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Fuzzy Logic Based Fire Monitoring System using Arduino

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Abstract – This paper Presents autonomous fire detection and prevent using fuzzy logic concept. We can do a lot to protect against the fire but the best defense is to prevent the fire from spreading to across various objects. If a fire occurs, it can damage and destroy property costing lakhs of rupees. Even worse ,workspace fires can cause by wires or death to employees with the right caution and knowledge , more number of accidents or even disaster can be avoided . In this paper , we have propounded a system which is capable of detecting fire with the range of fire and the distance of the fire form the sensor. ESP 8266 nodemcu which is integrated with multiple sensors has been used to control multiple arduino which are integrated with multiple sensors. If the fire is detected the system will immediately send a message along with the distance and the size of the fire to the desired user by means of wifi module which is inbuilt in ESP 8266 nodemcu. The message is send to the user by means of sms gateway concept with the help of IFTTT. The range of fire and distance from the sensor which is achieved by fuzzy logic concept and we can control the spread of the fire by turning off the generator or the electrical / electronic devices near to fire prone area and we can analyze the fire range. Use of fuzzy logic systems can take imprecise, distorted information and provide desired / acceptable result.

Keywords – Fuzzy Logic, Fire Detection, Wifi Module, Electricty Off, ESP 8266 controller, arduino micro controller, RF module, IR flame sensor, DHT11 sensor, smoke/gas sensor, Relay, Router.

I. INTRODUCTION

We can do a lot to protection against fire but the best defense is to prevent fire from starting in the first place. Malfunction of either a piece of electrical equipment, wiring or both may result in electrical fire. Electricity is a common source of ignition for major fires. There are thousands of chemical in use or in the modern workplace. One of the most prevalent dangers of these chemicals is their flammability or combustibility.

Causes Of Fire :Improper handling of flammable materials brings a great risk of fire. When a flammable signal is spilled , vapor begins to form immediately. It is the vapour that will ignite and which result the great danger. A power point that is overloaded with double adapter plugs can cause a fire from an overuse of electricity. Faulty electrical system, poor circuit design is cause the short circuit.

A. Incidents:

Dec,1995 in Hariyana 540 people were killed due to fire caused by short circuit of an electric generator. According to a statistical data from 2016,in India. On average , every year about 25,000 people die due to fires and related causes. Female accounts for about 66% of those killed in fire accidents. It is estimated that about 42 females,21 males die every day in India due to fire.

II. LITERATURE REVIEW

. [1] The author proposed a paradigm for detecting forest fire with the help of wireless sensor network. The authors have focused on how to process the data collected by the sensors rather than how to detect or sense the fire. They used neural network for processing the collected data and make the network energy efficient. [2] A fire alarming system based on video processing Propounded. They used smoke color and spreading characteristics of smoke to detect possible fire outbreak. But processing the images is time consuming and needs sophisticated resources. [3] Fire monitoring and control system was designed where they used various sensors like flame, smoke, gas sensors for detecting fire and staring fire extinguishing process. They also used the GSM/GPS system for locating the exact location of the fire. [4] Fuzi et. al. designed a fire alert detection system with ZigBee wireless module. The system consists of Arduino Uno Microcontroller,

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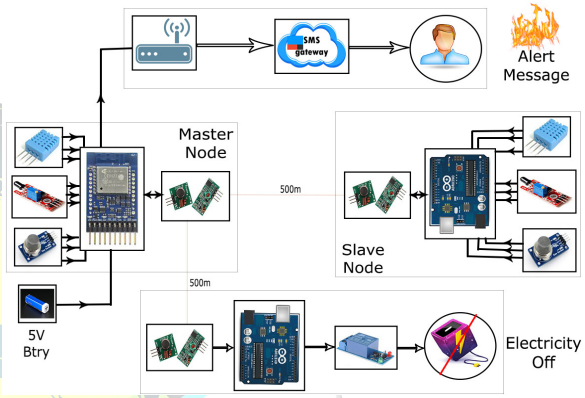
temperature sensor, buzzer alarm and operating software. The system used only temperature sensor for detecting fire and the receiver could receive signal from a distance of 10 meter. Our proposed system uses built-in Wi-Fi module on Arduino microcontroller and raspberry pi computer. [5] Kwon et. al. designed and implemented a system to detect fire outbreak using camera image processing. Although this is a novel approach, it is not as efficient and accurate in detecting fire as sensor based system. [6] T. Islam et. al. developed a fire detection system using the ZigBee wireless system. The authors used localization technique for finding the position and distance of fire. The system has a high relative cost and the authors used three sensors to localize a fire. [7] A prototype for detecting forest fire using a wireless sensor network was presented. They used mobile agent as software apart from sensor nodes. The software mobile agents collect data from the sensor nodes and return them to the sink. They did not implement the system.

In our base paper, they have used more pair of sensors to detect fire and using Authentication process to detect fire. In case of fire in electrical appliance it will spread in a faster manner and result on major damage. We have to produce a system to detect fire accurately and take appropriate measure. In this,they have used a system detect fire and authentication process to figure out fire. The fire causing and fire spreading materials are not suppressed. There are many ways to suppress fire by stopping gas and electricity supply on sensing fire break out and will start fire suppression system, will open fire extinguisher and water valves.

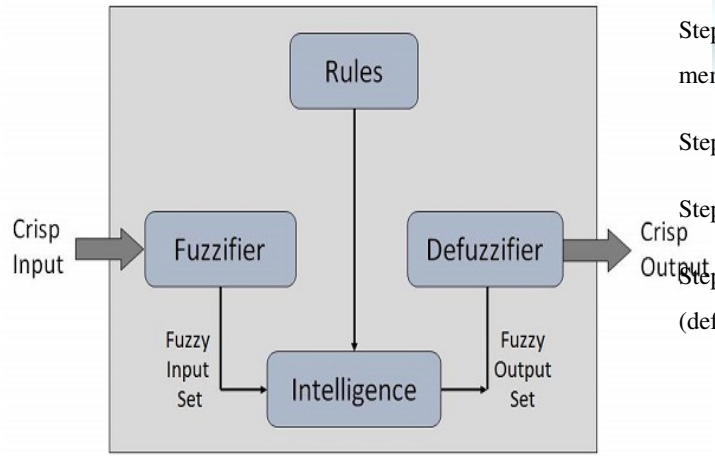
III. THE PROPOSED WORK



IV. THE EXISTANCE WORK

We are going to detect fire with most accuracy using MQ-2 sensor,DHT11 sensor , IR flame sensor and using Artificial Intelligence concept of Fuzzy Logic. We are going to detect the accuracy with the degree of truth and we will send the SMS with the degree of truth to the usr and stop the power supply to the concern device and help to reduce the spread of fire.

V. FUZZY LOGIC



Algorithm:

Step 1: Define linguistic variables and terms.

Step 2: Construct membership functions for them.

Step 3: Construct knowledge base of rules.

Step 4: Convert crisp data into fuzzy data sets using membership functions. (fuzzification)

Step 5: Evaluate rules in the rule base. (Inference Engine)

Step 6: Combine results from each rule. (Inference Engine)

Step 7: Convert output data into non-fuzzy values. (defuzzification)

VI. MODULES

1. ESP 8266 as Master:

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ESP 8266 controller is a Arduino Controller with Wi-Fi module and it has 3 sensor namely Smoke sensor, Flame sensor,DHT11 sensor for temperature and humidity and it has a rechargeable battery for power supply. By means of connecting RF module, it can get the data from the Slave Arduino and it can proceed further.By means of Wi-Fi module we can send the message "Regarding the presence of fire to the route.

2. 'n' Arduino UNO as Slaves:

In Arduino which will be a slave module and it has three type of sensor smoke,flame,DHT11 sensor rechargeable battery. It collects the data if there is a data which satisfies the condition, it is send to the ESP 8266 by means of RF flame sensor and then processed. More slaves can be connect to ESP 8266 controller.

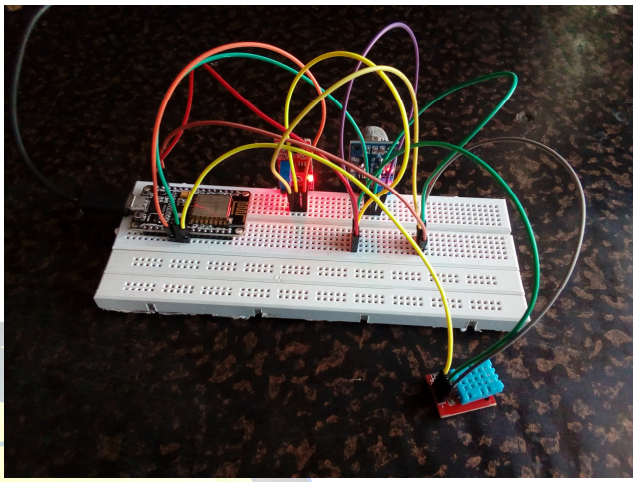
3. Sms Gateway using IFTTT:

By means of this module, the electricity of the desired electrical devices are cut.An Arduino which does the condition true or false. Relay which does the On or Off to the power supply.

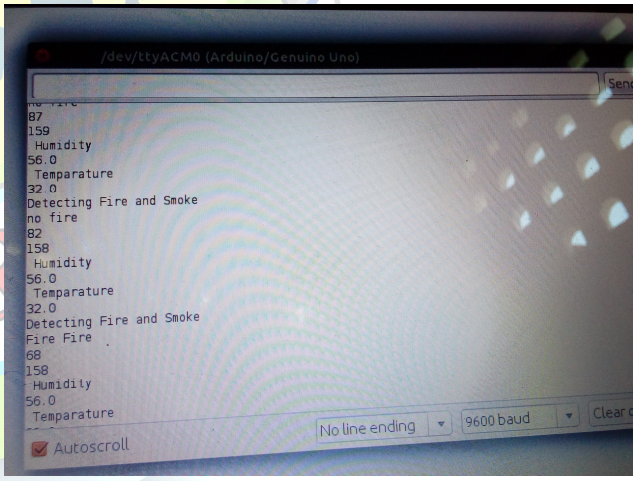
4. The Process to Power Off:

In this module, the desire message from ESP 8266 controller, which id in router is send to the SMS gateway and then to the user.

VII. EXPERIMENTAL RESULTS



Master Node(ESP 8266 nodemcu)



Fire Detecting result.

VIII CONCLUSIONS

Fire detection and protection based on fuzzy logic can detect fire more accurately and reduce the false detection. In this paper, we discussed the latest technology than can helpful to reduce catastropic accidents cause by fire. The proposed method address the smoke detection which is an induction for an early fire. Hence we can detect hidden fires (covered by dense smokes or object) which is far away from the sensor. If this system can be successfully integrate in every factories, malls,..then it is hoped that the lose of life and

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properly due to fire accidents will reduce remarkally and the country's economy will not be stumbled by such tragic accidents.

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