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AN IOT BASED FIRE ALARMING AND AUTHENTICATION SYSTEM FOR WORKHOUSE USING RASPBERRY PI 3

[#1]A. V. Duraivel, [*2]Beniel Wellington, [*3]A. Arul Nayagam,[* 4]R. C. Kijral

[1#] *Associate Professor, Department of Electronics and Communication Engineering, Kings Engineering College, Chennai.*
[*2, 3, 4,] *Uundergraduate Scholars, Department of Electronics and Communication Engineering, Kings Engineeering College, Chennai.*
duraivel.n@gmail.com, beniel.wellington14@gmail.com, arulnayagam14@gmail.com, kijral98@gmail.com

***Abstract*— Ensuring minimum rights and safety of the garment workers has become a burning issue nowadays. The workers of garment factories are facing some labyrinths and broken out of fire is surely one of them. The investors are losing their interest and the prominence of this sector is getting toneless. 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 which are integrated with a couple of sensors and camera. 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 device 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.**

***Keywords*—Raspberry Pi 3, IoT, Sensors**

I. INTRODUCTION

In the earlier days, personal computers were used to handle daily tasks of individuals like mail surfing, access to bank portal, and other things. Nowadays, IoT enabled smart devices like smart mobile phones are being used by them for such tasks due to rapid growth in Internet of Things (IoT). With the inception of IoT, the idea of remotely monitoring objects through the Internet has emerged [1].

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 and rescue system. Hundreds of factories are vulnerable to fire break out because the factories are very old and lack fire detection technology. Assume 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 the cause and claim any insurance.

We have implemented a fire alarming and authentication system with the help of Raspberry Pi 3 which is a credit card sized minicomputer. The system which will continuously record relevant data from Flame sensor, PIR sensor & Gas sensor. A webcam is used to capture an image in case of an intruder and sends the captured image to our email via Wi-Fi. If fire has been detected, the system sends the captured image to the registered email via Wi-Fi and switches ON the sprinkler motor and alarm to alert the fire brigade.

II. LOW COST AND EFFICIENT SYSTEM

The proposed system uses a Raspberry Pi 3 which is a credit card sized minicomputer that runs on a 5V power source via MicroUSB. Unlike the conventional CCTV (closed circuit Television) system, not only does our system draw less power but the equipment cost too is very low. The cost of implementation of CCTV varies depending upon the size and use of the system [2]. The efficiency of the proposed system increases as the camera used switches ON to capture images only when either an intruder or a fire event is detected; it remains OFF at all other time. The conventional CCTV system cannot automatically trigger an alarm or sprinkler motors without human intervention. It simply records the video footage 24x7 and stores it in a hard disk (large memory space) which can be damaged in case of a fire accident.

III. SYSTEM ARCHITECTURE

We are providing an integrated system which is capable of detecting intruders and fire and sends a captured image to email via Wi-Fi as well as triggers the alarm & sprinkler motor. This is being implemented in garment factories and workhouse to provide security. Raspberry Pi 3 has 1.2GHz CPU with 1GB RAM. Depending on the budget, any webcam or Pi camera which is compatible with the Raspberry Pi via a 15 pin ribbon cable can be used. We have used a normal webcam to keep the overall cost low. The image is captured in the event of a fire or an intruder and is sent to the registered email id via Wi-Fi.

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.

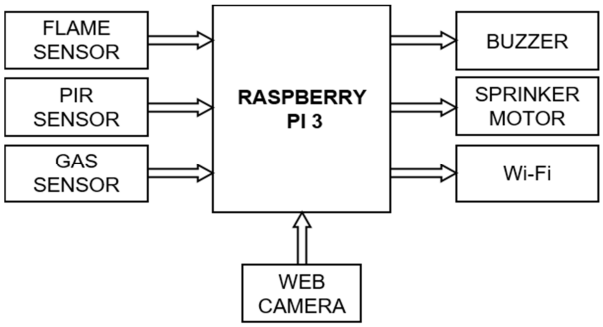

Fig. 1 Block diagram of the system

The inputs flame sensor, PIR sensor and Gas sensor are used to detect fire, and intruder and measure gas levels respectively. The Web Camera is used to capture the image and the captured image is sent to email via Wi-Fi. Sprinkler motor and Buzzer is activated when fire is detected.

1) RASPBERRY PI 3: The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer which is a ARM Cortex-A53 1.2GHz, 64bit quad-core ARMv8 CPU can be used for many applications and supersedes the original Raspberry Pi Model B+. It has a 1GB RAM and additional memory is provided by using a micro SD card. It has 4 USB ports, 40 GPIO pins. A Full HDMI port is used to connect to a display.

Fig.2. Raspberry Pi 3

2) WEB CAMERA*:* Webcam is used in proposed approach to capture images whenever it is triggered by the sensor output signals. These images are sent immediately to the registered email id via Wi-Fi.

Fig. 3. Web Camera

3) PIR SENSOR (Passive Infrared Sensor): The PIR Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects[3]. This motion can be detected by checking for a high signal on a single I/O pin.

Fig. 4. PIR Sensor

4) FLAME SENSOR: A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. It also can detect ordinary light source in the range of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm.

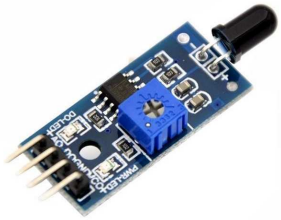

Fig. 5. Flame Sensor

5) GAS SENSOR: MQ-2(HYDRO CARBON)
This CO2 Sensor can be used in a wide range of applications, including air quality monitoring, smoke alarms, mine and tunnel warning systems, greenhouses, etc. The sensor is easy to use and can be easily incorporated in a small portable unit.

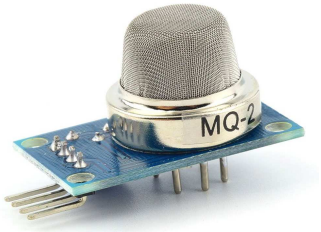

Fig. 6. Gas Sensor

B. Software:

RASPBIAN PIXEL*:* Raspbian is a Debian-based computer operating system for Raspberry Pi. Raspbian uses PIXEL, **P**i **I**mproved **X**windows **E**nvironment, **L**ightweight as its main desktop environment as of the latest update.

A Raspbian image is a file that you can download onto an SD card which in turn can be used to boot your Raspberry Pi into the Raspbian operating system. Using a Raspbian image is the easiest way for a new user to get started with Raspberry pi.

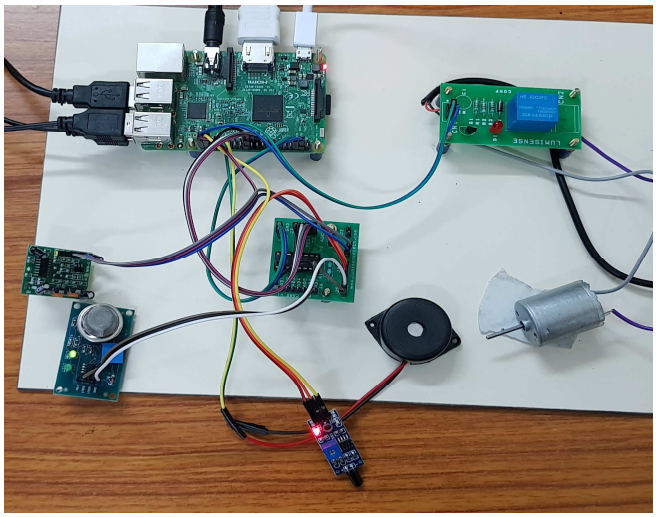

Fig. 7. Hardware Module of the Proposed System

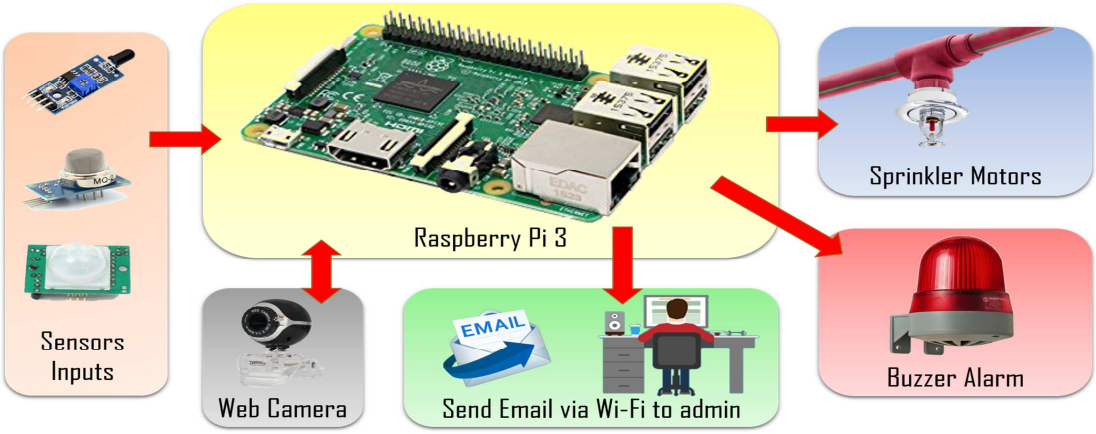

Fig. 8. Complete overview of the System

IV. WORKING PRINCIPLE

The overall working of the camera can be explained with the help of a flowchart. The sensors record the data continuously and send signals to the Raspberry Pi 3 as inputs via the GPIO pins. The Raspberry Pi processes all the received data and responds based on the values of the sensor outputs. It switches ON the web camera to capture image whenever the PIR sensor and flame sensor output is TRUE and activates the Buzzer. The Captured image is sent to email immediately. The Sprinkler motor is switched ON when the fire is detected.

```
while True:
 i = GPIO.input(21)          #PIR sensor OUTPUT pin
 if i == 1:
  print "motion detect"
   GPIO.output(buzzer, 1)  #Switch ON Buzzer
  os.system('sudo python gmail.py')
  time.sleep(delay)
 elif i == 0:
  print "motion not detect"
  GPIO.output(buzzer, 0)  #Switch OFF Buzzer
     time.sleep(delay)

 i1 = GPIO.input(20)   #Flame sensor OUTPUT pin
 if i1 == 0:
  print "fire detect"
     GPIO.output(relay, 1)    #Switch ON Sprinkler Motor
     GPIO.output(buzzer, 1)  #Switch ON Buzzer
  os.system('sudo python gmail.py')
  time.sleep(delay)
 elif i1 == 1:
  print "fire not detect"
     GPIO.output(relay, 0)  #Switch OFF Sprinkler Motor
     GPIO.output(buzzer, 0)  #Switch OFF Buzzer
  time.sleep(delay)
```

Fig. 9. Part of the Main Program (Python Code)

Kumar M. *et al*. [4] introduced intruder detection and alert system using three processing units, a micro-controller, a raspberry pi single board computer and a PC. We have also included in our proposed system an intrusion detection using PIR sensor.

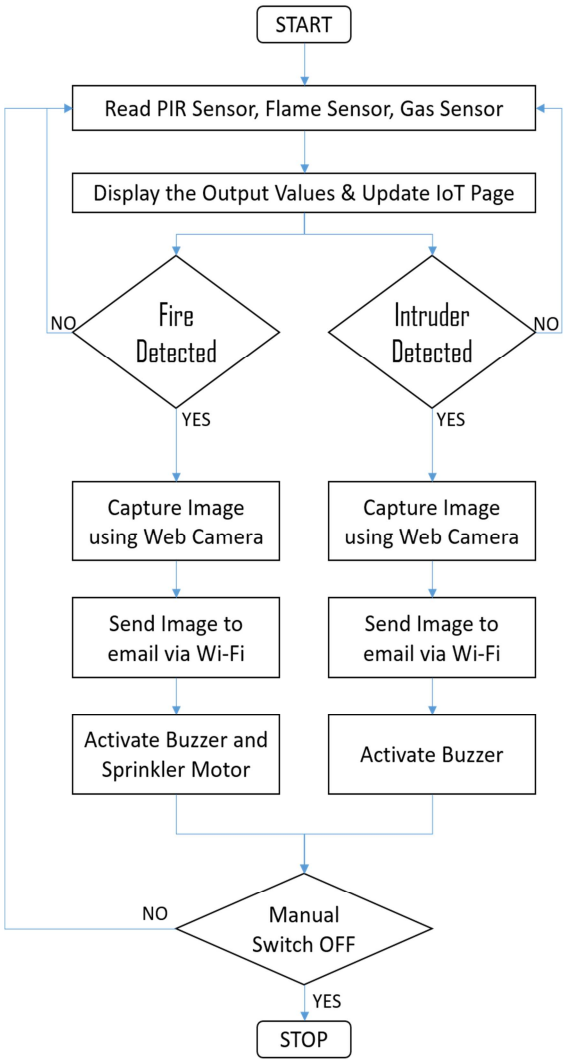

Fig. 10. Flow Chart of the System

V. RESULT

The main program (python language) is executed with the command *"sudo 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. The following is a part of the terminal execution in case fire is detected by the flame sensor.

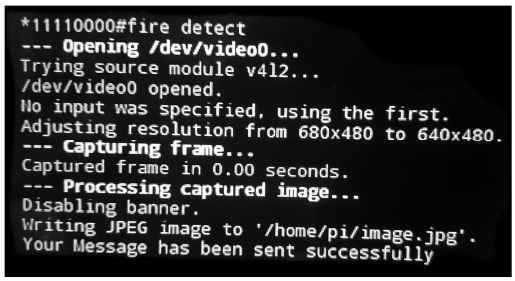

Fig. 11. Terminal Window while sending email

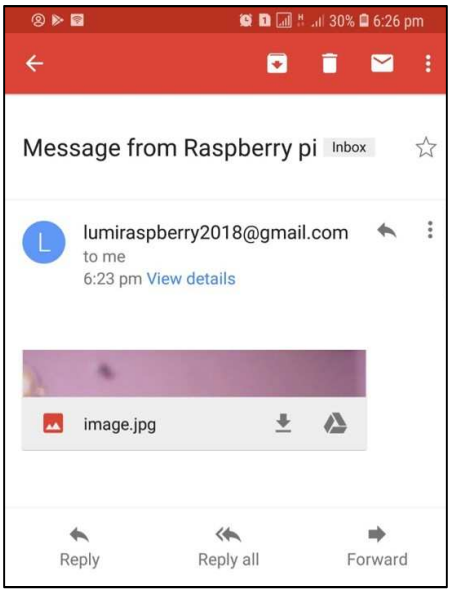

Fig. 12. Proposed system sent captured image via email

VI. 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. Also the system is compact and can be implemented with low cost. With the help of the images sent to the email, investigation to find the cause of fire can be determined better and it can be used as evidence to claim insurance.

VII. FUTURE SCOPE

This system has a wide range of uses in various fields, such as schools, offices, factories, power plants, etc… The reason this system is quiet useful is due to the fact that it is highly compact and it provides fire alarming and authentication system.

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AUTHORS DESCRIPTION

Mr. A. V. Duraivel, is an Associate Professor working at Kings Engineering College, Chennai, Affliated to Anna University, Chennai.

Beniel Wellington is an Undergraduate Student persuing his Bachlor's degree in Electronics and Communication Engineering at Kings Engineering College, Chennai, Afflited To Anna University, Chennai.

A. Arul Nayagam is an Undergraduate Student persuing his Bachlor's degree in Electronics and Communication Engineering at Kings Engineering College, Chennai, Afflited To Anna University, Chennai.

R. C. Kijral is an Undergraduate Student persuing his Bachlor's degree in Electronics and Communication Engineering at Kings Engineering College, Chennai, Afflited To Anna University, Chennai.