Resistant Surveillance System Using Internet of Things

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***Abstract*—This paper suggests a methodology to develop a low cost, effective and uniform resistant surveillance system using the Raspberry-Pi. The system can accessed and managed remotely through an Internet of Things (IoT) platform. It senses the flame detection information, motion detection information, biometric detection information and store the data to the web server, where it could be fetched anywhere and anytime through web. Experimental results exhibit that the system is intelligently analyze the sensor data. The system module of the resistant surveillance system is depends on a mixture of ubiquitous different sensing modules, results stored in web servers for awareness. These results can be utilized for home safety. The paradigm aims to notify the home users about their home safety with an option of controlling the sensors on their device connected to the internet. Therefore, this system can enhance home welfare.**

Keywords : IOT, Raspberry-Pi, Sensor, GPIO.

I. Introduction

In todays´ era, securing resources and loss of lives against fire is becoming more crucial. Monitoring residential and commercial arenas throughout is an efficient technique to decrease personal and property losses due to fire catastrophes. The proposed system is extensively deployed in those web sites. The proposed framework offers actual time remark, run time observations and automated alarm system for notification. The main feature of fireplace protection is to reveal an emerging fire disaster in a properly-timed way, and to alert the house occupants and fire disaster catastrophes administrations additionally insures the safety through PIR motion sensor, finger print sensor and web digital camera. This is the function of resistant surveillance system

Traditional module framework does no longer guarantee 24/7 checking from fireplace security. Furthermore, existing fire place protection module could spread anxiety in entire house or constructing as it does not reveal the area of fire place. It simply run alarm for notification as soon as fire is sensed at any area. So that afraid persons may want to begin to run away chaotically. As an end result buildings full of labors in the factories human beings may be devastated with the aid of the outgoing force. Then again, individuals does not get a handle on the quality of the fire and not set up to clear fire influenced fabricating quickly. It could lead a shattering outcome. This paper developed the framework that how we can decrease these mischance. To keep fire from expanding some diligent work are hugely imperative.

For example, breaking electric circuits of the influenced field, discharges fire smothering gas in the mishap spot, illuminating flame, advising building observing advisory group by instant messages.

On the other hand the large fire indicators are planned to react at an underlying stage to at least one of the four main features of burning, warmness, smoke, fire or gas. No single kind of indicators are reasonable for a wide range of areas or flames. Temperature indicators respond to the temperature increment related with a fire and smoke identifier respond to the smoke or gas delivered due to fire crisis. Also PIR motion sensor, finger print sensor and web camera insures intruder detection for security concern. The paper describes the whole configuration and design of system with fire alarm control system with intruder detection model. The proposed system discuss automatic fire alarm system and home security surveillance system. The existing various smoke indicator modules, and their functionality are deliberated completely in [1]. Various straight smoke indicators and their functions are elaborated thoroughly in [2]. For the intruder detection various sensors used such as finger print sensor, PIR sensor etc. and their working discussed detailed in [3]. On the basis of this data, our proposed work is explain with an unbiased to construct a fire alarm and intruder detection system for smart home surveillance using IOT for home welfare. The method-ology is explained in Section III. The system implementation and design is discussed in Section IV and V. We review our proposed work and conclude this paper in Section VIII.

II. Related Work

After going through various papers we found out that the problems such as intrusion as well the fire problems were the hot topics for the researchers over a long period of time. The different techniques such as networking and monitoring the network remotely were used to implemented on large scale. one of the key system types which is fire alarm system has been using widely from the traditional wired networking techniques as the cost of the wired networking is more as compared to the wireless technology, and handing of the cabling is one the difficult task. The wireless technique is one of the easiest and simplest way to overcome the wired technique challenges. So the wireless sensor network are the alternative to the wired technique. As for the wireless sensor

network does not require the maintenance of the system nor the preexisting environment for the infrastructure. The main drawback of the wireless sensor network is, it is less reliable then the wired network. The reliability has been main issue in WSNs. The scientist name Faouzi Derbel being working on the reliability of the networks in WSNs for the residential as well as commercial areas. He was working on the radio transmission parameters and there influence on the buildings. There was proper analysis made on the challenges and requirements of the wireless sensor network to secure the applications like fire detections. The main focused was on the mobile localization, self-association, fault tolerance to control firefighting operations and monitor on real time. In WSNs the rescue support framework and fire control detection is proposed. There has been development made on control firefighting operations such as fire forest surveillance systems. The platform which is used is Tiny OS, on which both the system will be based according to the IEEE 802.15.4. The complexity of the architecture is too high to be used for our application. The system which have designed for intruder detection and same for the fire protection systems.

The requirements of the points, which has to monitor will be larger as the rise of building increases as we are limited with the distances, the amount of low power radios required to get will increase by using more number of repeaters. Basically the repeaters are used to get information of relay monitoring to detect errors. The information to be transmitted will be directly to the surveillance center. So the load will also rise. In order to maintain the stability in the network the load has to reduce. The design we have made which is used with more number count for repeaters is increased as well as the for detectors in local centers constitute the wireless sensor network, the repeaters basically used for monitoring the specific area network and detector will monitor the data and it will be connected with repeaters. The architecture for existing system shown in below figure 1.

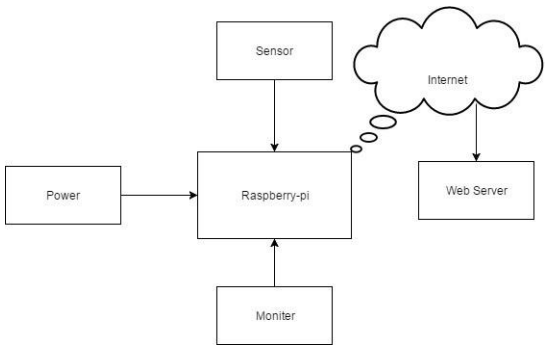

Fig. 1. Existing system Architecture

Several existing biometric recognition systems for smart homes are discussed below. Keystroke dynamics, specifically identify an individual on the basis of the periodicity of typing and the sequence of the words. The parameters that keystroke dynamics follow are flight time and dwell time. Flight time is once the pressed key is released and another key is pressed and the Dwell time is once the certain key is pressed. If the typing period is mismatched then an individual must again repeat his actions [13]. The Speaker recognition may be the automated approach of uniquely identifying an individual on the basis of the voice. The four steps associated with speaker recognition method are pattern matching, voice recording, decisions, feature extraction [14]. The major disadvantage with this Speaker recognition system is everyone can imitate the voice and break the security. The speech recognition is the procedure of recognizing what's being said. An unauthorized user can access the machine by imitating the voice of the speaker [15].

III. Proposed System

Primary block diagram of the proposed automated resistant surveillance system is explained in figure 2. In the proposed work very simplex form of proposed system methodology is given and also provides the basic system software and hardware components required.

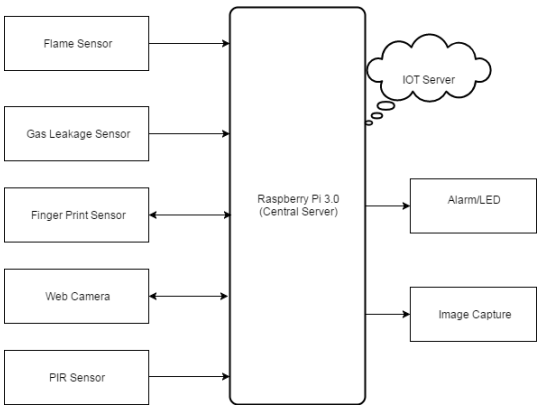

Fig. 2. A Schematic Diagram Of The Proposed System

The important components of this proposed system frame-work are:

1) Sensor: Sensors such as flame sensor detect the fire crisis and notify the sensor actions to the alarm system.
2) Raspberry-pi: Raspberry Pi is a sequence of credit card sized single-board computers developed in the United Kingdom with the aid of the Raspberry Pi foundation to promote the teaching of basic computer science in schools and developing nations.
3) Raspbian OS: It is the computer operating system which is used for Raspberry Pi.
4) Data line: That sensed information of the room passes to display unit through records line (CAT5). Data line also transmits the signal to activate the alarm system.
5) Web server: The threshold value of temperature will be stored and compared with captured value.
6) Display unit: It shows ID of the room which is on fire.
7) Temperature sensor: Temperature sensor was selected to be TMP36. Basic motive behind this is, the sensor's long sensing capability and no need of negative voltage supply.

8) Flame Sensor: Very sensitive to IR wavelength at 760nm to 1100nm mild. When a temperature ranges above threshold then the flame sensor detects the flame and data stored on the database.
9) PIR sensor: A PIR-based movement detector is used to feel motion of human being, animals, or other objects.
10) Finger print sensor: It makes use of a mild-sensitive microchip to provide a virtual photo. The computer examines picture routinely, choosing simply fingerprint, after which makes use of state of the art sample matching software for verification.
11) Web camera: Camera produces image of 5 MP resolution. The raspberry Pi 3 provided USB ports which is interfaced to the web camera. In many of the security applications the web camera integrated with the Rasp- berry Pi 3 serves efficiently.

IV. Proposed System Design

A flow chart for resistant surveillance system is shown in figure 3. Based on the flow chart an algorithm is designed to explain logical work of the resistant surveillance system. Flow chart clearly reveals multiple types of sensors used.

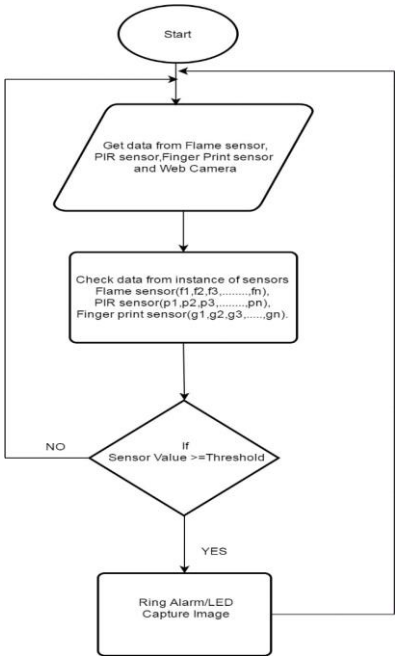

Fig. 3. Flow Chart Of Resistant Surveillance System Implementation

Flame sensor is used to detect the flame having $f1, f2, \ldots, fn$ sensor instances, to detect the motion having $p1, p2, \ldots pn$ sensor instances and to detect biometric having $g1, g2, \ldots gn$ sensor instances. Flowchart begins with a loop which runs infinitely for all sensor values. After that it checks if any of flame sensor have value higher than the threshold? If yes then it rings the alarm and announces the location on the other hand PIR motion sensor detects the motion and finger print sensor scan the finger print. If that finger print matches with the existing one then authorization will complete, or if it fails then capture the image.

The algorithm for resistant surveillance system is shown below in Algorithm 1.

Initialization of sensors and positioning
Prepare sensor data
Flame μ **:=** { $f_1, f_2, f_3, \ldots, f_n$ }
PIR α **:=** { $p_1, p_2, p_3, \ldots, p_n$ }
Finger Print β **:=** { $g_1, g_2, g_3, \ldots, g_n$ }
Threshold **=** γ
SetThreshold
while *sensor value* **do**
  LogSensorData**:=** **(***fμ, pα, gβ***)** //Save Data
  $D \Leftarrow$ Check **if (***fμ, pα, gβ***) ≥ then**
  Return{ True }
end
if !*D* **==** *True* **then**
  Do nothing
else
  LogData**(***fμ, pα, gβ***)** //Save Deceptive Data
  while *D=True && (pα ≥ λ||fμ ≥ λ||gβ***) ≥** λ**)**
  do
    Alarm**::**Ring()
    GetSensorLocation()
    AnnounceLocation ()
    CaptureImage()//Announce Location Of Sensor
  end
end
end

Algorithm 1: Resistant Surveillance System

This algorithm presents very clear and vivid outline of implementation logic. In algorithm flame sensor value instances indicated by fμ ,PIR sensor value instances is indicated by pα, and finger print sensor value instances indicated by gβ. After initialization and positioning, sensor data is prepared. Threshold values are set for all temperature and flame instances. Whenever sensor value cross this threshold, it rings the alarm and announces the location where fire is detected or temperature got increased.

V. IMPLEMENTATION

Various Hardware and Software required to implement the proposed system are discussed below in brief.

A. Hardware Materials

1) Temperature Sensor

Temperature sensor was selected to be TMP36. Basic motive behind this is the sensors long sensing capability and no need of negative voltage supply.

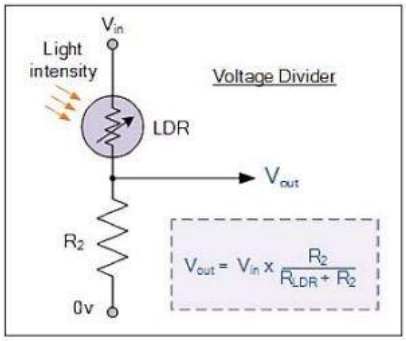

Fig. 4. Temperature Sensor Circuit Design

2) Flame Sensor

Parameter	Vlaue
Temperature Threshold	0 C to 60 C
Operating Voltage	4.5 V to 6V
Range	10cm to 80cm
Output Type	Analog or Digital Output
Dimension	0.6 X 1.3 X 0.5 inch

Fig. 5. Flame Sensor Specifications

3) Finger Print Sensor

Item		Value
CPU		ARM Cortex M3 Core (Holtek HT32F2755)
Sensor		optical Sensor
Effective area of the Sensor		14 x 12.5(mm)
Image Size		202 x 258 Pixels
Resolution		450 dpi
The maximum number of fingerprints		200 fingerprints
Matching Mode		1:1, 1:N
The size of template		496 Bytes (template) + 2 Bytes (checksum)
Communication interface		UART, default baud rate = 9600bps after power on USB Ver1.1, Full speed
False Acceptance Rate (FAR)		< 0.001%
False Rejection Rate(FRR)		< 0.1%
Enrollment time		< 3 sec (3 fingerprints)
Identification time		< 1.0 sec (200 fingerprints)
Operating voltage		DC 3.3~6V
Operating current		< 130mA
Operating environment	Temperature	-20℃ ~ +60℃
	Humidity	20% ~ 80%

Fig. 6. Finger Print Sensor Specifications

4) Raspberry Pi

Fig. 7. Raspberry Pi

B. Software Material

1) Putty: : Putty is open-source and free of cost terminal emulator, serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection.

2) Advanced IP Scanner : : For implementation we need the IP address of Raspberry-Pi in order to use SSH. There are different techniques available to IP address of R-pi but advanced IP scanner will give it very easily.

3) LAMP/MAMP/WAMP Server: : LAMP/MAMP/WAMP are the servers which provides apache as a web server, MySQL as a RDMS and PHP as object oriented scripting language.

C. Hardware Implementation

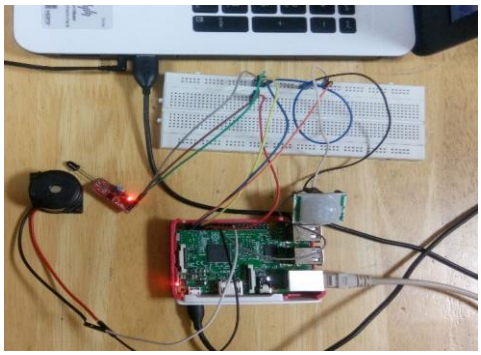

Fig. 8. Implemented Hardware Of The Resistant Surveillance System.

The all sensors are linked to raspberry-pi which include flame sensor, PIR sensor etc. through cables which is shown in figure 8.

Following steps are carried out in order to complete hardware implementation :

1) The Raspberry-Pi is connected to the Breadboard.
2) Flame sensor is interfaced with breadboard to the Raspberry-Pi.
3) PIR motion sensor is connected to the Breadboard.
4) Finger print sensor and web camera are interfaced with Raspberry-Pi.
5) Buzzer is connected to Breadboard.

D. Software Implementation

Raspberry-Pi runs headless the (PuTTy) software is used to interconnect with the raspberry pi without any hardware peripherals like display, mouse or keyboard. This is passible by connecting the raspberry pi to the web server using the internet connection after which supplying PuTTy with the R-Pi's IP address. The purpose of this technique is consume or prevent the power which is consumed by raspberry pi's hardware peripherals. Hence, by applying this technique, the raspberry pi's power consumption restriction is reduced.

VI. Result

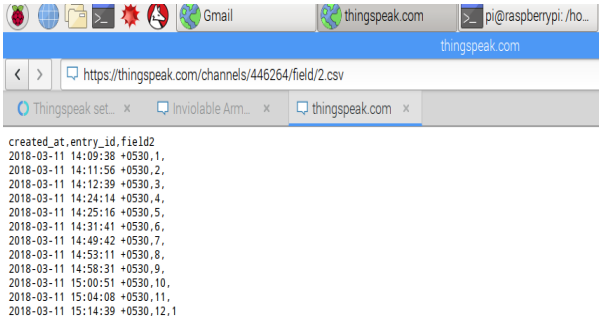

Fig. 9. Shows Flame Detected And Data Stored Into Database

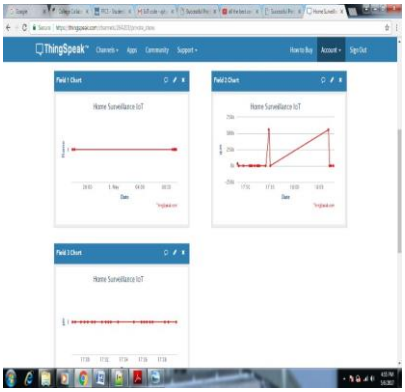

Fig. 10. Uploaded Data On Cloud After Detecting Vulnerable Activity

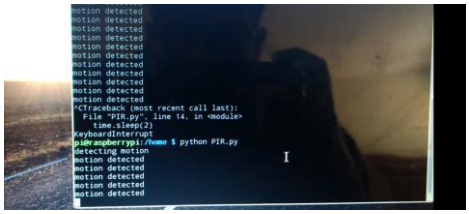

Fig. 11. Shows Motion Detected And Motion Data Stored Into Database

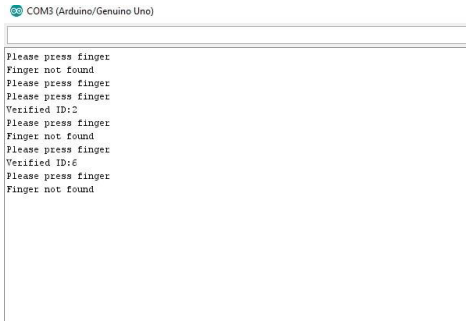

Fig. 12. Shows Finger Print Sensor Data

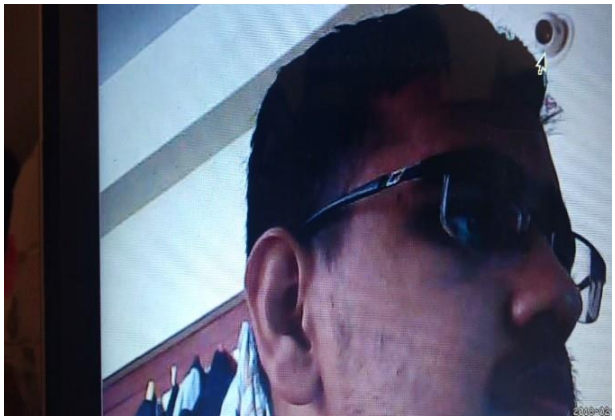

Fig. 13. Webcam Captured The Picture Of Individual Who Is Requesting The System Access

For the demo purpose fire is ignited through the lighter and the flame data is detected and stored in database which shown in figure 9. When flame sensor detects the flame it will store 1 to database at a particular instance of time and will ring the alarm. Along with that the flame sensor data get uploaded on the cloud which is accessible by anywhere and anytime through mobile shown in figure 10. For the intruder detection system PIR sensor sense the motion and displays the message motion detected which is shown in figure 11. Finger print sensor matches the new finger print image with already stored image in the database and gives the result in terms of verified id. And web camera captures the image of individual who is requesting the system access and send it to the configured email id.

VII. DISCUSSION

Some technical problems have been faced during the implementation process:

- Raspberry pi has distinct features including the digital input only and power restriction pointed the choices of compatible units.
- The current draw and poly-fuse in the raspberry pi bound the current to the 5V GPIO pin, because of this the number of sensors interfaced with the raspberry pi get restrict. If we connect more sensors to the pin then the high possibility of damage to the raspberry or sensors.

VIII. Conclusion

There's a huge need of implementation of resistant surveillance system to provide protection and safety for assets from threats and intruder. The paper proposes the fire resistive framework as well as intruder detection system using different sensors and cameras has explained. For detection of the intruder framework module does all vital activities. Therefore it's a whole package of fire protection system and intrusion detection module. This kind of framework is absolutely necessary for the protection of homes, factories, government offices ,crowded places, military purpose

complex malls, storage places and big shops. Government should impose rule that resistant surveillance system must be installed. Hence, as a result, this noble framework can used in each and every buildings and cities to defend valuable lives and property from fire crisis and promise the safety.

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