Department : Information Technology		
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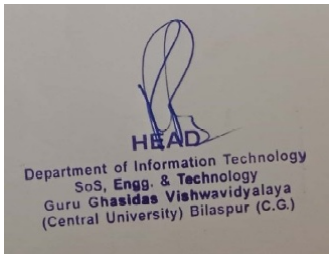
Following students have carried out their Project work/ Internship/ Field Project/Industrial Training for the academic session 2021-22

S.No.	**Name of the Students**	**Page No ……. To ……..**
1	Jyoti Tiwari	2-18
2	Ranjana Rathore	19-31
3	Swapnil Dange	32-43



Signature and Seal of the Head

To Enhance the Energy Efficiency of WSN

A Dissertation-Interim evaluation submitted in partial fulfillment of the requirement for the degree

Of

MASTER OF TECHNOLOGY
(Information Technology)

Submitted by

JYOTI TIWARI

Under the supervision of

DR.SANTOSH SONI

AND

MR.PANKAJ CHANDRA

Assistant Professor

Department of Information Technology

School of Studies of Engineering & Technologies

Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur,

Chhatisgarh, India

March 2023

CANDIDATE DECLARATION

I hereby certify that the work which is being presented in the thesis entitled **"To Enhance the Energy Efficiency of WSN"** by **JYOTI TIWARI** in partial fulfillment for the award of degree of M. Tech (Information Technology) submitted to the Department of Information Technology of Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur, Chhatisgarh, India is an authentic record of my own work carried out during the period from November 2022 to March 2023 under supervision of **DR.SANTOSH SONI** and **MR.PANKAJ CHANDRA**. The matter presented in this thesis has not been submitted by me or anybody else in any other University/Institute for the award of any degree/Diploma.

Signature of the student

(JYOTI TIWARI)

This is to certify that the above statement made by the candidate is correct to the best of my own knowledge.

Signature of the supervisor

(DR.SANTOSH SONI)

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CERTIFICATE

As per University grant commission (promotion of academic integrity and prevention of plagiarism in higher institute) regulation 2022 dated 14 march 2022 the thesis "TO ENHANCE THE ENERGY EFFICIENCY OF WSN" of JYOTI TIWARI, student of M.Tech (Information Technology) 03rd semester has been checked by URKUND software available at Central Library, Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh, INDIA. The amount of similarity in the thesis is __ percent. Signed URKUND similarity report is attached with certificate.

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I would like to express my deep sense of gratitude and respect to my supervisor DR.SANTOSH SONI and MR.PANKAJ CHANDRA, Assistant Professor, Department of Information Technology, Guru Ghasidas Vishwavidyala, Bilaspur, Chhattisgarh for her invaluable guidance, motivation, constant inspiration and above all for her ever cooperating attitude that enabled me in bringing up this thesis in the present form. I am extremely thankful to all my family members for their help and support. Their love, affection and patience made this research work possible and the blessings and encouragement of my beloved parents greatly helped me in carrying out this research work.

Dated: 23/3/23

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ABSTRACT

Wireless Sensor Networks (WSNs) are being widely used in various applications such as environmental monitoring, healthcare, and industrial automation. However, due to their limited power supply and communication range, energy efficiency is a critical factor that affects the performance and lifetime of WSNs. Therefore, enhancing the energy efficiency of WSNs has become an important research area.

This Thesis presents a comprehensive review of various techniques that have been proposed to enhance the energy efficiency of WSNs. The techniques can be broadly classified into three categories: hardware-based, protocol-based, and application-based. The hardware-based techniques include the use of energy-efficient hardware components such as low-power microprocessors, energy harvesting, and power management systems. The protocol-based techniques include the use of energy-efficient communication protocols, routing protocols, and data aggregation techniques. The application-based techniques include the use of energy-efficient data processing and application-specific optimizations.

In this Thesis, we discuss the advantages and disadvantages of each technique and provide a comparative analysis of their effectiveness in enhancing the energy efficiency of WSNs. We also highlight some of the challenges and future research directions in this field. The results of this study can help researchers and practitioners to design and implement energy-efficient WSNs for various applications.

Chapter 01

Introduction

A Wireless Sensor Network is mainly composed of sensing, computation and communication which authorized user the flexibility to measure, watch and response to numerous events and situations in a specific environment. The authorized user may belong to research, industry. Engineering or defence organizations. The scientist, researchers are observing that WSN will s be the key technological area in next decade. WSN applications are not only restricted to loT Healthcare, data collection, automation, environmental monitoring and defence systems but WSN can be utilized where wired systems cannot be used (e.g. kind of dangerous location). The rapid working, self-deployment fault-tolerance features of WSNs make it unique for various real time applications (01). Generally sensor network works with coverage, location and data collection process Data is the most important part of a sensor network. Sensor network mostly supports network computation. Sensor-nodes contain low size inexpensive WSN sensor nodes which measures environment condition/parameters to carry/forward sensed information to sink/end user. Sensor nodes can communicate with other neighbours sensor nodes to perform network computation. Sensor nodes mostly face constraint in energy and radio transmission. Some important technological standards and elements which are common to WSN are as follows [01]:

- Sensors

  Essential working

  Signal transmission

  Error and flow control

  Data collection

  Clustering

  Self-diagnosis

- Radio transmission

  Software based radio
  Range of transmission Modulation
  Topologies

- IEEE standards

  IEEE 802 .15.1(PAN)

- Software

  Tiny OS

- Applications

  Data Logger

  Database connectivity software

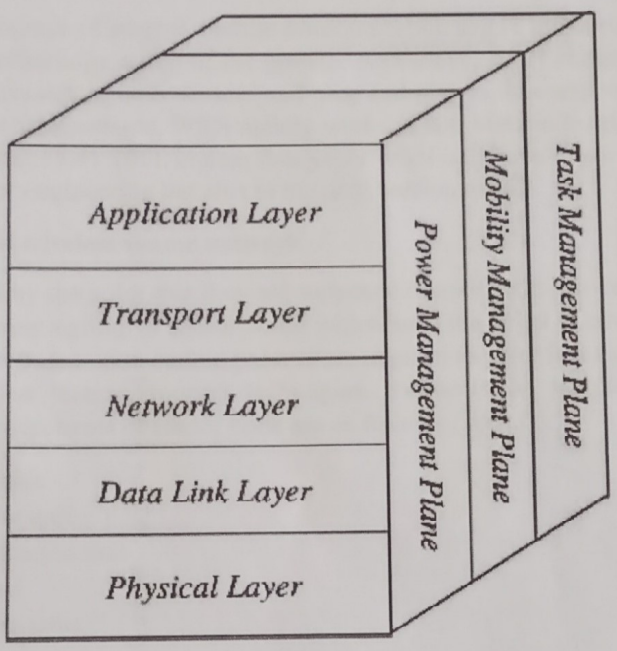

Fig 1.1 The layer protocol architecture for wireless sensor network [01]

Fig 1.1 shows protocol stack model where physical layer used for communication, signal transmission and sensing task. Data link layer is used for MAC and contention detection purpose. Network layer is used for routing and networking purpose. Transport layer used for caching, storage and data dissemination purpose. Application layer used for external software. Data aggregation and other upper layer task. WSN is self-controlling and configuration system. The main task of WSN is to be capable to work with undefined situations and tasks. Here the accuracy of information is expected even if link goes down, sensor node fails low bandwidth or low latency To create WSN fully adoptable, certain challenges and obstacle shall be overcome. These challenges are as follows:

- Limited resources

- Power issues
- Sensor node cost
- Topology control
- Radio transmission
- Deployment
- Scalability
- International standards

Due to large convergence of internet, mobile communication and IT infrastructure enabled services has taken sensor technology at top of the growth. Nowadays. WSN components mainly contain low-cost microprocessors in-built sensors and plug and play radio components which follow the emerging international standards, WSN mainly works at 900 MHz industrial system works at 2.4 GHz range (EEE 802.15.41 1011 In next five years WSN will have major expansion not only in research, medical or engineering but also to the next version of loT

1.2 Architecture of wireless sensor network

WSNs are featured by the point that they are supposed to operate in low-resources environments. Generally WSN forms a group of sensor nodes which have the target to cover entire area (field) to provide sensed data based upon certain parameters in point to point link manner By-default WSN have communication feature, routing techniques. Transmission handler and other add one component. The components of sensor node are as follows (fig1.2):

- A Sensing unit
- A processing unit
- A communication unit
- A power unit
- Other add on units

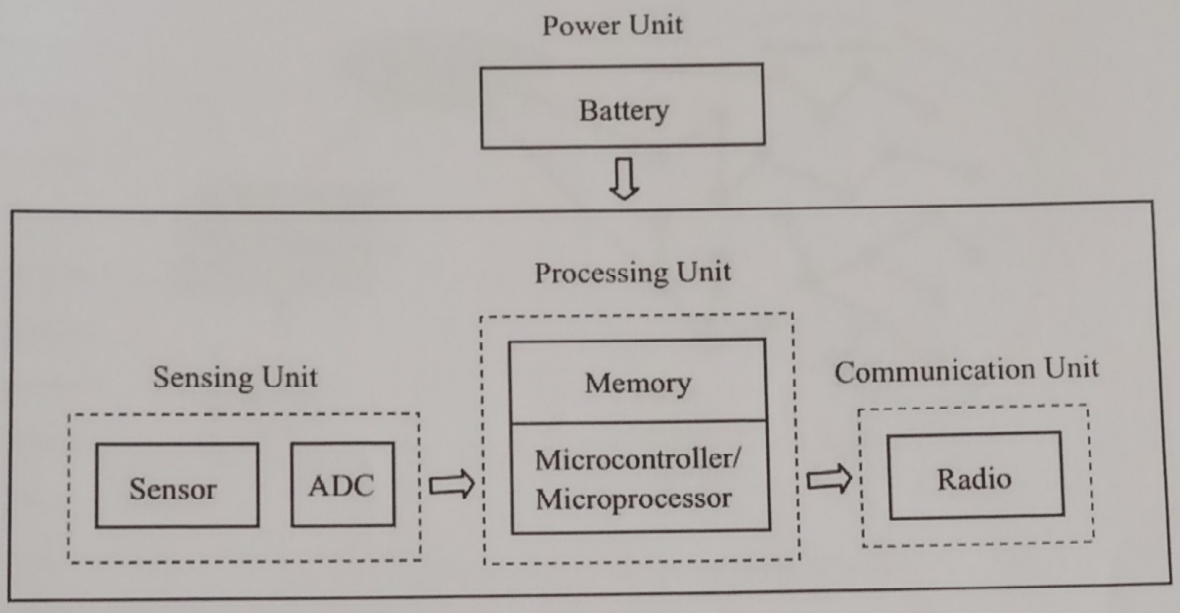

Fig 1.2 Wireless sensor node architecture

1.3 Typical working of WSN

WSN includes the numerous research disciplines such as query processing algorithms. Networking and data collection in timely manner Sensing involves environmental data sensing (temperature, humidity, heat) chemical data sensing (toxic agents), medical data sensing (heart rate, blood pressure), human made data sensing (intrusion detection) etc [01] There is a need of small scale, less in cost, scalable, reliable and practical sensor network WSN includes customizable sensor nodes as per the specific requirement of any environment or application. The typical working of WSN is shown in fig 1.3 and fig 1.4. which involves Following steps:

Step 01: Deployment

Step 02: Topology selection

Step 03: Clustering

Step 04: Sensing interval

Step 05: Data collection

Step 06: Information sends/receives to end user (sink)

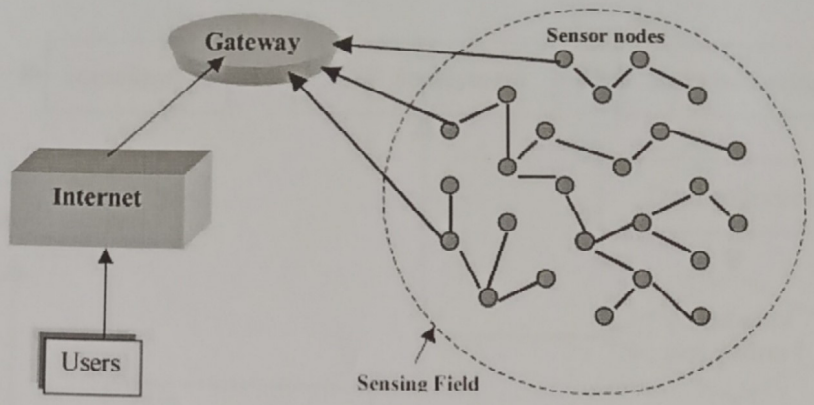

Fig 1.3 Typical working of wireless sensor network

WSN mainly suffers with the below resource constraints

- Battery power
- Limited bandwidth communication
- Low computing facility
- Intrinsic uncertainty in sensed parameters

In this protocol study, author(s) have used ZigBee which is based upon IEEE 802.15.4 standard to fulfil the requirements of low-cost less-power sensor nodes for remote monitoring purpose

1.4 Real time set-up of wireless sensor network

Author(s) of this research staty have been motivated towards WSN becue of to various real time applications Authorts) have also deployed sensor nodes, data receiver and microcontroller burner kit to understand the complete working of WSN The deployment of WSN (fig 1.5) is based upon following model:

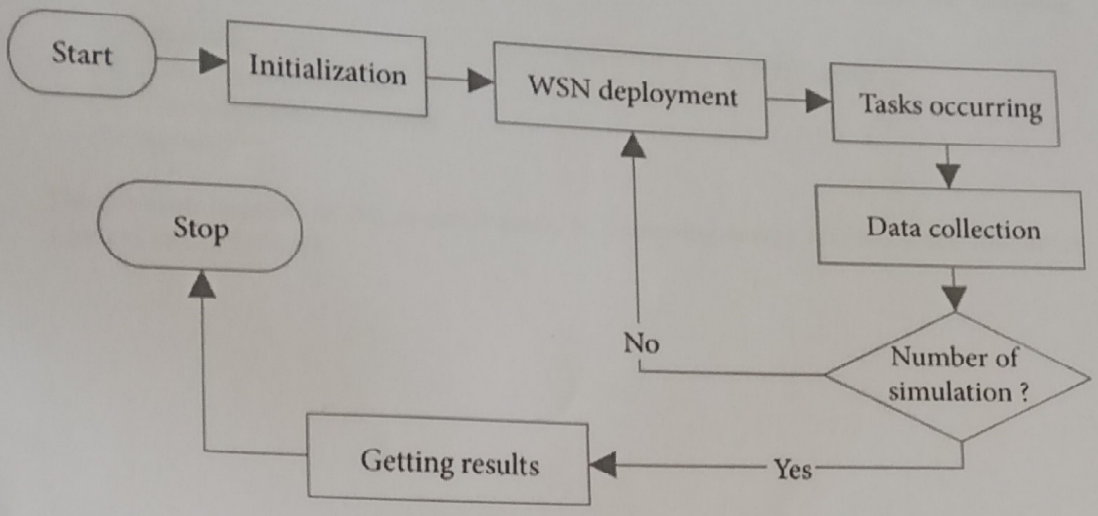

Fig 1.4 Wireless sensor network model for data collection

Based upon fig 1.5, author(s) have deployed five sensor nodes randomly and attached one receiver with desktop pc for data collection purpose by using ZigBee The real time deployment of sensor nodes (fig 16 to fig 113) is as follows

1.5 Motivation

Presently technology is playing key role in all over of the world. Sensors are the key part of emerging technology like loT where sensor's adoptability and usability has been increased significantly. Wireless sensor network contains numbers of sensor nodes deployed in various areas of importance like space, defence, industry, home automation, agriculture and various research fields. The key components of sensor are processors, antenna, power and other optional parts: WSN provides the ability to sense and process the data even from remote locations like volcano monitoring, tsunami detection, earthquake and mobilizations

There are so many challenges associated with WSN for ex energy efficiency data aggregation, localization, deployment and cost analysis of WSN node etc. Nowadays, there is a huge requirement of energy efficient solutions which may improve the performance of specific and extempore requirements. Therefore author(s) motivated to overcome these challenges by developing energy efficient protocols, smart algorithms by using machine learning techniques. The vision of this doctoral thesis is to design and analysis of the learning algorithms based upon reinforcement learning for wireless sensor network

1.6 Problem areas

As per the motivation discussed in above action and literature review found the following problem

(1) High data traffic
(2) Dynamic environment
(3) Communication Overhead
(4) Security
(5) Energy Efficiency

The problem targeted in this research thesis is, improving energy efficiency and lifetime of wireless sensor network.

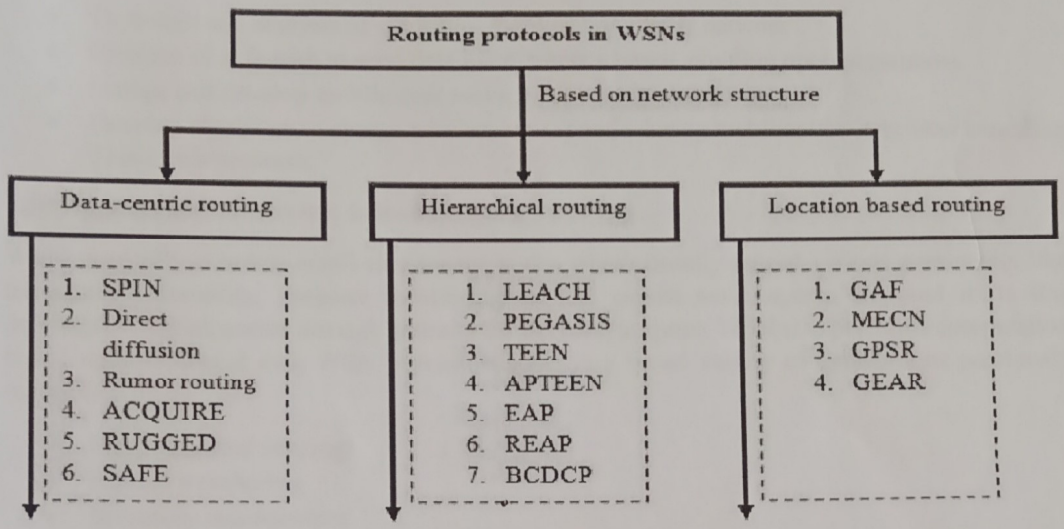

Fig1.5 WSN Routing protocol

1.7 Research questions

As per the problem statement stated, author(s) have raised certain research question which have been fulfilled successfully in this research study, are as follows:

- How to enhance the nerwork lifetime lifetime of WSN with bettry energy optimization?
- How to set data routing paths while sending data in an emergency situation ?
- How to charge battery of sensor nodes in any remote locations?
- Can we design efficient learning algorithm to achieve all of above issues?

1.8 Research assumptions

Author(s) have made following assumptions in this research study:

- All the installed wireless sensor nodes are static and homogeneous in nature.
- Same amount of initial energy has been distributed to all WSN nodes.
- The network environment model doesn't contain any kind of obstacle
- The mobile sink Is able to collect the various data from cluster heads in scheduled time
- The fixed and mobile chargers are capable of transferring wireless energy to Rechargeable mobile sensor nodes.
- The wireless charger radius is about 01 meter

1.9 Research objectives

The design of learning algorithms for wireless sensor network required to be join very closely If challenges are to be overcome efficiently. This research study has following objectives:

- To design and analysis of algorithm for Wireless sensor network
- Creation of safe path to send data in emergency based situation upon algorithms.
- Design and develop mobile sink move to all base station issue.
- Develop algorithm to charge wireless sensor node during mobilization in critical condition

This thesis presents:

1.10 Applications of wireless sensor network

WSN typically contains small-size sensor nodes which usually record various parameters like temperature humidity, pressure location, presence, smoke toxic agents etc, and route this information to sink server through gateway for decision purpose: WSN also performs computation based upon collected data WSN provide support to a broad variety of applications preciously mentioned below [01]

- Environmental sensing
- Habitat monitoring
- Inventory management
- Earthquake detection
- Tsunami detection
- Biomedical applications
- Infrastructure monitoring
- Defence (Battle field management)
- Home automation
- Forest fire management
- Patience monitoring
- Chemical (Detecting toxic agents)
- Disaster management
- Energy management
- HVAC control
- Intrusion detection (Security)
- Mobile robots
- Near field communication (NFC)

NOVEL APPROACH FOR FIELD MAPPING & CROP YIELD ESTIMATION

A dissertation-interim evaluation submitted in partial fulfillment of the requirement for the degree

Of

MASTER OF TECHNOLOGY
(Information technology)

Submitted

By

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March 2023

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I hereby certify that the work which is being presented in the progress report entitled **"NOVEL APPROACH FOR FIELD MAPPING & CROP YIELD ESTIMATION"** by **"RANJANA RATHORE"** in partial fulfillment for the award of the degree of M.Tech (Information Technology) submitted to the Department of Information Technology Engineering of Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur, Chhattisgarh, India is an authentic record of my work carried out during the period from Nov 2022 to March 2023 under supervision of **Mr. SUHEL AHAMED (ASSISTANT PROF.), Mrs. ARADHANA SONI (ASSISTANT PROF.)**. The matter presented in the progress report has not been submitted by me or anybody else in any other university /institute for the award of any degree/diploma.

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This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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ACKNOWLEDGEMENT

"You cannot teach a man anything: you can only help him discover it in himself"

-Galileo

I feel immense pleasure in expressing my profound sense of gratitude to my thesis supervisors, **Mr. SUHEL AHAMED (ASSISTANT PROF), Mrs. ARADHANA SONI (ASSISTANT PROF)** under whose supervision and inspiring guidance, I have the privilege to carry out my research work. I am indebted to them for their constant and ungrudging encouragement, valuable suggestion and ingenious ideas.

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Next, I extend my gratitude to my parents for their support throughout this work. Without their motivation, it might not have been possible for me to complete this study. The blessing of my beloved parents helped me reach this end.

Finally, thanks are due to my friends for their advice and continued supports.

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ABSTRACT

Agriculture is the major backbone of the India as well as of the world to improving the livelihood the population and contributing highest GDP. Field use and Field cover (FUFC) mapping using imagery plays a vital role in any land use inventories. In this study, a hybrid feature optimization algorithm along with a deep learning classifier is proposed to improve the performance of FUFC classification helping to identify field area. Crop yield estimation (CYE) is one of the main tasks in the crop management and marketing. Based on the result of CYE, the farmer can make a better decision on the harvesting period, prevention strategies for crop disease, subsequent follow-up for cultivation practices, etc. To overcome these issues, an intelligent CYE system was proposed which detects the crop in the field using deep leaning based model.

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CHAPTER 1

INTRODUCTION

Novel Approach for Field Mapping and Crop Yield Estimation. An overview of the research work has been carried out in this thesis work. A simple introduction about the research work has been presented in this chapter. The background and motivation of the research work has been discussed in the first par and summary of the definition of crop yield estimation. Aims and objective of present research work illustrated in the second part and finally, the outline of the thesis presented in the third part of this chapter.

1.1 Background and Motivation

Agriculture plays a pivotal role in economic growth all over the world as it reported 4% Gross Domestic Product (GDP) in developed countries and more than 25% GDP in developing countries for the year 2018 (https: www.worldbank.org). The field mapping for the crop is essential step to estimate gross profit of production. Field mapping allows for more precise and accurate data collection about a field's physical features and helps farmers to take a right decision for utilization of their field for crop production.Government of India plans to migrate towards technology based yield estimate from the conventional crop cutting experiment (CCE) based yield estimation approach.

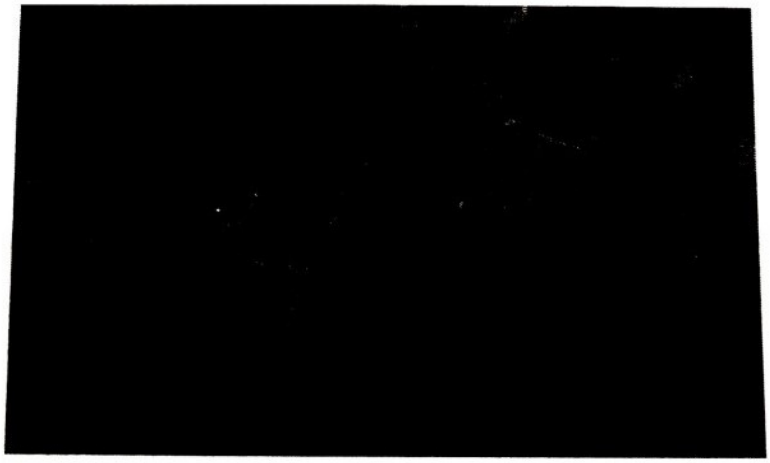

Fig 1.1 field image

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1.1.1 Mapping the field

Precision agriculture mapping entails collection of geospatial information regarding plant or soil properties and requirements and later applying and prescribing site-specific treatments to increases produce while protecting the environment at the same time. A field mapping describes how a persistent, it also contains data on how link the field the data of its owing object, and how to link the field data of any related objects (if the field represents a relation to one or more other persistent objects).

Fig 1.1 field image with objects

1.1.2 Measurement methods used for crop area estimation

Crop area plays an important role in estimating crop production. The accuracy of crop production estimates depends on the accuracy of crop area estimates. The most appropriate measurement technique to estimate crop area depends on various operational factors, such as land configuration, field shape, crop type, cropping pattern.

1.1.3 Farmer assessment of crop area

In this method, the farmers are asked to estimate the area of their fields. The

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enumerator and the farmer may visit all of the farmer's fields and estimate the surface area by visual inspection (David, 1978). Notably, if some plots are located far apart from each other, the farmer can declare the size of the area without necessarily having to visit the plot with the enumerator.

1.1.4 Classification

Deep Learning (DL) is the subfield of Machine Learning (ML), which is the main method used in Artificial Intelligence (AI). In ML, the source objects (like images, videos and audios) cannot be given directly to the learning models for training i.e., the features extracted from the source objects are the input to the learning models. DL is the advanced ML method where there is no requirement for feature extraction as it is hierarchical learning (i.e., the architecture itself extracts the abstract features at each level). With the advancement in technologies, (for example, using cameras on mobile phones) a good amount of datasets can be collected from an agricultural field. DL provides encouraging results through smart handling of big data due to the (cheap) widespread availability of excellent computational resources like Graphics Processing Unit (GPU).For better object (i.e., fruit in our work) detection and localization, semantic segmentation is one of the techniques used in image processing. It provides complete information regarding a particular scene. Through semantic segmentation, instead of predicting the whole image to a particular class (this is the scenario in a normal classification task), every pixel is labeled to a specific class. In the past, various works have been performed for estimating the yield of fruits using computer vision employing semantic segmentation techniques.

1.2 Aims and Objective of Research work

The main objective of this research work is to be used in the country's agriculture industry to improve yield estimation and predict crop yields. The project will be help farmers to improve their yield land.To estimate the maximum yield of the crops produced at minimum cost. Early detection and management of problems associated with crop yield indicators can help increase yield and economic growth.

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1.3 Outline of the thesis work

These thesis reports have been separated into six chapters, which are as follows:

- First, the introduction, background and motivation, aims and objective.
- The detailed discussions on effort related to previous and current investigation available in the literature, presented in the second Chapter.
- The pre-processing for the field and the steps involved in it are briefly described and other details are being discussed in third Chapter.
- The time plane of the future work is described in fourth chapter.

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EEG SIGNAL ANALYSIS AND CLASSIFICATION OF EPILETIC SEIZURE

A dissertation-interim evaluation submitted in partial fulfillment of the requirement for the degree

Of

MASTER OF TECHNOLOGY
(Information Technology)

Submitted

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Signature of student
Swapnil Dange

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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Mr. Abhishek Jain

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Signature of the supervisor
Dr. Amit kumar Dewangan

CERTIFICATE

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-Galileo

I feel immense pleasure in expressing my profound sense of gratitude to my thesis supervisors, Dr. Amit Kumar Dewangan & Mr. Abhishek Jain under whose supervision and inspiring guidance, I have the privilege to carry out my research work. I am indebted to them for their constant and ungrudging encouragement, valuable suggestion, and ingenious ideas.

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ABSTRACT

Electroencephalogram (EEG) signals typically identify the neurological condition epilepsy. EEG visual analysis and interpretation is a difficult, slow process that is prone to human mistake and subjectivity. As a result, numerous attempts to create automatic algorithms for detecting and classifying epileptic seizures have been made. EEG visual analysis is a laborious process that is prone to human error. With the help of automatic detection of ictal epileptiform activity in the EEG of epileptic patients, our work suggests a reliable technique to lessen the burden of uncontrollable seizures. Several machine learning methods are used to classify the EEG's using KNN, SVM etc.

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CHAPTER 1

INTRODUCTION

An overview of the research work has been carried out in this thesis work. A simple introduction about the research work has been presented in this chapter. The background and motivation of the research work has been discussed in the first par and summary of the definition of EEG and EEG signals. Aims and objective of present research work illustrated in the second part and finally, the outline of the thesis presented in the third part of this chapter.

1.1 Background and Motivation

An EEG is a test that looks for abnormalities in your brain's electrical activity or brain waves The scalp will be covered with electrodes, which are tiny metal discs with thin wires, during the process. Your brain's activity generates tiny electrical charges that are detected by the electrodes. Several different forms of brain diseases are evaluated using the EEG shown in fig1. In EEG when epilepsy is present Seizure activity will show up as quick-spiking waves . The test can also be used to identify other conditions that affect brain activity, including narcolepsy, some psychoses, and Alzheimer's disease. The general electrical activity of the brain can also be assessed using the EEG (for example, to evaluate trauma, or extent of brain damage patients). During surgery, the EEG may also be used to track blood flow to the brain.

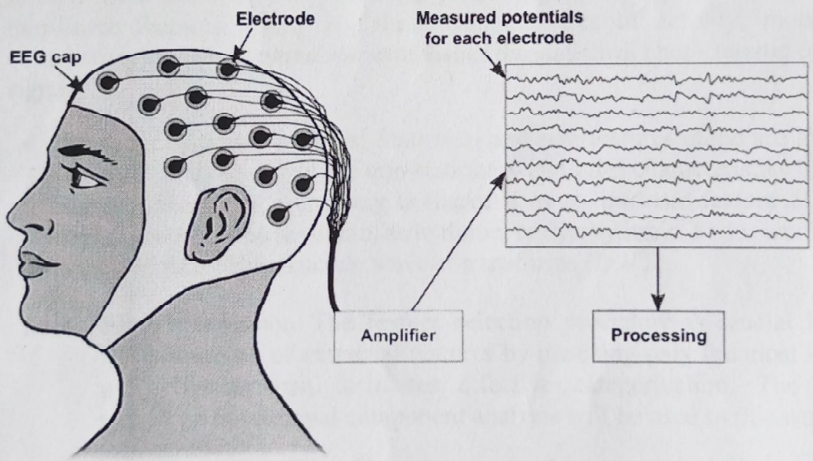

Fig 1.1 Sketch of EEG

1.1.1 Representing by Segments and Sequences are used to represent data. A segment is the area of a signal that lies between two consecutive amplitude extrema. EEG segments make up the dataset that we employed for our research. A sequence is a section made up of segments with a particular amplitude. Its characterization is aided by the segments' duration, size, and orientation. The problem emerges when waves of longer length are overlaid with a noise of modest amplitude because the latter does not appear as a single segment after decomposition.

1.1.2 Analysis based on epoch: The obtained segmented EEG is subjected to a short-time analysis to extract time and frequency domain properties. The sampling frequency, Fs, of the dataset is used to determine the length of each epoch window. In other words, a 1-second epoch duration is chosen because it represents the smallest stationary interval in an EEG. For EEG collected at 256 Hz, 1-second epoch length provides a sufficient number of samples for epoch-based analysis.

1.1.3 Feature Extraction: The crucial process of feature extraction minimizes the space dimension of the non-stationary EEG data while increasing classification accuracy. Feature were classified based upon the following charateristics:

- Time domain characteristics: Eleven traits in all are extracted, and they are further divided into the following categories:

a. Statistical features: The mean, median, mode, standard deviation, minimum, maximum, skewness, and kurtosis were retrieved from the sequentially segmented EEG signal for our investigation. To extract information on any changes in the distribution and amplitude of the signal, statistical metrics like mean, skewness, and kurtosis are used.

b. Non-linear features: The Hjorth parameter and Hurst exponent are retrieved as non-linear features. Using the three characteristics of activity, mobility, and complexity, the Hjorth parameter establishes the statistical characteristic of the EEG signal.

- Frequency domain features: Statistical and non-features alone are insufficient for EEG analysis due to the non-stationary and brief characteristics of the EEG signals. Moreover, frequency is regarded as an intrinsic feature of the EEG signal and might be rhythmic, arrhythmic, or dysrhythmic. In our work, we have analyzed data using discrete wavelet transforms (DWT).

1.1.4 Feature Selection: The feature selection procedure is crucial because it reduces the set of extracted features by choosing only the most significant traits, which then facilitates effective categorization. The statistical technique of principal component analysis will be used in this work.

1.1.5 Classification: In machine learning, there are various classification algorithms such as

- Support Vector Machine (SVM)
- Multilayer Perceptron (MLP)
- k-Nearest Neighbor (k-NN)
- K-fold Cross Validation

1.1.6 Performance measurement: the performance of the classifiers will be assessed by calculating sensitivity, specificity, and classification accuracy.

1.1 Aims and Objective of Research work

Traditionally, neurologists relied on visual examination to draw conclusions on EEG signals. Unfortunately, the results depend on the reader's level of skill and were typically highly time-consuming. It is therefore necessary to use automatic epileptic seizure detection methods that can deliver accurate results quickly. The main objective of our work is Automate classification of EEG signal analysis for epileptic patients using Machine learning based classification algorithms. Thus, to increase the accuracy and reduce the computation complexity, Outcomes must be such that our suggested approach outperforms other suggested ways in terms of accuracy

1.2 Outline of the thesis work

These thesis reports have been separated into six chapters, which are as follows:

- First, the introduction, background and motivation, aims and objective.
- The detailed discussions on effort related to previous and current investigation available in the literature, presented in the second Chapter.
- The pre-processing of the signals and the steps involved in it are briefly described and the details on number of electrodes, segments, slices etc are being discussed in third Chapter.
- The time plane of the future work is described in fourth chapter.