IoT Based Forest Fire Detection System

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Abstract- *Forest fires are one of problems that threaten sustainability of the forest.Early prevention system for indications of forest fires is absolutely necessary.*

The extent of the forest to be one of the problems encountered in the forest condition monitoring.

To overcome the problems of forest extent, designed a system of forest fire detection system by adopting the Wireless Sensor Network (WSN) using multiple sensor nodes.

Each sensor node has a microcontroller, IoT module, water pump and three sensors. Measurement method is performed by measuring the temperature, flame and gas level and alert through cloud communication using IoT module.

In this system we go for detection and Monitoring of forest fires through several sensors and send to IoT cloud Depending upon the sensor values in the cloud if it is greater than the preset values it will send mail to the user. Continuous monitoring and uploading values to cayenne cloud can be achieved

Keywords- Internet of Things, NodeMCU, Relay,Fire Detection.

I. INTRODUCTION

Apart from causing tragic loss of lives and valuable natural and individual properties including thousands of hectares of forest and hundreds of houses, forest fires are a great menace to ecologically healthy grown forests and protection of the environment.

Every year, thousands of forest fire across the globe cause disasters beyond measure and description.

This issue has been the research interest for many years; there are a huge amount of very well studied solutions available out there for testing or even ready for use to resolve this problem.

Forest and urban fires have been and still are serious problem for many countries in the world. Currently, there are many different solutions to detect the forest fires. We are using sensors to detect the fire and alert through IoT communication.

II. LITERATURE SURVEY

A semi-supervised rule-based classification model is proposed in this paper to detect whether its zone is high active, medium active (MA) or low active (LA) cluster in the forest.

We train our proposed integrated model in such a way when only one parameter of sensed data is transmitted by the sensor nodes due to energy constraint to the initiator of that zone, initiator can be able to predict the state of (HA, MA, LA) zone with 96% accuracy.

All the sensor nodes in HA cluster transmit their packet through cluster head to the base station continuously applying greedy forwarding technique. Authors consider energy saving strategy during cluster head selection and data transmission in HA zone.

III. CONSTRUCTION

The incoming supply is fed to the sensors through node MCU which is taken from the survllance camera line which is kept inside the forest. All the circuits were kept above a certain height above the ground level, to kept it save from the animals, and the kit is covered with camouflage rain resistance cover to protect it from rain and excess heat.

IV. BLOCK DIAGRAM

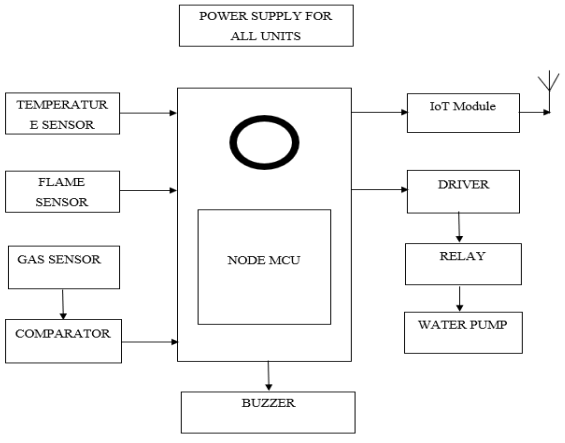


Fig1: Block Diagram

V. WORKING PRINICIPLE

Once the sensor detects the any form of fire near it, it will automatically triggers the node MCU and runs the circuit.At first the flame sensor senses the fire near by it the, the gas sensor detects the gas which is developed by the fire then the smoke detector detects the smoke which is created by the fire then all the three sensors turn on the relay and passes a signal to the node MCU which immediately rises the buzzer sound and turn on the wi-fi signal which the forest officer or the people near it can spot the locate it.

VI. COMPONENTS DESCRIPTION

NODEMCU:

NodeMCU is an open-source Lua based firmware and **development board** specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

SMOKE DETECTOR:

Gas MQ2 Sensor is one of the most commonly used Sensors throughout the world. This Sensor is most commonly used for the Smoke and Gas detection.

This Gas Sensor mq2 Module features an MQ-2 sensor. The MQ-2 sensor is a versatile gas sensor capable of detecting a wide range of gases including alcohol, carbon monoxide, hydrogen, isobutene, liquefied petroleum gas, methane, propane, and smoke. This module is provided with male header interface and can be easily interfaced with Arduino/Mega using male to female type jumper wires.

GAS SENSOR:

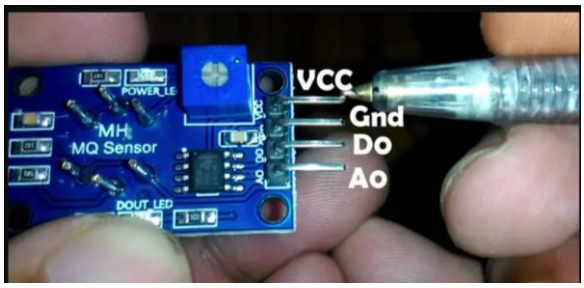


Fig2:Gas Sensor MQ2 Pinout

The **Four** male headers are labeled with

- ✓ A0
- ✓ D0
- ✓ GND, and
- ✓ VCC

A0 is the Analog output of the sensor and should be connected with the analog pin of the Arduino Uno or Mega.
D0 is the digital output in the form of 5v or Gnd. The level can be adjusted using the variable resistor.
GND pin of this module will be connected with GND of the Arduino or mega.
VCC should be connected with 5 volts of Arduino or mega.

FLAME SENSOR:

This Flame Sensor can be used to detect fire source or other light sources of the wave length in the range of 760nm - 1100 nm. It is based on the YG1006 sensor which is a high speed and high sensitive NPN silicon phototransistor. Due to its black epoxy, the sensor is sensitive to infrared radiation. Sensor can be a great addition in a fire fighting robot, it can be used as a robot eyes to find the fire source. When the sensor detects flame the Signal LED will light up and the D0 pin goes LOW.

THERMISTER:

This is a type of **resistor** whose resistance varies with change in temperature. These **NTC thermistors** are made up from the combination of metal oxides which passed through sintering process which gives negative electrical resistance versus temperature (R/T) relationship to it.

Thermistor is an electronic component used to calculate the temperature. Due to having a large negative slope a small change in temperature cause a huge change in electrical resistance.

Basically, there are two **types of thermistor** one is **NTC** (**Negative Temperature Coefficient**) and second one is **PTC** (**Positive Temperature Coefficient**). If the thermistor is NTC type then it decreases the resistance as increase in temperature and PTC behavior is just opposite to the NTC. A thermistor is connected with any electrical circuit to measure the temperature of the body or the substance. This thermistor's operating temperature range is -55 °C to 125 °C, the range of the temperature is depend upon the base resistance.

WATER PUMP:

WATERING CONFIGURATION:

Much the same, additional sprinklers and timers are required 12V DC reflux diaphragm pump 550, the price is the price of a pump, without other accessories.

RELAY

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

RESISTOR:

Resistors are made from a mixture of carbon black or powdered graphite clay and resin binder the mixture is molded into the rods by compression or heating and then wire leads are fixed at the ends. Such registers are called carbon composition resistors.

The other types of resistors are carbon film resistors, metal film resistors, and wire-wound resistors.

The colour code of the resistor indicates the value of resistance and its percentage reliability for tolerance.

10K / 10K Ohm Resistor Color Code – A resistor is a fundamental passive component for an electrical circuit. It provides a specific resistance to the circuit

Resistor color code is a color code to indicate the resistance of that resistor. Resistor color code can be formed with 3, 4, or 5 color bands. Each band has their own number to form a resistance number. We can learn about this resistor color code easily when searching about "Resistor Color Code Chart". This resistor color code standard follows the IEC60062 used by worldwide applications.

VII. CIRCUIT DIAGRAM

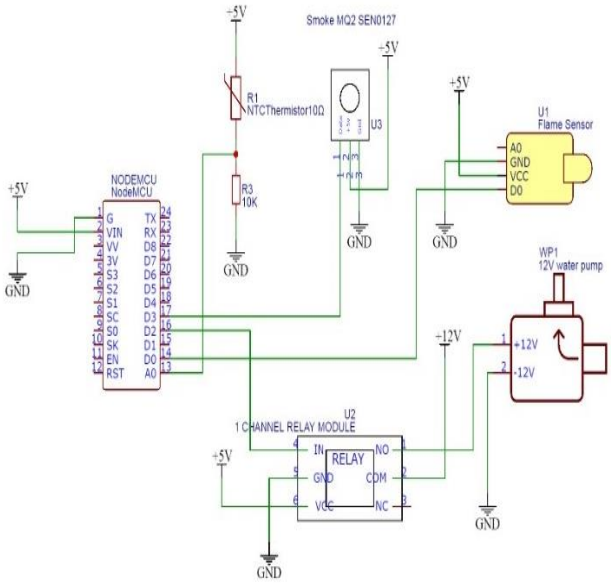


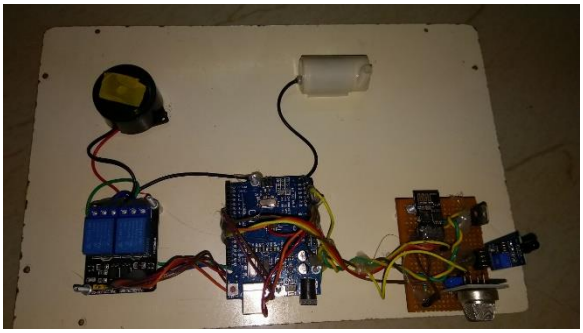
Fig3: Circuit diagram

VIII. ADVANTAGES

- In this system we go for detection and Monitoring of forest fires through several sensors and send to IoT cloud.
- Depending upon the sensor values in the cloud if it is greater than the present values it will send mail to the user.
- Continuous monitoring and uploading values to Thing speak cloud can be achieved.
- Monitoring of the potential risk areas and an early detection of fire can significantly shorten the reaction time and also reduce the potential damage as well as the cost of fire fighting.

IX. RESULTS

The result of this project is to detect the forest and rise a alert to nearby ranger , to starts to off the fire by using the water which is available in the nearby reservoirs.



X. CONCLUSION & FUTURE SCOPE

Forest is one of the major life source of living things in the world. So it is our duty to protect the forest resources. In this 21st century we do anything through tech by involving our idea in the forest protecting duty, we can protect the forest before any danger.

In future, by developing our idea, the forest fire can be easily controlled before destroying the life forms in the forest. It can be used in deep forest area to monitoring the forest fire.

XI. ACKNOWLEDGMENT

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REFERENCES

[1] Tao H., Zhang H., "Forest Monitoring Application Systems Based on Wireless Sensor Networks", Third International Symposium on Intelligent Information Technology Application Workshops, IEEE, 2009
[2] P.J Vivek , G. Raju , S. Akarsh, "Forest Fire Detection System", International Journal of Innovative Research in Science, Engineering and Technology, ISSN: 2319-8753, Vol 3, Issue 6, June 2014
[3] "Types and Function of Air Filters | Air Filtration System For Home, Office and Car". Official Blog Updates - Honeywell Air Purifiers. 2017-09-04. Retrieved 2018-02-12.
[4] https://en.wikipedia.org/wiki/Air_purifier
[5] https://create.arduino.cc/projecthub/aaronkow/simple-and-smart-air-purifier-system-8604ab
[6] https://engineering.dartmouth.edu/~d30345d/courses/engs37/esps.pdf