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

[1]Shwetha T
Department of Electronics and Communication
Engineering
Bangalore Institute of Technology
Bangalore, India

[2]Dr. Mukthi S L
Department of Electronics and Communication
Engineering
Bangalore Institute of Technology
Bangalore, India

Abstract—Guaranteeing least rights and security of clothing laborers has turned into a consuming issue these days. The specialists of piece of clothing plants are confronting a few mazes and broken out of flame is most likely one of them. The speculators are losing their advantage and the noticeable quality of this segment is getting toneless. This paper had propounded a framework which is proficient to distinguish fire, atmospheric temperature and can give the data about the lethal smoke from influenced district. Raspberry Pi 3 B+ has been used to control system Architecture which is integrated with a couple of sensors and camera. Proposed work is to provide an affirmation of the flame speculating framework to keep away from any false alert. The framework will promptly communicate something specific alongside the picture of the influenced spot. An administrator can verify or refute the prosecution and, in the event, that the administrator affirms the circumstance as a breaking out of flame, at that point the framework will quickly raise an alert and a programmed message will be sent to the close-by flame detachment.

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 have replaced the traditional method 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. Sowah *et. al.* [2] as given a practical implementation a fire detection system using fuzzy logic. They have designed the architecture with the help of temperature sensors, flame and smoke sensors for fire detection. The system also can extinguish fire in 20 seconds and they used the air-conditioning system for extinguishing fire. Fire break out in cloth factory [3] at Mumbai's Damu Nagar on Dec 23, 2018 at 7:15.

The author in [4] 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.

A fire alarming system based on video processing propounded in [5]. They utilized smoke colour and spreading attributes of smoke to recognize conceivable fire break out. But image processing itself is a task and consumes time and requires quiet more sophisticated resources. In case of a garment factory, if there is any occurrence to fire break out which should be detected as early as possible to avoid further complications. 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.

Implementing a fire alarming and authentication system with the help of Raspberry Pi 3B+ which is a credit card sized minicomputer. The system which will continuously record relevant data from Flame sensor, PIR sensor Temperature and Humidity sensor and Air quality or Gas sensor.

Kwon *et. al.* [6] 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 Raspberry Pi Camera [7] is used to capture an image in case of an intruder, S. Tanwar *et. al.* introduced a pyroelectric device which detects the movement of objects with the help of change in the level of infrared level which are emitted by surrounding objects [8] and sends the captured image to our email via Wi-Fi. In case of fire broken out event, 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.

III. LOW COST AND EFFICIENT SYSTEM

The proposed system uses a Raspberry Pi 3 B+ which is a minicomputer that runs on a 5V power source via MicroUSB. Unlike the Raspberry Pi camera system, not only does our system draw less power but the equipment cost too is very low.

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 system cannot automatically trigger an alarm or sprinkler motors without human intervention.

<div align="center">IV. PROPOSED SYSTEM</div>

In the examination, extraordinary consideration is put on the basic condition that makes the segment and the module work proficiently. All segments are talked about and the capacities in this area. The serious issue hailed in building configuration is to completely and effectively determine the prerequisites of the plan.

The "Fire Alarm System utilizing Email" framework structure process includes the accompanying:
1. Full investigation of the framework detail.
2. Equipment structure.

The equipment errands incorporate the definition and investigation of appropriate circuit segments utilized in accomplishing the circuit plan of the Fire Alarm System utilizing email. We have the ecological sensors S1to S4, these sense a flame/high temperature/inside contamination occasion and pass the data to the Microcontroller MC; the microcontroller at that point surveys whether the blend of readings from the sensors is really a flame occasion or a bogus caution in view of this, accepting a real flame occasion, at that point the microcontroller enacts the Wi-Fi module and sends a ready email to the different reaction focuses.

A. Hardware design for the proposed system

The system architecture of this paper is shown below which has a few basic components, but it is quite efficient in producing the result as required.
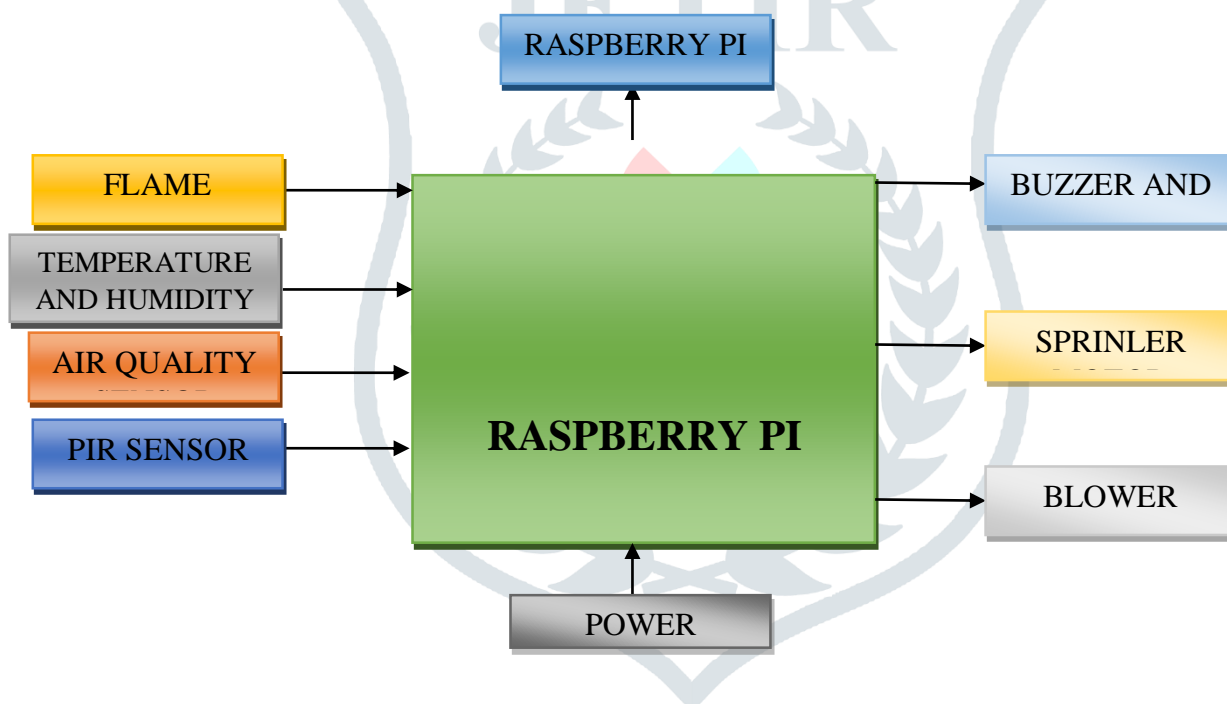

Fig. 1 Block Diagram

The main control unit of the proposed methodology is Raspberry Pi 3B+. The Raspberry Pi 3 Model B+ is the third generation Raspberry Pi. This powerful single board computer which is 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 and Raspbian software is added in the SD card. It has 4 USB ports wherein we will be using a USB port to connect another camera, 40 GPIO pins, wherein by using them for the interface of Sensors. A Full HDMI port is used to connect to a display.

The inputs flame sensor, temperature and humidity sensor and Air quality/Gas sensor are used to detect fire and measure the temperature and measure gas levels respectively.

Flame Sensor which has the identification gadget, combined with an appropriate fire control instrument creates a flag. That flag at that point issues in a physical activity, which enables the framework to keep on running within the sight of a fire or closing down the framework in a deliberate way in the fire's nonappearance. A fire identifier is a sensor intended to distinguish and react to the nearness of a fire or flame. It additionally can identify standard light source in the scope of a wavelength 760nm-1100 nm. The discovery separate is up to 100 cm.

Temperature and Humidity Sensor (DHT22) is an essential, minimal effort advanced temperature and dampness sensor. It's genuinely easy to utilize however requires cautious planning to get information. The main genuine drawback of this sensor is

you can just get new information from it once at regular intervals, so when utilizing our library, sensor readings can be as long as 2 seconds old.

Air Quality/Gas Sensor (MQ135) is used for recognizing a wide scope of gases, including NH3, NOx, liquor, benzene, smoke and CO2. Perfect for use in office or manufacturing plant. MQ135 gas sensor has high affectability to Ammonia, Sulfide and Benze steam, likewise touchy to smoke and other unsafe gases.

The PIR Sensor is a pyroelectric gadget that identifies movement by estimating changes in the infrared dimensions radiated by encompassing items [3]. This movement can be recognized by checking for a high flag on a solitary I/O pin.

The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs wherein camera is connected to controller via ribbon cable. By making use of this Raspberry pi camera one can take the picture of fire broken out area and send the same image to the concerned person mail Id.

The Raspberry PI 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.

When the fire presence detected from Flame sensors then LEDs and Buzzer are enacted for visual and sound sign. A fire sprinkler system is a functioning flame protection method, comprising of a water supply framework, giving satisfactory weight and flow rate to a water dissemination funnelling framework, onto which fire sprinklers are associated. Although utilized in manufacturing plants and expansive business structures, frameworks for homes and little structures are presently accessible at a savvy cost. Flame sprinkler frameworks are broadly utilized around the world, with more than 40 million sprinkler heads fitted every year. In structures totally secured by flame sprinkler frameworks, over 96% of flames were constrained by flame sprinklers alone.

Exhaust blowers are commonly used to exhaust contaminated, noxious fumes or hot air away from a process to allow machine operators to breathe cleaner air. A good example would be welders. If the fumes and smoke produced in a welding operation are not exhausted away from the welder, the welding quality and the welder's health will suffer. Both could cost a great deal more to correct later.

B. *Software design of proposed design*

Raspberry pi is a controller wherein an operating system can to be installed on hardware hence it is user friendly. Raspbian is the OS. Raspbian is a Debian-based PC working framework for Raspberry Pi. Raspbian utilizes PIXEL, Pi Improved Xwindows Environment, Lightweight as its primary work area condition as of the most recent update. A Raspbian image is a file that one can download onto a SD card which thus can be utilized to boot the Raspberry Pi into the Raspbian working framework. Utilizing a Raspbian image is the most straightforward path for another client to begin with Raspberry pi.
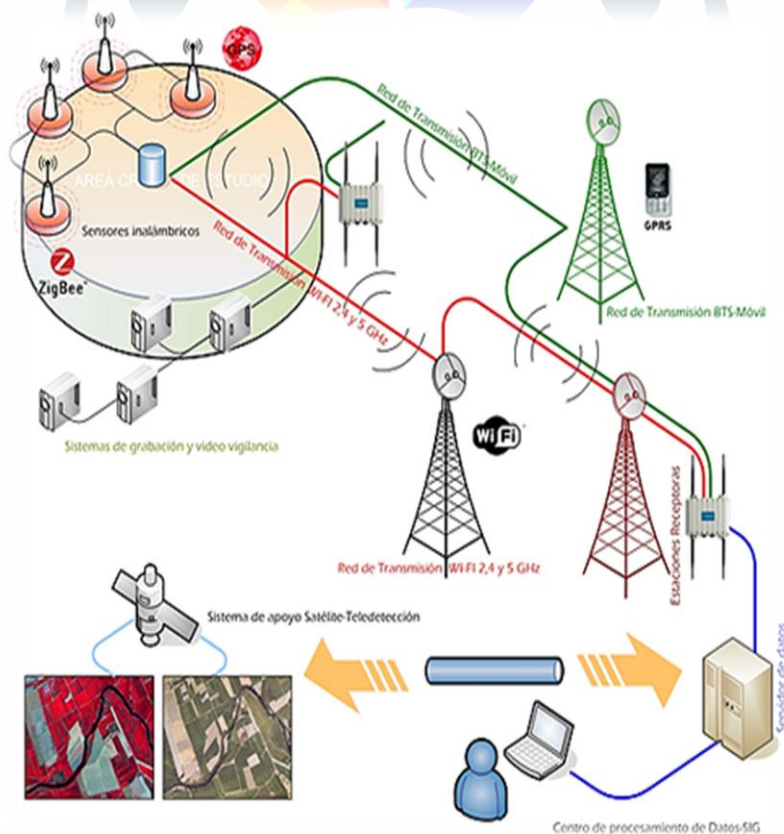

Fig 2. System Architecture.

V. WORKING PRINCIPLE

The overall working of the module is explained with the help of a flowchart.

Step:1 In this project we are using raspberry pi 3 b+ module which mainly works based on OS it's a computer which is of credit cart seized and easily portable also.

Step:2 All sensors data will be monitored continuously.

Step:3 If the sensor value crosses the threshold value then corresponding actuator will act as per the programmer defined in the program.

Step:4 If fire sensor is detected then buzzer and led will be activated with some delay time as defined in the program.

Step:5 After that, the camera will capture the image which is connected to the microcontroller, here we are using pi camera.

Step:6 The captured image will be sent to the user through mail.

Step:7 After sending mail to the user sprinkler and blower will be turn ON to control the flame / fire detected in the work house.

Step:8 And this is one part of the project and other part of the project is human intrusion detection.

Step:9 To monitor human intrusion we are using PIR sensor , This sensor is used to monitor or to detect any intrusion in the work place.

Step:10 If any intruder is detected the camera again gets triggered and captures the image.

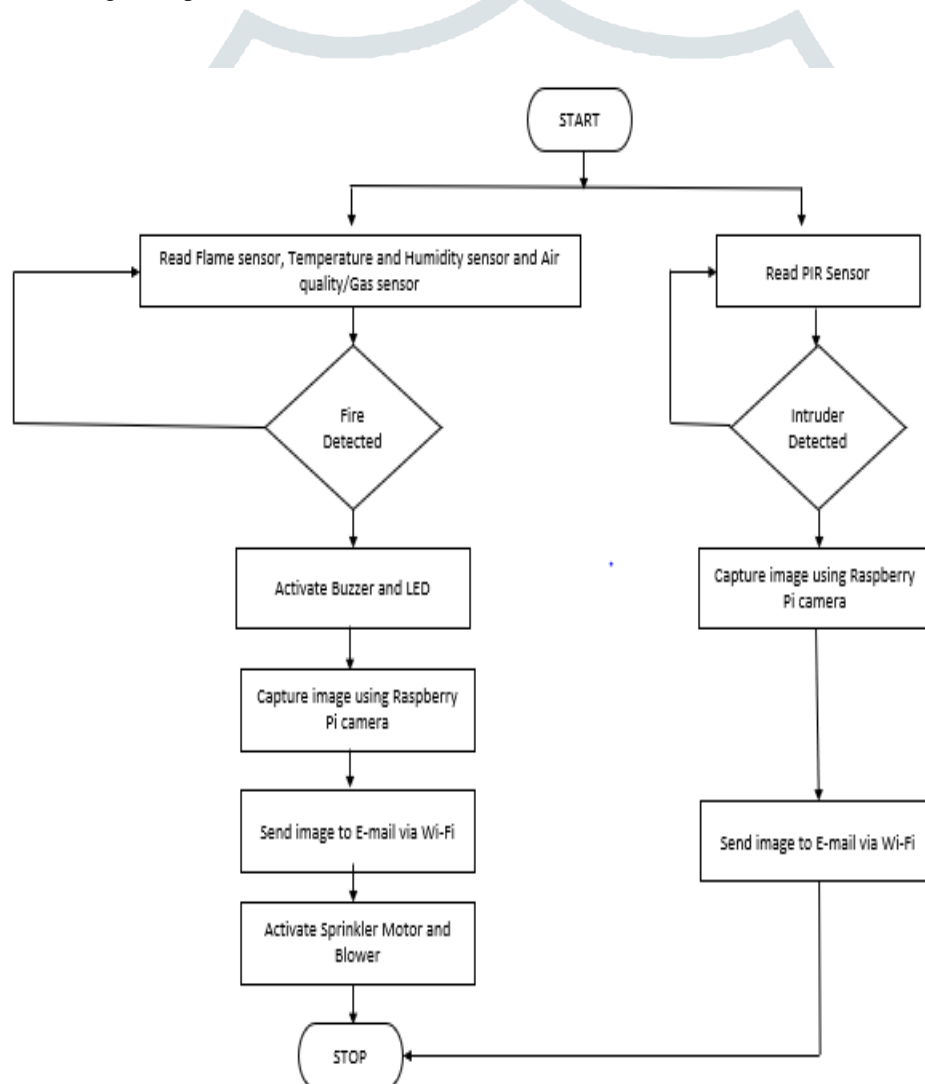Step:11 Once image is captured it is sent the user via email.

Fig.3 FlowChart

VI. RESULTS

The main program (python language) is executed with the command "*python camera_gmail_image.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

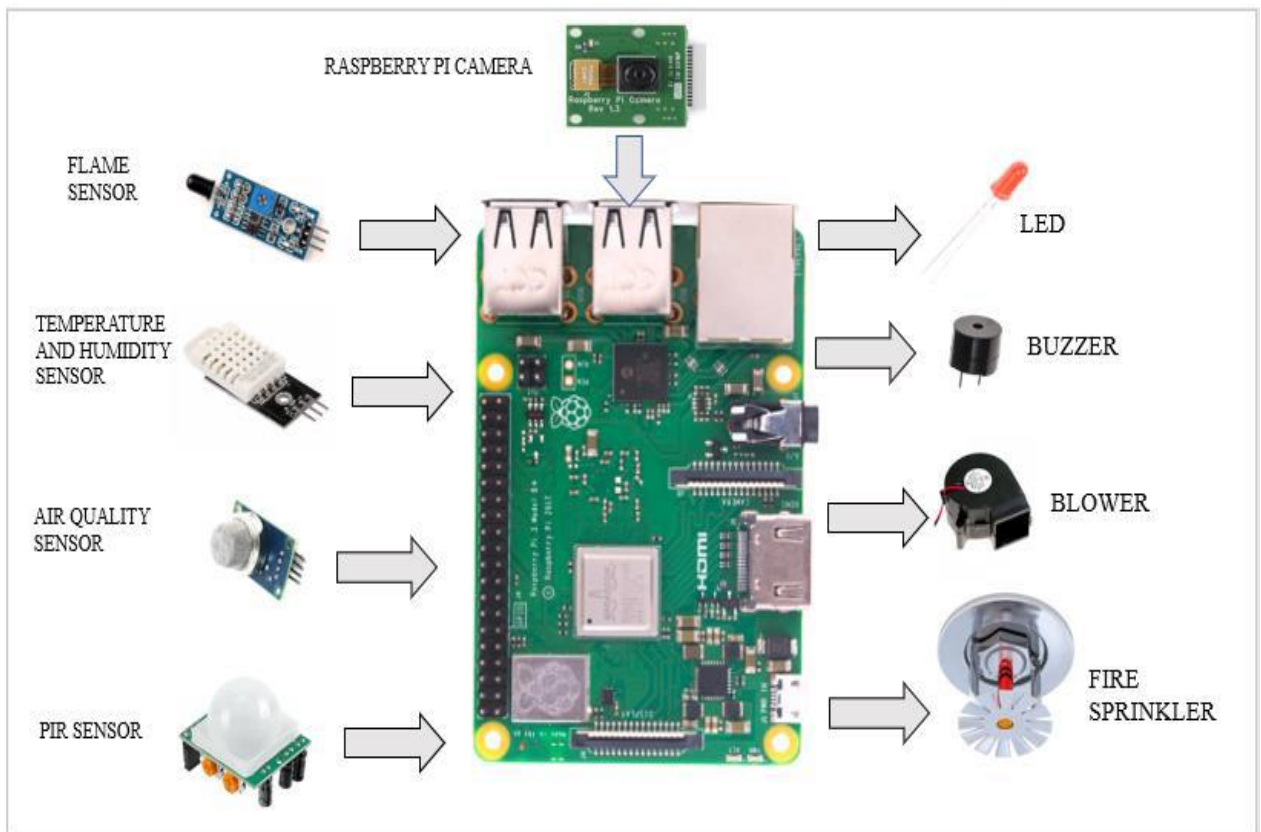execution in case fire is detected by the flame sensor.

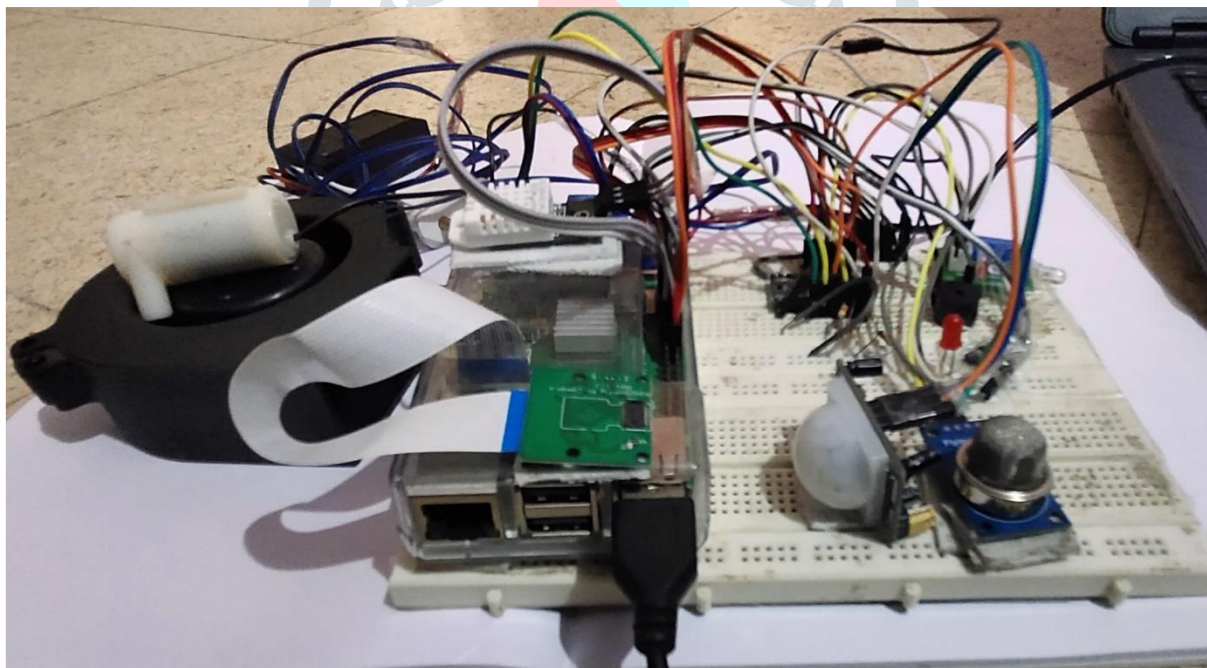Fig 4. Hardware components of proposed methodology.

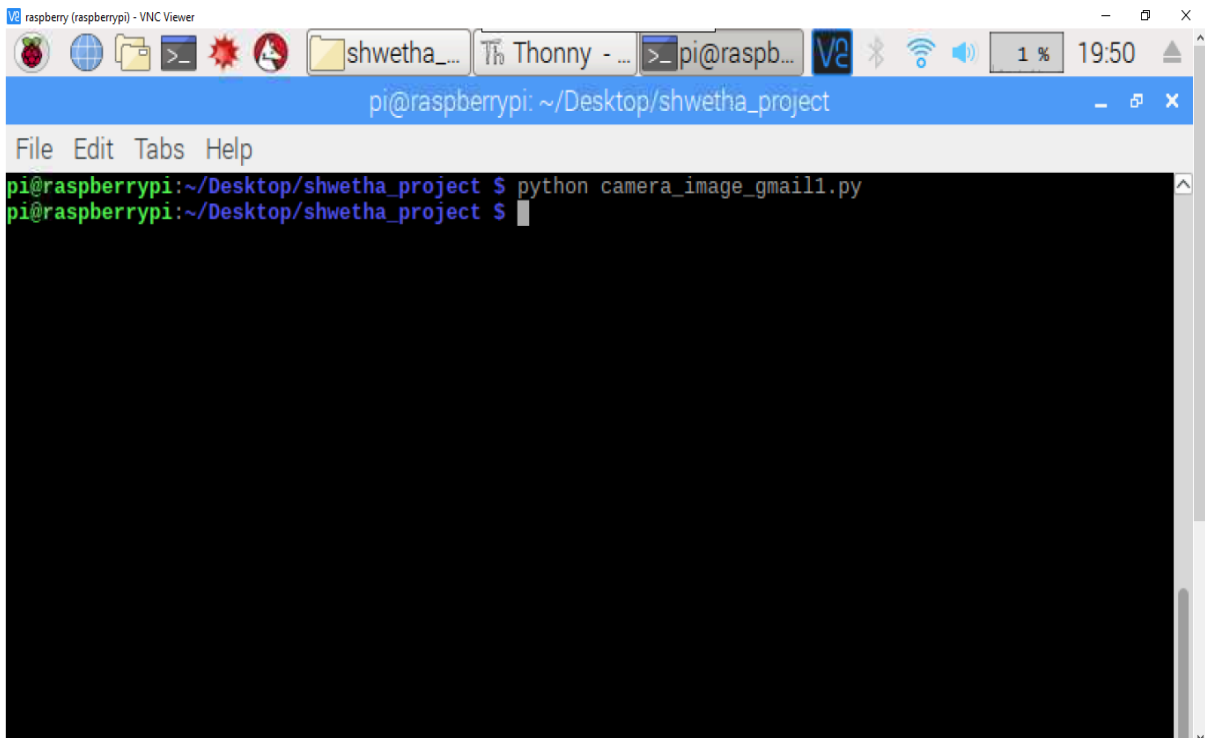Fig 5. Hardware connections of the proposed methodology.
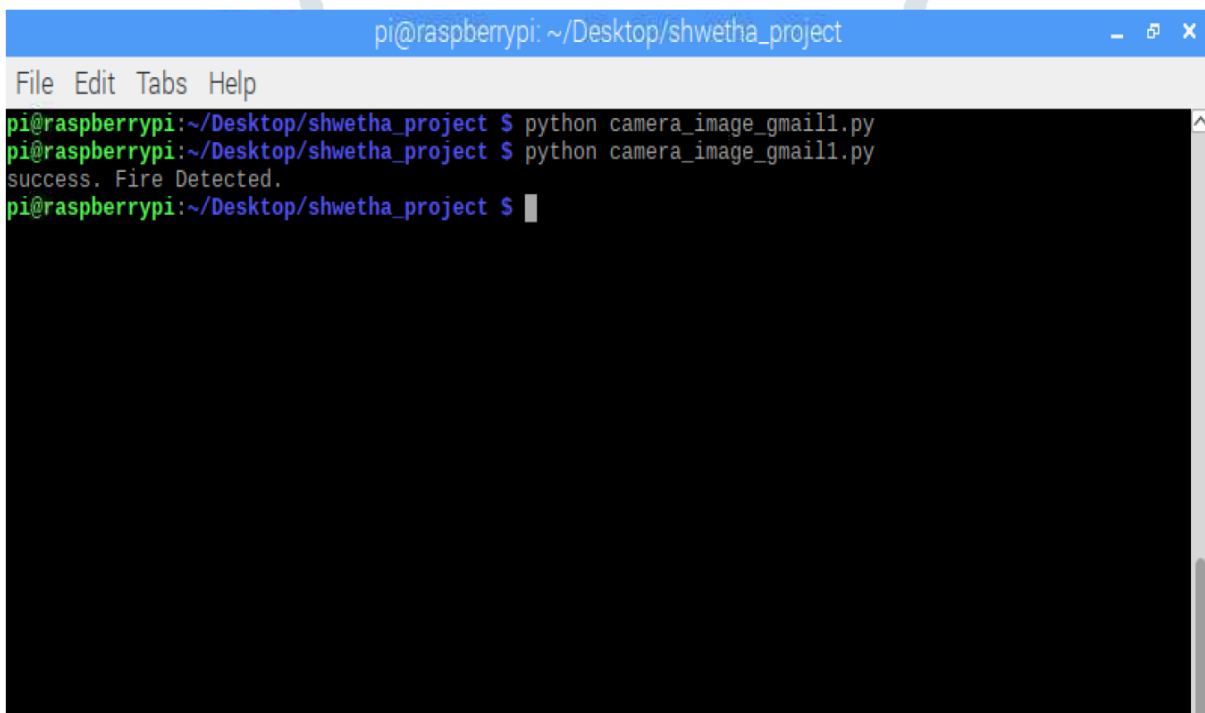
Fig.6 Terminal window without fire being detected

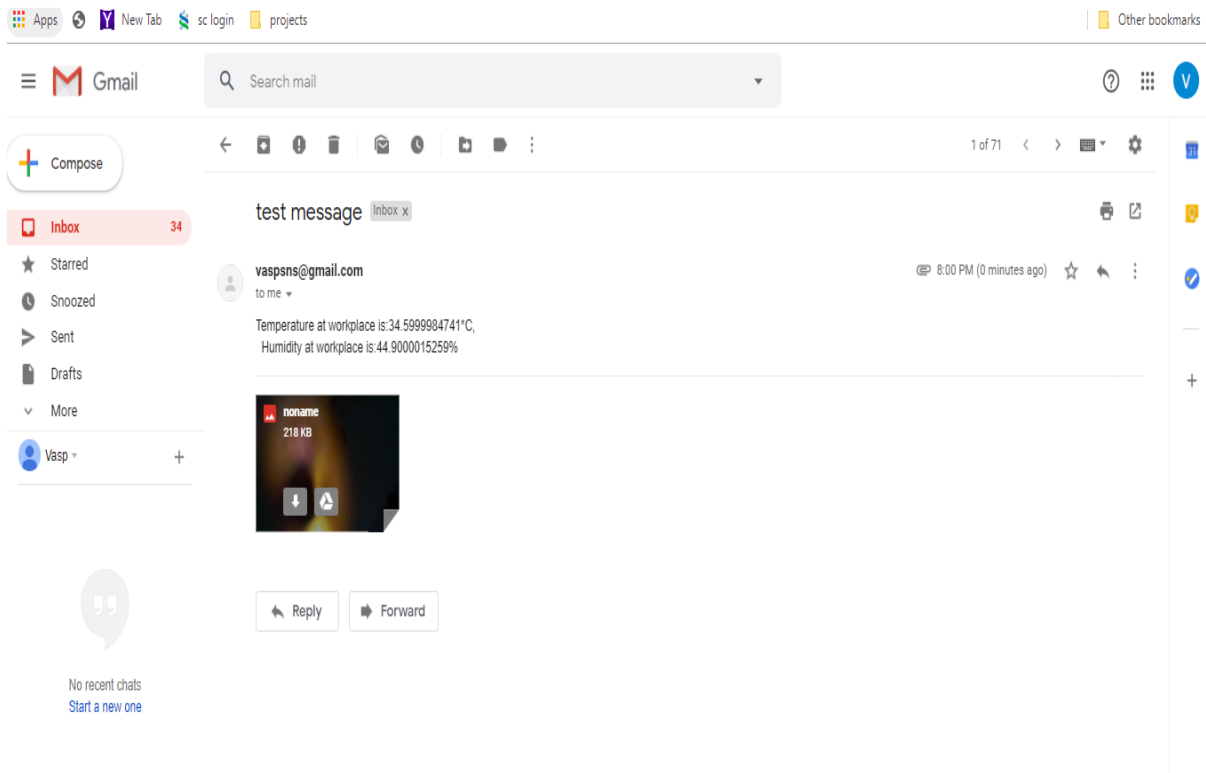

Fig.7 Terminal window when fire is detected

Fig.8 mail which is been sent with the image captured and temperature & humidity details
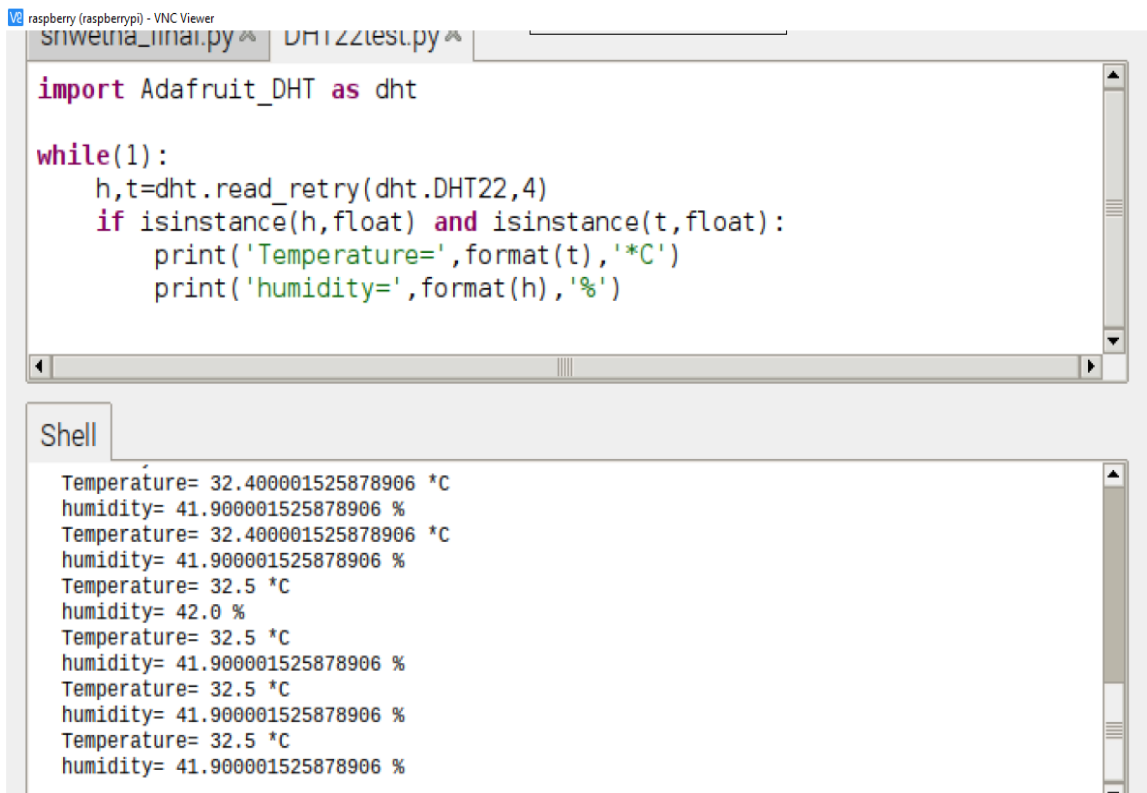

Fig.9 Displaying results from Temperature and Humidity Sensor.

VII. 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.

VIII. REFERENCES

[1] M. S. Obaidat, and P. Nicopolitidis, "Smart Cites and Homes: Key Enabling Technologies", Elsevier, 2016.

[2] 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.

[3] https://economictimes.indiatimes.com/news/politics-and-nation/fire-breaks-out-in-cloth-factory-at-mumbais-damu-nagar/videoshow/67218792.cms.

[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 based on video processing," in Proceedings of International Conference on Intelligent Information Hiding and Multimedia, 2006.

[6] Kwon, Oh-Hyun, Sung-Min Cho, and Sun-Myung Hwang, "Design and implementation of fire detection system," in Proceedings of Advanced Software Engineering and Its Applications, 2008.

[7] Wilson Feipeng Abaya, "Low cost smart security camera with night vision capability using Raspberry Pi and OpenCV" Electron. & Commun. Eng. Dept., De La Salle Univ., Manila, Philippines

[8] S. Tanwar, P. Pately, K. Patelz, S. Tyagix, N. Kumar, and M. S. Obaidat, "An Advanced Internet of Thing based Security Alert System for Smart Home", IEEE 2017

[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 on Computational Intelligence and Computing Research (ICCIC), 2014.

[10] 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.

[11] Manish Kumar, Shubham Kaul, Vibhutesh Kumar Singh and Vivek Ashok Bohara," iDART-Intruder Detection and Alert in Real Time", India Innovation Initiative - i3, 2015, pp. 126-132.

[12] 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.