Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

An IoT based Fire Detection, Precaution & Monitoring System using Raspberry Pi3 & GSM

[#1]Kulkarni Sangam, [*2]T. Prasanna, [*3]K. Bramaramba,
[1#] Postgraduate students,
[*2, 3]Assiatant Professoer,
Department of Electronics and Communication Engineering,
SCETW, Hyderabad.

***Abstract*— According to the National Crime Records bureau (NCRB), on an average, in India, every year about 25,000 persons die due to fires and related causes. Female accounts for about 66% of those killed in fire accidents. It is estimated that about 42 female and 21 male die every day in India due of fire at 2010 to 2016. When it comes to any textile workhouse, fire accident is a crucial issue to the workers and the investors. In this paper, we have propounded a system which is capable to detect fire and can provide the location of the affected region. Raspberry Pi 3 has been used to control multiple Node MCU which are integrated with a couple of sensors. A 360° relay motor is assembled with the camera so that it can snap the image in whatever angle the fire is detected. The sensor data values & images always update on webpage. We have provided a confirmation of the fire suspecting system to avoid any false alarm. The system will immediately send a message along with the image of the affected spot and Node MCU location. An admin can confirm or deny the impeachment and if the admin confirms the situation as a breaking out of fire, then the system will immediately raise an alarm and an automatic message will be sent to the nearby fire brigade.**

I.INTRODUCTION

In the earlier days, personal computers were used to handle daily tasks of individual like mail surfing, access to bank portal & other things. Nowadays, IoT enable smart devices like smart mobile phones are being used by them for such tasks due to rapid growth in Internet of Things (IoT).

INDIA is the second most populous Country in the World and is a fast growing economy. When it comes to any textile workhouse, fire accident is a crucial issue to the workers and the investors. At present many garment factories do not have proper fire prevention & rescue system. Hundreds of factories are vulnerable to fire break out because the factories are very old and lack fire detection technology. Moreover, most of the factories do not have an automatic system to stop fuel electricity supply when fire breaks out & it takes a lot of time for the fire service to reach the disaster spot. In this perspective, a system to detect fire and alarm the employees before it breaks out is a crying need. Ensuring minimum rights and safety of the garment workers has become a burning issue nowadays. The workers of garment factories are facing broken out of fire is surely one of them. . There isn't anyone at the garment factory and a fire breaks out. This will not only cause loss for the investors but also there wouldn't be any data available to investigate cause & claim any insurance. The investors are losing their interest and the prominence of this sector is getting toneless. In this paper, we designed an IoT based fire alarming system to help detect fire as soon as possible & take immediate precaution using water pump used as well as send email to owner & SMS to nearest fire station & save precious human lives. Raspberry pi3 is central control board that has secure SD card reader or micro SD card reader & provide Raspbian Linux OS that support python language. The system will use several sensors to detect any symptoms of fire. The sensors will be placed on proper places after doing surveys on the factory for its vulnerable places of fire. After choosing the best places for placing the sensors, the sensor will be activated. The data collected by sensors will be sent to Node MCU Wi-Fi module placed on various places. The node MCU will then process the data. All the node MCU will be controlled centrally by Raspberry Pi microcomputer. If fire has detected, the system send captured image to the registered email via wifi & switches on the sprinkler motor & alarm & SMS will be send to alert fire bridge. All this process monitor by LCD. Sensor data values & images also upload on webpage.

II.LITERATURE SURVEY

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

Sowah *et. al.* [3] designed and implemented a fire detection system for vehicle using fuzzy logic. They used temperature, flame and smoke sensors for sensing fire. The system also can extinguish fire in 20 seconds and they used the air-conditioning system for extinguishing fire.

A fire alarming system based on video processing propounded in [5]. 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. In case of a garment factory, the fire should be detected as soon possible because the garments are very much susceptible to fire.

Fuzi *et. al.* [7] designed a fire alert detection system with

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

ZigBee wireless module. The system consists of Arduino Uno Microcontroller, 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.

Kwon *et. al.* [8] 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.

A prototype for detecting forest fire using a wireless sensor network was presented in [10]. 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 [4], author Sudhir G. Nikhade discusses wireless sensor network system that has been developed using open source hardware platforms, Raspberry pi and Zigbee.

Table 1: Comparison Table on Survey Done

Sr.NO	PROJECT	TECHNIQUES	RESULT	ISSUES
1	Wireless sensor network system using Raspberry Pi and ZigBee for environmental monitoring applications	Wireless sensor technology	The system is low cost, low power consuming and highly scalable	Costly and time- consuming as multiple sensor nodes decide the possibilities of fire occurrence
2	An early fire-detection method based on image processing	RGB(red, green, blue) model	The system is fully automatic surveillance of fire accident with a lower false alarm rate	Time consumption and power computation are very high.
3	Real-time fire detection for video-surveillance applications using a combination of experts based on color, shape	MES (multi expert system)	Identifies moving objects based on background subtraction is effective	Very high chance of false alarm

III.SYSTEM DESCRIPTION

The propounded autonomous system uses Raspberry Pi 3 as main device, Node MCU as secondary device and consists of couple of sensors and module which are the Flame sensor, Gas sensor, Servo motor, Camera module, GSM module and Relay module.

The camera Module can rotate 360° by using a servo motor. PIR sensor is used to find out any intruder detected. When Raspberry Pi receives the data, then it will send the data to the admin by using GSM module and an admin will check the validity of the warning message of our system and confirm or deny any suspect.

A. Block Diagram

The block diagram of the paper is quite simple which has a few basic components but it is quite efficient in producing the result as required.

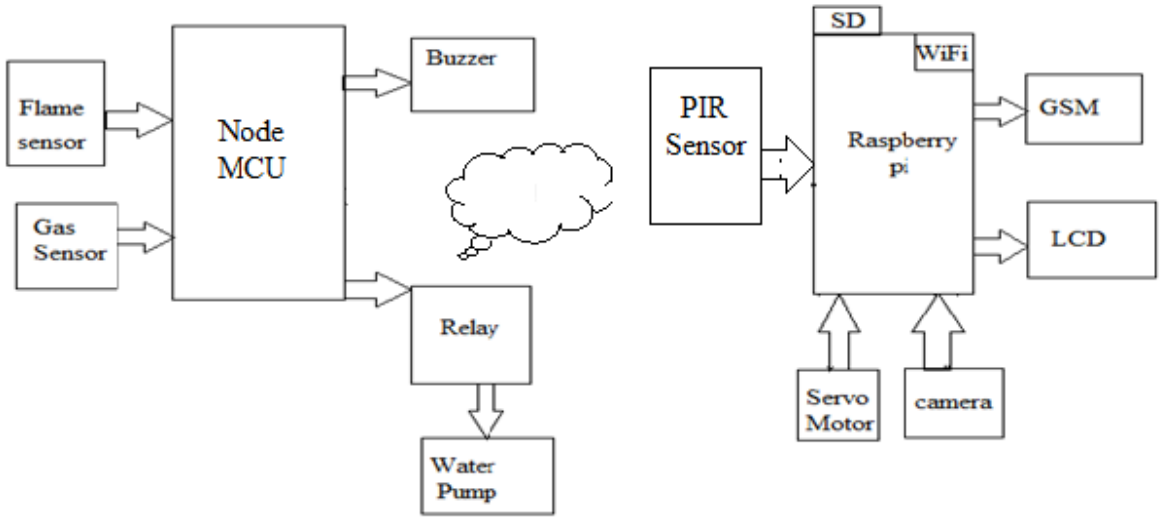


Fig 1. Block diagram of the system

The propounded autonomous system uses Raspberry Pi 3 as main device, node MCU as secondary device and consists of couple of sensors and module which are the flame sensor, Gas sensor, Servo motor, Camera module, GSM module and Relay module. The sensors sense the data if getting values is above the threshold

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

value the fire alarm gets ON. If fire is occurs then water pump & buzzer gets ON. If gas is detected only buzzer gets ON. All these information send to raspberry pi & it capture images, upload into webpage, SMS & mail send to owner & fire station. The camera Module can rotate 360° by using a servo motor. After this condition is true the fire alarm will trigger by the help of the Relay module..LCD monitoring all the thing where the system is working properly or not. It give an update step by step. PIR sensor can be placed for any unknown person is found at authorized place.

B. Software:

ARDUINO IDE:

It is open source software. In this programming having two main function void setup() & void loop().

PYTHON Language:

Python is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale.

IV.WORKING PRINCIPLE

In this autonomous system the process occur in two parts. One part is node MCU read the data from sensors and the other part is Raspberry pi receive the data what was taken by node MCU.

The code written node MCU would contain a specific IP address for each node MCU to identify the each of them. Each node MCU acting as Server takes the readings from the sensors, compares them to the threshold value. If the sensor values get to reach of threshold, the node MCU performs necessary actions.

Flow process

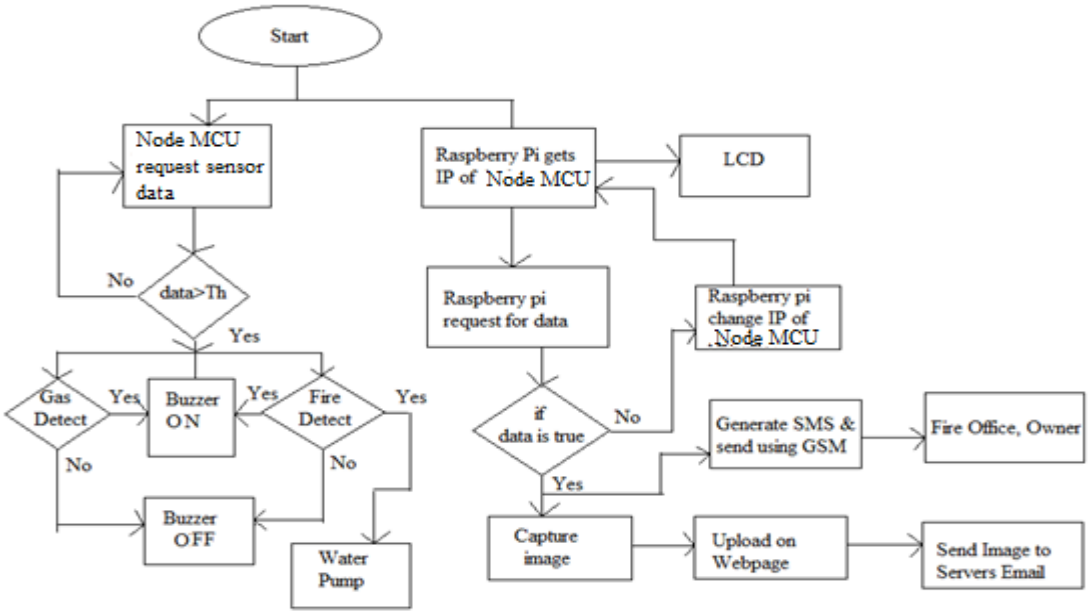


Fig. 2. Flow Chart of the System

Here, the system is using few sensors. One of them is fire sensor module and the other one is Gas sensor. If both the sensor value is hit up to mark that means above the threshold value then the condition is true and the camera module will rotate 60° by the help of servo motor. This condition will active when only a single pair of sensor value is true. But if the two pair are active at the same time, then it give different threshold value for each pair & rotate the camera in different angle. After that it detect fire & it can immediately activate alarm & water pump gets on. After that camera module takes the snap, then it throws the pair no to the Raspberry Pi 3. When raspberry pi received the snap and sensor pair no then it will compare with IP and sensor pair no. If matched, then generate an SMS and send the SMS to the Admin via GSM module.

STEPS OF IMPLEMENTATION:

Step 1 (Configure the Programmable Devices):

Write a program for each programmable device which

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

are- Raspberry Pi 3, Node MCU, GSM Module SIM808.Program in Raspberry Pi wold be written in Python to traverse each Node MCU with IP specified to each . All the IPs of from all the Node MCU should be put in a list of Raspberry Pi's program.

Part of the Main Program

```
if int(f_data) == 0:
  if not int(f_data):
        sms = subject + fire_text
        print "Fire detected"
        lcd.LCD_Byte(0x01,0)
        time.sleep(0.2)
        lcd.LCD_STRING(" Fire Detected ")
        lcd.LCD_Byte(0x80,0)
        time.sleep(02)
        lcd.LCD_STRING(" Captured Image ")
        time.sleep(2)
        for i in range(0, 2):
              message_send(Mobile[i], sms)
              time.sleep(1)
        send_email(sms)
```

Step 3 (Integrating the sensor modules):

Each Node MCU would be connected to 2 sensors where 1 of them will Flame sensor & other is Gas sensor.

Step 4 (Connecting the Servo and Relay module):

The Relay module and the Servo motor both have a digital input pin. Relay module connected to water pump & Node MCU. Servo motor is used to rotate web camera. It is connected to Raspberry pi.

Step 6 (Setting up the PIR sensor & LCD with Raspberry pi 3):

PIR sensor is used to detect unknown person. It gets connected with GPIO 7 pin of Raspberry pi BOARD mode.

Step 2 (Burning the codes in the sketch of Node MCU and Setting up code in Raspberry pi 3):

The Node MCU program should be burnt to each sketch of all the Node MCU configuring the code with specific IP and MAC address.

Step 7 (Connecting the SIM808 GSM module with Raspberry Pi 3):

One of the transfer pin of SIM808 GSM module gets connected with USB connection of Raspberry Pi.

Step 8 (Powering up all the devices):

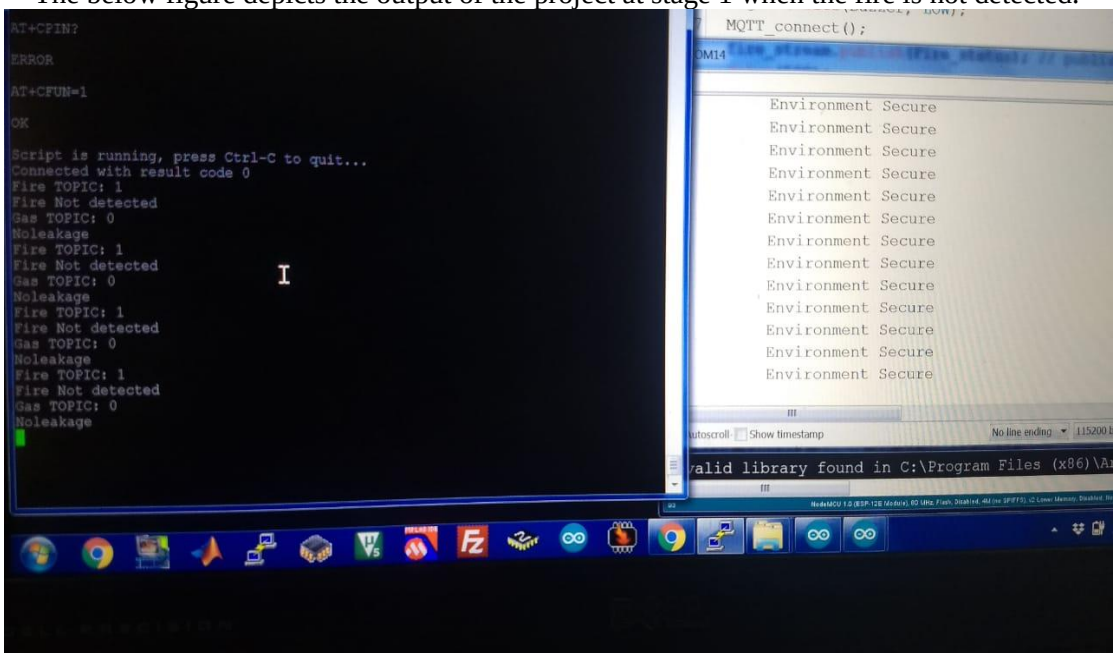
In the proposed system, the main devices that will be directly connected to the power sources are the Raspberry Pi 3, Node MCU, SIM808 GSM module and the Router. Raspberry Pi 3 and each of the Node MCU need to be connected with a 3.3v power supply adapter.

V.EXPERIMENTED RESULT

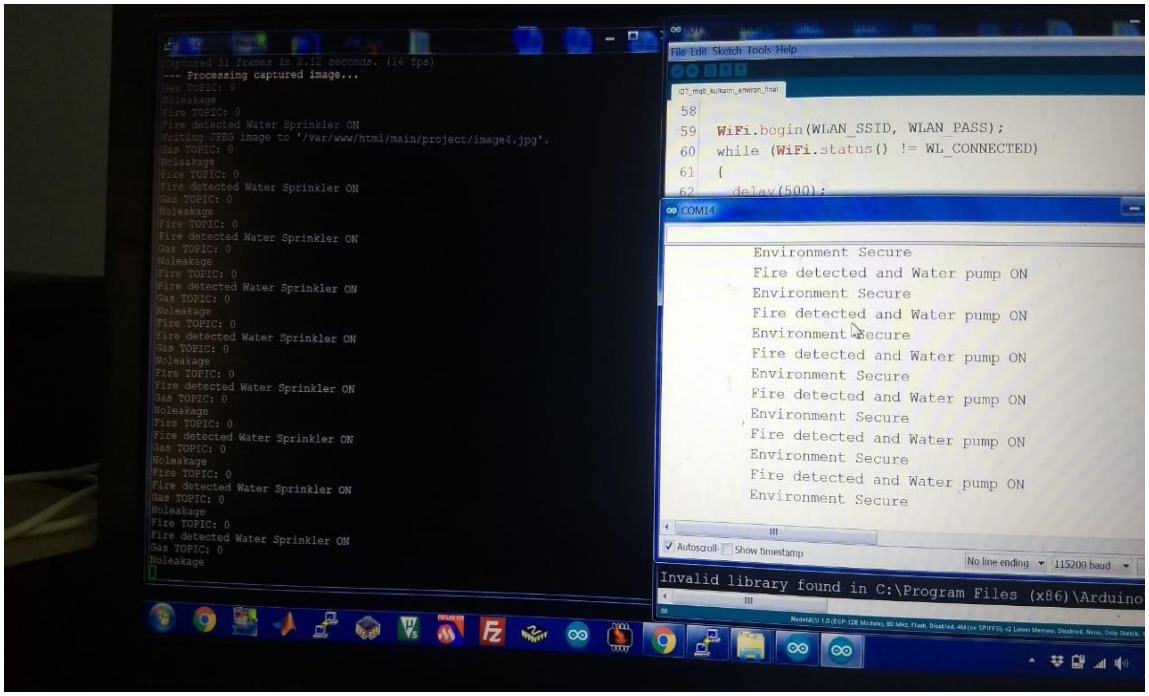
After assembling our system, the reading of the sensors has been checked. The main program (python language) is executed with the command "*python project.py"*on the Terminal. The program begins to execute each statement in the code and reads the signals from sensors and produce the outputs depending upon the conditions provided in the code.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

The below figure depicts the output of the project at stage 1 when the fire is not detected.

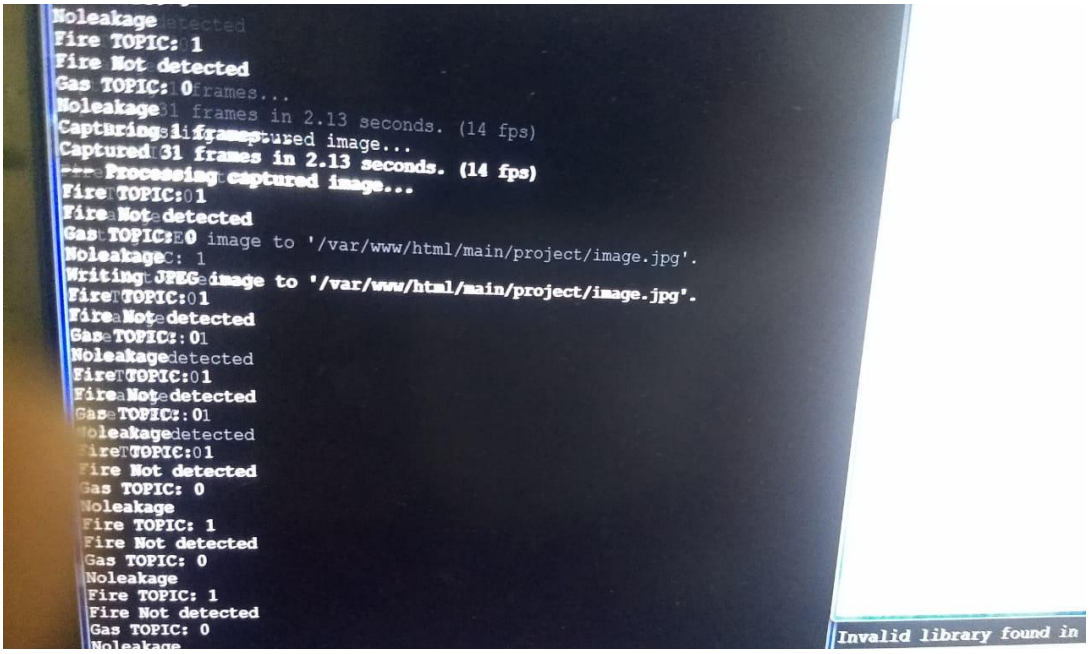


The below figure depicts the output of the project at stage-2 when the fire is detected.

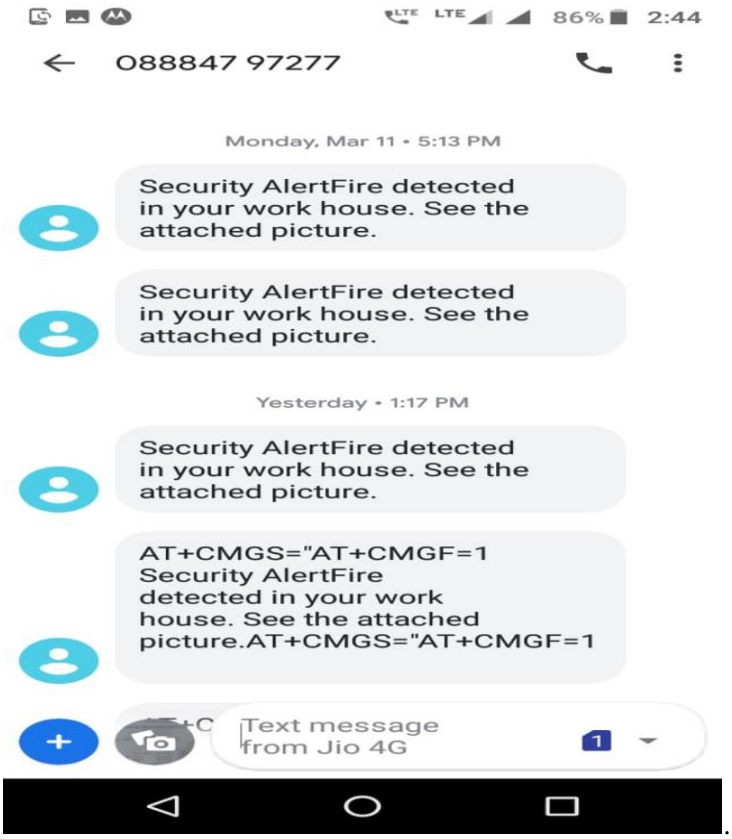


International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

The below figure depicts the output of the project at stage-3 when the image is capture.

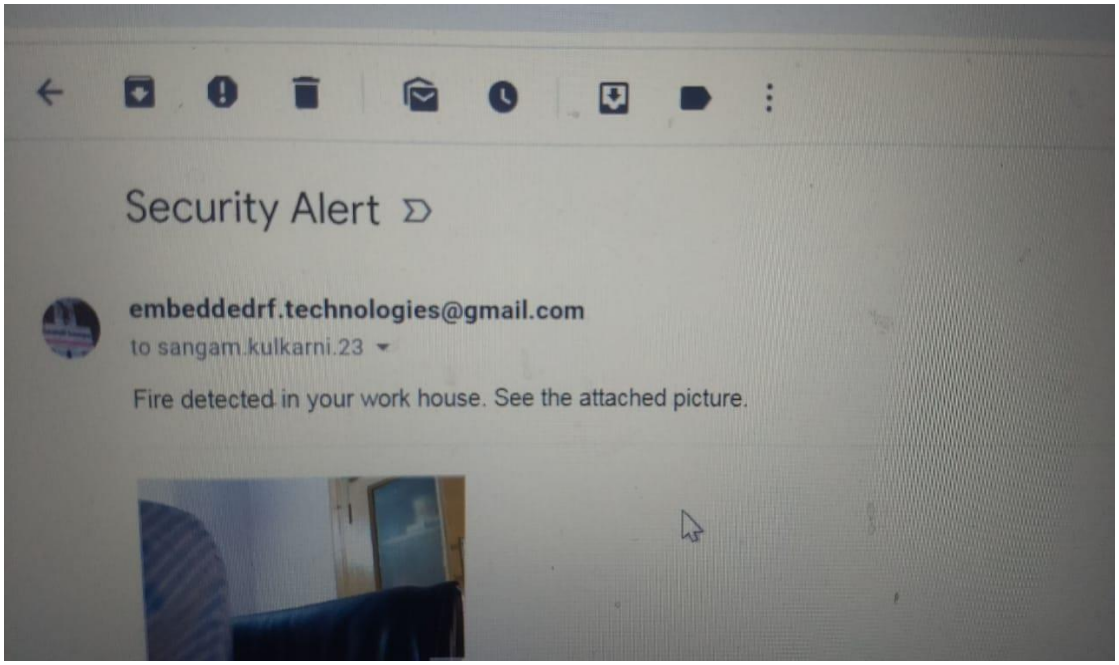


The below figure depicts the output of the project at stage-4 SMS send to owner



International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 07, July-2019

The below figure depicts the output of the project at stage-4 Email send to owner



CONCLUSION

In this paper, we discussed the latest technology that can help to reduce catastrophic accidents caused by fire. We designed the whole system and evaluated its effectiveness as well as scalability. With the improvement of sensor technology, the system will become more efficient and useful. If this system can be successfully integrated in every factories, then it is hoped that the loss of life and property due to the fire accidents will reduce remarkably and the country's economy will not be stumbled by such tragic accidents.

It can further extend this project by adding some more features which can make it more efficient and security oriented. The camcorder can also be used to track all the activities of the unknown person or intruders.

REFERENCES

[1] Ethirajan Anbarasan, "Dhaka Bangladesh clothes factory fire kills more than 100," in BBC, 25 November 2012.
[2] Oxfam, "31 die in Bangladesh factory fire as brands do too little, too late," in press.
[3] Sowah, Robert, et al., "Design and implementation of a fire detection and control system for automobiles using fuzzy logic," in Proceedings of Industry Applications Society Annual Meeting, 2016.
[4] Yu, Liyang, Neng Wang, and Xiaoqiao Meng "Real-time forest fire detection with wireless sensor networks," in Proceedings of International Conference on Wireless Communications, Networking and Mobile Computing, Vol. 2, 2005.
[5] Chen, Thou-Ho, et al. "The smoke detection for early fire-alarming system base on video processing," in Proceedings of International Conference on Intelligent Information Hiding and Multimedia, 2006.
[6] Gaikwad, K. M., et al., "Fire Monitoring and Control System," in Proceedings of International Research Journal of Engineering and Technology (IRJET), 2016.
[7] Fuzi, Mohd Faris Mohd, et al., "HOME FADS: A dedicated fire alert detection system using ZigBee wireless network," in Proceedings of Control and System Graduate Research Colloquium (ICSGRC), 2014.
[8] Islam, Taoufikul, Hafiz Abdur Rahman, and Minhaz Ahmed Syrus, "Fire detection system with indoor localization using ZigBee based wireless sensor network," in Proceedings of International Conference on Informatics, Electronics & Vision (ICIEV), 2015.
[9] Trivedi, Kartik, and Ashish Kumar Srivastava, "An energy efficient framework for detection and monitoring of forest fire using mobile agent in wireless sensor networks," in Proceedings of International Conference
[10] Dong, Wen-hui, Li Wang, Guang-zhi Yu, and Zhi-bin Mei, "Design of Wireless Automatic Fire Alarm System," in Proceedings of *Procedia Engineering* 135, 412-416, 2016.