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IoT based Thief Detection and Surveillance System using Raspberry Pi

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Abstract - Security has become the most challenging task. In order to keep our property safe from thieves and from getting destructed, it is necessary to safeguard the property. In our absence, we propose the theft detection and monitoring System using IOT and Raspberry Pi to secure and guard our house. The older methods used for surveillance includes CCTV cameras but it becomes costly as it needs computers and manpower for monitoring. Compare to the actual System, Raspberry Pi is much reasonable with better resolution and low power utilization features. The system keeps tracking the entire floor for movement. Even a single step anywhere on the floor is tracked and the user is alerted through mail using IoT. The images are captured and send through the email to the owner which provides real-time alerting and better security.

Key Words: IoT ,HTTP Protocol , PIR Sensor, Raspberry Pi , GMAIL, Camera.

1.INTRODUCTION

In the current scenario security is one of the most challenging tasks. We keep our capital and other valuable belonging in our house, but there is no assurance of their safety, many systems are designed to keep track of their properties but still, it is difficult to obtain a hundred percent security in real-time. The security systems nowadays include CCTV surveillance. Although it is used on a large scale but continuous manpower is required for its secure results. Along with that CCTV surveillance is very costly. To overcome this, we have built IoT based thief detection and alerting system using raspberry pi, it is a system that tracks the movements in your house in your absence and alerts you through email. By sending real-time images and also provides live video streaming and also reduces the manpower required for keeping a constant eye on the surveillance. The system also provides automatic control over the door which can be done remotely, which provides a highly secure and controlled environment. Some Application are Home Security, Used at Bank and Can be used at jewelry shops and Malls. The Main objectives of paper are

A. To create a surveillance system with the least manpower.
B. To get real-time alert messages when an intruder arrives.
C. To reduce high storage requirements in CCTV surveillance systems.
D. To demonstrate HTTP protocol.

The Complete paper has been organized in different sections as

Section 2: introduces block schematic.

Section 3: proposes the algorithmic flow.

Section 4: explains the hardware requirements with Sensors.

Section 5: Software Requirements are given

Section 6: Discusses implemented result and finally paper is concluded in section 7

2. BLOCK DIAGRAM

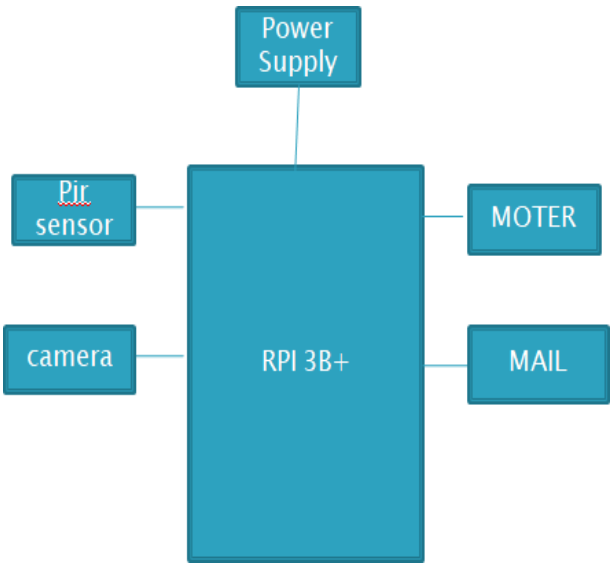

Fig 1. Block diagram.

The surveillance system has a PIR sensor that is used to detect movement. The Camera is interfaced with raspberry pi which captures the images. The PIR sensor is placed at the entrance from where thieves can enter the house. Once the doors are locked, we must turn on the system. Whenever a thief enters the house, the motion is detected by PIR sensors and it sends the data to the Raspberry pi. The camera is turned on and

images are captured and sent to the owner through email, now the owner can control the gate

3.PROPOSE ALGORITHM FLOW

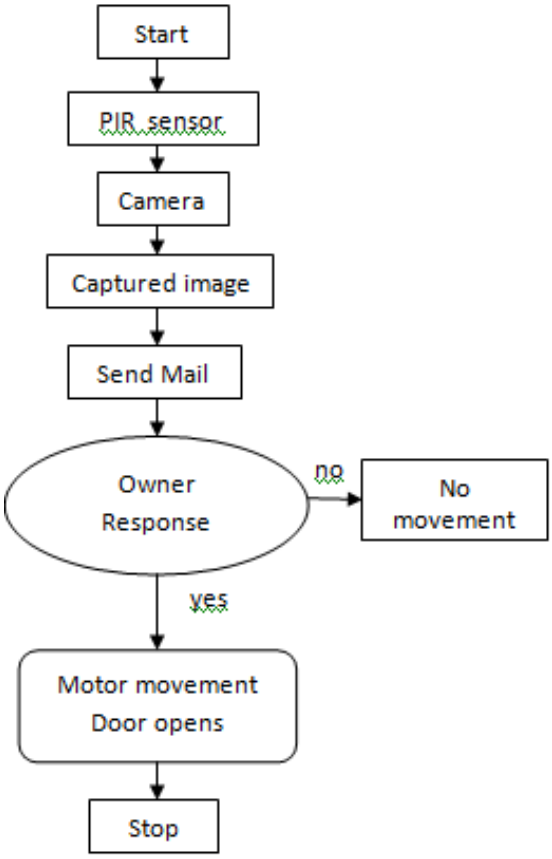

Fig.2 Flow chart of a designed system

Step1: System is started when power supply of 5V is applied and is connected with internet.
Step 2: If any object enters in range of the PIR sensor, it will sense the motion and high digital pulses are send to controller.
Step 3: Camera is triggered and activated, it will capture the images .the images are stored in .jpg format. The camera is controlled and managed by open CV, it is a computer vision library tool
Step 4. The captured image is send to owner through Email, which is done by using smtplib. The text and attachments are encoded in to base64.
Step 5: When owner receives the mail, it provides the ink to a webpage which can be accessed by owner by login Id and password.
Step 6: A Servo motor is fixed at the door which enables door to rotate for 90 degree. Owner has control over the motor and door can be controlled remotely.

4.HARDWARE REQUIREMENTS

The proposed circuit diagram is shown in Fig 3

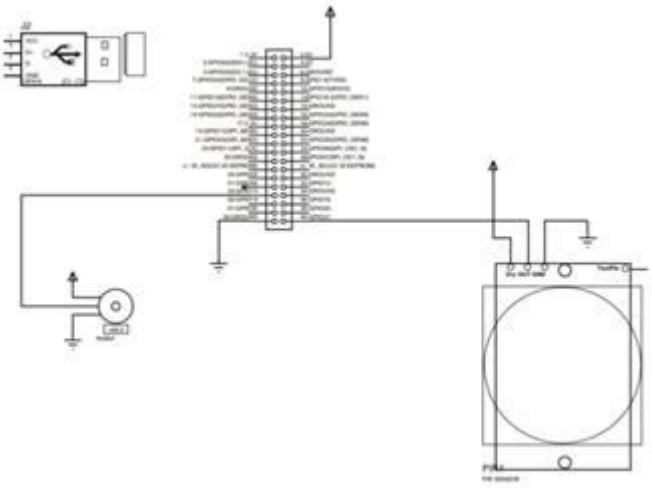

Fig.3 Circuit Diagram

It has various Hardware Components as

- Raspberry pi 3B+
- PIR sensor
- Camera
- Servo Motor

A. RASPBERRY PI

Raspberry pi is Quart core 1.2 GHz Broadcom BCM2837 64bits ARMv7 powerful processor Shown in Fig4. It has Inbuilt features: -

- 1 GB RAM
- 40 GPIO pins
- 4 USB 2 ports
- CSI camera ports
- BCM43143 WIFI on board.

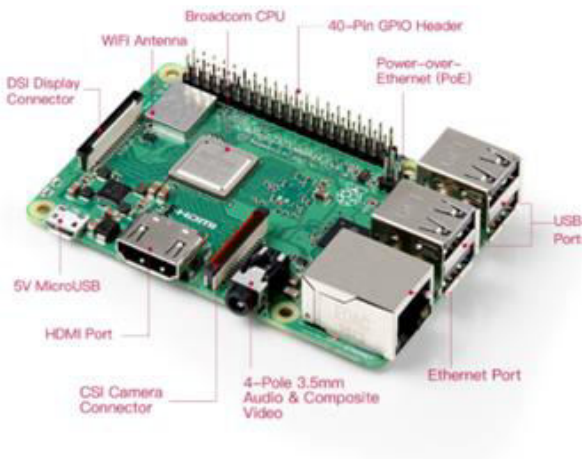

Fig 4. Raspberry pi 3B+

B. PIR SENSOR

The PIR sensor stands for Passive Infrared sensor. It is used for detecting the presence of Human beings or animals. This sensor has three output pins 1. Vcc, 2. Output and 3. Ground Shown in Fig 5. Along with Pin details in Table 1.

Fig 5.PIR Sensor

Table1: Pin configuration of PIR sensor

pins	Pin name	Description
1	Vcc	Input voltage Can range from 4.5V-12V
2	Output	Digital pulse high (3.3V) when triggered digital low(0V) when no motion detected.
3	Ground	Connected to ground of circuit

Features of PIR sensor: -

- The input voltage varies from 4.V to 12V (+5V recommended)
- Output voltage is High/Low (3.3V TTL
- Human movement and object movement can be detected.
- Total distance around 120° and 7 meters can be covered.
- Operating temperature from -20° to +80° Celsius

C. CAMERA

UVC (Universal Video Class) Driver Camera is applies to all devices or functions. Inside the composite devices, which are related to all video functionality. It uses USB for connection which allows high-speed data transfer. The Came structure is shown in Fig 6.

D. MOTOR

Using PWM pins of the Raspberry pi servo motor is attached. The Servo motor used is SG90 it is a small servo motor that does not require any motor controller it can be controlled by any servo code. Specifications of servo motor shown in Fig 8 are

- Rotation: 0°-180°
- Gear Type: Plastic
- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°

Fig 6. Camera

Fig 7. Servo motor

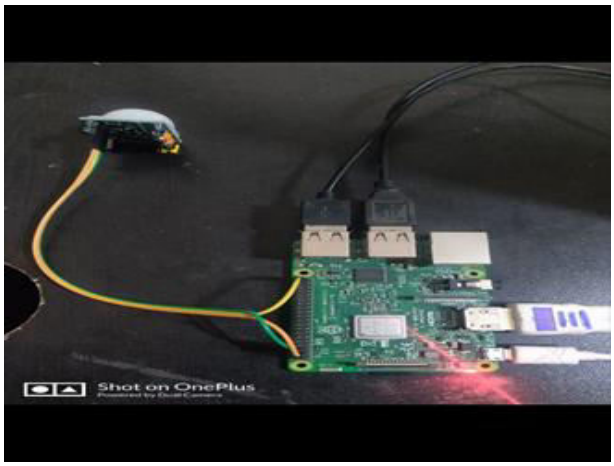

Fig 8.Hardware Implimentation

As shown in Fig.8, The PIR sensor is interfaced with raspberry pi at pin no.21, Raspberry pi has four PWM pins out of which servo motor is connected to pin no.3.UVC camera is interfaced with raspberry pi at its USB port. Power supply of 5V is given to raspberry pi and device is connected over internet through HTTP protocol [7].

5.SOFTWARE REQUIREMENTS

A. Raspbian Operating System

Raspberry pi requires an operating system. It is a free OS supported Debian optimized for the Raspberry Pi hardware. Raspbian provides smooth and faster performance for applications that include heavy use of floating-point arithmetic operations. Although Raspbian is created by Mike Thompson and Peter Green, it has also been benefited greatly from the community members of Raspberry Pi [8-10].

B. Python

Python is high level, object-oriented programming language. Python is simple to learn it has very simple syntax it is highly readable and easy for maintenance. Python is generally used for

- Back end in web application and mobile app development
- Desktop app and software development
- Processing big data
- Performing mathematical computations
- Writing system scripts

Python is an open-source programming language, which means it is free to use and enables users to modify or create extensions for the Python language as it is open- source so it allows other programming languages to have frameworks, libraries and, other tools that keep the Python language relevant and adaptable over time. It is highly readable and easy-to-use language.

6.RESULTS AND DISCUSSIONS

The surveillance system is created which requires the least manpower which gives alerting messages in real time whenever an intruder arrives. Fig 10. Shows a message is sent through an email which contains image captured by the camera. The surveillance system has successfully reduced the high storage requirements which are required in CCTV surveillance. The HTTP protocol is successfully demonstrated in this system. Fig.9 shows website, where user can sign in using user id and password, after successfully login user can see live streaming. Website provides the functionality of controlling servo motor remotely.

Fig.9 Websites

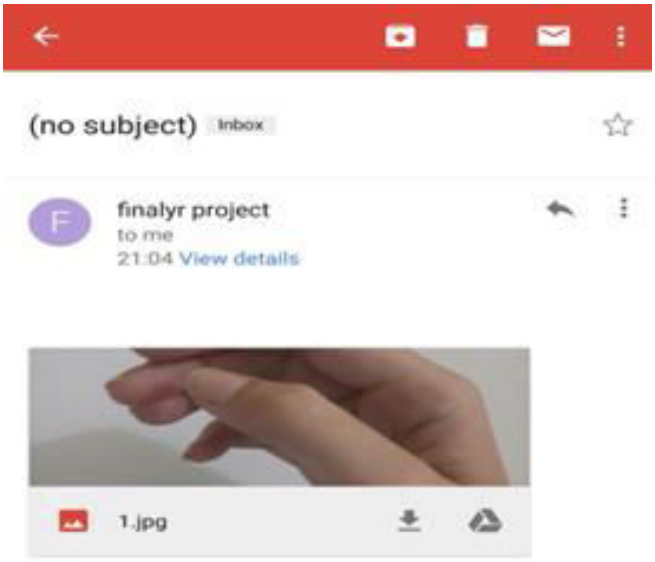

Fig 10. Email sent to the owner

7.CONCLUSION

The proposed surveillance system in the paper provides effective security and real-time data analysis. It is cost-effective and many numbers of PIR sensors can be added to the system for increasing its efficiency. The variety of images can be captured and used as evidence. Hence the proposal is highly efficient and low-cost.

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