International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

Development of IoT based Blaze Corroboration Response System for Global Applications

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Abstract*: *IoT (Internet of Things) is a system of inter relating computer device, objects, people, digital and mechanical modules that are furnished with interesting identifiers and capacity to exchange information over a system without expecting human-to-human or human-to-PC connection. In present scenario the catastrophic accidents that are occurring in educational institutions, hospitals, factories, and industries are mostly due to blaze. In order to avoid the damage due to these blaze accidents, the proposed system is going to implement a blaze detection and corroboration system using ardunio which will give the fast response and can provide the information of affected region along with the location. This proposed system will be under the control of IoT. The proposed system will turn out to be more effective and helpful. In this way, by utilizing the proposed framework it can decrease the loss of life and property because of the fire mishaps and the country economy will not be affected by these tragic accidents. In this system is going to use an ardunio, sensors, Wi-Fi module and a camera. A Servo motor will be connected to the camera so that; it can rotate and can view the area where the fire is detected. Ardunio software is used in order to implement the proposed system.

Keywords* : *IoT, WiFi, GSM, Sensors, NodeMCU

I. INTRODUCTION

In the past decade's most of the accidents that are occurring in industries, institutions etc., are mostly due to fire. In order to avoid these fire accidents we have implemented a system which is mainly based on Arduino and Internet of Things. Various trends exist in the world of information technology for instance those that involve the size and performance of microprocessors, those relating to the use of information technology in business and finally those that deal with the physical size of computer systems. However, a more interesting trend has developed over the years where by low cost microcontrollers with sufficient processing capabilities have been developed to connect to the Internet. Microcontrollers serve as a core component to the concept of the "Internet-of-things" commonly abbreviated as IoT. The Internet-of-Things (IoT) is a new revolution of the Internet. The main goal of IoT is to enable things (objects) to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service. The object or things mentioned above could be vehicles, doors, water sprinklers and much more. Articles make themselves unmistakable and they acquire knowledge by settling on or empowering setting related choices, the truth of the matter is that they can convey data about themselves. The microcontrollers which have communication and data transfer capabilities through methods such as GSM and Bluetooth together with other devices such as sensors have made IoT a reality today. IoT is largely used in home automation systems such as controlling thermostats, windows and various electrical gadgets. These capabilities, can be extended to solving other problem areas in the world today one being that of fire outbreaks [5]. The applications for web associated gadgets are broad. Different orders have been recommended, a large portion of which concur on a division between buyer, undertaking (business), and framework applications. George Osborne, the previous British Chancellor of the Exchequer, set that the Internet of things is the following phase of the data insurgency and referenced the between network of everything from urban transport to restorative gadgets to household machines [6]. The capacity to organize installed peripherals with restricted CPU, memory and power assets implies that IoT discovers applications in almost every field. Such frameworks could be responsible for gathering data in settings going from regular biological communities to structures and industrial facilities, in this manner discovering applications in fields of ecological detecting and urban arranging. For instance, shrewd shopping frameworks could screen particular clients buying propensities in a store by following their particular cell phones. These clients could then be furnished with uncommon offers on their most loved items, or even area of things that they require, which their refrigerator has naturally passed on to the telephone. Extra precedents of detecting and inciting are reflected in applications that arrangement with heat, water, power and vitality administration, and in addition voyage helping transportation frameworks. Different applications that the Internet of things can give is empowering expanded home security highlights and home mechanization. The idea of a "Web of living things" has been proposed to depict systems of natural sensors that could utilize cloud-based examinations to enable clients to think about DNA or different molecules.

Manuscript published on November 30, 2019.
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In order to avoid the accidents that are causing due to fire [7], we have implemented a system which is mainly based on Arduino and Internet of Things. The Internet has just brought a huge number of individual's together and made associations that were at no other time conceivable. IoT will interface for all intents and purposes each protest the Internet, preparing everything from furniture and ways to nourishment and toiletries with sensors to gauge and send information to the cloud. At the end of the day, everything will be "keen." The ramifications of IoT are enormous: The whole planet will wind up brought together, cerebrum like framework. In basic we can state the Internet of Things (IoT) is an arrangement of interrelated figuring gadgets, mechanical and computerized machines, articles, creatures or individuals that are given one of a kind identifiers and the capacity to exchange information over a system without expecting human-to-human or human-to-PC cooperation. In addition to this we have used Arduino as our platform because it makes our system more efficient and also cost effective. So, this proposed system is used to reduce many of the factors such as loss of life, property etc., in this system we have used Arduino, Temperature sensors (DS18B20), GSM module, NodeMCU module and a Buzzer.

II. BACK GROUND

A hardware system is developed on the basis of Fuzzy logic in [1]. They have used multiple sensors for the Fire detection system and a web based notification system. In this paper they have said that most buyer review fire discovery frameworks depended entirely on smoke indicators. The protection given by these has been set up to be restricted by the sort of flame present and the recognition innovation at utilize. The issue is additionally aggravated by the absence of satisfactory alarm and notification systems. A run of the mill framework depends on the physical nearness of a person to follow up on the caution. In creating nations, lack of common sense and tending to contrarily influences the fire and safeguard team's reaction time. To address this issue, a fuzzy logic framework was executed utilizing an Arduino advancement board with contributions from a MQ2 smoke sensor, a TMP102 temperature sensor, and a DF Robot fire sensor. The yield of the recognition framework is sent over short message benefit (SMS) utilizing a SIM900 worldwide framework for versatile correspondence (GSM) module to the online framework and the house proprietor or guardian continuously. With get to conceded to the electronic framework, the fire and save group likewise get saw progressively with area data. A correlation between the effectiveness of the notification framework utilized by standard fire identifiers and the multisensor remote-based notification approach embraced in this paper demonstrated noteworthy enhancements as auspicious location, cautioning, and reaction. At long last in this paper they have inferred that not at all like the current terminate locators, this framework utilizes a multisensor approach whereby the yields of three sensors detecting three distinctive fire signature parameters (smoke, fire, temperature) add to the fire ready choice and consequently deliver a more dependable fire identification framework without false alerts. Trial results acquired by presenting fire (utilizing flame), smoke (consuming a paper), and warmth (utilizing hair dryer) to the gadget demonstrate that the framework can adequately improve the unwavering quality of a fire recognition framework. At the point when a fire caution is recognized, the framework consequently reports them to the fire and save benefit and furthermore informs the users through SMS informing on their mobile phones.

A method is proposed to reduce the accidents that are happening on the roads due to unwanted fire in [2]. The huge advantages of flame in street transport can't be over accentuated. In any case, in excess of two thousand vehicles are harmed by undesirable fire once a day. On a worldwide scale, combustible misfortunes to the car and protection ventures have kept running into billions of dollars in the course of the most recent decade. A not really far off contributory factor is the absence of an advanced fire security framework on the car. This has been tended to by planning and actualizing fluffy rationale control framework with input over an Arduino smaller scale controller framework. The robotize framework comprising of fire sensors, temperature sensors, smoke sensors and a re-designed versatile carbon dioxide cooling unit was tried on a medium measured physical ear. Results demonstrate that the car fire discovery and control framework without false cautions recognizes and stifles fire under 20 seconds. A creative, exceptionally encouraging arrangement module for equipment execution in flame location and control for autos has been produced by utilizing new calculations and fuzzy logic. At long last in this paper they have reasoned that confirmation that fire episode has not any more deadly outcomes in the car and particularly in electric autos where the a large number of battery cells driving the vehicle have a tendency to overheat, burst into flames and detonate conveys new quality to street transport well-being. Calculations got from sound thinking thoughts have been executed and tried, utilizing fuzzy logic innovation inserted on an Arduino board. Vehicle fire has been identified and smothered viably without driver's intercession and is without false cautions in light of ebb and flow testing. This multi-sensor fire recognition and control framework is a helpful ease modern framework, which can likewise be tried and sent on different frameworks where forced air systems have been introduced. With framework's magnificent execution under 20 seconds, it is normal that framework will represent no risk to human life albeit broader testing may be required. In addition, fabricating a fused usefulness that arrangements with forecast of the soundness of sensors will be helpful to the continuous identification and control of in-vehicle flames and fill in as mode for preventive support. Genuine framework usage in vehicles without existing versatile carbon dioxide cooling blowers ought to be finished with the 2Kg chamber mounted in the upright position, ideally behind the back seats of the traveller lodge.

A method based on wireless sensor network paradigm for real-time forest fire detection is proposed in [3]. The main aim of them is to identify and foresee wood fire quickly and precisely with a specific end goal to limit the loss of timberlands, wild creatures, and individuals in the backwoods fire. The remote sensor system can recognize and estimate woods fire more instantly than the customary satellite-based identification approach. This paper for the most part portrays the information gathering and preparing in remote sensor systems for constant timberland fire discovery.

A neural system technique is connected to in-arrange information preparing. They assess the execution of our methodology by reproductions. Remote sensor organizes worldview for continuous backwoods fire identification. The remote sensor system can distinguish and estimate wood fire more expeditiously than the conventional satellite-based recognition approach. This paper mostly depicts the information gathering and preparing in remote sensor systems for constant backwoods fire location. A neural system technique is connected to in-organize information handling. They assess the execution of their methodology by reproductions. In this paper they investigate the utilization of remote sensor arranges innovation continuously woods fire recognition. The forest fire is a deadly risk on the planet: it is accounted for that an aggregate of 77,534 rapidly spreading fires consumed 6,790,692 sections of land in USA for 2004. Satellite based checking is a prevalent technique to recognize backwoods fire now. Be that as it may, the long output time frame and low goals of satellites confine the adequacy of the satellite-based timberland fire identification. Also, satellites more often than not can't conjecture woods fires before the fire is spread wild. At last they have inferred that they utilized neural systems to draw out the lifetime of the sensor organize. The reproduction results demonstrate that their in-organize preparing approach is proficient to decrease interchanges between sensor hubs. They trust their neural system situated in-arrange handling approach can be connected to other observing and identifying sensor systems.

A strategy is suggested based on smoke-location technique for early fire-disturbing framework in light of video handling in [4]. The essential methodology of smoke-pixel judgment is made out of two choice standards: a chromaticity-based static choice lead and dispersion based powerful trademark choice run the show. The chromatic choice manage is derived by greyish shade of smoke and dynamic choice run is reliant on the spreading characteristics of smoke. Test results demonstrate that the proposed technique can give an early caution at a lower false alert rate before the fire consumes, and henceforth is exceptionally alluring for the essential military, government managed savings, business applications etc. In this they have for the most part utilized video based fire identification framework. At long last they have reasoned that this exploration builds up a smoke-identification technique in view of picture preparing to give an early alert to the fire mischances. Both static and dynamic highlights of smoke are included into the choice capacity to enhance the unwavering quality of smoke location. Trial results demonstrate that the proposed technique can give a dependable and practical answer for smoke location, and it might be more alluring than the ordinary methods for smoke recognition.

III. PROPOSED WORK

The system model for the proposed work is shown in the Fig. 1. Initially four temperature sensors are placed in the four directions, if in any direction the temperature raised more than the normal room temperature or normal temperature of the device then the data of the sensor of whose temperature is changed has been sent to the Arduino. The Arduino continuously monitor the data that is coming from the temperature sensors. Once the temperature value rises from the default value or threshold value then the Arduino sent the data to the Wi-Fi module i.e., NodeMCU and at the same time the Buzzer will be activated as a primary caution. NodeMCU module sends this data to the cloud. Here, we are using blynk server so, the data directly sent to the blynk cloud. The data from the cloud has been sent to the Blynk application in the mobile. In the mobile if we confirm it as fire, not by the damage of sensors then the data again transferred in the same form back to Arduino. Here, the Arduino sends this data to the GSM module; this module sends the message to the nearest fire department. Here we are sending our data to the admin as now we cannot directly send our data to the fire department [5] as it is just a prototype. All the four temperature sensor data sends to the Arduino and the Arduino is continuously monitor the data that is coming from the sensors. If any temperature sensor data value rises than the threshold value then, the data sends to Wi-Fi module and from the Wi-Fi module the data again sends to the cloud server. From the cloud server the data has been sent to blynk mobile application. The circuit diagram for the proposed system is shown in Fig. 2.

In the application if we confirm it as fire, the data that is received is send back to the Arduino. The Arduino sends a command to the GSM module and this module immediately send an alert message to the nearest Fire station or Fire rescue people [7].

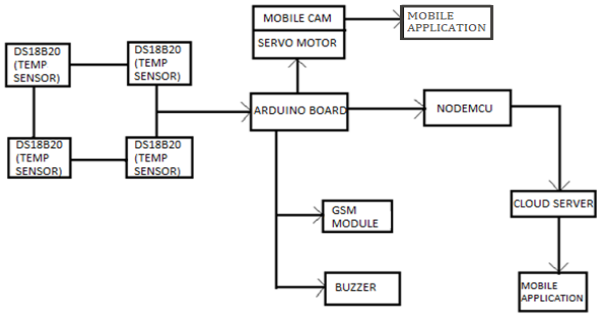

Fig. 1.System model

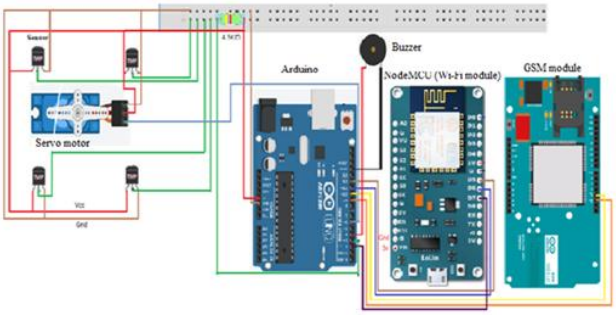

Fig. 2.Circuit for Proposed System

IV. RESULTS AND DISCUSSION

NodeMCU module has been connected as shown in the Fig. 3 to the laptop using USB cable in order to dump the program in NodeMCU. For this module power supply has been directly taken from the USB cable which gives 5v input to the NodeMCU module.

Here the NodeMCU is registered with a Wi-Fi and a video streaming Widget is placed in Blynk application in order to view the video where the fire has been detected. In extension to this we have placed LCD display and LED's for displaying the notification and to identify the direction in which the fire is occurred simultaneously.

In Fig. 4, the fire initiation and detection in the Blynk application is shown. It shows the initiation of fire in the West direction, due this the temperature have been raised than the threshold temperature value, the camera has been turned to the west direction along with that there is a notification shows that Fire detected in West direction. In the Fig. 5, we have taken the SIM900A GSM module for transmitting and receiving the messages. Here, 9th pin of the Arduino is taken as a receiver pin and is connected to transmitter of the GSM module. In the similar fashion 10th pin of Arduino is taken as transmitter and is connected to receiver of the GSM module. Coming to power supply we have taken 12volts 1A constant power supply from adapter to run GSM module.

Fig. 3.Component arrangement of NodeMCU

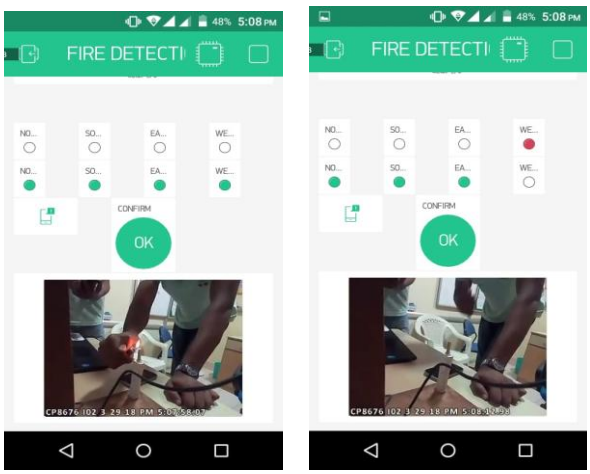

Fig. 4.Fire Initiation and Detection

Connections for the GSM module is shown in the circuit diagram after the connections are done, we write the program for GSM as shown in the program. In the program we use header file software serial, which has been developed to allow serial communication between other digital pins of Arduino. Since we are required to send a message when the fire is detected, we have developed a program in the Arduino software for GSM using Attention commands. First we should set the GSM module in the text mode next we should give the phone number to which the message should be sent then, we have to type the message to be sent. Here as we are dealing with fire detection system we are sending a message that fire is detected. The main purpose of sensors is to get temperature values from all directions. We have taken the SIM900A GSM module for transmitting and receiving the messages. Here, 9th pin of the Arduino is taken as a receiver pin and is connected to transmitter of the GSM module. In the similar way 10th pin of Arduino is taken as transmitter and is connected to receiver of the GSM module. Coming to power supply we have taken 12volts 1A constant power supply from adapter to run GSM module. From GSM module we have taken 12v and give as input to voltage regulator where we get constant 5v supply used for powering up all modules. We have connected servomotor for rotating the camera. For this we have connected the signal pin of servomotor to the one of the PWM pin's of the Arduino. For the power supply we have connected Vcc of servomotor to regulator output pin. In the similar way ground pin of the servomotor is connected to ground of Voltage regulator. A NodeMCU module has been connected for transmitting the data from Arduino to BLYNK application. Power supply for NodeMCU is given from Arduino 5v pin. Data pins D5, D6, D7 of NodeMCU are connected to 12th, 11th and 2nd pin of Ardunio respectively. A buzzer has been connected to 4th digital pin of Arduino and similarly ground pin of buzzer is given to ground pin of Arduino.

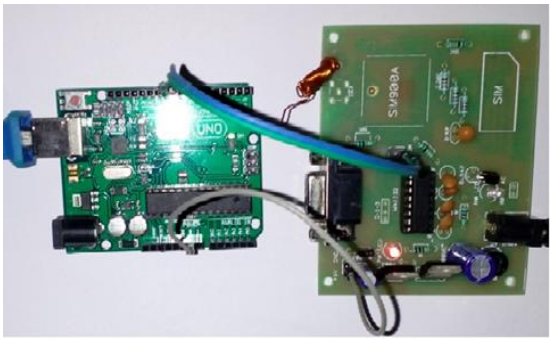

Fig. 5.Proposed GSM Module

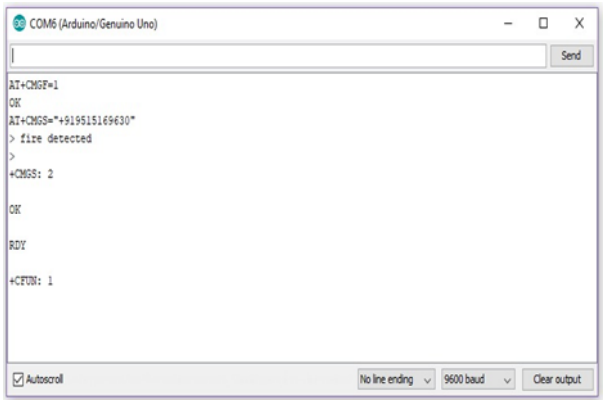

Fig. 6.Serial Monitoring Ouput

All the connections of proposed system have been done and an external power supply is given to GSM module with help of adaptor. The program for Arduino and NodeMCU module has been written and dumped individually using Arduino Software. Temperature value of sensor is gradually increased in one direction using flame.

As we got the temperature value greater than threshold value that is 50℃, a notification is sent to Blynk application through NodeMCU and simultaneously we get an alert from the buzzer, at the same time camera is rotated in the direction where the fire has occurred. With the help of camera we can cover an area where fire occurred. In the BLYNK application, we have four LEDs which show the state of temperature sensors. When LED is showing GREEN light it states that sensor is in normal position.

If LED shows RED light the sensor is getting heated and it is an alert. If the temperature value is above threshold, then we get red light in the affected direction and a message in LCD Widget that is present in the application shows that fire has been detected in a specified direction. We can also watch the fire initiated region through a camera Widget located in application. Once we observed it as fire, we tap OK button that is present in the application. After tapping on that button a signal is passed to Arduino and Arduino will trigger GSM module so that GSM module will sent information and alert spot the nearest fire department as shown in the Fig.6. Then the action from the fire department will be quick so that they can control fire quickly while it is damaging impact is more. Once the fire has been controlled, the not LED that showing the RED light will again come to the Original position that is showing the GREEN light that represents normal state of the surrounding environment. Here we have given fire in south direction placed sensor. As the temperature has been crossed threshold value that is specified, a notification and LCD display has been got a message that fire detected Southside. This is shown in the Fig.6. From this we can take the action immediately and can reduce loss of life and property.

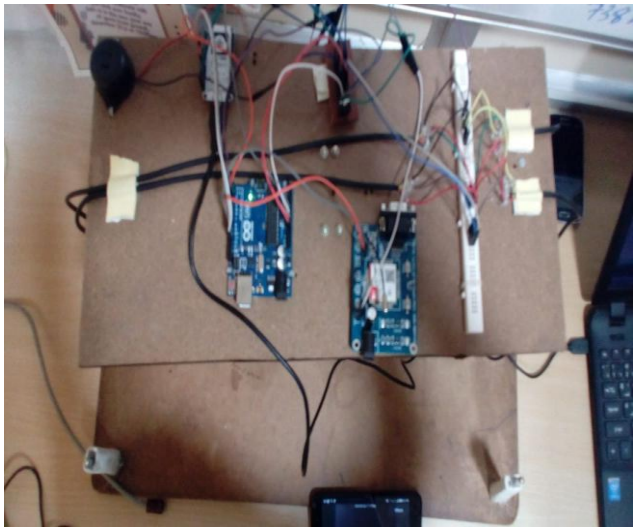

Fig. 7.Top view of the proposed system

Fig.7. shows the top view of our proposed prototype model. Here, all the required connections have been connected and when the power supply is given to the Arduino and other components in the design we will definitely get the output. In this Figure, we have taken four temperature sensors that are placed in four directions namely North, South, East and West. In this we have connected all the Ground pins of temperature sensor's parallel to the ground rail and similarly all Vcc pins are connected to +ve rail of bread board. In between source and data pins a 4.7KΩ resistor is connected. All the data pins of sensors are connected parallel and a one wire bus is taken from it and is connected to one of the Arduino digital pins. The use of one wire bus is for getting all the data from the sensors. For this setup we have given 5v Power supply from voltage regulator that is IC7805 to the sensors and ground pins of the sensors is connected to the ground pin of Voltage regulator. When the fire is detected it will show an alert message in mobile. After confirmation of fire in Blynk application, GSM will send message to fire station that fire detected as shown in Fig.8.

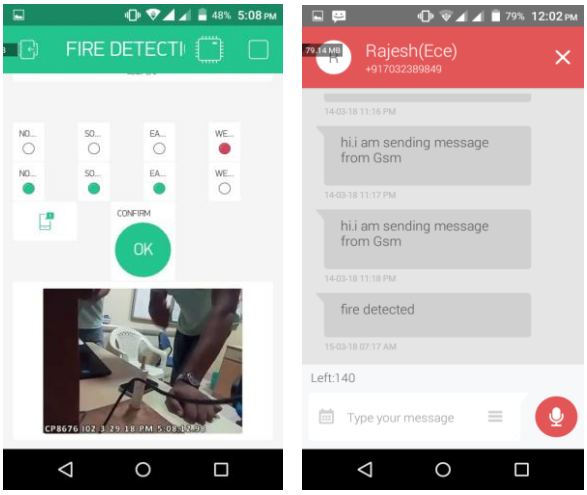

Fig.8. Fire alert and receiving SMS from GSM

V. CONCLUSION

The main challenge identified under fire detection is high false alarm rates by detection devices and difficulty in installation. The high false alarms are especially due to faulty smoke and thermal sensors. To reduce the false alarms a prototype model is developed at a reasonable cost which works on Internet of Things using Ardunio. Also this model provides information to fire department services so that they can prevent the fire in a minimum time. This will go a long way in saving lives and property. Data collected from the detection device also provide an opportunity for better reporting and data analysis.

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