pulse. The transducer operates on that principle. An electrical amount is changed into a nonelectrical quantity by the transducer. Take a speaker as an example [1 - 5].

An electrical signal is the speaker's input: for instance, our mobile device's speaker. The signal has an electrical composition. However, the voice may be heard in the output, making it a sound. It is an electrically inert quantity. Consequently, our speaker is a transducer. Inside the mobile ship, it transforms the electrical signal from the phone into a sound wave. The electrical quantity is transformed into nonelectrical values *via* the transducer. The technique also works in the opposite situation since the antenna doubles as a transducer. For instance, the input of a microphone is a sound wave, which is a nonlectrical quantity. The microphone then generates a voltage based on the sound wave, which is electrical by nature. Therefore, the ideas might be combined. A transducer is any device that transforms electrical values into nonelectrical quantities or vice versa. A transducer is one of several different types. A sinusoidal current of the voltage signal may be used to analytically analyze the nature of electrical signals [6 - 10].

Electromagnetic waves are emitted by the antenna. Assuming the input electrical signal is sinusoidal in form, the antenna will not be able to radiate the signal since the DC voltage will remain constant throughout time. An antenna can only transmit or produce this electromagnetic wave if the electrical signal it receives is sinusoidal in nature. A medium is not necessary for the propagation of an electromagnetic wave [11 - 15]. It is capable of travelling across empty space and moves at the speed of light in a vacuum.

Every time we discuss antennas, we get the impression that they may be enormous, hefty, and metallic in composition. In the past, antennas were often made of metal, were huge, and unwieldy. However, a lot has changed. Now, the

idea of an antenna may be applied to tiny scales. There are also nanoantennas that are invisible to the human eye [16 - 20]. These categorizations are based on several circumstances. For instance, the first is a dish antenna, whereas the second is a satellite-related space antenna. Signals may reach billions of kilometers using space antennas, which are fueled by solar energy. In such instances, a massive or enormous antenna would be used as the receiving antenna. The dish size in astronomy antennas is huge. It is very strong, with a circumference of like thousands of feet. It can send messages to far-off galaxies and stars that are billions of kilometres away [30]. Additionally, it can pick up signals from such far-off locations. The strength of the antenna increases with its growth. The third kind of antenna is called a Wi-Fi antenna. It is linked to a wireless router.

Machine Learning in Antenna Design

A method called machine learning uses a large quantity of data to generate a result. A mathematical model is the result [2]. These labelled or well-defined data sets may be used to run a machine learning system. Machine learning is very sophisticated in that it can also develop its own pattern to recognise the incoming data and then produce a mathematical model that predicts the future. We have another subset of machine learning, which is termed deep learning. As a result, deep learning is slightly more intelligent than machine learning. In other ways, it's more intense because it resembles how the human brain works. There are many billions of neurons in the human brain. One neuron serves no use. But these billions of neurons' combinations and interactions with one another are what matter [21–25]. In order to create the output data sets, the deep learning technique acts on the input data sets in a manner that replicates the multi-layered structure of our brain's neurons [13].

Algorithms that are trained using training data sets are at the core of machine learning. The AI system receives the input data and creates a mathematical model based on training data sets [15]. In situations when we lack a closed form of an analytical model of any system, it is thus highly helpful. In conclusion, the machine learning algorithm requires input data to work, and we must also train it using training data sets. Then a mathematical model is produced as the result. If we supply enough data sets for training, the caliber of the training data sets will decide how accurate our mathematical model is in the output [31]. If we use high-quality data sets during training, the result will be a mathematical model that is very accurate.

The three main kinds of machine learning algorithms are reinforcement learning, unsupervised learning, and supervised learning [34]. The training data sets in a supervised learning system are labelled. When the input and output data sets are

CHAPTER 2

Multimodal Biometric Authentication Using Watermarking

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Abstract: The primary goal of this study is to provide a robust validation for biometric systems. When compared to unimodal biometrics, which use just one biometric feature, such as a unique finger print, facial feature, or palm print, multimodal validation provides a higher level of confirmation. In this paper, we use an individual's distinctive fingerprint as a watermark that is installed in the desired locations of the facial image of that individual that is captured with the aid of using a camera. This is accomplished by using a technique known as the Discrete Wavelet Transform (DWT). Between unwatermarked and watermarked face images, there is a significant serious level of visual relationship. Peak Signal-to-Noise Ratio (PSNR) and Mean Squared Error (MSE) procedures have been compared to and evaluated by the proposed watermarking strategy.

Keywords: Biometrics, Discrete wavelet transform, Inverse discrete wavelet transform, Watermarking.

INTRODUCTION

Multimodal biometric frameworks have enabled ID recognition and security over the last several years. To increase the dependability of person recognition, a multimodal biometric framework mixes at least two biometric information acknowledgment results. Multimodal biometric frameworks use or have the ability to use a variety of physiological IDs or verifications. Several watermarking systems are available for safely encoding data in a picture. There are two different sorts of techniques that may be used: change space process and spatial area strategy. In this study, watermarking in connection to biometric identifiers is applied. Fingerprints and facial characteristics are valid biometric identifiers.

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When compared to a photograph of a face, the fingerprints are smaller. As a result, we implant a unique finger impression in an individual's facial photograph to bend the extricated watermark.

LITERATURE SURVEY

Sub Band Splitting Technique for Embedding the Fingerprint

A logical biometric watermarking improves fingerprint security. Fingerprints are obtained by using a DWT technique to embed a face as a watermark in a unique finger impression. Fingerprints are exposed to DWT and afterwards, parted into sub-groups. A sign is deteriorated utilizing a 1-dimensional wavelet change to acquire the changed sign. A 2-dimensional wavelet change is acquired by applying a 1-dimensional change along the lines and sections. The 2-level disintegration comprises many subgroups like HH, HL, LH, and LL, and it contains the slanting, even, vertical, and coarse subtleties of the unique finger impression picture. When using Discrete Wavelet Transform to remove the inserted unique mark and text images, the first set of watermarked images is not required. Instead, we can install two watermarked images: a unique finger impression image and related text information of a person into the chosen surface areas of finger impression images. The absence of the watermark in the removed watermark would reveal that the integrity of the facial image has been jeopardised.

However, we will merely insert the unique mark picture into the face image in this instance. The face picture is broken into smaller groups after the DWT correction. We are unable to implement any improvements at this level since the LL2 already handles the finer details of the image. There will be adjustments in the first image if any progress is made in this area. When that happens, we may implant the finger imprint in the subgroups HL2, LH2, and HH2 since only minor details of the facial image are present in these subgroups.

In the unlikely event that any development is made in this area and none is discovered, we may look for progress in the face image. Accordingly, we can install the finger imprint image in these subgroups. Then, at that time, we may store any text-based repeated information in the subgroups HL1, HH1, and LH1. On separating the surface components of the face picture, we must first get the face image. Next, we must apply DWT on the face image, which will result in several subgroups.

The finger imprint image may then be added at that point. IDWT may then be used to get the watermarked facial image. The watermarked face image may then be stored in the data set at that moment. Currently, we will apply the DWT

modification to the watermarked face image. The sub-band will then be produced, indicating that the surface elements of the watermarked face image may be made at that moment. The finger imprint image that will be injected into the facial image may be removed with the use of a watermark extractor approach. As a result, the unique mark image may be divided [1 - 5].

Maintaining the Integrity of the Specifications

A technique for identification and access control is biometric authentication, sometimes referred to as multimodal biometric authentication. This technique may also be used to identify members of organisations. Biometric identifiers are often divided into categories based on physiological and behavioural traits. A physical biometric is one that is based on an individual's physical characteristics. Examples include fingerprints, hand geometry, retinal scans, and DNA. Examples of behavioural biometrics include speech patterns, signatures, and keystrokes. A behavioural biometric is one that is based on an individual's behaviour. Since biometric identifiers are more trustworthy than tokens in confirming identification. The signatureA multimodal biometric system may combine fingerprint and facial recognition. A system that may use more than one physiological or behavioural trait is called a multimodal biometric. To provide the highest security, multimodal biometrics combines the aforementioned recognition technologies. If one of the technologies malfunctions for whatever reason, it may still accurately identify a person. Utilising many forms of identity, maintaining a high threshold of recognition, and allowing the system administrator to choose any degree of security are all advantages of multimodal biometrics. Up to three biometric identities may be used for a site with very high security. This significantly lowers the likelihood of accepting a forger. Multimodal biometrics are increasingly necessary since unimodal biometrics only use one kind of identification.

Examples include face, fingerprint, and voice recognition systems, which are susceptible to issues like noisy data, non-universality, and spoofing assaults. It results in a high rate of erroneous acceptance and false rejection. Compared to unimodal systems, multimodal systems are more dependable. Using multimodal biometrics has a number of advantages, including enhancing the entire system's accuracy and providing a backup method of enrolment and identification in the event that not enough information can be gleaned from a particular biometric sample. It can also detect efforts to trick biometric systems using non-live data sources, including phoney fingers [6 - 10].

CHAPTER 3

Underwater AUV Localization with Optimal Cardinal Selection Using Dynamic Positioning Parameters

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Abstract: Today, underwater communication has become a hot issue in research on both undersea and deep-sea navigation, as well as in autonomous underwater vehicle management, and acoustic communication has been accounted for due to its flexibility and lower degree of attenuation. However, owing to influencing elements such as channel time changing circumstances, bandwidth measurements, longer propagations delay and the greatest degree of Doppler spread, pressure conditions, and salinity level, establishing acoustic communication in real-time is much more difficult.

With a new monitoring era of global physical entities, a new agent-based multipath routing protocol has been proposed in this work including underwater sensor nodes and underwater gateways with an autonomous underwater vehicle (AUV). The clustering head in the impacted region of sensor nodes will gather and aggregate data using mobile agent-initiated routing algorithms for identifying numerous pathways, as well as parameters including hope counting, delay propagation, nodal energy, and channel quality. In this paper, an agent-based dynamic AUV traversal method is developed for increasing the network's dependability and connection while reorienting the AUV's movement direction.

Keywords: Challenges, Routing, Radio waves, Sensors, Underwater communication.

INTRODUCTION

There are many challenges existing in underwater sensor networks like GPS absence, node deployment in the 3D method, and water currents with mobility [1, 2] along with the biggest challenge of using radio waves with feasibility for

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underwater communication. Though the radio waves propagate through shorter distances, they will get faded inside water due to larger absorption thus making the node design methodology more complicated as the large waves will require the larger antenna. Hence, acoustic waves are being utilized for longer distance underwater communication but, still they also have challenges like high noise, the highest bit rate error, the Doppler effect, and the highest propagation delays [3, 4] and it is a must to consider these characteristics while designing the sensor network [5] for underwater communication and the general architecture of it is shown below in Fig. (**1**).

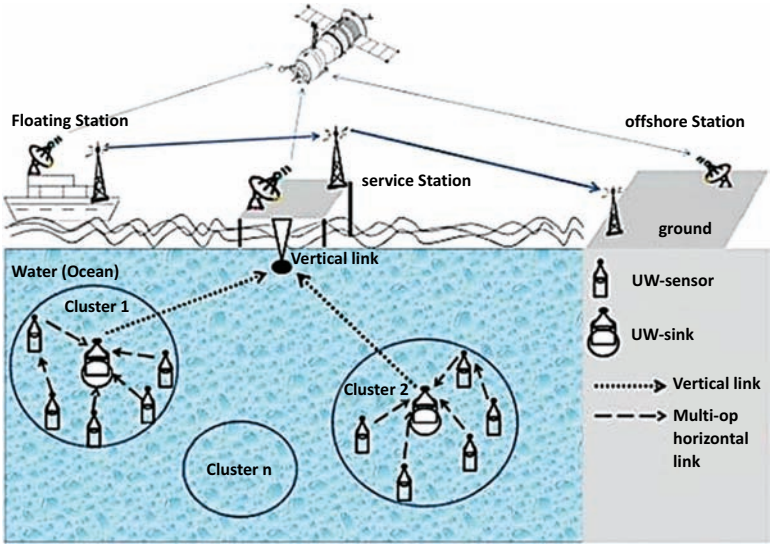

Fig. (1). Underwater sensor network architecture [10].

The architecture consists of either the static sensor nodes or the mobile sensor nodes being equipped with the acoustic transceivers which will be deployed in underwater. Depending upon the sink nodes, the routing of sensor nodes will occur as relays in the lower level of the depth whereas the autonomous underwater vehicles (AUV) will be employed directly to receive data from the sensors, and it requires an efficient path for routing.

In general, while the designing process of UWSNs will be carried out, routing protocols will be playing an efficient role thereby determining the routing data paths along the paths from sensor nodes to interpreted stations. Robust protocols are selected to achieve optimal performance against harsh channel conditions by dealing with energy constraints efficiently with the highest SINR, higher level of end-to-end delays, and the node mobility [6-9]. Though many surveys will not be

focusing on the recent work, some of them do discuss the advantages and the disadvantages of the routing protocols with a better understanding of the protocols [8, 9].

ISSUES TO BE ADDRESSED BY ROUTING PROTOCOL

The List of Issues Addressed by the Routing Protocols is as Follows

i. Estimating the Location – This is the challenging part due to GPS unavailability underwater by using the routing protocols incurred owing to localization.

ii. Required Location - The required geographical location will be indicated and this is the main issue to be addressed by the proposed scheme.

iii. Constraints of energy- Energy constraints of UWSN are considered as the batteries will neither be recharged nor replaced [10] by considering the energy conversation.

iv. Mobility- Underwater sensor node moment may interrupt end-to-end paths by creating void connectivity from the source to the sink with free movements of nodes.

v. Connectivity avoidance-If the node lies on the route of packets, connectivity voids will be created owing to the malfunctions or the energy drainage, there avoiding the voids with the balanced loads and delivering the packets to the destination nodes successfully.

vi. Deployment in 3D - Due to the additional third dimensions,3D deployment will be quite challenging as the sensor nodes can rely on data to sink forward multi-hop paths using the current transmission.

vii. Clustering- It is used to decide whether this is a cluster-based scheme or not with lower communication overhead under a small contention domain with lower power of transmission.

viii. Selection criteria of the next hop-This is done to determine the proposed scheme's capability to address routine issues such as residual energy by considering the SNR or the link condition.

Challenges in Underwater Communications

Considering the challenges involved in underwater communication, a UWSN routing protocol will be designed, and the related necessities of the challenges are mentioned below.

CHAPTER 4

Detection of COVID-19 Pandemic Face Mask Using ConvNet in Busy Environments

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Abstract: The number of people using face masks has increased on public transportation, retail outlets, and at the workplace. All municipal entrances, workplaces, malls, schools, and hospital gates must have temperature and mask checks in order for people to enter. The paper's goal is to find someone who isn't wearing a face mask in order to control COVID-19. ConvNets may be used to recognize and classify images. The model depends on ConvNot to assess whether or not someone is wearing a mask. It is possible to identify an image's face by utilizing a face identification algorithm. These faces are then processed using Conv Net face mask detection. If the model is able to extract patterns and characteristics from photographs, it will be categorized as either “Mask” or “No Mask”. With an accuracy rate of 99.85 percent, Mobile Net V2 is the most accurate in regard to training data. MobilenetV2 correctly identifies the mask in “Mask” or “No Mask” video transmissions.

Keywords: Conv Net, Covid-19, Face Mask Detection, MobilenetV2, Open CV.

INTRODUCTION

During the worst public health outbreak in recorded history, the COVID-19 virus sparked it. Wearing a face mask is the most effective way to prevent the virus from spreading. Droplets from the infected person could be the potential medium to propagate the infection. One can protect themselves from the disease by wearing a mask as illustrated in Fig. (**1**). One must wear a mask that totally covers

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one's nose and mouth in order to protect them. Incorrect use of the mask could result in the transmission of disease and inadequate protection. Face-mask recognizers can be used in public settings to keep looking on the crowd and identify people who are or aren't wearing masks correctly. One possible purpose for this is to spread the word about proper mask usage and to help others learn how to do it themselves. In regard to the public use of face masks, Covid-19 has witnessed an uptick in popularity. Face identification is becoming increasingly difficult as the number of people using Covid-19-resistant masks rises. Wearing masks and avoiding eye contact have become increasingly trendy [2].

COVID-19 prompted governments around the world to make face masks and other protective gear essential for the public. People are now wearing face masks more frequently in settings where people come into close proximity, such as public transit, shopping malls, and the workplace. To avoid dizziness caused by carbon dioxide retention rebreathing, long-term use of face masks should be avoided [3]. The precautionary principle has been in effect since March of this year. One of the most recent safety measures was the use of surgical-style masks to cover our mouths and nostrils [4]. The current COVID-19 outbreak has resulted in an unprecedented loss of human life and severe post-disease repercussions for people of all ages, living situations, health statuses, and other distinguishing traits [5]. The term “single-use mask” refers to a mask that is intended to be worn only once before being discarded as shown in Fig. (**1**). Medical professionals and the general public alike favour single-use face masks for their high filtration capacity, lightweight, low cost, ease of use, breathability, and ease of disposal [6].

Fig. (1). Using a mask in a crowded environment.

Thrown into bushes, water bodies on the street, and mixed with regular trash, face masks are also seen abandoned at beaches, in waiting areas, dust/toilet bins, and

in automobiles. Face masks were more likely to be thrown away in urban, sub-urban, and rural areas, according to the current study [7]. Toxic concentrations of biowaste and medical waste fuel led sudden rise in plastic pollution by the COVID-19 pandemic. Reusable masks are more breathable and porous than surgical masks or respirators, yet they are less effective in dangerous conditions. Only 5% of the single-use face masks given during the COVID-19 epidemic were reprocessed using multi-use masks, according to a study. Face mask pretreatment, which entails separating plastic materials and disinfecting them, is a time-consuming and expensive operation. In view of the largenumber of face masks and PPE kits created during the COVID-19 epidemic, it is vital that more attention be given to developing a circular economy [8].

Salivation droplets are a primary mode of transmission for Coronaviruses. As a result, containing the virus at an early stage would be a large win. The use of a face mask can help prevent the spread of the disease both within and outside of the mask. It is helpful to wear face masks to keep the illness from spreading [9].Masks are the best form of protection in public places and anywhere else. All of these measures were put in place as precautionary measures to prevent the spread of the disease, which included social distancing, mandatory face masks in homes, quarantine, restrictions on citizens' travel, and the cancellation or exclusion of large social events and meetings. As a precaution, people with elevated body temperatures should not be permitted into public spaces and should wear a mask while they are there in order to prevent infection and spread of the virus.

Temperature and mask inspections must be conducted at all city gateways, offices, shopping malls, and hospital entrances. In the wake of this research, a door-opening device that automatically detects human body temperature was developed. Mask detection, the number of individuals present, and the temperature are all integrated into this system's revolutionary concept [10].

LITERATURE SURVEY

Das *et al.* claimed that nodoubt Covid-19 has had an enormous influence on the economics, psyche, and well-being of the human species as a whole. COVID-19 can be prevented by wearing a face mask in public. The form and categorization of masks are explored in this study. There is a global shortage of N95 and medical masks. To be safe against the coronavirus epidemic, it is recommended that everyone uses a mask whenever feasible [11]. By blocking transmission from an infected individual or protecting healthy persons who wear the mask, a face mask may help prevent the spread of a virus [12]. Face masks, particularly FFPs worn by medical staff, are in high demand during the COVID-19 epidemic. The

CHAPTER 5

Wireless Ph Sensor Employing Zigbee 3.0 Protocol

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Abstract: PH plays an important role in determining product quality in industries like various chemical, petrochemical, petroleum refineries, fertilizer, pharmaceutical, food industries, effluent treatment, and in many other organic and inorganic plants. For instance, in any industrial wastewater treatment plant, PH is monitored and controlled by manipulating the acid or base stream which is a strong acid or strong base. Modern treatment plant involves physical and chemical precipitation/flocculation along with biological treatment in aerators/trickle filters, membranes, *etc*, where the control of PH is the key factor for efficient treatment. In chemistry, PH is ameasure of the acidity or basicity of an aqueous solution. Pure water is said to be neutral, with a PH close to 7.0 at 25 degree Celsius. Solutions with a PH less than 7 are said to be acidic and solutions with a PH greater than 7 are basic or alkaline. PHmeasurements are important in medicine, biology, chemistry, agriculture, forestry, *etc.* By PH control we mean to maintain the PH value during continuous operation at a specific desired value through manipulating the alkaline flow rate. Usually in most industrial applications, the desired value is chosen to be around 7. This is the safest value for portable water, utility water used in industry, or waste disposing water.

Keywords: Agriculture, Filter, PH, Sensors, Zigbee.

INTRODUCTION

The working of this PH controlling system is as follows: firstly the pH electrode senses the PH value of the solution that transfers it to the AVR. In the microcontroller, we can set a desired set point value. If the output of the pH electrode is less than the set point value, and the behaviour of the solution is acidic, then compare the PH value of the solution with the set point value. Then the microcontroller transmits an electrical signal to the solenoid value that fixes in the tank containing base through the relay circuit. Suddenly the solenoid value becomes open and basic reagent mixed with the solution. If the PH values of the solution becomes equal to the set point value, then the solenoid valves becomes

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closed. A slight increase in the PH value of the solution and then the set point value causes the opening of the solenoid valve fixed in the acid reagent tank [1 - 5].

THEORY AND PRINCIPLE

Water is an afunny substance. It makes possible much of the chemistry that goes on in our bodies and all around us. But most people take for granted the chemical properties of water. We've already learned that water molecules are constantly in motion. And keep in mind that each water molecule carries a dipole or net charge across the molecule. As we saw in the atomic bonding lesson, this dipole causes each molecule to behave like a little magnet with a positive and negative end. This dipole causes water molecules to be attracted to each other; the positive hydrogen is attracted to the negative oxygen of a nearby molecule. By PH control, we mean to maintain the PH value during continuous operation at a specific desired value through manipulating the alkaline flow rate. Usually in most industrial applications, the desired value is chosen to be around 7. This is the safest value for portable water, utility water used in industry, or waste disposing water [6-10].

In essence, a PH control system measures the PH of the solution, and controls the addition of a neutralizing agent (on demand) to maintain the solution at the PH of neutrality, or within certain acceptable limits. It is, in effect, a continuous titration. These PH control systems are highly varied, and the design depends on such factors as flow, acid or base strength or variability of strength, the method of adding a neutralizing agent, the accuracy of control (*i.e.*, limits to which pH must be held 0 and physical and other requirements [11-15].

INTRODUCTION TO EMBEDDED SYSTEMS

The embedded system is any electronic equipment but with intelligence and dedicated software. All embedded systems use either a microprocessor or a microcontroller. The application of these microcontrollers makes user- friendly cheaper solutions and enables to add features otherwise impossible to provide by other means. Embedded devices can be defined as any device with an embedded microprocessor or a microcontroller .The software for the Embedded System is called firmware. The firmware is written in Assembly language for time or resource-critical operations or in high-level languages like C or Embedded C. The software will be simultaneously do microcode simulation for the largest processor. Since they are supported to perform only specific tasks, these programs are stored in Read Memory (ROM). Moreover, they may need to have minimal input from the user, hence the user interface like monitor, mouse and large keyboard, *etc.* may be absent [16-18].

Embedded Systems are also known as Real Time systems since they respond to an input or event and produce the result within the guaranteed period. This time period can be a few microseconds to days or months.

Embedded System development: In the development of an Embedded System application, the hardware and software must go hand in hand. The software created by software engineers must be fed into or micro-coded into the hardware or microcontroller produced by the VLSI engineers. The microcontroller and the software micro-coded unit together form the system for a particular application. The Software program for the real-time system is written either in Assembly or a high-level language such as C. The assembly language is used in the case of some critical applications. Nowadays high-level languages replace most of the assembly language constructs.

Embedded technology is present in almost every electronic device we use today (Fig. **1**). There is embedded software inside the cellular phone, automobiles and thermostats in air conditioners, industrial control equipment and scientific and medical equipment, defence use, communication satellites, *etc.* An embedded technology thus covers a broad range of products the generalization of which is difficult.

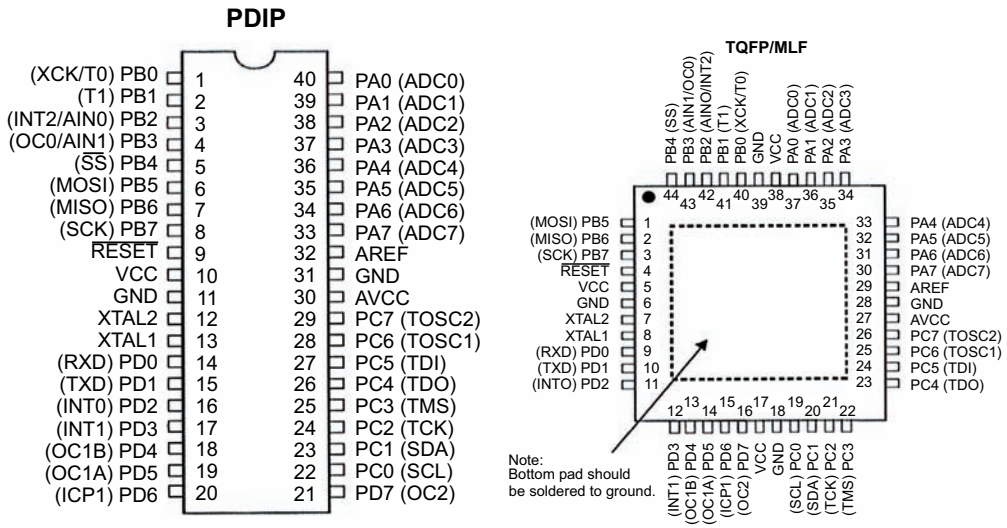

Fig. (1). PIN diagram of ATMEGA 32.

The AVR is a modified hardware architecture 8-bit RISC single-chip microcontroller that was developed by Atmel. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage as

CHAPTER 6

Identification OF Differential Pattern in ADES AL: Initiation

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Abstract: ***Aedes albopictus*** is considered the primary threatening vector affecting public health. The process of identifying the specific transcripts for enhancing the growth factor in ***Aedes albopictus*** is the initiation towards the development of a therapeutic marker. It implicates the identification of a particular antagonist. The approach was a reference-based analysis of the whole transcriptome to reveal the differentially expressed pattern of transcripts. Further research requires the mathematical modeling of gene regulation and differential expression.

Keywords: ADES, AL, Dengue, Mapping.

INTRODUCTION

The *albopictus* species of *Aedes* is an essential vector for various human pathogens, including Zika, chikungunya, and dengue viruses. *Aedes albopictus a* is a competent vector of medical importance with a lack of reliable information on essential traits. Strategies for controlling the *albopictus* species of *Aedes* mosquitoes are limited [1-3]. This species of Aedes has a large genome with significant population-based size variation. Aedes mosquitoes transmit chikungunya. In recent years, various studies have determined the competence of *Aedes albopictus* for Zika. Understanding the mechanism of gene regulation associated with insecticide resistance is vital to developing a novel diagnostic biomarker and the differential gene expression of deltamethrine in *ae*. *Albopictus* from various studies incorporating the RNAseq technology [4-6].

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MATERIALS AND METHODS

Analytics

The data analysis of the transcript in the platform for sequencing RNA detects multiple patterns of noncoding RNA.

Experiment

Transcriptome sequencing experiments include RNA extraction and Quality Control (QC), and each step is essential to ensure data quality.

Mapping

It is necessary to choose the reference ordination for optimum analysis. Sequences at intervals in the deoxyribonucleic acid region are additionally attributable to immature RNA contamination or incomplete genomic annotation. In contrast, sequences mapped to the intergenic region are additionally attributable to incomplete genomic annotations and background.

Quantification

The approach involves the quantification of the number of reads that match the reference genome (read count). This quantification in the sequence level uses a standard sequence format. Each model represents the structure of transcripts created by a given sequence, and the live TPM (Transcript per million reads) accounts for every sequence length and library size.

Expression

The level of differential gene expression is studied based on “read density”; *i.e.,* read density is directly proportional to genes' expression level—application of Salmon TPM (Transcripts Per Million reads). The read count mapped to the gene normalized to total read counts.

Annotation

Gene Set Enrichment Analysis (GSEA) involves the Functional Annotation (FA) of the Differentially Expressed Genes (DEG).

RESULT

After Executing (a) quality control, (b) mapping, (c) quantification, and (d) differential gene expression analysis, we get the results containing differentially.

expressed genes, *i.e.,* co-expressed, up-regulated, and down-regulated. The red color region represents a high expression rate in the heat map, and the blue area represents a low expression rate Fig. (**1**).

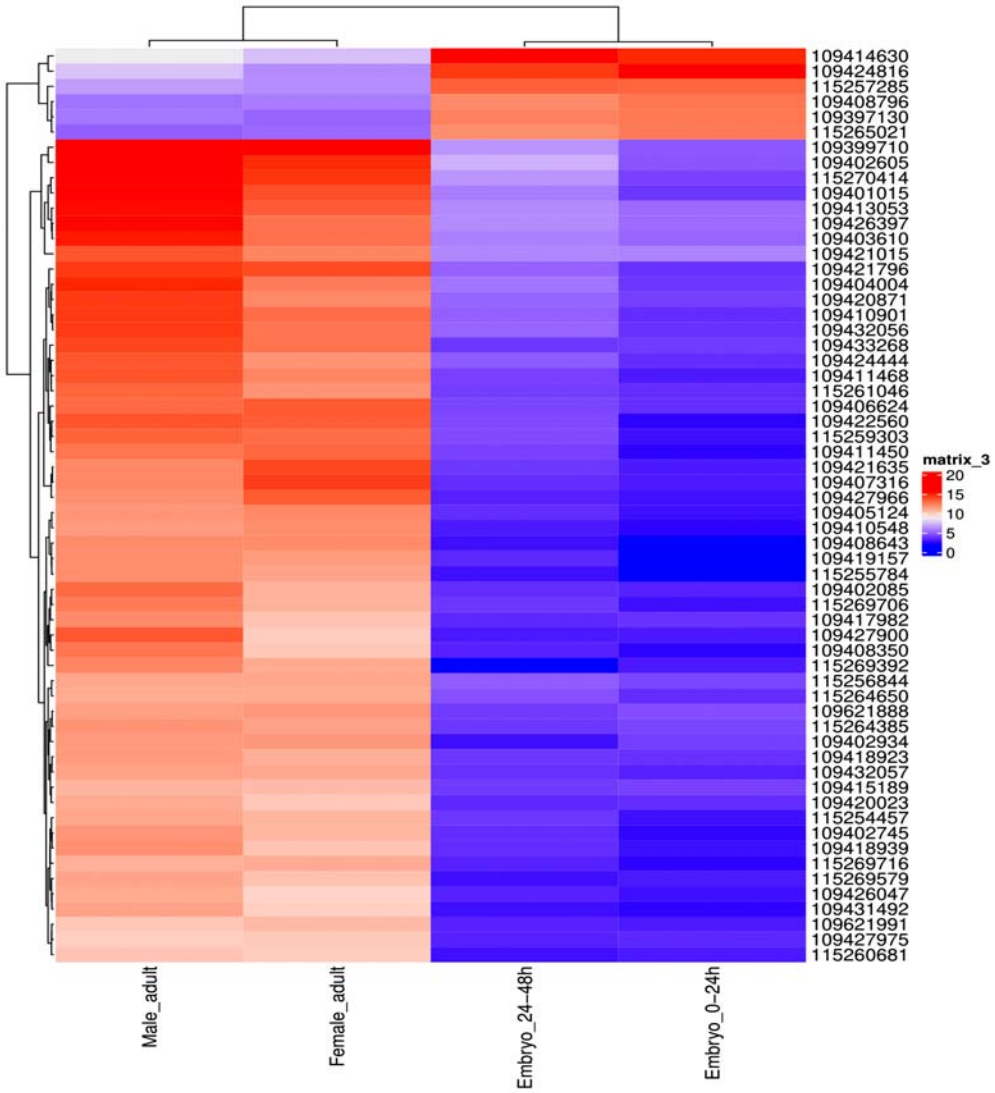

Fig. (1). Heat map (Embryo_*vs*_Adult).

The volcano plot shows differentially expressed regions in red color and baseline regions in green color. Differentially expressed genes are segregated based on the

CHAPTER 7

Comparative Modelling and Binding Compatibility of Bi-Functional Proteins in Microcystis aeruginosa

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Abstract: The objective of the study was to identify a potential inhibitor for Bifunctional Protein in Microcystisaeruginosa. The *in silico* modeling of the protein using the "TBM" module of "Galaxy Seok Lab" extended the execution of virtual screening using MTi open screen. Finally, the protein-ligand interaction was studied using LIGPLOT software for "Bifunctional Protein" in "Microcystis aeruginosa." The virtual screening revealed 7176 compounds from the drug library, and the "best fit" screening resulted in 1500 compounds. Among the 1500 compounds, the molecule MK-3207 showed a better affinity towards the bifunctional Protein with -11.3Kcal/mol binding energy.

Keywords: Aeruginosa, Bi, Blooms, Ligplot, Proteins.

INTRODUCTION

The primary duty of humans in the twenty-first century is to maintain water quality. Mostly, cyanobacteria grow in unsafe water. The species of Phytoplankton species grow in eutrophic water bodies. The most common species of cyanobacteria in freshwater settings that range from tropical to cold subzones is Microcystis aeruginosa. Blooms of *M. aeruginosa* create various environmental issues, including an unpleasant odor, but the most significant problem is developing microcystins.

MATERIALS AND METHODS

Protein Modeling: Template-based modeling (TBM) is a structure prediction approach that uses homologous proteins as templates in this context. Computational Screening of Leads: The web server MTiOpen Screen comprises two services, MTiAutoDock and MTiOpen Screen. MTiAutoDock supports doc-

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king compounds into a predetermined or user-defined binding site and a rigid docking with Autodock 4.2. MTiOpen Screen automates virtual screening by docking with Autodock Vina.

Analysis of Non Bonding Interactions: Ligplot tool of the European Bioinformatics Institute (EBI) gave the details of H bonding along with Vander Wall and Columb interaction [1-10].

RESULT

The Rampage server's target protein quality provided knowledge of nonbonding interactions between the protein and the ligands (Figs. **1-3**) to determine their binding free energy (Figs. **4-6**). This MTi automated docking research identified 7176 compounds in the drug library and the best fit of 1500 molecules (Figs. **7-9**). The Protein had the most excellent relationship with the Mk3207 chemical, with a -11.3Kcal/mol binding energy. Because of the reduced binding energy, the ligand is more stable than another molecule (Figs. **10-13**).

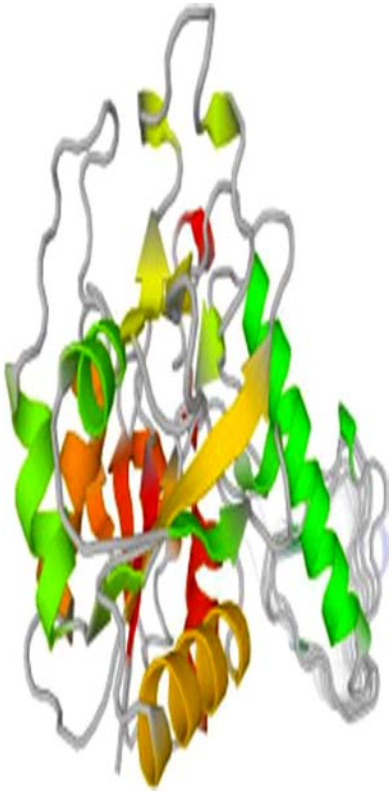

Fig. (1). Predicted Structure of Bifunctional Protein.

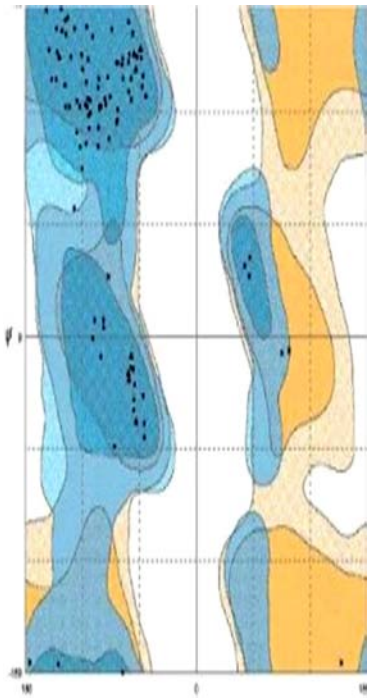

Fig. (2). Quality of Predicted Structure.

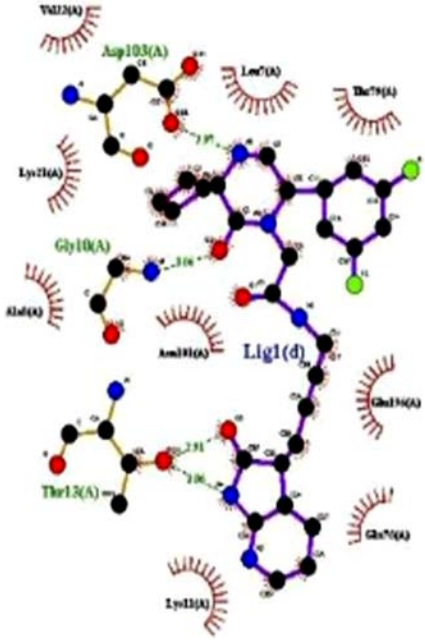

Fig. (3). Protein-Ligand Interaction.

CHAPTER 8

Economic Consideration of an Off-Grid Hybrid Power Generation System using Renewable Energy Technologies: Case Study of an Institutional Area in the State of Rajasthan

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Abstract: The focal point of this study is to recreate and plan a hybrid system consisting of a solar photovoltaic, a battery and a diesel generator and optimize the configuration into an off-grid hybrid structure to meet the electricity demand of an institutional area situated in Jaipur, Rajasthan, India. Various configurations have different specifications obtained to meet the load demand based on input parameters which are obtained from a pilot survey and the main survey a particular location. Various costing parameters such as per unit of cost and net present cost are estimated with the condition of meeting the maximum load demand. The HOMER (Hybrid Optimization Model for Electric Renewable) software is used for different simulation processes and finally it is found that solar PV-battery-diesel generator hybrid system is an economical system to meet the electricity demand in which the cost of energy is obtained as ₹ 13.83 and Net Present Cost is ₹ 9.78M with initial capital and operating costs of ₹ 4.20M and ₹ 646,319 per year, respectively. The diesel fuel cost is obtained as ₹ 5,09,288 per year. Meanwhile, the electricity produced and consumption are also estimated as 1,09,040 kWh/year and 81,939 kWh/year, respectively, with an unmet load of 1.77% only.

Keywords: Renewable energy resources, Hybrid power generation system, Optimization, HOMER, Cost of energy, Net Present Cost.

INTRODUCTION

Today, electricity is the basic requirement for the development of any country. The need for electricity is increasing enormously with rapidly increasing population growth. To fullfill the present and future need for power, new strategies are needed to develop in the developing nations like India. Hybrid

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systems with sustainable power source assets give an affordable and solid inventory of power bringing down per unit cost of energy delivered. Nowadays renewable energy sources like biomass, biogas, wind, solar photovoltaic, and micro-hydro are widely used in standalone as well as hybrid power generating systems of various combinations with a diesel generator as per the load demand and the availability of resources [1 - 9]. India's per capita power consumption has consistently been growing over time, from 734 kWh in 2008–09, the consumption has reached 1075 kWh in 2016, and finally, it has reached 1181 kWh in 2019, a prosperous growth of 60% in eleven years, *i.e.,* an average of 5.5% every year [10 - 16]. The conventional method is fulfilling the load requirements and peak load demands but it has some problems and constraints such as pollution, air contamination and global warming, high maintenance and operating cost of expensive equipment, lack of highly skilled labour; risk of severe accidents like boiler explosion, transmission line hazardous accidents, *etc.* So, in order to eliminate such problems, the concept of decentralized power generation with renewable energy sources is being utilised. Renewable energy includes solar, wind, biomass, geothermal, hydropower, and tidal energy forms, which give energy such as electricity generation, air, and water heating/cooling, and transportation services [17 - 28]. The hybrid combinations may be solar-wind, solar-biomass, wind-biomass, *etc.* for different locations based on the feasibility of various renewable energy resources. Sometimes diesel generators are also used with hybrid combinations to increase the overall reliability of the hybrid renewable energy system [29 - 36].

Table **1** represents the total power generated across the world per year from 2005 to 2019. It shows that the demand for electricity has continuously increased every year from 18,333TWh in 2005 to 25,721 TWh in 2019, hence there is a great need for electricity for global development. Tables **2** and **3** present the contribution of renewable energy resources and nation-level energy, respectively [10, 11].

Table 1. Global Electricity Generation (TWh) [10, 11].

Year	Electricity Generation (TWh)	Year	Electricity Generation (TWh)
2005	18,333	2013	23,375
2006	19,040	2014	23,765
2007	19,874	2015	23,950
2008	20,263	2016	25,082
2009	20,204	2017	25,570
2010	21,515	2018	25,648
2011	22,212	2019	25,721

(Table 1) cont.....

Year	Electricity Generation (TWh)	Year	Electricity Generation (TWh)
2012	22,709	-	-

Table 2. Contribution of Renewable Sources in Global Electricity Generation [10, 11].

Year	Electricity Generation (TWh)	Year	Electricity Generation (TWh)
2005	3278.93	2013	5041.65
2006	3437.04	2014	5295.24
2007	3552.73	2015	5513.01
2008	3804.49	2016	5859.62
2009	3886.53	2017	6231.93
2010	4187.10	2018	6673.49
2011	4398.93	2019	6943.84
2012	4722.20	-	-

Table 3. Nation Electricity Generation (TWh) [14].

Year	Electricity Generation (TWh)	Year	Electricity Generation (TWh)
2005	766.848	2013	1177.810
2006	768.492	2014	1271.872
2007	818.876	2015	1351.970
2008	840.048	2016	1433.392
2009	892.458	2017	1486.493
2010	976.432	2018	1546.517
2011	1056.838	2019	1588.261
2012	1056.838	-	-

Fig. (**1**) represents the total renewable contribution which is about 35.4%, comprising 10.1% from wind, 12.6% from large hydro, 8.7% from solar, 2.7% from biomass and 1.3% from small hydro and waste to power is about 0.04% together with the various non-renewable contributions such as coal 53.9%, gas 6.9%, nuclear 1.9%, diesel 0.2%.

RELATED LITERATURE REVIEW

There are different studies that are available in the literature mentioned by many researchers focused on single and/or hybrid renewable energy based on different locations and climate conditions. Some of them are presented in this section.

CHAPTER 9

High Optimization of Image Transmission and Object Detection Technique for Wireless Multimedia Sensor Network

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Abstract: One of the most important issues in Wireless Multimedia Sensor Networks is the energy efficiency of object detection and image transmission. In-node object detection and tracking algorithms have been proposed in recent WMSN approaches. However, with a little effort, the WMSN will be able to detect the presence and absence of objects in images. For the WMSN, a new approach for the above technique is suggested in this research. Instead of sending a whole image, this technique sends image parts. It ensures energy saving inside the node and minimum picture content which is transferred to the sink node. On the basis of in-node reconstructed and energy consumption picture, it suggests that the technique is evaluated using (PSNR). In comparison with existing state-of-the-art methodologies, simulation results demonstrate that the suggested methodology saves 95 percent of node energy with a received picture PSNR of 46 dB.

Keywords: WMSN, PSNR, SNR, transmission, the detection algorithm.

INTRODUCTION

Any sort of signal processing in which the input is an image, such as a photograph or a video frame, is known as image processing. The result of image processing might be a picture or a set of image-related features or parameters. The majority of image processing approaches consider the picture as a two-dimensional signal that is then processed using traditional signal processing techniques. Although digital image processing is the most common, optical and analogue image proces-

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sing are also feasible [1-6]. The output of a segmentation step, which is normally raw pixel data, is nearly always followed by a representation and description, forming either the region's boundary or all points within the region. Choosing a representation is simply one aspect of the process of translating raw data into a format that can be processed by a computer. Lossy or lossless image compression is possible. For archiving purposes, lossless compression is desirable, as it is for medical imaging, technical drawings, clip art, and comics. Compression artefacts are created by lossy compression algorithms, especially when utilised at low bit rates [7]. Lossy approaches are best for natural pictures like photographs, when a small (often undetectable) loss of quality is acceptable in exchange for a significant drop in the bit rate [8-15]. The fundamental objective of image compression is to get the highest picture quality at a given bit rate (or compression rate), however, there are other essential aspects of image compression schemes: Generally speaking, it refers to a loss in quality produced by manipulating the bit stream or file (without decompression and recompression). Scalability is also known as progressive coding or embedded bit stream. Scalability may also be seen in lossless codecs, commonly in the form of coarse-to-fine pixel scans, despite its contradictory nature. Scalability is particularly helpful for evaluating images while they are being downloaded (for example, in a web browser) or enabling varying quality access to databases. Histogram equalisation (HE) is a widely used technique for improving picture contrast. Its core concept is to map grey levels using the probability distribution of the input grey levels as a guide. It improves the overall contrast by flattening and stretching the dynamical range of the image's histogram. Medical image processing and radar image processing are two examples of where HE has been used.

The characteristics of interest in certain CT radiographs only occupy a small portion of the grey scale. Contrast enhancement is a technique for increasing the contrast of certain elements so that they occupy a larger amount of the displayed grey level range while preserving the overall image quality. Contrast enhancement approaches aim to find the best transformation function between the original grey level and the projected intensity so that the contrast between neighboring structures in a picture is maximized [16-20].

Three-dimensional facial recognition is a new trend that claims to attain higher accuracy. This method captures information on the geometry of a face using 3D sensors. The shape of the eye sockets, nose, and chin are among the characteristic features on the surface of a face that are identified using this information.

One advantage of 3D facial recognition is that, unlike other systems, it is unaffected by changes in illumination. It can also recognise a face from a variety

of angles, even from a profile perspective. The precision of facial recognition is much improved when three-dimensional data points from a face are used. The development of advanced sensors that capture 3D facial imagery better is enhancing 3D research. Structured light is projected onto the face by the sensors. On a single CMOS chip, up to a dozen or more of these image sensors may be put, each capturing a distinct part of the spectrum [21-26].

RELATED WORK

Target Tracking by Particle Filtering in Binary Sensor Networks

One of the most intriguing uses for wireless sensor networks is surveillance and other key areas such as embedded computing, computer vision, and image sensors. As a result, research in areas such as video processing algorithms, distributed engines, and power management, is still needed for wireless surveillance systems. We present a wireless smart camera with an infrared sensor and a solar energy harvester in this research.

Image Texture Feature Extraction Using GLCM Approach

Structure functions are generated in a statistical structure study from the mathematical submission of detected mixes of extremes at defined roles in comparison to each other in the image. Research is classified as first-order, second-order, or higher-order based on the number of strength components (pixels) in each combination. The Grayish Level Co-occurrence Matrix (GLCM) approach is a technique for obtaining mathematical structural functions in the second order. The method has been implemented by a number of different programmers. The matrix element P I j (x, y) represents the relative frequency with which two pixels are separated by a pixel distance (x, y), one with intensity I and the other with intensity 'j', appear within a particular neighborhood. The second-order statistical probability values for changes between grey levels I and 'j' at a specific displacement distance d and at a particular angle () are included in the matrix element P I j | d,). Using a high number of intensity levels, G necessitates keeping a lot of temporary data, *i.e.* a G G matrix for each (x, y) or (d, d) combination.

Co-Occurrence Matrix and its Statistical Features

From n inputs, a k-winner-take-all (kWTA) network can discover the k greatest numbers. To implement the kWTA method, a dual neural network (DNN) solution has been presented. The DNN technique has a substantially lower number of links than the traditional way. The convergence time of the DNN-kWTA model, stated in terms of input variables, was given a rough upper bound.

CHAPTER 10

ANN Based Malicious IoT-BoT Traffic Detection in IoT Network

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Abstract: The purpose of this study is to discover anomalies and malicious traffic in the Internet of Things (IoT) network, which is critical for IoT security, as well as to keep monitoring and stop undesired traffic flows in the IoT network. For this objective, a number of researchers have developed several machine learning (ML) approach models to limit fraudulent traffic flows in the Internet of Things network. On the other side, due to poor feature selection, some machine learning algorithms are prone to misclassifying mostly damaging traffic flows. Nonetheless, further study is needed on the vital problem of how to choose helpful attributes for accurate malicious traffic identification in the Internet of Things network. As a solution to the problem, an Artificial Neural Network (ANN) model is proposed. The Area under Curve (AUC) metric is used to employ the cross-entropy approach to effectively filter features using the confusion matrix and identify effective features for the chosen Machine Learning algorithm.

Keywords: Artificial neural network (ANN), IoT Network, Machine learning (ML), Malicious traffic.

INTRODUCTION

Large volumes of sensitive user data are vulnerable to internal and external assaults. As technology has improved, cyber-attacks have evolved in tandem with algorithm sophistication. Attacks on systems that process, store, or rely on significant data or services are the most popular targets for cyberattacks. An individual Intrusion Detection System (IDS) is necessary for the detection of destructive cyber-attacks that pose a security risk. At both the network and host

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levels, an intrusion detection system detects and classifies attacks, security policy violations, and intrusions [1-5].

The changing nature of threats has needed extensive modification of IDS performance, which has been accomplished by using Machine Learning (ML). Machine learning (ML) is a subfield of AI that allows computers to learn without the necessity of external programming. Machine learning algorithms aid in prediction by learning from existing data. The ultimate objective of machine learning is to develop an efficient algorithm that analyses incoming data and generates a prediction using statistical analysis.

There are two types of machine learning algorithms: 1) supervised learning and 2) unsupervised learning [6-10].

For supervised learning, a well-labelled training dataset containing both normal and attack samples is necessary. This is a type of learning in which the input and intended results are supplied to the learning model in order for it to generate future predictions. In a binary classification problem, the true or false labels must be adequate in number when each data sample includes a high number of characteristics utilised as an input to train the model. The dataset used for training may have a big influence on how well a machine-learning model works. An erroneous classification or prediction might be caused by a skewed dataset.

To attain optimal performance for accurate prediction and classification of threat types, modern IDS must use the power of AI through machine learning (ML). The datasets used to train these ML models determine the amount of training required. Biases in data or an algorithm that are overlooked or hidden might lead to skewed predictions, harming the performance of an AI application.

The Internet of Things (IoT) has become increasingly popular in recent years all across the world. By 2030, the total number of linked IoT devices is expected to reach 125 billion. The integration of these IoT devices with a variety of other technologies, services, and protocols has made IoT network management more difficult. As a result, the internet is subject to major cyber-attacks and dangers, putting users of such gadgets in peril. Distributed Denial-of-service (DDoS), DoS, ransom ware, and botnet attacks are some of the most common attacks on IoT systems.

There are various IoT-based datasets that are utilised in anomaly detection research, and the BoT-IoT dataset is one of the most well-known. The BoT-IoT dataset was created on a realistic test bed that included both simulated and real-world IoT network traffic, as well as several forms of assault. For multiclass

classisification, this dataset comprises labelled features identifying the attack flow, category, and subcategories [11-18].

The BoT-IoT dataset, which was published in 2019, is the centre of this research. In terms of features and assault kinds, this dataset is extensive. The purpose of this research is to look into the factors that contribute to the dataset imbalance.

EXISTING SYSTEM

Existing technical feature selection challenges are explored and resilient features are selected by proposing several ways for Instant Message (IM) traffic identification and assault traffic detection in our existing system . Similarly, multiple feature selection strategies are given for accurate network traffic classification utilising machine learning algorithms to tackle the difficulty of feature selection. However, based on the findings of the previous study, we concluded that picking a larger range of features is inefficient for successful identification using ML approaches and that selecting a larger set of features can reduce ML classifier accuracy and increase computing complexity. However, no viable machine learning model for detecting cyber-attacks on IoT networks has yet been suggested. As a result, it is critical to investigate the problem of effective feature selection for anomaly and malicious traffic in the IoT network and present a new technique to solve it.

Support Vector Machine Algorithm

The Support Vector Machine, or SVM, is a Supervised Learning technique that may be used to solve both classification and regression issues. However, it is mostly utilised in Machine Learning for classification difficulties as shown in Fig. (**1**).

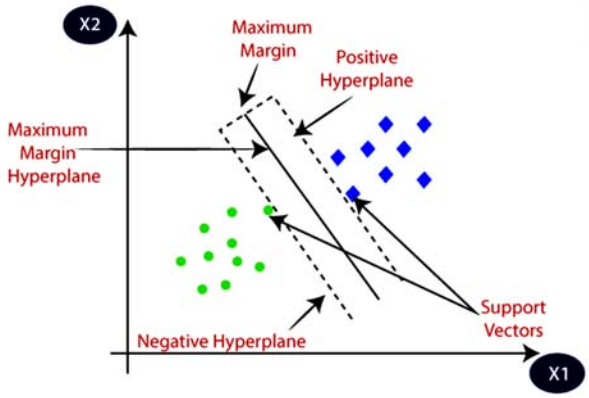

Fig. (1). Service Vector Machine.

CHAPTER 11

High-Performance Mixed Signal VLSI Design For Multimode Demodulator

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Abstract: A mixed signal quadrature demodulator was suggested in this study. In 90 nm CMOS technology, to get the desired frequency range, a quadrature VCO is employed. The fast speed is achieved with a three-bit ADC. Unused ADC construction components have been removed to conserve energy and space. Outputs obtained are used to meet the power needed in the mixed signal demodulator designed for multi-gigabit applications. QVCO, baseband AGC, frequency synthesizers, and IQ mixers, are all part of the demodulator. This displays the highest level of integration while using the least amount of electricity. To sample the symbols at optimal SNR, the baseband modem included a mixed signal timing recovery loop based on the Gardner timing error detector.

Keywords: AGC, CMOS, Error detector, PLL, VCO.

INTRODUCTION

VLSI technology may be used to create mixed analogue digital chips with over one million transistors and other devices. We should emphasize that interfacing to the analogue world entails not only A/D or D/A converters, but also pre-and post-conversion signal conditioning (amplification, filtering for anti-aliasing or smoothing, sampling, holding, multiplexing, demultiplexing, and so on), as well as direct signal processing without conversion into digital signals, particularly in combinations with medium signal to noise ratio with high speed and or low power. Sensors, receiving antennas, transmission lines, and other circuits all contribute to the signal that must be processed by the analogue component of the MAD chips. Activators, transmitting antennas, transmission lines, and other circuits must all be driven by them. Due to substantial work on sensors and actu-

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ators, the range of both sources and destinations for analogue signals is growing. The growing use of sensors in current systems implies that MAD circuits will play a larger role in these systems. Because of the advantages that MOS technology provides for digital circuits, the majority of MAD chips have been implemented in this technology. All of them are now on the MAD chip in modern disc drives. Another area where MAD chips are utilised is in digital communication networks for signal processing of digital pulses.

For mixed-signal applications, a digital-to-analog converter (DAC) functions as a technological test vehicle. Current steering D/A converters, which are based on an array of matched current sources that are switched to the output according to a digital input word, are commonly employed for signal processing applications. The use of both unary and binary coded bits results in a design that is both simple and resilient, as well as having a high degree of precision. The total of the binary scaled currents is obtained from the unary scaled current sources to avoid a mismatch between the binary and unary parts. These values describe performance constraints in dynamic DACs, such as harmonic distortion, synchronization and timing problems in switch control signals, or capacitive feed through the clock and data signals to the output.

Modern communication systems make extensive use of phase-locked-loop circuits. For clock creation or regeneration as a frequency synthesizer, PLLs are made up of digital (PFD & FD), analogue (CP & LF), and RF (VCO) components. The phase of the VCO is changed *via* negative feedback to match the phase of the reference clock f ref, resulting in a constant skew between the two PFD inputs. When the PLL is locked in a steady state, the desired synchronization f out = N f ref is accomplished. PLL performance is defined by power consumption, circuit size, and jitter, in addition to the goal frequency range (f ref &f out) and locking time. Jitter is the integrated phase noise of the carrier f out and describes the timing uncertainty of the clock edges. As a result, a charge-pump PLL is used as a secondary test vehicle for complicated mixed-signal circuits with a focus on noise and matching [1-6].

Existing Systems

Gilbert Cell Mixer

The Gilbert cell mixer, sometimes known as the Gilbert cell multiplier, is a kind of double-balanced mixer that uses a symmetrical architecture to eliminate undesirable RF and LO output signals from the IF.

Ring Vco

It can create multiple-phase clock signals that are utilized to sample incoming data, ring VCOs are frequently employed in clock and data recovery phase-locked loops. Ring oscillators are also the easiest way to evaluate a technology's performance. Many publications on CML ring oscillators employing SiGe or GaAs technologies have already been published, but only a few papers have documented success in deep sub-micron silicon CMOS technology.

Adc

A device that transforms a continuous number to a discrete digital number is known as an analog-to-digital converter (abbreviated ADC, A/D, or A to D). An ADC is a type of electrical device that transforms an analogue voltage (or current) into a digital number proportionate to its magnitude. Different coding techniques may be used in the digital output is shown in Fig. (**1**).

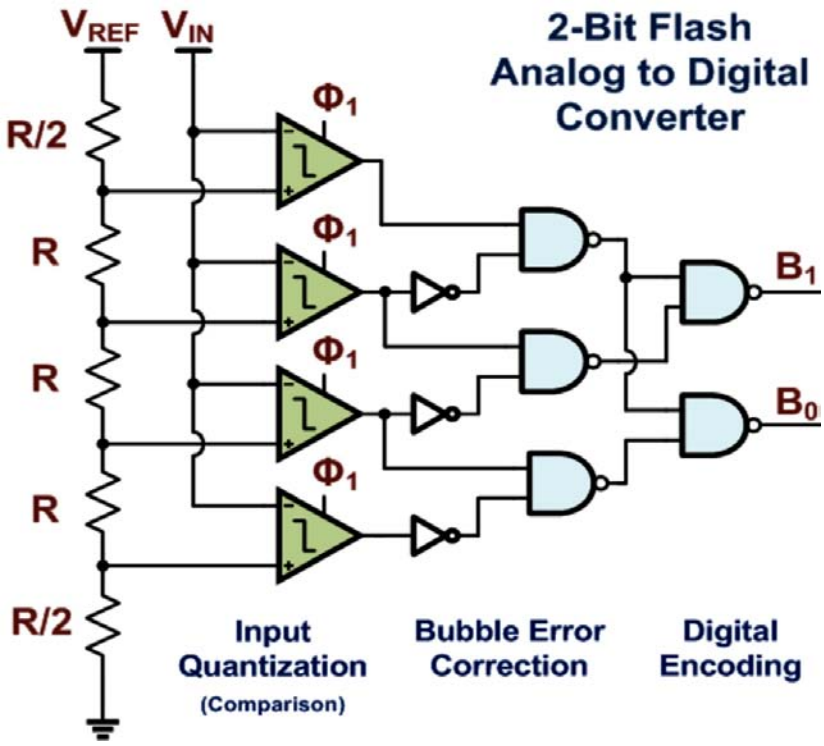

Fig. (1). Two-bit flash ADC.

CHAPTER 12

Pre Placement 3D Floor planning of 3D Modules Using Vertical Constraints For 3D IC'S

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Abstract: This project focuses on wire length reduction throughout the 3D floor layout stage. The 3D cell layout stage is part of the floor planning process. Previously, it was expected that the entire module would be placed on a single device layer. They don't consider how a module's cells may be dispersed across many device levels to reduce the cable length. Each of the device layers is assigned to one of the cells that make up a module (a 2D module is converted into a 3D module). To place cells in three dimensions, several constraints are used. The placement aware constraints are a set of constraints that determine whether a 2D module may be turned into a 3D module. The vertical alignment of identical submodules owing to the same planar placement requirement is referred to as vertical constraint. The size of the solution will be reduced as a result of this. A 3D floor design module packing method is proposed by the author. Calculating the wire length and taking into consideration the feasibility requirement, a smaller solution area is used to arrange the 3D cells in an initial set of floor layouts. After finding the best floor design, the modules are packed using a packing algorithm, and the technique is finished. A placement aware 3D floor design method is the name of the approach, which is developed in C++ and operates on Fedora Linux.

Keywords: AGC, CMOS, Error detector, VCO,PLL.

INTRODUCTION

VLSI refers to the process of combining thousands of transistors onto a single chip. VLSI arose in the 1970s while complex semiconductor and communication technologies were being developed. The microprocessor is a VLSI device.

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Speed, power, and space are all important factors in VLSI (layout). Signal propagation delays through gates and wires occur even for areas just a few micrometres wide. The operating speed is so rapid that when the delays build, they resemble the clock speeds. High operational frequencies can result in increased power usage. This has two effects: electronics absorb battery energy faster, and heat dissipation increases. When heat is paired with the fact that surface areas have reduced, the circuit's integrity is jeopardised.

Circuit component layout is a profession that is identical to anything in the electronics area. The fact that we have different possibilities for doing so makes our situation unique: several layers of diverse materials on the same silicon, various arrangements of smaller components for the same component, and so on. There is a trade-off in the circuit between power dissipation and speed; if one is maximised, the other suffers. The bulk of today's VLSI designs are classified as analogue, ASIC (Application Specific Integrated Circuits), or SoC (System-on-Chip) designs (System on Chip). The purpose of research and development in this discipline is to optimise area, speed, and power. Alternative strategies for generating improved system-level performance are becoming more significant as a result of the growing difficulties in sustaining technological achievements *via* conventional scaling at a rate corresponding with Moore's law. 3D technology has the potential to provide significant performance increases over 2D for multiple generations. In 3D physical design, planning, buffering, and temperature control are all key issues.

Alternative strategies for generating improved system level performance are becoming more significant as a result of the growing difficulties in sustaining technological achievements *via* conventional scaling at a rate corresponding with Moore's law. 3D technology has the ability to significantly increase performance across numerous generations. 3D technology refers to the production of a single integrated circuit whose functional components (for example, transistors) extend in three dimensions, *i.e.*, the vertical arrangement of several bare integrated circuits in a single package. Because of the vertical extension of chips in 3D technology, improved performance and power efficiency are achieved *via* the use of chip area, decreased connection length, and increased packing density.

Transitioning from conventional single chip packaging to 3D technology saves a lot of space and weight. The key limiting factors for 3D technology are connection capacity, thermal characteristics, and the required durability. 3D technology has been claimed to provide a 40-50 times decrease in size and weight when compared to conventional processes. All of these reductions are the result of eliminating the overhead weight and size that conventional technology entails.

One of the most critical considerations in packaging technology is the chip footprint, or the area of the printed circuit board occupied by the chip. “Silicon efficiency” refers to the ratio of total silicon footprint area to substrate area. As a consequence, the silicon efficiency in any 2D technology can never exceed 100%; nevertheless, owing to many overlapping footprints within one stack in 3D technology, this limit is broken. As a consequence, shortening the stack's connections minimises the propagation latency between chips.

RELATED WORKS

Through-silicon *Via* Planning in 3-d Floorplanning

None of the studies take into account TSV's size and location. Previously, they were used as points while calculating the wirelength. For wire length reduction, the position and area of TSVs are taken into account. Because a significant mistake in the wirelength estimate reduces the optimality of the floor plan results, accurate results may be obtained by considering the area and location of TSVs. Previously, the wirelength was estimated using half the perimeter length of the bounding box holding the pins without taking into account the position of TSVs.

Without considering the position of TSVs, the bounding box is tiny; however, when the position of TSVs is taken into account, the bounding box becomes large, and the bounding box's half perimeter length grows. As a result, a more accurate wire length estimation is attained.

At first, probabilistic TSV planning was chosen at high temperatures, and as the temperature dropped, thorough TSV planning was preferred. As a result, the heat issue was also brought up. By 57 percent, our technique outperformed the postprocessing TSV planning algorithm.

Efficient Thermal *via* Planning Approach and its Application in 3-d Floorplanning

During three-dimensional (3-D) floorplanning, the 3D floorplanning method has been devised to account for thermal *via* (T-via) planning. It also incorporates dynamic TVP into the three-dimensional floorplanning process. A series of simplified interlayer and interlayer TVP sub problems are used to solve the temperature-limited TVP issue. Each subproblem is recast as a convex programming problem, and the best solution for the detailed T-via distribution is found. A two-stage strategy is used to construct an integrated TVP and 3-D floorplanning algorithm based on the TVP solution.

CHAPTER 13

Underwater Bio-Mimic Robotic Fish

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Abstract: This chapter discusses the design and fabrication of biomimetic underwater robotic fish. A robot fish is a type of bionic robot that looks and moves like a real fish. Two motors, an Arduino microcontroller, Bluetooth, and a pump are required to complete the underwater robotic fish project. Motors are employed for quick forward and rotating motion, and the pump assembly aids in deep-water diving. In addition, sensors assist the robot in making intelligent judgments such as obstacle detection, direction shift, and so forth. Additionally, essential information such as live streaming, pressure, and temperature is provided. The innovative technology compromises the agility and performance of the robot that helps to achieve the real motion of the fish, making the robot competent for an aquatic-based design of the robot that helps to reduce the complex structure without applications such as underwater exploration, oceanic supervision, pollution level detection, and military detection This project is also beneficial.

Keywords: Arduino microcontroller, Bluetooth, Camera, Power supply, Servo motor, Temperature sensor, Water pump.

INTRODUCTION

A flexible tail mechanism allows a fish-like underwater robot to swim quicker and more softly while consuming less energy. The design of the robotic fish is based on the locomotion mechanism utilised in a variety of applications such as ocean development, military operations, and marine environment protection, and it necessitates a high-performance automated underwater vehicle (AUV). Robotics is the study of creating devices that can take the place of humans and mimic their actions. Robots can be employed in a variety of scenarios and for a variety of objectives, but many are now used in hazardous areas (such as radioactive material inspection, bomb detection, and deactivation), manufacturing operations, or in situations where humans are unable to live for example, in space, under-

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water, in high heat, and clean up and containment of hazardous materials and radiation. Robots can take on any shape, but some are designed to seem like people. This is said to aid robot adoption in certain replicative activities that are normally performed by humans. Walking, lifting, speaking, cognition, and any other human activities are all attempted by these robots [1-5]. Many of today's robots are influenced by nature, making bio-inspired robotics a growing area. Today, we require a variety of technologies for monitoring and studying our environment. Underwater vehicles of this type have been developed in recent decades to investigate and experiment with water. Fish, an aquatic animal with outstanding man-ability and improved propulsion efficiency, is the best solution for underwater research. The two motors on this Robot's propulsion mechanism allow it to swim in the water. Sensors, actuators, and microprocessors, as well as a control mechanism, are all essential hardware and software components of underwater robots [6-10]. With its propelling mechanism, this robot is meant to swim in the water using two servo motors. It may also descend into the water thanks to a ballast tank system. We built and constructed an autonomous robotic fish to detect and follow an underwater object in this research as shown in Fig. (**1**).

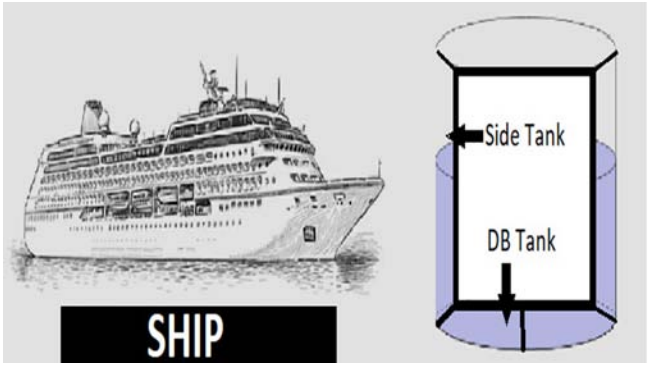

Fig. (1). Ballast Tank System.

Design of Underwater Robotic Fish

A streamlined head, a body, and a tail make up the most basic biomimetic robotic fish. All control modules, including a wireless communication module, batteries, and a signal processor, are housed in the head, which is often composed of a stiff plastic substance (fibreglass). The body could be made up of several jointed segments connected by servomotors. The rotation angle of the joint is controlled by servomotors. Pectoral fins are placed on both sides of the body in some designs to ensure stability in the water.

Motive power is provided *via* an oscillating caudal (tail) fin coupled to joints and operated by a motor as shown in Fig. (**2**).

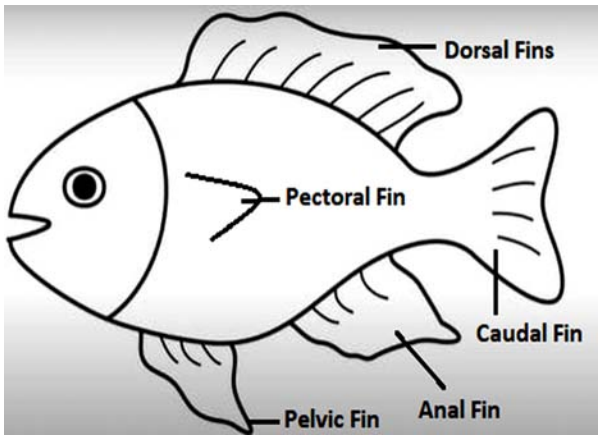

Fig. (2). Skeleton of robotic fish.

PRINCIPLE OF UNDERWATER ROBOTIC FISH

The most essential aspects of robot fish research and development are improving their control and navigation, allowing them to 'communicate' with their environment, travel along a certain course, and respond to directions to make their 'fins' flap. The three primary principles of underwater robotic fish are:

- Anguilliform: Propulsion by a muscle wave in the animal's body that goes from head to tail, similar to an eel.
- Carangiform: Salmon, Trout, Tuna, and Swordfish have oscillating tail fins and tail peduncles.
- Ostraciiform: Like the boxfish, it oscillates only the tail fin without moving the rest of the body.
- Mechanical design for underwater robot fishes can be divided into four types.
- Changing wave: The body wave is used to propel from head to tail. With so many hinges and joints, a smooth motion of the entire body is essential.
- Body Foil: The fish pushes the water away from them by oscillating its tail fin and moving its body in a wave pattern.
- Oscillating wing: This approach relies on an oscillating wing-shaped tail fin to provide nearly all propulsion force.
- Oscillating plate: In this manner, fish only vibrate at the tail fin, similar to a plate.

CHAPTER 14

IoT-Based Automatic Irrigation System

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Abstract: Agriculture is one of the backbones of our Indian economy. India is primarily an agricultural country. It plays an important role in the development of our nation. This project proposes an automatic irrigation system, because it maintains the moisture content present in the soil by automatic irrigation system. This setup uses a capacitive soil moisture sensor v1.2 that measures the exact amount of soil moisture. It monitors soil properties such as temperature, humidity, soil moisture, and motor status. These parameters are measured using a soil moisture sensor, a DHT11 sensor, which is controlled by a NodeMCU that acts both as a microprocessor and as a server. It is possible to remotely control many farm operations from any part of the world through IoT.

Keywords: DHT 11 sensor, IoT, NodeMCU, Pump, Relay, Soil moisture sensor.

INTRODUCTION

The automatic irrigation Developing Model is a real-time monitoring system. Most farmers use many hectares of farmland. It's becoming very difficult to monitor and check every area of large land. Sometimes there is a chance of uneven irrigation for crops. This results in low quality crops, which also leads to a loss of production. At present, automation is among the most essential roles in human life. This not only brings comfort, but it also reduces energy consumption or saves time. Industries are now using control and automation machine that is expensive and not approximate for use in farming [1, 2]. This also constructs a low-cost, intelligent irrigation technology that can be used by Indian farmers. This project proposes an automated irrigation system and maintains the moisture

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content of the soil through automatic irrigation. In the existing farming system, crops are monitored with the help of Arduino boards and GSM technology [3], in which Arduino boards act as microcontrollers but not as servers. Therefore, in order to overcome all of these features, a microcontroller like NodeMCU is the latest version that acts as both a microcontroller and a server. The main feature of this methodology is that its cost of installation is cheap and has numerous advantages. Here you can access and visualize and control the farming system on your laptop, cell phone, *etc.* [4, 5].

LITERATURE SURVEY

Before briefing IoT-based Automated Irrigation System, we shall revise the existing agricultural system. In a few of the existing irrigation systems, soil moisture is monitored using a voltage meter and water irrigation controller system .In few other irrigation systems, fuzzy logic controllers are used for the effective irrigation of various crops. Fuzzy logic system rises the standard rate of the values obtained and helps to make decisions. Wireless Sensor Network and a GPRS Module are used for automatic irrigation in the current system of irrigation [6-8]. The temperature and humidity are measured using sensors and controlled by a microcontroller.

The WIU also has a GPRS module that transmits data to the server on a public mobile internet. The information data achieved can be monitored remotely through a graphical representation of the server. This irrigation system makes it easy to monitor and cultivate even in places with less water, and making the system feasible. But Zigbee Protocol makes this system costly. Modern agriculture is based on a greenhouse which must be accurately controlled both in terms of humidity and temperature. The atmospheric conditions around the plants vary from place to place, making it nearly impossible to irrigate uniformly in in all locations of the field manually. To that end, GSM technology is used to gain the report of the irrigation process *via* farmers, mobile phone, or other social communication devices [9-11].

PROPOSED SYSTEM

The main objective of this study is to supply water when there is less moisture content in the soil without anyone's presence to avoid excess water supply during irrigation and also monitoring soil parameters such as soil moisture, atmospheric temperature and atmospheric humidity. The various parameters of the field can also be remotely controlled at any time, through mobile phone and web applications. This sends signals to the mobile phone whether to supply water or not (*i.e.,* when the field is dry) to the field. It includes Node MCU and sensors

such as soil moisture sensor and DHT11 sensor, relays, OLED display and submersible motor.

METHOLOGY

The current methodologies include Arduino board and GSM technology. It operates only as a microcontroller, but never as a server. Thus, to overcome these differences, a microcontroller like NodeMCU which is the latest version that acts as both a microcontroller and a server is used. Fig. (**1**) shows the block diagram that gives the basic outcome of the project. It also includes components used in the project such as soil moisture sensor, humidity sensor, and temperature sensor in a single sensor known as DHT 11 sensor, OLED display, relay, and submersible pump for use in this experiment.

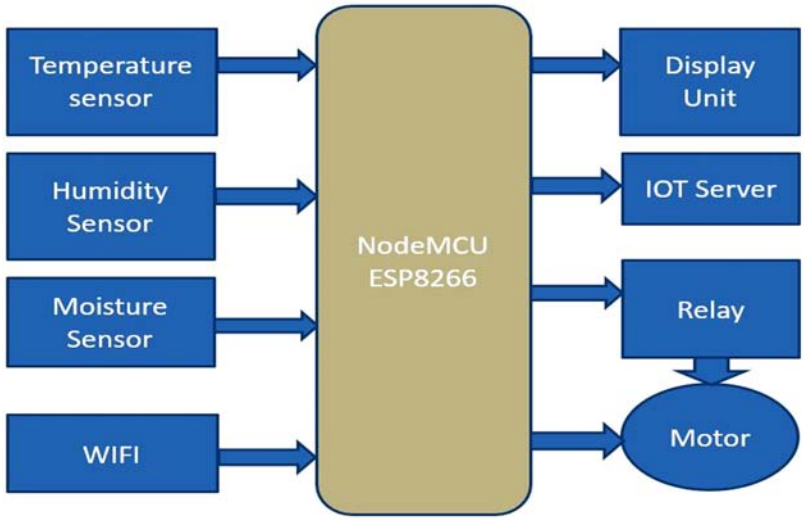

Fig. (1). Block diagram.

HARDWARE DISCRIPTION

NodeMCU

NodeMCU works on a multiparadigm, lightweight, high-level programming language designed primarily for embedded applications known as Lua and specifically used for IoT-based applications. It works both as a microcontroller and as a modem. It also works with the help of ESP8266 [NodeMCU] Wi-Fi and hardware equipment depending on the ESP-12 module.

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