FOREST FIRE DETECTION AND PREDICTION USING IOT

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Abstract**—***The system is capable of detecting and predicting the occurance of a forest fire in real-time.It can detect the presence of smoke or an increase in temperature or humidity and issue an alert to nearby people,fire departments and other organizations.The system also provides a visual display of the fire location as well as a graphical representation of the fire' s intensity.The system is also able to perform predictive analysis using historical data to predict the liklihood of a fire occuring in a certain area.Additionally,the proposed system can be connected to the internet and other systemsthrough the use of IOT,thus providing greater reach the potential to be an effective early warning system for forest fire management.*

Keywords—Temperature,Humidity,Alert,Fire location,Graphical representation,IoT

I. INTRODUCTION

Forest fires are a recurrent phenomenon in many parts of the world. They are the uncontrollable fires which cause significant damage to natural and human resources; Once the fire starts ignited, it rapidly spreads all over the forest and create more emissions, which in turn contribute to more global warming, which will then cause more fires. The causes for forest fires are categorized into two.There are Natural causes and Man-made causes. Natural causes include lightning, high atmospheric temperatures and dryness, climatic change etc.., Man-made causes include illegal logging etc..,

According to UCS (Union of Concerned Scientists), seasons with higher wildfire potential - has universally become longer over the past 40 years.Projections by the UCS suggest that wildfires could get four, five and even six times as bad as they currently are within this century.Recent wildfires have already caused significant human health impacts across Southeast Asia.

In August 2017, the National Green Tribunal had asked the Ministry of Environment and Forests (MoEF) to evolve a national policy to prevent and control forest fires. The green tribunal had also asked the state governments to prepare and implement a forest fire management plan for effective prevention and control of forest fires and submit the first draft of these policies by November 2017. But no progress was made and on April 14, 2018, the principal bench of the NGT directed the MoEF to finalise a national policy on forest fires within two weeks.

Based on the Forest Survey of India' s data on forest fire it is stated that around 50% of the forest areas as fire prone. Based on the forest inventory records, 54.40% of forests in India are exposed to occasional fires, 7.49% to moderately frequent fires and 2.405 to high incidence levels while 35.71% of India' s forests have not yet been exposed to fires of any real significance. Between January 1, 2019, and February 26, 2019, a count of 558 forest fire occurred in India.

II. EXISTING SYSTEM

Nature has lost approximately half of trees because of deforestation. The World Bank has reckoned in a 2012 report that illegal logging of trees has generated up to $15 Billion a year for criminals involved in the logging of trees. Most of the existing systems for deforestation control are done by manual work by forest rangers and officers. The RFID based system is installed on trees while the forest officers will have the tracking device consisting of RFID reader. This method is not that resourceful as the forest officers have to manually inspect day and night. Many a times, tree logging will be reported only after a tree has been cut down completely.

Using the ATV system helps to avoid the human damage and to reduce the manual power we are currently. But the ATV system is inefficient many a times as it could be life threatening. This system requires manual periodic monitoring throughout the forest area. Covering the vast forest area is a challenge. Detecting the location of forest fire with this existing system can be a difficult task. Thermistor based fire alarms have a drawback; the alarm turns on only if the fire heats the thermistor in close vicinity.

III. METHODOLOGY

1. Install the required hardware components – Pic controller, Microwave sensor, Temperature sensor, Smoke sensor, Humidity sensor, Buzzer, Relay and pump motor, LCD and IoT.
2. Connect the hardware components through appropriate wiring and check for any possible short circuits.
3. Program the PIC controller with the code for forest fire detection and prediction.
4. Test the code for accuracy.
5. Connect the IOT to the PIC controller and the other hardware components.
6. Configure the IOT for the forest fire detection and prediction.
7. Test the IOT for accuracy.
8. Connect the LCD for displaying the real-time data.

9. Connect the buzzer and the relay with the pic controller for alerting and activating the pump motor.
10. Set the threshold values for the sensors according to the environment.
11. Test the entire system for accuracy.
12. Deploy the system in the forest.

IV. PROPOSED SYSTEM

This proposed system involves the use of a Pic Controller, Smoke Sensor, Temperature Sensor, Humidity Sensor, Microwave Sensor, Buzzer, Relay and Pump Motor, LCD, and IoT.

The PIC controller is connected to the power supply. Power Supply board converts 12 v to 5 v and gives it to the PIC controller. Gas sensor, temperature sensor, node MCU, humidity sensor, microwave sensor are connected to the PIC controller. Relay, LCD, buzzer and pump motor are connected directly to power supply. When the temperature increases or the smoke level increases or the humidity level decreases the Pic controller recognizes that there is a fire and activates the motor with the help of a relay and the buzzer sounds is on. The motor stops running when the sensor values drop.

Normal values of temperature sensor, gas sensor, humidity sensor are stored in IOT cloud. When these levels increase or decrease, the PIC controller compares them with the normal level to determine whether a fire has occurred or not. The value of this sensor can be predicted on the Thingspeak webpage.

A previous project was to detect fire by analyzing a photo, or detect logging based on the color of the forest on Google Maps or detect logging by the sound of tree cutting or detect fire by temperature and humidity. It also had some drawbacks.

This project is a next phase project. It uses a gas sensor to detect smoke particles and detect the presence of fire.

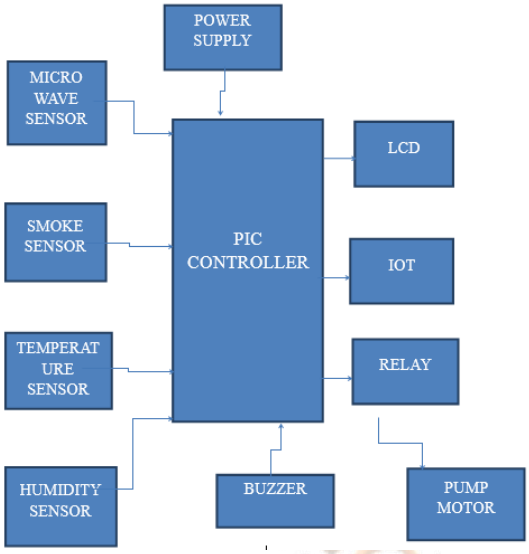
The range of this project can be realized up to about 30m.It is 85% more efficient in fire detection than previous by adding a gas sensor.

The Pic Controller is a microcontroller used to capture data from the sensors and control the relay and pump motor. It is programmed using a language such as C or Assembly, and can be used to control the flow of data between the sensors and the relay and pump motor. The Smoke Sensor detects smoke particles in the air and sends the data to the Pic Controller.

The Temperature Sensor measures the temperature of the air, and the Humidity Sensor measures the moisture content of the air. Both of these sensors send the data to the Pic Controller. The Microwave Sensor measures the distance to the nearby trees, and sends the data to the Pic Controller.

The Buzzer is an audible alarm that alerts people in the area of the presence of smoke. The Relay and Pump Motor are used to turn on and off a fire suppression system. The LCD is used to display data from the sensors and to provide real-time updates of the fire situation. The IoT is used to send data from the sensors to a remote monitoring station.

Once the data is gathered by the Pic Controller, it is processed to determine the risk of a fire. If the risk is high, the Buzzer is activated to alert people in the area. The Relay and Pump Motor is then activated to turn on the fire suppression system. If the risk is low, the data is sent to the remote monitoring station via the IoT.

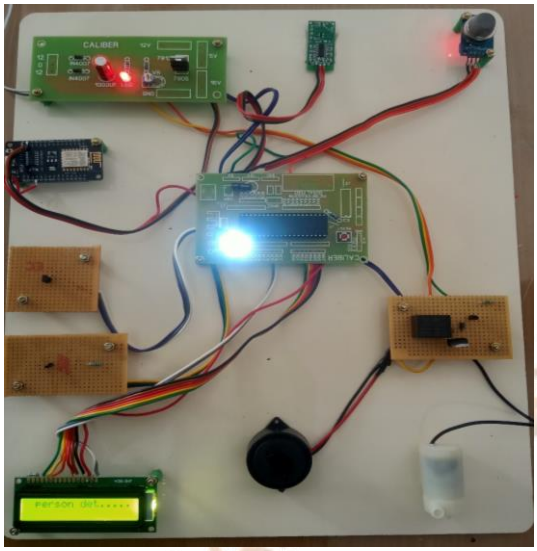


V. WORKING

The PIC Controller is the main component that regulates the functioning of other components in the system. It controls the sensors and other components like Buzzer, Relay and Pump Motor, LCD and IoT. The Smoke Sensor, Temperature Sensor, Humidity Sensor, and Micro Wave Sensor are connected to the PIC Controller. The Smoke Sensor detects the presence of smoke in the air, the Temperature Sensor detects the temperature, the Humidity Sensor detects the humidity levels, and the Micro Wave Sensor detects the presence of any fire.

The data detected by the sensors is sent to the PIC Controller which processes the data and makes a decision. If the data indicates a potential fire, the PIC Controller activates the Buzzer, Relay and Pump Motor, which in turn activates the Fire Alarm and the Water Pump to start pumping water. The data is also sent to the LCD and IoT which displays the data on the screen and sends out an alert to the concerned authorities. This block diagram depicts a system for forest fire detection and prediction using a PIC Controller. The PIC Controller is connected to a Smoke Sensor, Temperature Sensor, Humidity Sensor, and Microwave Sensor. The outputs of these sensors are then connected to a Relay & Pump Motor, Buzzer, and LCD. Finally, these are all connected to the Internet of Things (IoT). The PIC Controller will use the sensor outputs to detect and predict forest fires, and the Relay & Pump Motor and Buzzer will be used to alert any nearby people or authorities of the danger. The LCD will be used to display any relevant information, and the IoT will be used to transmit this information to other connected devices.

VI. IMPLEMENTATION



- Connect the pic controller to the smoke sensor, temperature sensor, humidity sensor, and micro wave sensor.
- Connect the buzzer, relay, and pump motor to the pic controller.
- Connect the LCD and IoT to the pic controller.
- Program the pic controller to detect any changes in the smoke sensor, temperature sensor, humidity sensor, and micro wave sensor.
- When the pic controller detects a change in any of these sensors, it should trigger the buzzer, relay, and pump motor.
- The buzzer should alert people nearby of the forest fire.
- The relay should activate the pump motor to deliver water to the fire.
- The LCD should display the readings of the sensors and the status of the pump motor.
- Test the system and make sure it is working properly.
- Thingspeak is used to predict the sensor values.

VII. RESULT

The use of IoT for forest fire detection and prediction is an innovative approach to preventing and controlling forest fires. By integrating data from various sources such as weather, satellite imagery, and air quality sensors, an IoT system can detect the onset of a fire, accurately predict the spread of the fire, and alert authorities in real-time. This will enable them to respond quickly and accurately, minimizing damage and loss of life. Furthermore, the system can be used for monitoring and analyzing fire behavior, enabling authorities to take preventative measures to reduce the risk of future forest fires.

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IX. CONCLUSION

This paper presents forest fire detection and prediction using IoT is an effective way to help protect our forests from devastating fires. By utilizing sensors, cameras, and other IoT devices, we can monitor and detect fires in real-time and predict their potential spread easily. This technology can help reduce the damage caused by fires, along with the associated costs. In addition, it can also give us valuable insight into the underlying causes of forest fires. With the right implementation and maintenance, forest fire detection and prediction using IoT can help us protect our forests and ensure their future sustainability.

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