IOT Based Fire Alert System In Farming Land

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Abstract- *Agriculture is an essential part of the Indian economy, and it is essential to improve the productivity and efficiency of crops and soil. However, farm fire accidents are dangerous, as they can burn all the crops and damage the soil, causing soil erosion. It is difficult for everyone to monitor the unexpected event that causes a huge loss for farmers on agricultural farmland. The fire alarm system is a solution to one of the most dangerous fire disasters. To build a smart IoT-based fire alarm system, hardware components such as a flame sensor, a smoke sensor, an ultrasonic sensor, and a buzzer send the message to the system. The fire alarm system is built by combining both the software and the hardware components to identify the fire quickly and control it. This work aims to suggest a system that can detect and prevent the fire from its initial stage and alert the landlord through notifications about the flame and the detection of any rodents through a group of sensors.*

Keywords- Alert, Agriculture,Flame,Internet of Things, rodent.

I. INTRODUCTION

India's farmers and companies depend heavily on agriculture as a source of income, which is frequently impacted by changes in the weather, a lack of water, and natural calamities. Due to farmland fires, one of the most significant problems harming the ecology of large-scale farms is fire. The Internet of Things (IoT) is a network of electronics, software, sensors, and communication systems that facilitates data collection and transfer. It has several uses, including in smart homes, smart agriculture, smart industry, and smart healthcare. Contrary to conventional methods, IoT-based farming and agriculture systems that use sensors to monitor the crop field and automate farming tasks are much more productive. Agriculture is a crucial component of non-industrial countries' economies since it gives their citizens access to food, income, and employment. Agriculture is the world's main source of food products, and farmers are the cornerstone of the farming industry. The likelihood of ranch fires caused by human activity increases in the summer because homesteads are dry and plants are parched. India's economy heavily depends on agriculture; hence, it is crucial to increase the efficiency and production of soil and crops. Farm fires, on the other hand, can burn crops and soil and are usually brought on by human error, such as faulty electricity lines and other mishaps. A method that uses farm water to act is being developed to stop these accidents. This device not only detects the fire but also assists in halting it before it gets to an early stage and notifies the landlord of the fire. Additionally, it can be modified with ultrasonic technology to detect rats or pests and take the necessary action before the infestation decimates the crop. A nearby fire station is also automatically notified by this system.

1.1 PROBLEM STATEMENT

Weather, a lack of water, and natural calamities have all had an impact on Indian agriculture recently. To solve these challenges, analytical and image processing approaches are applied to deliver an accessible and understandable answer. IoT sensors are utilized to connect equipment and collect data, while machine learning and artificial intelligence are employed to grow and manage the fields. Data processing and modification require analysis, which includes data acquisition. IoT is a contemporary method for tying together gadgets and gathering data. It decreases labor costs and facilitates handling and interacting with the gathered data. It is affordable and simple to modify to meet needs. High reliability, strong anti-interference, speed detection alarms, fire detection in specific locations, prompt notification of the fire department, fault detection features like under-voltage alarms and system self-test functions, high anti-interference, and a long-life cycle are all requirements for automatic fire alarm systems.

1.2 OBJECTIVE:

An IoT-based fire alarm system's main objective is to provide very sensitive flame detection in addition to quick and efficient water sprinkler action. This project focuses on the development of wireless sensor networks, their varieties, and emerging trends. To integrate with the Internet of Things and lessen fire-related accidents, the new fire-checking system relies on a sensor network. Sensors identify the fire situation and provide information to the building. The development and deployment of monitoring and fire-extinguishing systems based on wireless sensor networks is the main goal of this

project. A fire alarm, water sprinklers, and a notification to the cellphone and email addresses are all included in the proposed system. In comparison to conventional fire alarm systems, it will be more effective and offer more safety. The management of firefighting safety from conventional to modern firefighting is improved by IoT technology.

1.3 EXISTING SYSTEM:

Fire detectors are necessary for businesses, stores, shopping centres, apartment buildings, and parking lots. They help with early fire or smoke detection, which could help save lives. Due to human irresponsibility and natural disasters, fire events are now frequently recorded in agricultural areas. In this study, a flame and smoke sensor-based IoT-based fire alerting system is proposed. Using flame sensors that detect fire and provide information to the microcontroller, it uses farm water to act and sprinkles on all sides of the farm. When a fire is discovered within a constrained area, the present systems feature fire alarms that alert by raising the alarm

1.4 PROPOSED SYSTEM:

The suggested method makes use of several sensors to find the field fire and notify the user via a mobile application. A flame sensor, a smoke sensor, and Arduino pins are used by the system to find the fire. When a fire is discovered, the automated system, also known as the fire prevention system, is handed control when the fire detection system (FDS) delivers a signal via the mobile application (FPS).

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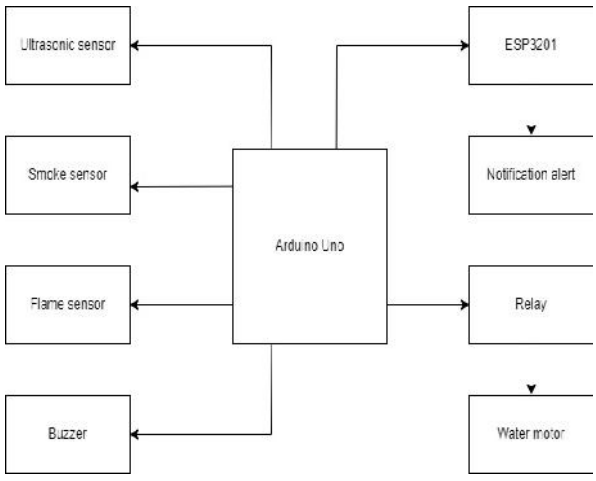

Fig 1.1 System architecture

ROPO The automated systems wait for the specified timestamp, and if no user action is performed, they automatically activate the sprinkler system and pour water where the position has been detected. The system can be modified utilizing an ultrasonic sensor to detect rodents or pests and take the necessary action before the infestation decimates the crop. The ultrasonic sensor detects the animal incursion and uses the Arduino UNO Board to communicate with other components.

1.5 WORKING:

The simplest alarm system is solely designed to be manually operated. The proposed system uses a variety of sensors, including a flame sensor, a smoke sensor, and an Arduino, to detect a fire in the field and notifies the user via a mobile application. The proposed system is broken down into several subsystems, such as the FDS (Fire detection system) for fire detection and the FPS (Fire prevention system), which uses a servo motor and a pump that operates continuously without fail or human intervention. The method uses a flame sensor on a fire detection system (FDS) to find the fire.The system regularly gathers data from the sensors on the Arduino pins, and when a fire is spotted, the fire detection system (FDS) sends an alarm by notification via the mobile application, and the controls are then handed to the Automatic system, also known as the fire prevention system (FPS).

The Fire Detection System (FDS) algorithm employs a flame sensor to detect fires, pre-processes sensor data to remove irrelevant information, and assigns a threshold value. When the sensor value exceeds the threshold value, an alert is triggered, and a notification is sent to the user's mobile device via the mobile application. If the sensor value is below the threshold value, nothing is done.

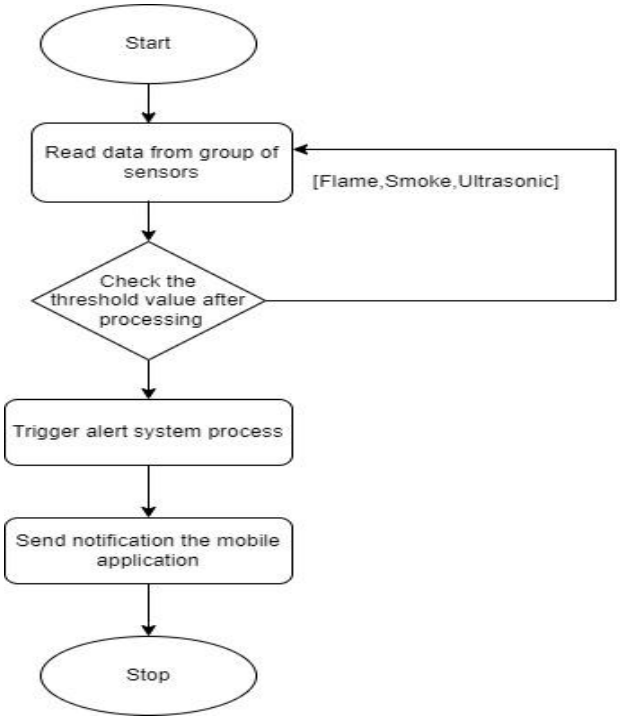

Fig 1.2 Fire detection system algorithm

The Fire Prevention System (FPS) is an algorithm that employs two approaches to prevent fires: a mobile application that notifies the user to activate the sprinkler system and an automated system that activates the system when a predetermined timing is reached. When a fire is detected, FPS employs a servo motor to pump water; it then efficiently pours the right amount of water based on the fire; and it shuts off the pump when the fire has been put out. This reduces unnecessary water waste and frees up water for other uses.

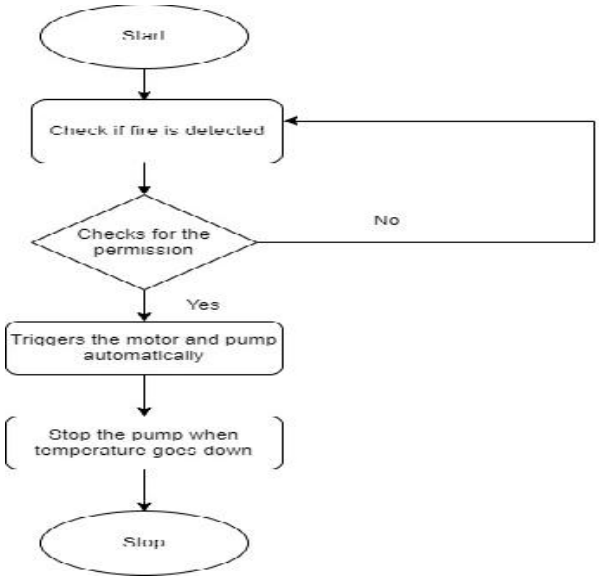

Fig 1.3 Fire prevention system algorithm

II. REQUIREEMENT SPECIFICATIONS

2.1Software Requirements

- Operating System: Windows 7 (minimum)
- IDE: Arduino IDE
- Programming Language: C++

2.2 Hardware Requirements

- Flame sensor
- Smoke sensor
- Ultrasonic sensor
- 5v Buzzer
- 12v Battery
- DC 3-6V Micro Submersible Mini Water Pump
- Breadboard
- Relay
- Wi-Fi module

2.3 SYSTEM COMPONENTS:

Our system uses the following sensors and components:

- Smoke sensor
- Ultrasonic Sensor
- Flame Sensor
- Buzzer
- Node MCU
- Arduino Uno
- Relay

2.3.1 SMOKE SENSOR:

The MQ135 air quality sensor is perfect for use in factories or offices because it can detect a wide range of gases. In addition to smoke and other dangerous gases, it is sensitive to ammonia, Sulphur dioxide, and benzene steam.

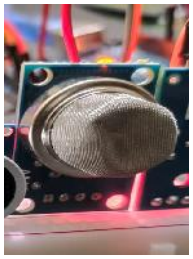

Fig 2.1Smoke Sensor

2.3.2 ULTRASONIC SENSOR:

An ultrasonic sensor is a device that uses sound waves to detect the presence and proximity of objects. It sends out high-frequency sound waves and measures the time it takes for them to return. It is used in applications such as parking assist systems, robotics, and distance-measuring devices.

Fig 2.2Ultrasonic sensor

2.3.3 FLAME SENSOR:

The flame sensor determines whether there is a fire or flame present using infrared flame flash technology. A photo transistor is used, and the infrared spectral band is used by flame detection systems. Carbon dioxide, which is produced by the combustion of organic compound materials, has a resonance frequency in this range. The flame sensor is triggered when it detects a fire, depending on variables such as humidity and temperature. It detects the sources of the wavelength in the range of 760nm–1100nm.

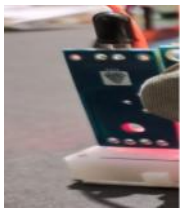

Fig 2.3Flame Sensor

2.3.4 BUZZER:

A buzzer functions similarly to an alarm clock by sounding an alarm and turning on the device. The buzzer is made up of two pins: Vcc and the microcontroller's data pin.

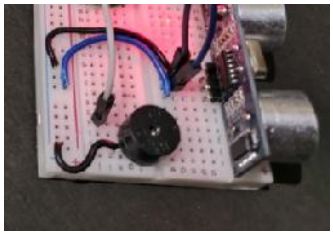

Fig 2.4Buzzer

2.3.5 NODE MCU:

Node MCU is a low-cost, open-source IoT platform that initially included firmware from Espressif Systems and hardware from the ESP-12. Later, support for the ESP32 32-bit MCU was added. Operating voltage is 3–3.6 volts, and 4 MB is the size of flash memory.

Fig 2.5Node MCU

2.3.6 ADRUINO UNO:

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. It can read inputs and use a simple hardware programming language called processing. It has a 5 V operating voltage, 32 KB flash memory, 2 KB SRAM, and a frequency (clock speed) of 16 MHZ.

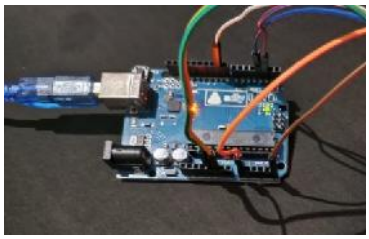

Fig 2.6Arduino UNO

2.3.7 RELAY:

A relay is an automatic switch used to control a high-current load using a low-current signal, with an input voltage ranging from 0 to 5 volts.

Fig 2.7Relay

2.4 EXPECTED OUTCOME:

This system features a variety of inexpensive, simple-to-change Internet of Things (IoT) sensors. A flame sensor or a smoke sensor will recursively detect a flame if it is noticed during the detection process. To detect the uninvited entry of rodents like squirrels, mice, and other moving things, etc., an

ultrasonic sensor is added in addition to these sensors. The Arduino Uno is a microcontroller board that has everything needed to support the sensors and notify the landlord in the event of a fire or the presence of rodents in an agricultural field. Additionally, the sprinkler system uses a servo motor and pumps to rotate and spray water towards the fire's source if the operator fails to take the appropriate precautions.

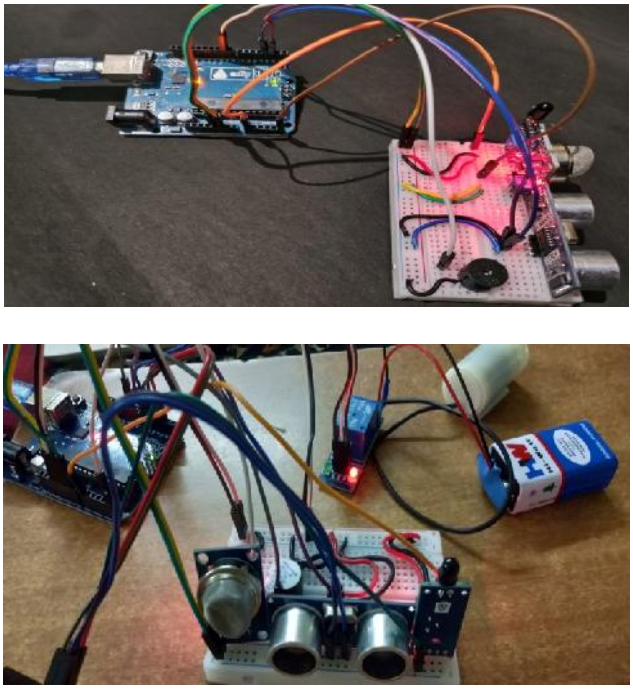

Fig 2.9 Experimental setup

2.5 FLOWCHART OF PROPOSED SYSTEM:

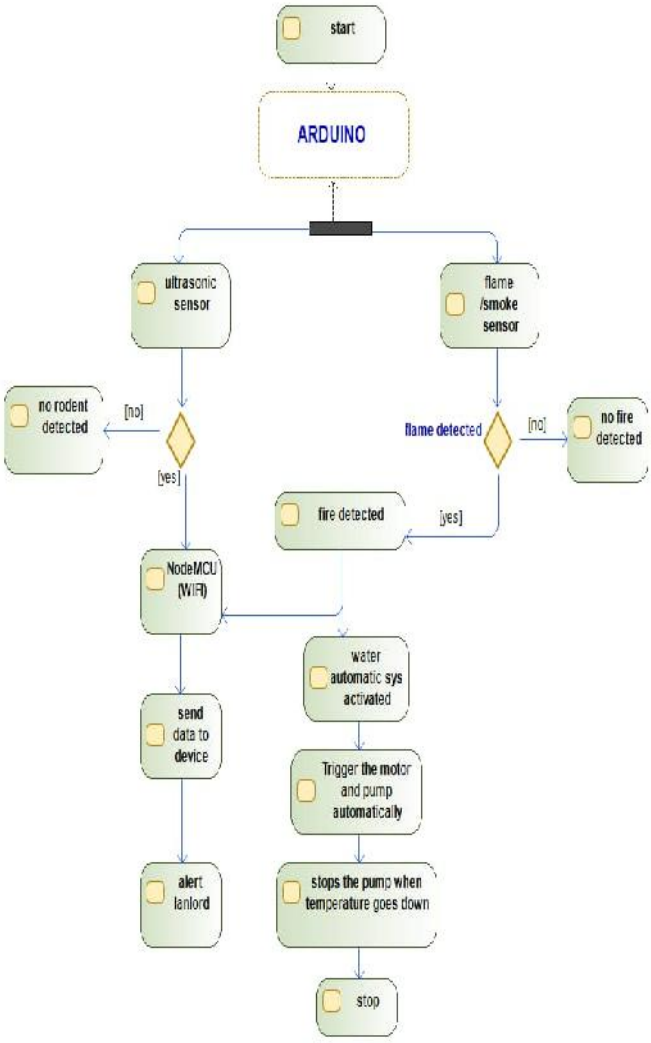

Fig 2.10 Proposed system flowchart

III. CONCLUSION

3.1SUMMARY:

The suggested system is an automation system that can recognise fires and alert users when one is present. It contains an ultrasonic sensor, a buzzer to warn the local fire department, and a feature to identify rats or pests before they damage crops. It will enable global connectivity, free up farmers' hands to address the issue, and stop their farm from catching fire. By actively pursuing system integration and information exchange for fire-fighting remote monitoring systems, it is possible to speed the development of firefighting IoT standard systems and build a national IoT platform.

3.2 FUTURE WORK:

- The project will eventually have a GSM sensor that may be used to Text or call a police station or the

property's owner. The ESP8266 chip, which connects microcontrollers to the Wi-Fi network, will receive data from Arduino. The IOT website will get the data from the ESP8266 so that authorized users can take the necessary action to put out the fire.

- The system in place can send out a warning when fire is detected at its source. It delivers an alarm signal when a fire is detected and informs the user or farmer of the field's regular state. The application turns on the water sprinkler system with the push of a button. To boost the system's effectiveness, the current sensors can be swapped out for ones of higher quality.

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