VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangam" Belagavi-590014, Karnataka

A MINI PROJECT REPORT

ON

"Anti-Smuggling system for forest trees using IOT WSN"

Submitted in partial fulfilment of the requirements for the award of the degree

BACHELOR OF ENGINEERING IN ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

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CERTIFICATE

This is to certify that the mini project work entitled "Anti-Smuggling system for forest trees using IOT WSN" is a bonafide work carried out by our students Ms. KOKILA S, USN: 1DB20EC043, Ms. LALITHASHREE K, USN: 1D20EC044 of Sixth semester, in partial fulfilment for the award of degree of Bachelor of Engineering in Electronics and Communication Engineering of Visvesvaraya Technological University, Belagavi in the academic year 2022-2023. It is certified that all corrections/suggestions indicated during mini project work have been incorporated in the report deposited in the department library. The mini project has been approved as it satisfies the academic requirement in respect of the project work described for the partial fulfilment of said degree.

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ABSTRACT

‘‘Digitalization of forest”, as this phrase itself suggests the sustainable implementation of cutting-edge technologies into forests for improving the current trends that are being used for forest environment monitoring, data acquisition, and analysis in the field of research and development. Technologies that can be used effectively for achieving these objectives include the Internet of Things, Wireless Sensor Networks. This work proposes the system called Anti-smuggling for forest tree that use for sensing, monitoring, used in applications such as forest fire incidents, illegal logging of trees, poaching. Sensing and monitoring are achieved through the sensors, the status is sent to the server, server in turn alert the concerned authorities about smuggling activities, forest fires, natural tree fall. This helps in reducing deforestation and maintains the ecological balance.

Keywords: IoT, WSN, forest fire, deforestation.

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CHAPTER 1

INTRODUCTION

During the last decades, the phrase ‘‘sustainability” has become very popular in the definition of utilizing energy resources. Within the sense of development in the Global Environment and Development Commission Report, the most general term and interpretation is known as sustainability (Hahn, 2010). In (Marchi et al.,2018) sustainable forest operations (SFO) is a holistic approachand strategy in an attempt to improve current and futureproblemseffectively, whereas integrating forest activities with economic,environmental, and socially sustainable development objectives. According to FAO (Foundation, 2020), ‘‘A forest is a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use”. Forest is the hub of the earth’s terrestrial biodiver-sity. Forest mitigates carbon emission and climate change,provides livelihood and it is essential for sustainable food produc-tion. In 2020, the total area of forest is estimated at 4.06 billion ha,comprising 31% of the total land area and this area is 0.52 ha of for-est per capita, even though the forests are not apportioned among the people around the world or geographically (Forest area, 2021).The tropical domains account for 45% of the world’s forests, pre-ceded by boreal (27%), temperate (16%), and subtropical (11%)domains. Europe covers 25% of the global forestry area, driven by South America (21%), North and Central America (19%), Africa(16%), Asia (15%), and Oceania (5 percent) (Köhl and MarchettiTrop, 2016). Russian Federation, Brazil, Canada, the United States of America, and China are the top five countries where half of the land is occupied with the forest

Introduction to IOT in Anti-Smuggling System

Illegal smuggling activities pose significant challenges for law enforcement agencies and governments worldwide. Smuggling can involve the illicit transportation of goods, drugs, weapons, or even human trafficking. To combat these activities effectively, advanced technologies such as the Internet of Things (IoT) are being employed in anti-smuggling systems.

The IoT refers to a network of interconnected physical devices, vehicles, buildings, and other objects embedded with sensors, software, and connectivity capabilities. These devices can collect and exchange data, enabling real-time monitoring, analysis, and control of various processes and environments. When applied to anti-smuggling systems, IoT technology can

enhance detection, surveillance, and enforcement capabilities. Tracking and Tracing: IoT devices, such as GPS trackers, can be integrated into shipments or packages to enable real-time tracking and tracing. Law enforcement agencies can monitor the movement of goods throughout the supply chain, enabling them to detect any unauthorized or suspicious activities..

Sensor Networks: IoT sensors can be deployed in strategic locations to detect specific parameters such as temperature, humidity, vibration, or gas emissions. For instance, sensors can be installed in cargo containers to identify unusual fluctuations in temperature that may indicate the presence of contraband goods or living organisms.

Data Analytics: IoT systems generate vast amounts of data, which can be analyzed using advanced analytics techniques. Machine learning algorithms can identify patterns, anomalies, or correlations in the data that may indicate smuggling activities. This data-driven approach enhances the efficiency and accuracy of anti-smuggling operations.

Surveillance and Security: IoT devices, such as cameras and motion sensors, can be deployed at ports, borders, or high-risk areas to monitor activities and identify suspicious behavior. These devices can provide real-time video feeds and alert authorities in case of unauthorized access or suspicious movements

Automation and Remote Control: IoT technology enables automation and remote control of various processes in anti-smuggling systems. For example, automated gateways equipped with IoT sensors can detect suspicious vehicles and trigger alerts or initiate preventive measures.

What is IOT?

The Internet of Things (IoT) refers to a network of physical devices, vehicles, buildings, and other objects that are embedded with sensors, software, and connectivity capabilities. These devices can collect and exchange data, enabling them to interact with each other and with the external environment. The data collected by IoT devices can be analyzed to provide valuable insights, automate processes, and enable informed decision-making.In IoT, objects or "things" are equipped with sensors and actuators to gather and transmit data. These sensors can detect various environmental parameters such as temperature, humidity, light, motion, or location. Actuators, on the other hand, allow IoT devices to take actions based on the received data, such as turning on/off appliances or adjusting settings.

The connectivity aspect of IoT enables these devices to communicate with each other and with other systems over the internet. This connectivity can be established through wireless technologies such as Wi-Fi, Bluetooth, Zigbee, or cellular networks. It allows for real-time data transmission and remote control of IoT devices.The data collected by IoT devices is typically sent to cloud-based platforms or edge computing systems for storage, processing, and analysis. Advanced analytics techniques, including machine learning and artificial intelligence, can be applied to this data to extract meaningful insights, detect patterns, and make predictions. These insights can be used to optimize processes, improve efficiency, and enable informed decision-making.

IoT technology finds applications in various industries and domains, including smart homes, smart cities, industrial automation, healthcare, agriculture, transportation, and environmental monitoring. For example, in a smart home, IoT devices such as smart thermostats, lights, and security systems can be interconnected to provide automation, energy efficiency, and remote monitoring capabilities.Overall, the Internet of Things (IoT) empowers the digital transformation of physical objects, enabling them to collect and share data, communicate, and make intelligent decisions. It has the potential to revolutionize industries, enhance productivity, improve quality of life, and drive innovation in numerous sectors.

1.1 LITERATURE SURVEY:

1. Paper1: Mr.V.Narasimman Asst. Prof, Anand.M, Anandha kumar.C, Krishnan. T "Design of a WSN node for forest trees against poaching", 978-93-87793-11-8, ICAETS-2018

This project proposes a based anti-poaching system employing WSN microcontroller technology, and MEMS accelerometer. WSN is widely used technology in remote monitoring applications. The microcontroller that is used over here is PIC16F877A. MEMS accelerometer senses the tilt of the tree. Sound sensor combines a microphone and some processing circuitry. It detects sound from silence and outputs digital trigger signal. Fire sensor is used to detect the rise in temperature. Smoke sensor detects the lubricant gases in the surrounding environment.GPS gives the latitude, longitude and altitude values. For the purpose of serial communication UART is used. Internet of Things is used to transfer data without requiring human to human or computer interaction and objects, animals or people are provided with unique identifiers

2.Santhosh Hebbar, Praveenraj Pattar, Rajeshwari Madli, Varaprasad Golla."Sandalwood Tree Protection Using Bluetooth Version 4.0", Conference on Computing and Network Communications, 978-1-4673-7309- 8/15/2015 IEEE.

The main objective here is to build a protection system using Bluetooth 4.0 and GSM to alert the concerned authorities in case of sandalwood robbery. IEEE standard for Bluetooth is 802.15.1. Technology called frequency-hopping spread spectrum is used in Bluetooth, where it makes use of 79 channels to transfer the packets. Version 4.0 of Bluetooth is called smart Bluetooth because it includes basic Bluetooth, low energy and high-speed protocols.The protection mechanism proposed in this paper can be implemented using either cluster or distributed architecture. Cluster architecture is a master slave architecture in which each tree is treated as slave node. Whereas distributed architecture is collection of clusters in which for a particular master node, other master node acts as slave. This protection model consists of two parts; protection circuit which serves the function of slave node and mobile application which is installed in every master node and monitors all the slave nodes

3. Prof. Mhaske D.A., Bhabad Vishnu S. PathareSagar A. "Anti- smuggling System for Treesin Forest using Flex Sensor with GSM & Zigbee Network", International Journal of Advanced Research in Computer and Communication. Engineering Vol. 5, Issue 4, April 2016.

In this paper, a low power MSP430 microcontroller along with RF modules is being used. WSN is widely cast-off technology in monitoring and controlling the remote applications. The design that is discussed over here has a portable wireless sensor node which is the part of a Wireless Sensor Networks. It will be attached on trunk of each tree, and is used to identify robbery and also sends signals to Central Base Station. The system is designed to consume low power, and it works better with rechargeable batteries which can charge using natural solar system. A solar panel taken in the system is used for recharging node’s batteries. The cluster of a node is around 5-10 trees. This can be formed into a cluster with a master node having extra properties and to communicate with central base station. The location of central base station is at the entrance of the forest which will communicate with node through RF network. The designed network will follow Star topology

4.Mohan Sai.S.Naresh K, RajKumar.S, Mohan Sai Ganesh, Loksai, Abhinav "An Infrared Image detecting System model to monitor human with weapon for controlling

smuggling of Sandalwood Trees". International Conference on Inventive Communication and Computational Technologies.

This paper discusses the application of machine learning to prevent smuggling of trees.Inception-V3 model is the pre-trained convolutional neural network used in the proposed system for training the system. System applies previous learning experiences to performpresentor future classifications. The Application uses Infrared cameras to capture images of objects near the tree,captured images are processed to obtain high resolution images from low resolution images. The processed images are next sent to pre-trained inception model for classification of objects in the image. On the basis of resemblance of classified images with bottlenecks probability of finding an intruder is calculated. Hence on detecting any abnormal value of probability,intimation in the form of message is sent to the concerned authority.

5. Prof. P. G. Salunkhe, Poonam U. Chaudhari "Design of WSN Node for Protection of Forest Trees Against Poaching Based MSP430", International Conference on Advances in Communication and Computing Technology (ICACCT),978-1- 5386-0926-2/18/©2018 IEEE.

The suggested system over here consists of tree unit and main server unit. Each tree has a microcontroller, Flex sensor, Accelerometer, temperature sensor, Zigbee and GSM module. The cutting down of tree is sensed by flex sensor and accelerometer. Tree unit gives the information about cutting down of trees when it catches fire and consists of three sensors accelerometer sensor, flex sensor and temperature sensor. There are several tree units and tree unit 1 is responsible to host the information from the multiple tree units. Each tree unit consists of ZigBee module and controller is accountable for data transmission from primary stage to final stage. Main server unit is responsible for user interface and displaying the data that was transmitted from stage 1. Once the base station is modified, the authorized person takes action Accordingly.

1.2 PROBLEM STATEMENT:

Protecting the forest and valuable medicine plants are very essential from smuggling and fire catch, currently there is no such system to detect and alarm above mentioned problems.Therefore, using the sensor and wireless technology we can build effective and efficient system to avoid the deforestation and maintain ecological balance which would play major role inreducing global warming.

1.3 MOTIVATION:

Forest fire is one of the causes of deforestation, as hundreds of trees are devastated each year because of forest fires in different parts of the world. The warmest summers and milder winters are the reason for this. Whether it is caused by human beings or by accident, fires lead to a major loss of forest cover. Forest fires are the major causative and accidental sources of biodiversity Loss, deterioration of productivity of terrestrial habitats and forest carbon Stocks, deterioration in soil fertility and subsequent crop production, increase in atmospheric pollution and increase in the severity of landslides sensitivity.

Climate imbalance rise in global warming & greenhouse emissions, soil erosion, floods occurrence, wildlife extinction & habitat loss, food insecurity, and loss of biodiversity are the effects of deforestation. Motivated by the prior remarks we introduce the Intelligent systems for sensing, monitoring, and methods for analysis to be used in applications such as forest fire incidents, illegal logging of trees, poaching.

1.4 OBJECTIVE OF PROJECT:

To detect any movement or displacement of the tree, which can indicate that it is being cut down or transported.The unauthorized activities such as drilling, digging, or blasting near the trees.It helps in taking immediate action to prevent the spread of fire and save the trees from any potential damage.To detect any smoke near the trees To detect any movement or presence of animals or humans near the trees. This can help in preventing 2illegal activities such as poaching, hunting, or deforestation.

1.5 SCOPE OF PROJECT:

An anti-smuggling system utilizing Optical Wireless Sensor Networks (OWSN) can provide a comprehensive and effective solution to detect and prevent smuggling activities. OWSN combines wireless communication with optical technologies to enable high-speed data transmission, secure communication, and precise sensing capabilities. By leveraging the capabilities of Optical Wireless Sensor Networks, an anti-smuggling system can significantly enhance border security, improve situational awareness, and facilitate effective interdiction of smuggling activities. The integration of optical sensing, wireless communication, and intelligent data processing empowers law enforcement agencies to detect, deter, and disrupt smuggling operations more efficiently

1.6 REPORT ORGANIZATION:

Another technique is that the utilization of satellite framework to differentiate the wild fire. the first segments of the framework are satellite and therefore the base station that gathers the knowledge send by the satellite and runs the dissecting calculation. The crude information from the satellite is handled and then Best in school High Determination Radiometer instrument is employed to acknowledge nearness of Problem areas. However the mists enormously influence the framework. Wild Fire Reconnaissance Framework which comprises of WSN was likewise proposed for identification of untamed fires in South Korea. The WSN decides the temperature and dampness after which middleware program and web application examines the gathered information. However during this approach of discovery of untamed fire there was some loss of data amid correspondence.

CHAPTER 2

EXISTING METHODOLOGY:

A wireless sensor network system includes sensor nodes, gateways (routers) and a monitoring host computer.To minimize the loss of energy and data packets, a multiple sensor network topology structure is applied in this design. The work is also capable of predicting the fire hazard going to happen in the region of interest, this is made with a group of sensors including temperature sensor and flame sensor. And also to detect the smuggling activity in the forest tilt and vibration sensor. Detection methods that use optical sensors and motion sensors combine features that are associated with the physical properties of flame and smoke, like colour, motion, spectral, spatial, temporal, and texture characteristics. Once the activity is detected the information is sent to the control system through transmitter which is connected to the Arduino sensor circuit. Control system processes the data and send a SMS note to the registered mobile number using GSM module. This location can be seen in the google maps application with the mobile. Other researchers where looking on the flickering effect of fire. This is observed in flame contours at a frequency of around 10 Hz, independently of the burning material and therefore the burner. The algorithm was applied to a video dataset consisting of various daytime and night time environments; however, at night, colour analysis is a smaller amount useful and night smoke is a smaller amount visible.

The existing system consists of hiring security personals for monitoring the entire area for suspicious activity , However due to physical limitations in human it is hard to monitor the entire area continuously ,thus hiring of guards proves unreliable and inadequate. Another existing system is the installation of CCTV cameras for covering large area proves very costly and is hard to implement. Also ,the latest trend for protection of trees is to tag an RF-ID to trees just like tagging an animal for knowing the whereabouts of a particular tree. However ,this technology does not give the real time information while the activity is happening. Activity is detected only when the tree leaves its initial position

CHAPTER 3

3.1 PROPOSED METHODOLOGY:

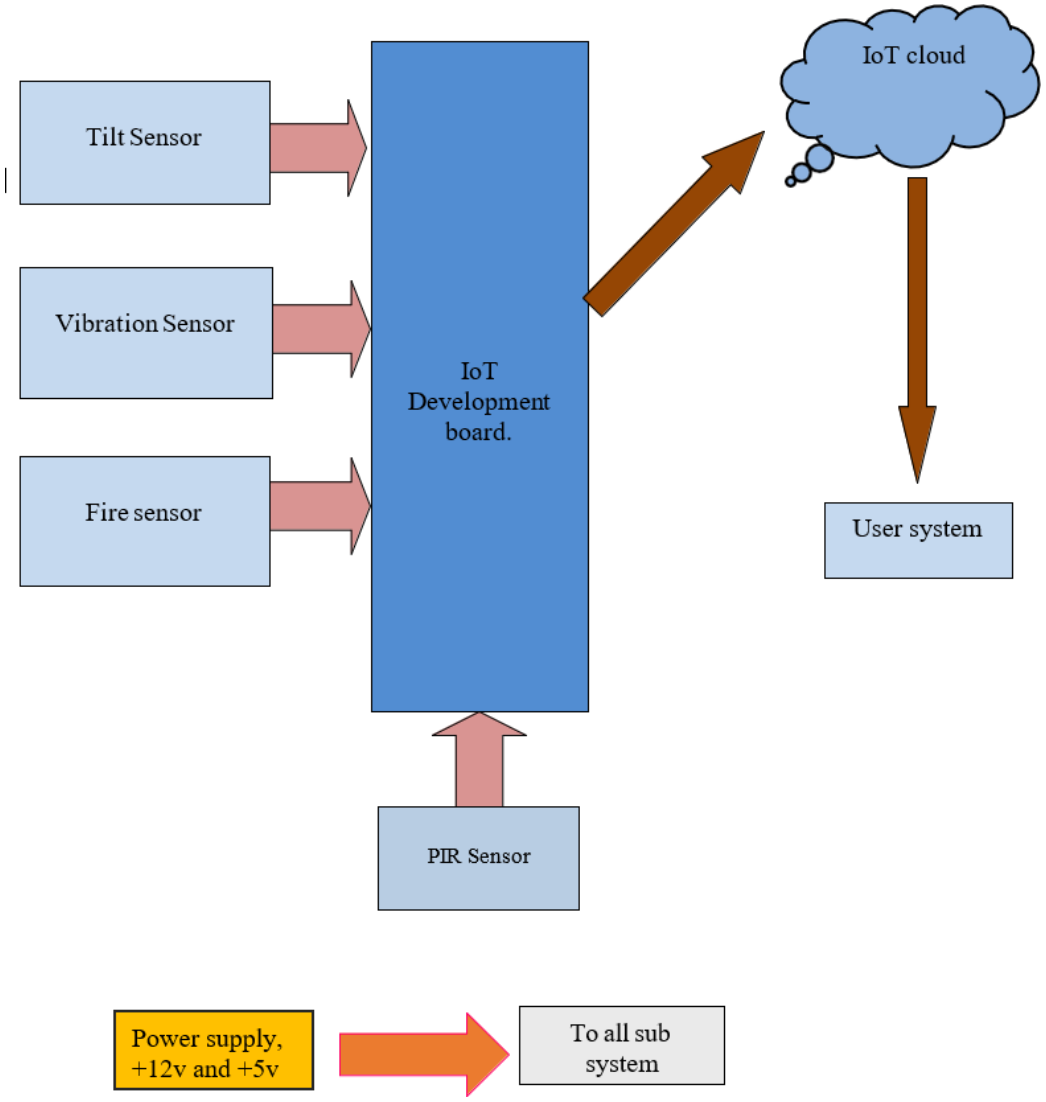


Figure 3.1: Proposed methodology

Microcontroller

A microcontroller is a computer on a single integrated circuit containing memory, a processor core and programmable input/output peripherals. It is designed for embedded applications. The Atmega 3288 has the following features: 1024 bytes EEPROM, 2 Kbyte SRAM, 10-bit ADC, 32 Kbytes of In-System Programmable Flash Program memory with Read-While-Write

Power

A 5V rechargeable battery or a 12 V D.C. adapter can be used as power source. Pumping System: The pumping system consists of a mini submersible type water pump that works on 5 V D.C. and a water tank. It is extremely simple and easy to use. A small pipe is used to carry water from pump outlet.

Sensors

Tilt sensors can also be used in an anti-smuggling system for forest trees using IoT WSN. These sensors can detect any movement or tilting of the trees caused by illegal logging activities**.** Vibration sensors can play a crucial role in an anti-smuggling system for forest trees using IoT WSN (Wireless Sensor Network). The system can be designed to detect any unauthorized activity such as tree cutting, logging, or transportation of forest resources. A PIR (Passive Infrared) sensor can be used in a variety of applications, including security systems, lighting control, and energy efficiency. In a security system, the PIR sensor detects motion and triggers an alarm or activates a camera to capture footage. fire sensor. This sensor can detect any sudden increase in temperature or smoke near the trees and alert the authorities in real-time.

3.2 FLOW CHART

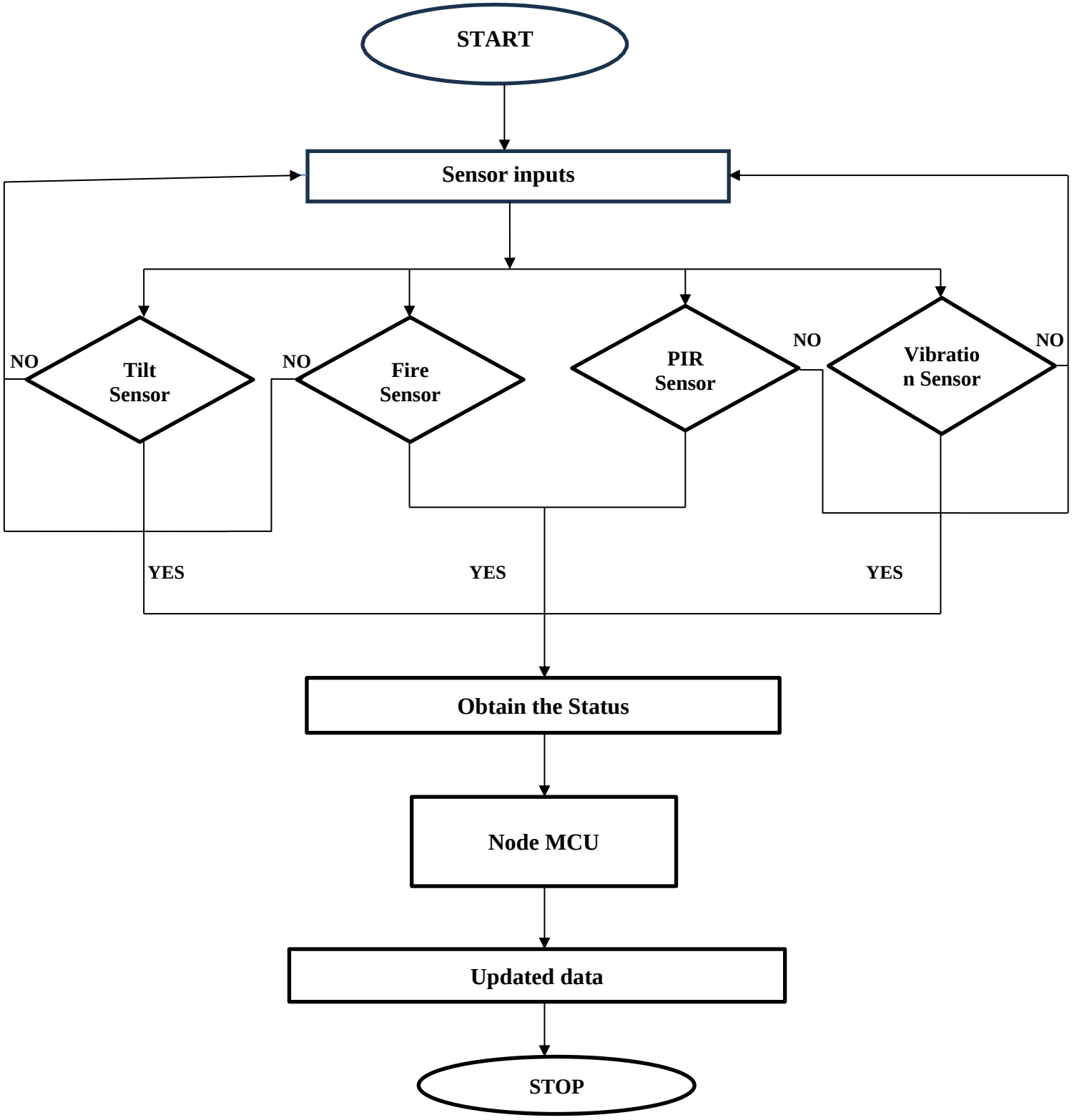


Figure 3.2 Flow chart on Anti-Smuggling system for Forest

1.Start: The system starts by initializing all the required components, including IoT devices, wireless sensor network (WSN), and the central control unit.

2. Connect IoT Devices: The IoT devices are connected to the WSN, forming a network that can communicate with each other and the central control unit.

3. Monitor Sensor Data: The WSN continuously collects data from various sensors deployed in the forest, such as temperature, humidity, light intensity, and motion sensors. This data is transmitted to the central control unit for analysis.

4. Analyze Sensor Data: The central control unit receives the sensor data and analyzes it to identify any suspicious activities related to smuggling of forest trees. This analysis may involve comparing the collected data with predefined thresholds or patterns associated with illegal activities.

5. Detection of Suspicious Activity: If the analysis identifies any suspicious activity, such as unauthorized movement or cutting down of trees, an alert is triggered.

6. Alert Generation: The central control unit generates an alert message indicating the location and nature of the suspicious activity. This alert can be sent to relevant authorities, such as forest rangers or law enforcement agencies, through various communication channels, such as SMS or email.

7. Dispatch Response Team: Upon receiving the alert, the relevant authorities can dispatch a response team to the reported location to investigate and take necessary action against the smugglers.

8. Continuous Monitoring: The system continues to monitor the forest area and collect sensor data in real-time. This allows for proactive identification of potential smuggling activities and timely intervention to prevent further damage.

9. Stop: The system can be stopped manually or automatically when required.

3.3 Schematic

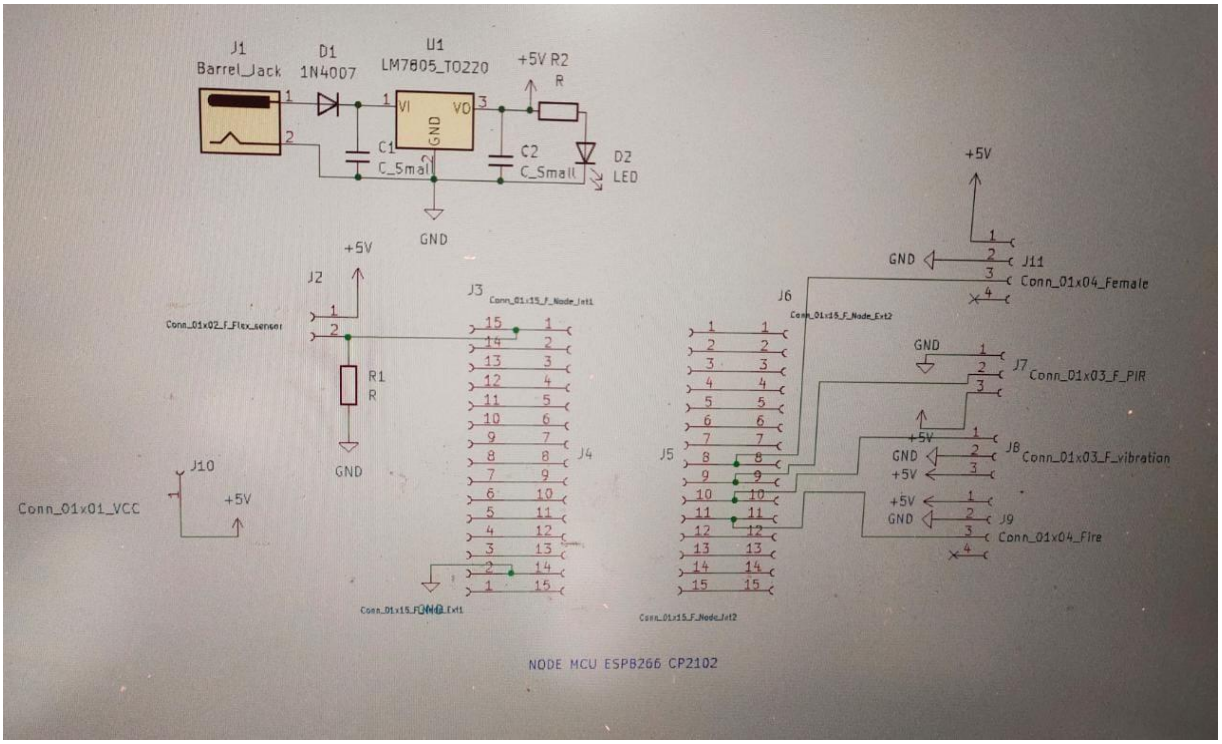


Figure 3.3 Schematic of Anti-Smuggling System

The anti-smuggling system for forest trees aims to prevent illegal logging and the smuggling of valuable tree resources. It utilizes IoT and WSN technologies to monitor and protect the forest area. Here's how the system works. Deployed throughout the forest, sensor nodes are small devices equipped with various sensors such as acoustic, motion, temperature, and humidity sensors. These nodes are responsible for collecting environmental data and detecting any suspicious activities in the forest. The sensor nodes are interconnected through a wireless network, forming a Wireless Sensor Network (WSN). This enables them to communicate with each other and transmit data to a central control unit. The central control unit serves as the brain of the system. It receives data from the sensor nodes and processes it to make decisions. The unit can be a powerful computer or a cloud-based platform that utilizes advanced algorithms and machine learning techniques for analysis. he central control unit analyzes the data received from the sensor nodes in real-time. It applies algorithms to detect anomalies or suspicious activities such as chainsaw sounds, unusual movement patterns, or sudden changes in environmental. When the central control unit detects suspicious activities, it generates alerts or notifications. These alerts can be sent to relevant authorities such as forest rangers, law enforcement agencies, or forest management teams.

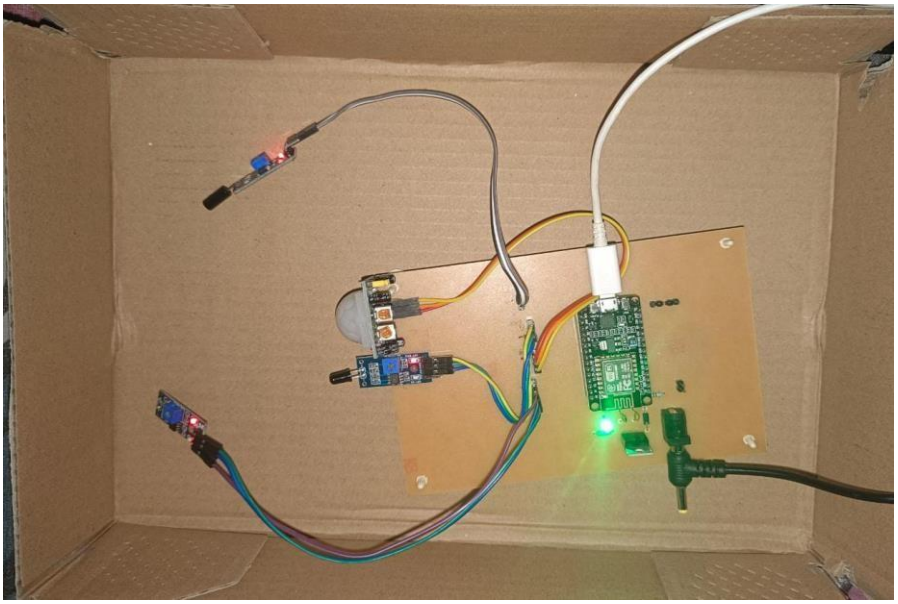
The system stores the collected data for further analysis, research, and evidence purposes. Historical data can be used to identify patterns, understand the dynamics of the forest, and develop long-term strategies for protection and conservation.

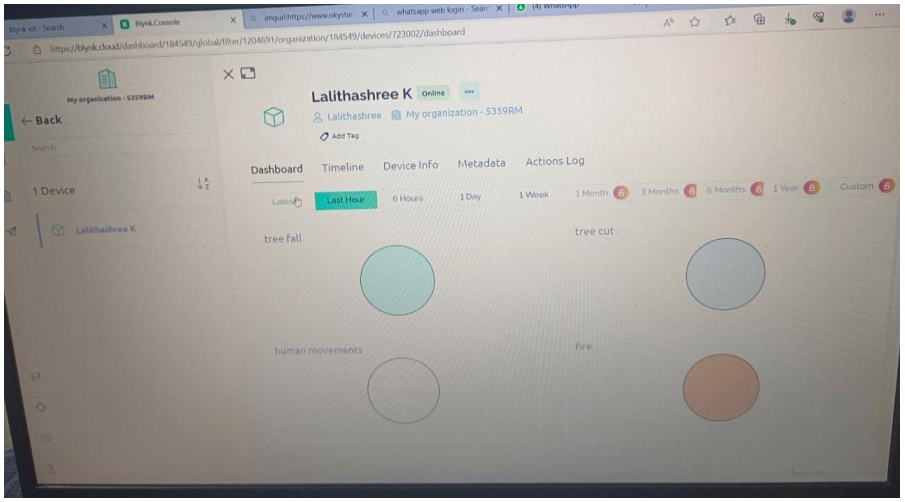
3.4 WORKING MODEL OF ANTI-SMUGGLING SYSTEM FOR FOREST TREES

IoT devices equipped with sensors are deployed throughout the forest area at strategic locations.The sensors on the IoT devices collect data related to temperature, humidity, light intensity, and motion in the forest environment. The IoT devices are connected to a wireless sensor network (WSN) that facilitates communication between the devices and the central control unit.The collected sensor data is transmitted from the IoT devices to the central control unit through the WSN. The central control unit analyzes the received sensor data using predefined thresholds or patterns associated with illegal activities. It compares the collected data with these thresholds or patterns to identify any suspicious activities.The alert message is sent to relevant authorities, such as forest rangers or law enforcement agencies, through communication channels like SMS or email.Upon receiving the alert, the relevant authorities dispatch a response team to the reported location.The response team investigates the reported suspicious activity and takes necessary action against the smugglers.The system continuously collects sensor data in real-time, allowing for proactive identification of potential smuggling activities and timely intervention to prevent further damage.The system can be manually or automatically stopped when required.Overall, the working model of the anti-smuggling system for forest trees using IoT WSN involves data collection, analysis, alert generation, communication, response team deployment, and continuous monitoring to detect and combat illegal activities related to smuggling of forest trees.

CHAPTER 4

RESULTS AND DISCUSSION





4.1 APPLICATIONS

- Forest fire detection and analysis and prediction.
- Rain fall analysis can be achieved.
- It can be used in all parks to provide security.
- This concept can be used to save trees such as Sandalwood, Red Sandalwood, Medicinal trees etc.
- This can be useful in detecting any damage caused by natural disasters such as earthquakes, landslides, or storms.
- The system can also help in wildlife protection by detecting and preventing activities such as poaching or illegal hunting that may occur in forested areas.
- The system can be deployed in protected areas such as national parks, wildlife sanctuaries, or nature reserves to prevent the illegal cutting and transportation of valuable tree species.

4.2 ADVANTAGES

- Man power is reduced to a great extent. This is because; the forest officials can supervise via the control room, without the need of going to each and every area of the forest checking.
- Global warming is also reduced to a great extent.
- The natural habitat of the wild animals is preserved this in turn helps in reducing Thereby, the ecological balance is maintained.
- Deforestation can be reduced
- Helps in detecting any illegal activities such as cutting down trees or smuggling

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

- The idea was eliminated to avoid managing important trees in a protected area in the jungle. There are many ways to protect the trees however a light procedure for inserting a few sensors around the trees with a microcontroller has been done.
- We are developing such a framework that can be used to prevent deforestation that will thus halt deforestation and maintain environmental balance that will understand one of the problems with global warming that is most commonly used in back forests

5.2 FUTURE SCOPE

Although it is claimed that a Smart module is being developed to protect trees, future improvements are needed to make the system more complex. The Unit / Hardware / Sensors should be hard. The fenced area should be made. – The module should be located in an inaccessible area of trees, not easily accessible to tree destroyers. – Forest officials must be properly trained.

Chapter 6

HARDWARE REQUIREMENTS

6.1 ESP8266

A Microcontroller is a compact device with a processor, storage and configurable input/output devices on a single integrated circuit. We'll be using the Arduino UNO board, which combines a microcontroller with all of the extras needed to quickly create and debug projects. The ATmega3288based

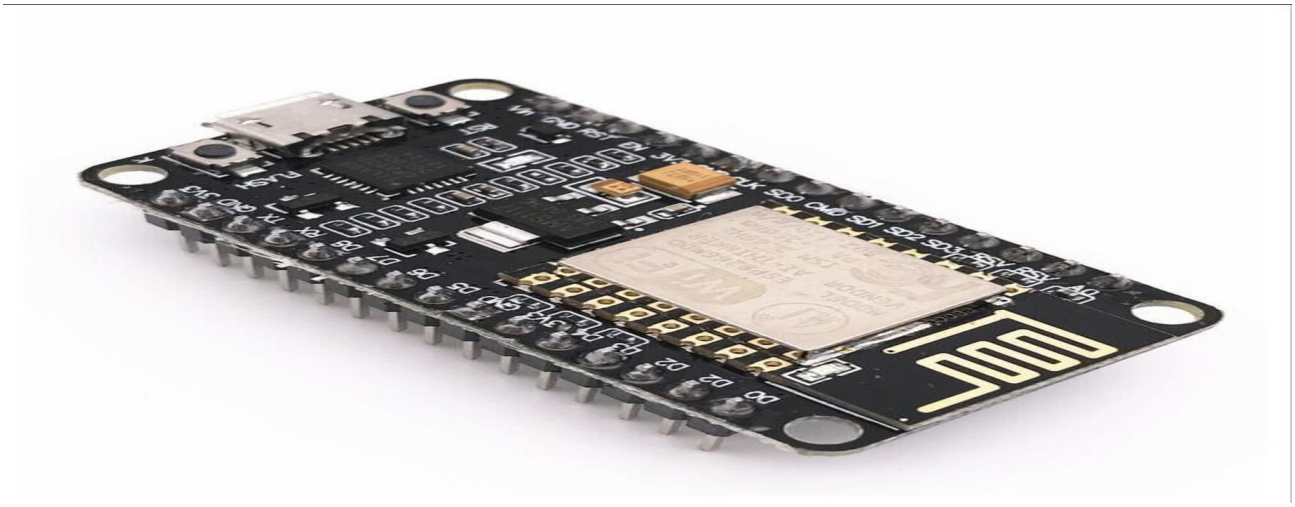


Figure 6.1 ESP8266

6.2 TILT SENSOR

Inclinometers, also called tilt sensors, measure the slope or angle or tilt of objects based on gravity in various applications. Our inclinometer sensors are available in configurations and packages to meet various customer demands for measurement range, signal, and environmental conditions. From single to dual axis inclinometers, offering either digital or analog output signals, with multiple mounting options, our inclination sensors come in robust designs and packaging. Common applications are in providing tip-over protection and autonomous control in trucks and heavy-duty vehicles.

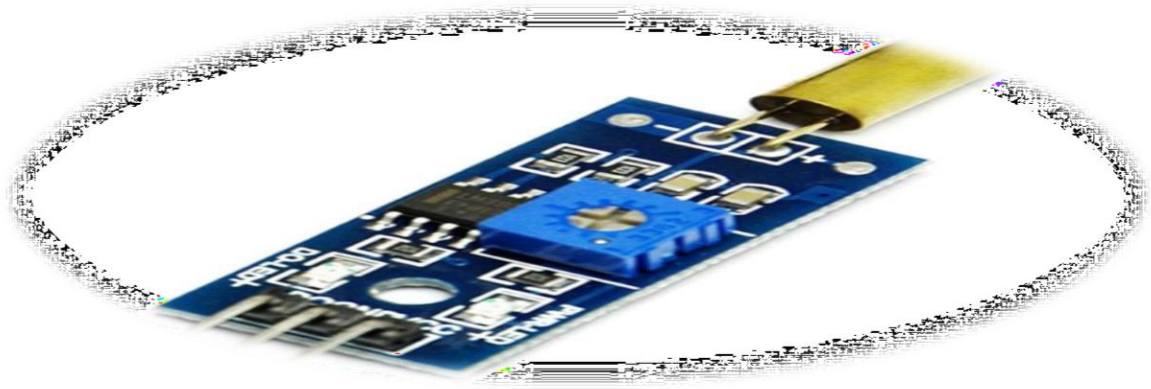


Figure 6.2 Tilt Sensor

Single and dual axis inclinometers

Various technologies including MEMS, fluid-based, and potentiometer designs

Analog and digital output signals

Horizontal and vertical mounting available

Various design packages with robust design packages for harsh environments

Accuracy up to ±0.1°

Resolution up to ±0.001°

6.3 PIR SENSOR

A passive infrared sensor is an electronic sensor that measures infrared light radiating from objects. PIR sensors mostly used in PIR-based motion detectors. Also, it used in security alarms and automatic lighting applications. The below image shows a typical pin configuration of the PIR sensor, which is quite simple to understand the pinouts. The PIR sensor consist of 3 pins,

Generally, PIR sensor can detect animal/human movement in a requirement range. PIR is made of a pyroelectric sensor, which is able to detect different levels of infrared radiation. The detector itself does not emit any energy but passively receives it.

Figure 6.3 PIR Sensor

Pin1 corresponds to the drain terminal of the device, which connected to the positive supply 5V DC. Pin2 corresponds to the source terminal of the device, which connects to the ground terminal via a 100K or 47K resistor. The Pin2 is the output pin of the sensor. The pin 2 of the sensor carries the detected IR signal to an amplifier from the Pin3 of the sensor connected to the ground

6.4 FIRE SENSOR:

A Fire detector is a sensor designed to detect and respond to the presence of a fire,allowing fire detection. A sensor which is most sensitive to anormal light is known as fire sensor. That's why this sensor module is used in fire alarms. These sensors fire A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is working properly; it can be

Figure 6.4 Fire Sensor

sensor. That's why this sensor module is used in fire alarms. These sensors afireA flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces,their role is to provide confirmation that the furnace is working properly; it can be used to turnoff the ignition system though in many cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately thana smoke or heat detector due to the mechanisms it uses to detect the flame.

Flame sensors are utilised in a number of hazardous environments, such as hydrogen stations, industrial heating and drying systems, industrial gas turbines, domestic heating systems and gas-powered cooking devices. Their primary purpose is to minimise the risks associated with combustion.

6.5 VIBRATION SENSOR

A vibration sensor is a device that measures the amount and frequency of vibration in a given system, machine, or piece of equipment. Vibration sensors can be used to give maintenance teams insight into conditions within key assets that might lead to equipment failure, allowing them to predict the maintenance of the machinery, to reduce overall costs and increase the performance of the machinery.

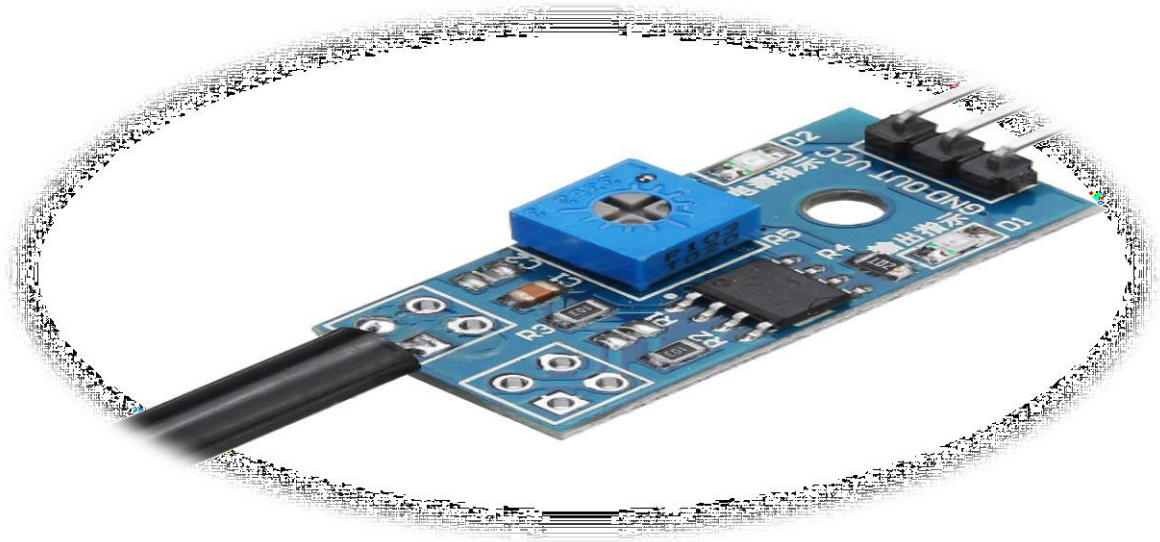


Figure 6.5 Vibration Sensor

6.6 POWER SUPPLY

All Arduino boards need electric power to function. A power supply is what is used to provide electric power to the boards and typically can be a battery, USB cable, AC adapter or a regulated power source device.

There are different ways to power your Arduino board. The most common way is through the USB connector available on every board, but there are a few other possibilities to power your board.

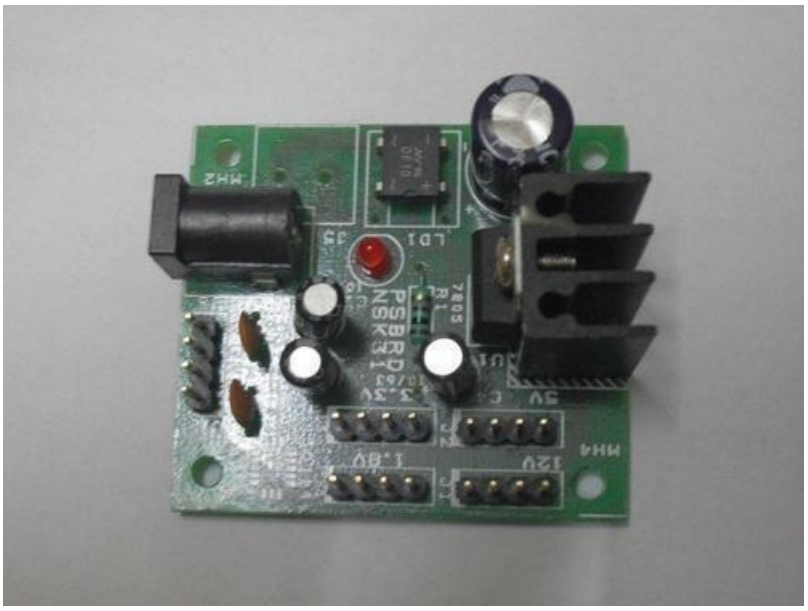


Figure 6.6 Power Supply

A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioningto prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

References

1. Rajesh Singh a , Anita Gehlot , Shaik Vaseem Akram , Amit Kumar Thakur , Dharam Buddhi Prabin Kumar Das , Forest 4.0: Digitalization of forest using the Internet of Things(IoT) Journal of King Saud University[ELSEVIER] – Computer and Information Sciences-2022 www.sciencedirect.com.

2. Mr.V.Narasimman Asst. Prof, Anand.M, Anandha kumar.C, Krishnan.T "Design of a WSN node for forest trees against poaching", 978-93-87793-11-8, ICAETS-2018

3. Santhosh Hebbar, Praveenraj Pattar, Rajeshwari Madli, Varaprasad Golla, "SandalwoodTree Protection Using Bluetooth Version 4.0", Conference on Computing and Network Communications, 978-1-4673-7309- 8/15/$31.00 ©2015 IEEE.

4. Prof. Mhaske D.A. , Bhabad Vishnu S. , PathareSagar A. "Anti-smuggling System for Treesin Forest using Flex Sensor with GSM & Zigbee Network", International Journal of Advanced Research in Computer and Communication. Engineering Vol. 5, Issue 4, April2016.

5. Mohan Sai.S, Naresh K, RajKumar.S, Mohan Sai Ganesh, LokSai, Abhinav "An InfraredImage detecting System model to monitor human with weapon for controlling smuggling of Sandalwood Trees", International Conference on Inventive Communication and Computational Technologies.

6. Prof. P. G. Salunkhe, Poonam U. Chaudhari "Design of WSN Node For Protection Of Forest Trees Against Poaching Based MSP430", International Conference On Advances in Communication and Computing Technology (ICACCT),978-1-5386-0926- 2/18/$31.00 ©2018 IEEE

APPENDIX

1.DATA SHEET

ESP8266

Features

The ESP8266 is a popular and versatile microcontroller module that integrates a Wi-Fi module, making it suitable for various Internet of Things (IoT) applications. Here are some key features of the ESP8266:

1. Microcontroller Core: The ESP8266 is based on the Xtensa LX106, a 32-bit RISC microcontroller core with a clock speed of 80 MHz.
2. Wi-Fi Connectivity: The ESP8266 module comes with built-in Wi-Fi capabilities, allowing it to connect to wireless networks and communicate with other devices over the internet.
3. Memory: It typically has 32KB of instruction RAM and 80KB of data RAM for program execution. Additionally, it contains 4MB of external Flash memory for storing firmware, code, and other data.
4. GPIO Pins: The module features a number of General Purpose Input/Output (GPIO) pins, typically ranging from 10 to 16 pins, depending on the specific variant. These pins can be used to interface with various sensors, actuators, and other external devices.
5. Analog Input: Some variants of the ESP8266 have a single analog input pin, which can be used to measure analog voltages from sensors or other analog sources.
6. UART, SPI, and I2C Interfaces: The module supports Universal Asynchronous Receiver-Transmitter (UART), Serial Peripheral Interface (SPI), and Inter-Integrated Circuit (I2C) communication protocols. These interfaces enable communication with other devices such as sensors, displays, and microcontrollers.
7. Programming: The ESP8266 can be programmed using various programming languages and development environments, including Arduino IDE, MicroPython, and the native Espressif IoT Development Framework (ESP-IDF).
8. Low Power Consumption: The module is designed to operate efficiently in low-power scenarios, making it suitable for battery powered IoT applications

Application:

1. The ESP8266 is popular among hobbyists, students, and makers due to its affordability and ease of use. It can be used for learning and prototyping projects, enabling individuals to build their own IoT devices a
2. experiment with Wi-Fi connectivity.
3. The ESP8266's small form factor and low power consumption make it suitable for wearable devices and small IoT gadgets. It can be used in applications such as fitness trackers, smartwatches, and wireless sensor devices.
4. The ESP8266 can be employed in energy management systems to monitor and control energy consumption. It can connect to smart meters, monitor electricity usage, and transmit data to energy management platforms for analysis and optimization.
5. With the ESP8266, you can collect data from sensors and log it to a remote server or cloud platform. This data can be temperature, humidity, light intensity, or any other parameter. It enables real-time monitoring and analysis of sensor data.
6. The module's Wi-Fi connectivity allows it to gather weather data from sensors such as temperature, humidity, and atmospheric pressure. It can then transmit this data to online platforms or display it locally on a web server

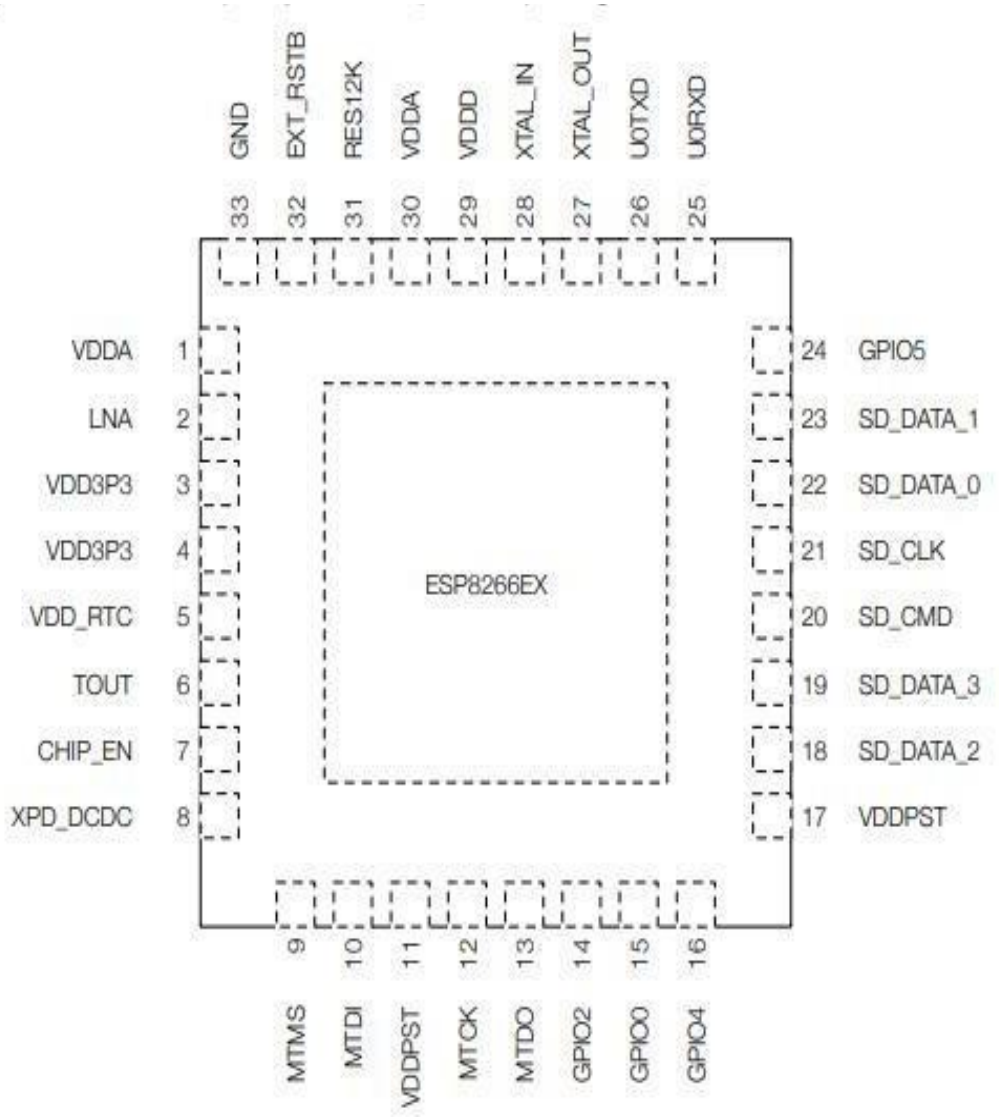


Figure A1: Architecture ESP8266 Microcontroller

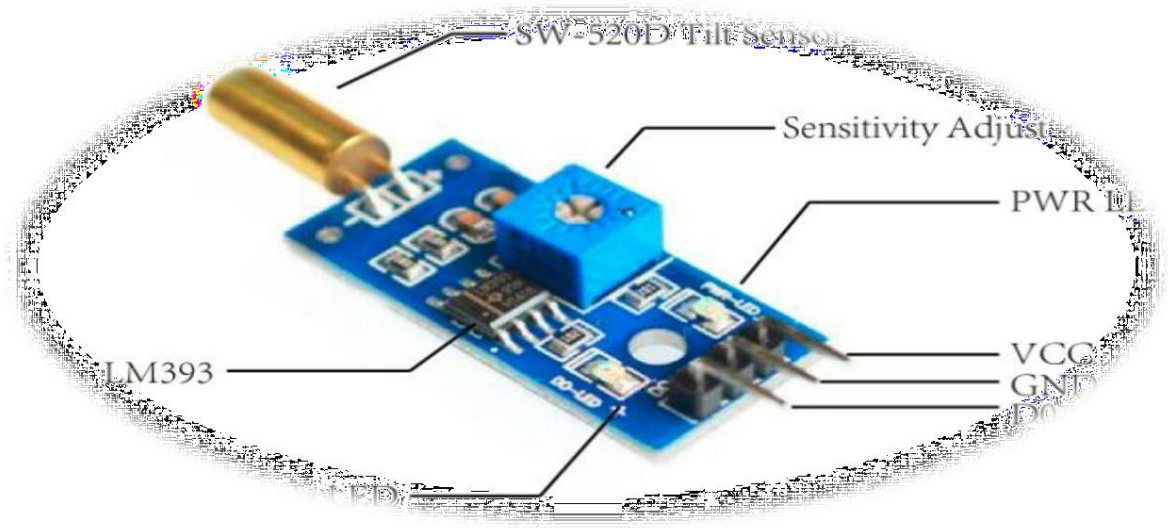
PIN DESCRIPTION

Pin Category	Name	Description
Power	Micro-USB, 3.3V, GND, Vin	**Micro-USB:** NodeMCU can be powered through the USB port **3.3V:** Regulated 3.3V can be supplied to this pin to power the board

		GND: Ground pins
Control Pins	**EN, RST**	The pin and the button resets the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	NodeMCU has 16 general purpose input-output pins on its board
SPI Pins	SD1, CMD, SD0, CLK	NodeMCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) andUART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

Table 1: Pin description of ESP32 microcontroller

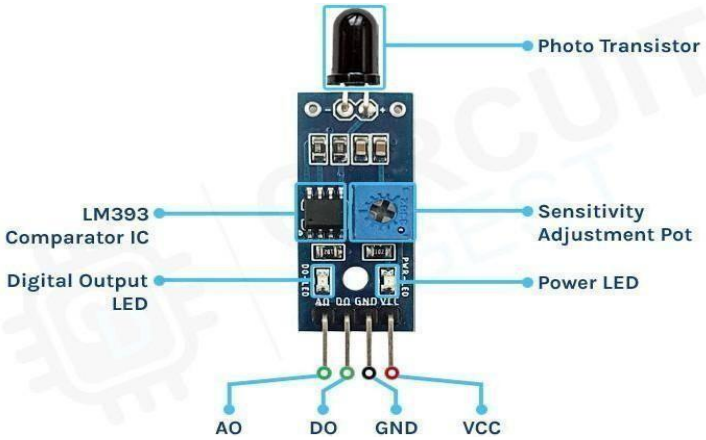
TILT SENSOR



Pin Name	Description
GND	Connected to GROUND
VCC	Connected to +5V
DO	Output of TILT SENSOR

Table 2: Pin description of Tilt Sensor

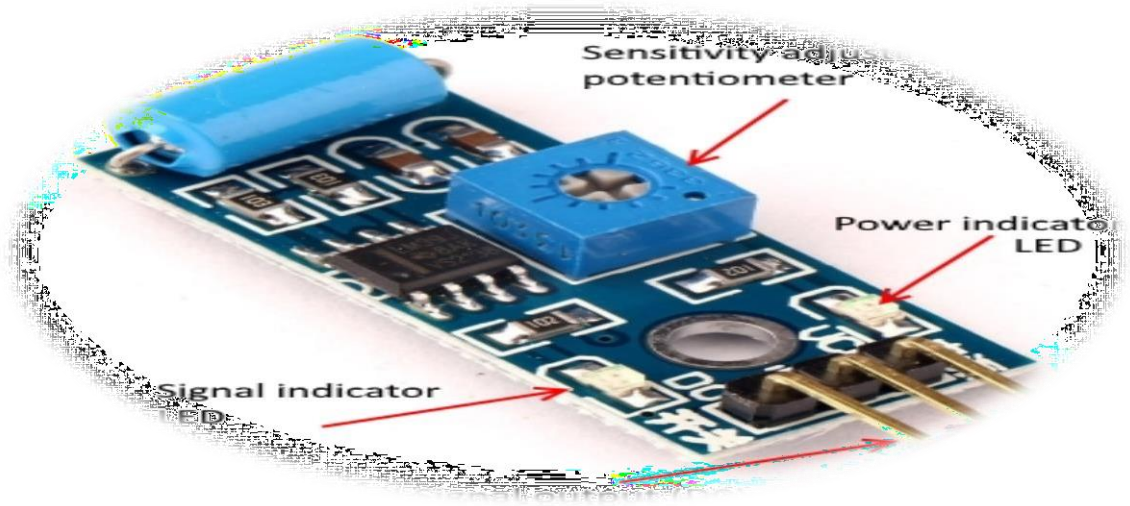
FIRE SENSOR:



Pin Number	Pin Name	Description
1	VCC	+5 v power supply
2	GND	Ground (-) power supply
3	OUT1(DO)	Digital output (0 or 1)
4	OUT2(A0)	Analog output

Table 3: Pin description of Fire Sensor

VIBRATION SENSOR:



Pin Type	Pin Description
VDD	Voltage Input pin
GND	Ground terminal
D0	Digital Signal Output pin
A0	Analog Signal Output pin

Table 4: Pin description of Vibration Sensor

PIR SENSOR

pin Name	Pin Description
Vcc	Input voltage is +5V for typical applications. Can range from 4.5V- 12V
High/Low Ouput (Dout)	Digital pulse high (3.3V) when triggered (motion detected) digital low(0V)when idle(no motion detected
Ground	Connected to groundof circuit

Table 5: Pin description of PIR Sensor

2. CODE

```
#define BLYNK_TEMPLATE_ID "TMPL3eByIUuaV"
#define BLYNK_TEMPLATE_NAME "Lalithashree K"
#define BLYNK_AUTH_TOKEN "iLqO4DkHbpV_e7AWzZVcLHDR3PfDpFTw"
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

#define tilt_in D8
#define fire_in D7
#define PIR_in D6
#define vib_in  D5

const char* ssid = "vivo 1909"; // Enter SSID here
const char* pass = "Lalith@123";
char auth[] = BLYNK_AUTH_TOKEN;
BlynkTimer timer;



void Read_Send_Sensor()
{
  int tilt_value=digitalRead(tilt_in);
  int fire_value=digitalRead(fire_in);
  int PIR_value=digitalRead(PIR_in);
  int vib_value= digitalRead(vib_in);

  Blynk.virtualWrite(V0,   tilt_value);
  Blynk.virtualWrite(V1,  fire_value);
  Blynk.virtualWrite(V2, PIR_value);
```

```
  Blynk.virtualWrite(V3, vib_value);
}



void setup()

{
  pinMode(tilt_in,INPUT);
  pinMode(fire_in,INPUT);
  pinMode(PIR_in,INPUT);
  pinMode(vib_in,INPUT);
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  timer.setInterval(1000L, Read_Send_Sensor);// put your setup code here, to run once:_
}

void loop()

{
  Blynk.run();
  timer.run();// put your main code here, to run repeatedly:


}
```