

Home Security System based on IOT: A Systematic Alert System

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Abstract – Many security systems are available in the market, but they are very expensive, so normal people cannot afford them. Not only the system, but the installation and maintenance cost are also too high. In addition, the existing security system works 24X7, thus requiring a large amount of storage space. So, this paper focuses on building a low-cost, beneficial, and efficient home security system that occupies less storage. Here, Raspberry pi acts as a central system. We proposed a systematic approach to alert users. If an intrusion occurs, it immediately sends an alert by sending notification and e-mail to the user over the internet. The whole system can be monitored from anywhere in the world and the owner can receive alerts over the internet. With the night vision camera interfaced with raspberry pi, makes it usable at daytime as well as at night. The proposed system is entirely programmed with python 3 language.

Key Words: Home security system, IOT, intruder detection, alert system

1. INTRODUCTION

Nowadays technologies are increasing rapidly, which makes people's life easier and more comfortable. One of the technology trends is Internet of things. It enables devices to connect over the internet to collect and exchange data without any human involvement. Urban regions are evolving into IOT-enabled smart cities as technology advances. Smart cities use IoT devices to improve infrastructure, safety, services, and many more. However, security is currently the biggest problem. Many upgraded systems are released in the market though they are not sufficient to handle the issues. One of those major issues is housebreaking and this paper focuses on cut-down the issue by giving a systematic approach to the proposed security alert system.

2. LITERATURE REVIEW

The paper entitled "Towards Smart Home Automation Using IoT-Enabled Edge-Computing Paradigm" presented a fully automated IOT-based platform for sensor connectivity. The purpose of the project is to provide a low-cost automation solution that can be controlled by a centralized system. Raspberry pi is used as a central controller for this system. In this project, the system contains a webpage for monitoring the home. It allows owner to stream the camera module

which is connected to the raspberry pi. MQTT protocol is used to transmit the sensor data to the end-user [2].

In the concept of infrared radiation for motion detection using PIR sensor, the PIR is connected to CC3200 microcontroller with inbuilt wi-fi module. Whenever the sensor identifies the movement, microcontroller processes the data and gives the output as either high or low. If the value is high, there is a motion detection otherwise if the value is low, there is no intrusion. The output is visualized by a chart using ThingSpeak cloud platform [1].

A continuous video of the intruder is taken when the human intrusion is detected. Using face recognition technique, the intruder image is being compared with the images in the database to avoid false alarm. If the image of the intruder is not matched with the images in the database, then the message and the image of the intruder is being sent to the owner through mail. Through an application the owner can acknowledge if he is real intruder so that the alarm can generate [4].

The paper [3] describes an IOT concept for home security system. The raspberry pi is being used to serve as a data processing centre. When a human object is detected by the PIR sensor, the system activates the camera module to capture pictures. The image data is sent to the web server via wi-fi communication. Upto 5 images can be sent to the owner to limit the storage space. The image can be viewed and downloaded by the owner for reporting to authorities. The intrusion log can be found from the web server.

The paper [6] describes an inexpensive home security system that works in real-time. Raspberry pi is used as a main computational device. The webcam and PIR motion sensors are connected to raspberry pi in order to detect and fetch the signals. The webcam is used to capture the intruder image and the raspberry pi fetches the image and send it to owner through email services.

3. PROPOSED METHOD

In this paper, we are proposing a Home Security System with a systematic alert where the input is taken from a live person. The IoT-based Security System uses Raspberry pi as a central system. The PIR motion sensor and the Pi night vision camera is linked to the raspberry pi unit. Sensors are

implemented in the home such that they are not visible. As soon as someone enters the house, the sensor will detect their movement immediately, and the signal will be passed to the raspberry pi. Based on the input signal, two alerts will be generated.

3.1 Notification Alert

At first, notification alert is sent to the user. To alert by notification, we proposed an application called IFTTT (If This Then That). In this system, webhook is used as a trigger service. If web request is invoked, notification alert will be sent to the owner from the IFTTT application.

3.2 E-mail Alert

Based on the input signal, a camera linked to the raspberry pi will record a video. Video frames are collected from the Pi night vision camera and are converted to viewable format. To transmit the video through email, SMTP (Simple Mail Transfer Protocol) is used to send to the owner. The owner can view the video footage from the mail sent by the raspberry pi. The intruder video footage is set to 20 seconds, to avoid occupying more storage space. Every video takes up to only 2MB of storage space.

An Initializer button is connected with the central system to ignore unwanted motion detections. It can be turned ON manually, if the owner is not available. By default, it is OFF.

In this system, it operates both day and night as we incorporated the Pi night vision camera module. The flow chart of the system is shown in the figure 3.1.

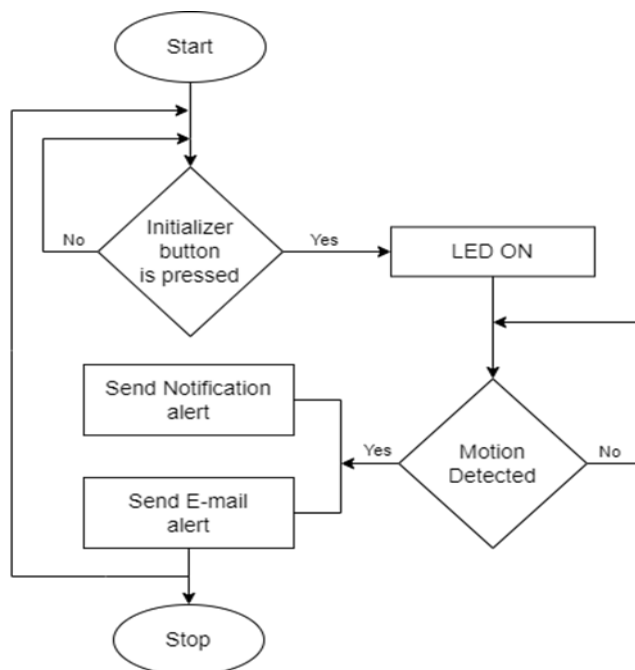


Fig - 3.1: Flow chart for IOT-based home security system with a systematic approach to alert system

4. SYSTEM ARCHITECTURE

4.1 Block Diagram

The System architecture of Smart Home Security System is shown in the figure 4.1. Raspberry Pi, Pi Camera, PIR sensor, and Power supply forms the entire security system to be installed at the required place. PIR motion sensor is connected to GPIO pins of Raspberry Pi.

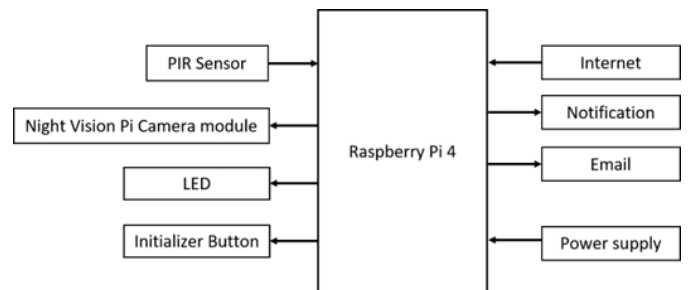


Fig - 4.1: Block diagram

4.2 Component Description

Raspberry Pi:

We have used Raspberry pi shown in the figure 4.2 as a central system. To detect motion, it connects a camera module and a PIR motion sensor. The Simple Mail Transfer Protocol is used to send the email to the owner after importing SMTP. The system is entirely programmed in Python 3 language.



Fig - 4.2: Raspberry Pi 4 Model B

Pi night vision camera:

The night vision camera module shown in the figure 4.3 operates both during the daytime and during the night time. The lens has a viewing angle of 75.7 degrees in such a manner that it reduces the chance of blind spots occurring. There is a camera interface port on the Raspberry Pi that connects it to the camera module.



Fig – 4.3: Pi Night Vision Camera

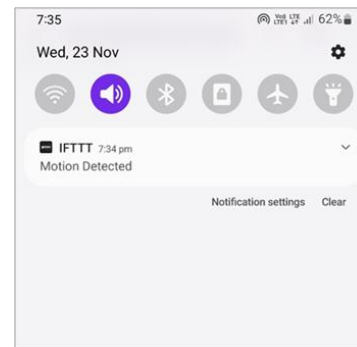


Fig – 5.2: Notification alert

PIR motion sensor:

The passive infrared motion sensor shown in the figure 4.4 is used to detect intruders in a room. It has a sensing range of 3 meters to 7 meters, which makes it possible to detect intruders throughout a whole room.



Fig – 4.4: PIR motion sensor

5. RESULTS AND DISCUSSIONS

5.1 Entire System

In this section, we can see the results of IoT based home security system which is implemented in prototype with all the system components as shown in figure 5.1. The required components are interfaced with the Raspberry Pi.

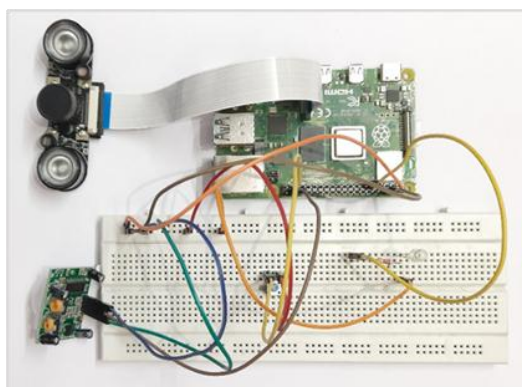


Fig – 5.1: Entire System

5.2 Notification Alert

In Figure 5.2, The webhook is triggered in the event of motion detection and a notification is sent to the owner by IFTTT.

5.3 Email Alert

In Figure 5.3, After a few seconds, an email alert is sent to the owner with video footage of the intruder. The owner can view the footage, and can take further steps accordingly.

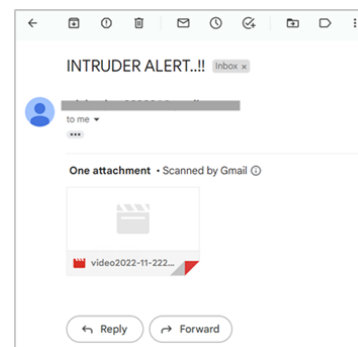


Fig – 5.3: Email alert with intruder footage

6. CONCLUSION AND FUTURE WORKS

The IoT based home security system has been designed and developed with Raspberry Pi 4 and a Pi night vision camera. The user can access information at anytime and anywhere through smart phones. When movement is detected, the camera records the video and sends it to the owner. As a result, the designed system works successfully. Using computer vision technology, the alert system can bypass animal intrusions. With the use of object tracking the camera turns along with the intruder. With the upcoming technologies, home security systems will be enhanced.

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