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WIFI BASED HOME SECURITY SYSTEM USING RASPBERRY PI AND ANDROID APP

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ABSTRACT

In present scenario security is the important issue. Protection from theft, fire, and leakage of flammable gas like LPG are the essential necessities of the home security system. CCTV camera is available for inspection purpose but it is very expensive. It requires 60 -65 GB of space approximately recorded by 3 MP camera for 24 hours CCTV footage and also requires manpower for surveillance purpose. This paper presents the implementation of a system for home surveillance using Raspberry Pi. As Compared with the other systems, Raspberry Pi and Android application system give better efficiency and it is also less expensive. This new version of Pi used has onboard WIFI module. In brief, Raspberry Pi is used to record data from PIR, Magnetic door and gas leakage sensors and then push notifications from the server to Android device. In addition to that Camera is used to take an image of the intruder detected by PIR sensor and sends the images to the Android app. The need for a microcontroller and wireless transceiver is eradicated by the IOT module, thus it makes the system compact, economical and convenient to use. The main advantage of the system is that the owner can monitor their home or system anywhere from the world and can take action according to the situation. To get a notification for monitoring purpose an Android application is required.)

Keywords: Raspberry Pi, Sensor, Android phone.

I. INTRODUCTION

Nowadays, making sure safety and security has become an unpreventable necessity. It plays an important role in the surveillance of houses and industries also. Today's technology requires a user -friendly device which is economical in cost and most effective as well and which is provided by Raspberry Pi and Android app. In today's generation, it is very convenient to send the notification to the Android app because of widespread use of smartphones. The whole system is distributed into two parts. The first part comprises setting up the Raspberry Pi and interfacing it with the several sensors. The second part consists of developing the Android app and connecting it to the server. And the Raspberry Pi has inbuilt Wi-Fi module because of that the transmission becomes simpler and faster. It also helps the owner to monitor system globally throughout the world. This system is simple to implement. It gives alert instantaneously and also it is economical for residential and personal use and becomes very convenient because of the smartphone. This System is designed to improve the security, flexibility and to remove the flaws of the existing system.

II. LITERATURE SURVEY

There are several techniques available for inspection. Among them, CCTV is the most commonly used one. But it has its own snags. It requires 60-65 GB of memory to take one day CCTV footage. Wireless Sensor Networks (WSN) technique also has been used for surveillance. Sensor nodes are wireless so they can be put anywhere. But it has some limitations they cannot use techniques like camera and Android Phones.

Zhau et.al. [1] proposed wireless sensor network system monitored by programmable system on a chip. Here zig bee module is used for wireless communication. This system depends on sensors network and it does not use modern techniques like camera, IOT, smartphones etc.

Rakesh et.al. [2] proposed a system using Zig bee protocol and Beagle board single board computer. The important feature of this system is remote altering on fire and intruder of the system. It uses improved techniques such as Camera, GSM, FTP server etc. But it is not suitable for a live recording.

Muheden et.al.[3] in their paper explains a WSN based fire alarm system using Arduino. The system is purely based on sensor alerts and it lacks other features like camera, web server etc.

Patel et.al. [4] proposed a system which is smart enough for supervision purpose. An Owner can be monitor remotely using the Android app. The system is connected to IOT. It will give notification, once the intruder gets detected. But in this system, Wi-Fi module is used for Wi-Fi connectivity.

Surthy et.al. [5] designed an IOT based security system using Raspberry Pi single board computer. This system uses wireless sensor nodes and controller section for surveillance.

Ansari et.al.[6] designed a system for surveillance purpose using Pi it gives information related to sensors only but it does not have features like camera streaming etc.

Tajika et.al.[7] proposed a system to make a domicile network which delivers convenient accommodations via Bluetooth. But the drawback of this system is that this system is high consumptive and it requires high budget so that it is not convenient to use in the security system.

Dhake et.al.[8] developed an embedded system for surveillance of home which evaluates the development of a low-cost.

Bhaskar et.al.[9] proposed a system for home automation that is for monitoring and controlling using microprocessor and controller. The main objective of this system is to do inspection using the camera and to detect the status of door.

Patil et.al.[10] proposed a system for theft detection using Raspberry Pi. This system will give alert to the owner via message or email through GSM modem if any intrusion is detected. Also, one additional provision is given in this system is that when an intruder is detected the door will close immediately after getting command.

III. PROPOSED WORK

The main objective of the system is to develop an intelligent home inspection system which can be scrutinized by landlord distantly throughout the world via the android application. This system is connected to the cloud, therefore; the system can send the push notification to the Android device when an intrusion is detected inside the room. It also gives the current status of the gas leakage sensor, proximity sensor, magnetic door sensor and temperature sensor. The surveillance system can be monitored by a permitted user remotely through the smartphone. Smartphone has the feature of continuous monitoring with alarm alert and also we can get the notification and has WIFI access. With the avail of these potent smartphone applications, the system becomes more astute, more expeditious and more perspicacious. The efficiency of the proposed system is approximately 60% greater than the existing system. Because the Raspberry Pi used here is 10 times faster than the original Raspberry Pi.

This scrutiny method comprises mainly two section:

- The first part consists of setting up the Raspberry Pi and interfacing it with the sensors.
- The second part consists of developing the Android app and linking it to the server for notification.

IV. IMPLEMENTATION OF SYSTEM

The system block diagram is divided into two parts. One section is the Raspberry Pi3 for monitoring activities which also contains different sensors for security. It is controlled by Android Phone remotely if there is network connectivity. The system consists of a camera to snap the picture of an intruder or any unauthorized person.

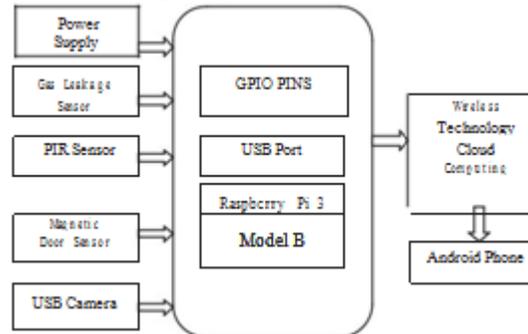


Figure 1. Block Diagram of Proposed System

The figure 1. Shows, Raspberry Pi is connected to the PIR Sensor, Gas leakage sensor, Magnetic door sensor, Temperature Sensor, and camera. The Pi collects the data and if the Gas or Temperature values exceed the critical value or if the intruder is detected by PIR sensor, then Pi alerts notifications via an Android application on a smartphone. The user can also monitor the values remotely through the android application.

The system is divided into four sections as shown in fig 2. The first section is the Sensor section. Those sensors send the data to the controller that is Raspberry Pi which is the second section of the system. Third and fourth sections comprise cloud server and smartphone.

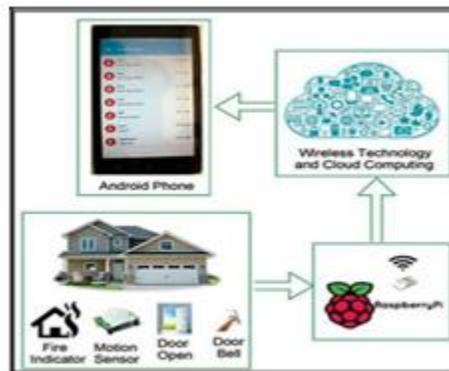


Figure 2. Implementation

V. HARDWARE REQUIREMENT

- **Raspberry Pi**

The Raspberry Pi3 is small and affordable computers. It uses a keyboard and mouse. The Raspberry Pi has inbuilt Wi-Fi module. It is ported to the Raspbian operating system. It has 1GB RAM, one Ethernet port, 4 USB ports, micro SD card slot, power supply port, and audio jack.

GPIO: It is the important feature of the Pi. Using GPIO pins of Raspberry Pi we can connect external devices with Raspberry Pi.

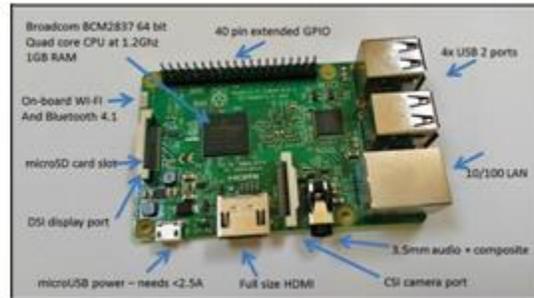


Figure 3. Raspberry Pi 3 Model B

We can verbally express it as an interface between the Raspberry Pi and the external devices. The Raspberry Pi model B board contains a single 40-pin among them 28 are GPIO pins, others are power, ground pins and some are special purpose pins.

Table I. Raspberry Pi 3 board specification

Name	Value
Working Voltage	5V
Processor	32-bit quad-core ARM Cortex-A7 processor
Model	Pi 3 Model B
RAM	1 GB
Broadcom	1.2GigaHz, 64-bit ARM Cortex- CPU

Figure 3. shows the Raspberry Pi 3 Model B used in this project. This board has 1.2GHz, 64-bit quad-core, 32-bit quad-core. It is 50% faster than Pi 2 and 10 times faster than original Pi. The main advantage of using this board it has onboard 4.1 Bluetooth and 802.11n WIFI.

• **Sensors**

PIR Sensor: The PIR sensor is Passive Infra-Red which is also called as a Pyroelectric device. It is electronics device used in the household or industrial area to detect the intrusion by sensing motion. A PIR sensor is an electronic sensor that measures IR light radiation senses the movement of human being, animals or other objects in its area. It is made up of specific material which is sensitive to IR. When the warm-blooded body passes from an effective range of about 7m, and a field of view less than 180 degrees it detects the intrusion. Human bodies and animals have the temperature above absolute zero hence it emits heat energy as radiation. This is infrared radiation which human eye cannot see. When any living being comes in the specified range of PIR then it detects heat and gives output in the form of voltage. A PIR sensor detects the changes in it varies as the temperature varies, and also depends on the surface of the object.

Temperature Sensor: DS18B20 is the best sensor for home security and weather station. It has an alarm system when the temperature crosses the default value it gives the alarm. The Advantages of DS18B20 Sensor: It has a one wire interface. It requires no external components. It is user definable and has a nonvolatile temperature alarm settings.

Gas Sensor: MQ6 Gas Sensor has high sensitivity to Liquefied Petroleum Gas and propane. It retorts very quickly and efficiently. It even has a long life. They can be used to detect gas leakage in Industries and Houses. It has a very simple drive circuit. A green led is triggered by the detection of gas.

Magnetic door sensors: Door sensors have one switch and one magnet which makes an enclosed path. If somebody opens a door, the magnet is dragged away from the switch, the circuit breakdowns and it gives a trigger. Magnetic Switch is often used to detect whether the door is open or close.

3. USB Camera

The image of the burglar is snapped by the USB camera and that image will be sent to the USB port of Raspberry Pi. We have used here the USB Camera model 2.0. For capturing images and interfacing, we have to install some packages on Raspbian. When an intrusion is detected by PIR sensor it sends a signal to Raspberry Pi, that signal is sensed by Pi and it gives output to the camera to capture the image. This image is stored on SD card and then it gives notification to the owner through the Android app.

- **Android device**

Android device is required to observe the captured images remotely and also receive the notification message. Nowadays everyone uses smartphones. So it is very convenient for users to get security related alert notification on the Android phone through Android app.

VI. PROJECT IMPLEMENTATION

1. Hardware

Raspberry Pi should connect with and the mouse, Keyboard, all the sensors, power supply and net connectivity. The first and primary function of the system is to set up Raspberry Pi with the preferred Operating system. Figure 4. Shows the setup of Raspberry Pi.

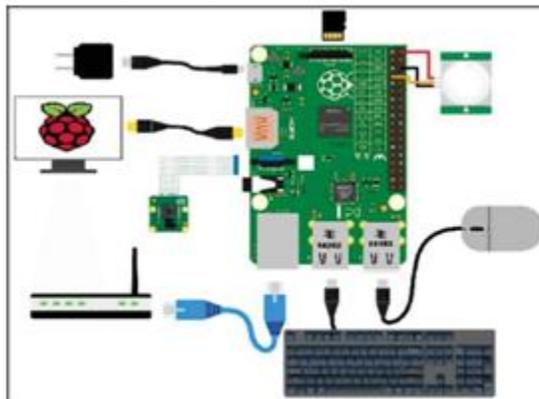


Figure 4. Raspberry Pi Setup

v. Setting up Raspberry Pi with Raspbian operating system. Raspbian is an operating system just like Ubuntu, Windows. The only difference is that it's for Raspberry Pi only and it is Linux based. Below some steps are given to set up Pi with Raspbian operating system. The preferred spelling of the Go to official site of Raspberry Pi

Go to official site of Raspberry Pi, download 'Raspbian Stretch with desktop', and save this. Download etcher.io and install it.

Start Etcher and select the Raspbian image you have downloaded.

Select the SD card drive. Then click Burn to transfer Raspbian operating system to the SD card.

Interfacing Sensors with the Raspberry Pi. Programming for the system is done by using Python language. The sensor is connected to Pi and it sends a notification to the Android Phone and cloud via WiFi connectivity.

2. Software

Here we have used two application Cayenne and Pushetta for notification purpose.

i. Cayenne: It currently supports Raspberry Pi, Arduino and Lora devices. Select the device you would like to get started on your IoT project. Install Cayenne android app on mobile. Install Cayenne onto the device and then manage your Raspberry Pi using online dashboard.

ii. Steps for installation of Cayenne on Raspberry Pi:

- A Install libraries
- B Install the agent
- C Install software
- D Install drivers

iii. After the completion of installation, the Online Dashboard will appear Raspbian desktop.

Cayenne works with temperature, pressure, distance, motion and generic sensors connected to your Raspberry Pi devices.

- Select Sensors, Temperature, then BMP180, PIR Sensor.
- Click Add Sensor.
- Now it will give the updated status of all the sensors which we have connected to the dashboard

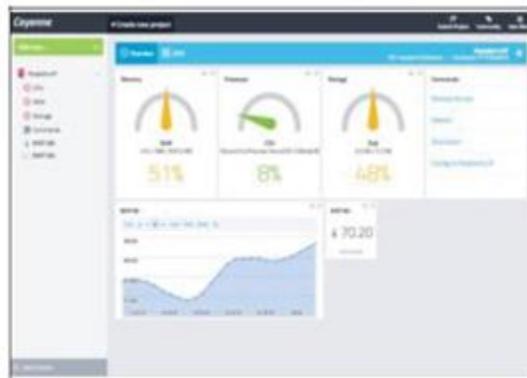


Figure 5. The dashboard of sensor status

- Add new sensor on the dashboard.
- Give Trigger
- Now drag Raspberry Pi from devices.
- Select the sensor. Then select notification and add an email address or phone number to which the text message is to be sent.
- Click “save trigger”.
- It gives alert message whenever the value of temperature sensor is over 40 degrees Celsius.
- Repeat the same procedure for other sensors.

iii. Pushetta Application: It is a simple intrusion detection system which sends a push notification when someone enters a room and also gives the status of other sensors. Pushetta gives push notification from the cloud, but before this registration on Pushetta website is mandatory.

Steps for Pushetta Application:

1. First of all, register on Pushetta web site.
2. Then log in and create your channel. On that channel notification will send. Subscribe channel in which we are interested to send a notification.

3. Now use Raspberry Pi then write the code in python language for this.
4. API key of your channel should be written in your python code.
5. Install Pushetta app in your android app. Subscribe your channel.
6. Now your sensor data is sent to the android app in the form of notification. In case of PIR sensor when the intruder is detected. The picture of the intruder is snapped by the camera and it sends a notification to the Android phone.

Subscription window and notification window of the Pushetta are shown in the figure below

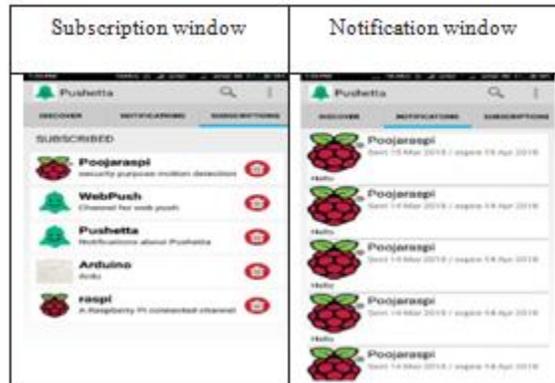


Figure 6. Snapshot of subscription and notification window of Pushetta

Android Application:

WSN Smart Home: This android app is created to get notification from the server. Two clients are connected to the one cloud server. One server is Raspberry Pi which is connected to the main server via IP address. Data is sent from Raspberry Pi to Cloud server and Server to second client which is an Android application.

Python Programming:

Python programming language is used for programming. Python is a reliable programming language that is convenient and suitable to use with Raspberry Pi. It even uses very fewer lines of codes as compared to C or C++. In our project, we use Python in order to make connections with Raspberry.

VII. RESULTS

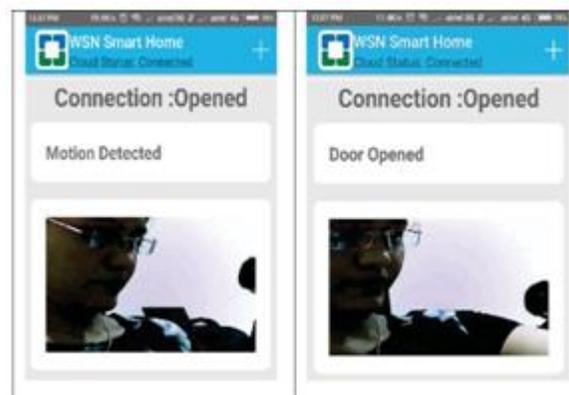


Figure 7. Results of WSN Smart Home App

Figure 7. shows the results of WSN Smart Home App that is images capture by the camera which is send to server and then to android app.

VIII. CONCLUSION

Smart surveillance systems significantly contribute to situational awareness in runtime. Its aim was to design a system in such a manner that it can be utilized for several surveillance areas such as banks, industries, home etc. Thus the system is proposed as a smart scrutiny system accomplished for capturing a picture, collecting current status of sensors and conveying to a smartphone. This work is implemented using Raspberry Pi and Raspbian operating system. The System is expedient as it proposals consistency and confidentiality on together sides. After attainment of notification essential action can be taken in case of emergency conditions. This system is designed to fulfill the objective that common man can afford and operate easily.

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