Hi-Tech Surveillance Camera

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ABSTRACT

This project deals with the design and implementation of a PIR sensor-based security system which uses Raspberry pi 3 and PIR sensor. It is designed to assure security through surveillance. HDMI transmits pictures and videos to a displaying screen which saves this information in the app as well as in the SD card and sends an alert to a specified mail recipient. Raspberry pi is responsible for the operation and control of motion. Detectors and video cameras, on the other hand, sense movement and give surveillance and stream live video or record occurrences for later playback. The sensor perceives Infrared Radiations (IR) emitted from humans within their field of view then provides a digital output. The design also will provide the number of persons located, with the help of a Passive Infrared sensor. When PIR Sensor detects motion, the camera automatically initiates recording and Raspberry pi device alerts the owner of a possible intrusion having a display on the screen and sending an email alert to a specified email address. The circuitry is inexpensive, and its electronic security system is highly secure.

Keywords: PIR sensor, Drop Box, Security.

1. INTRODUCTION

Surveillance, from homes to huge industries, plays a significant role in the fulfillment of our security. Aspects such as burglary and theft have always been a predicament. Individuals should have the choice to live without fear and the confidence to carry out any business without fear of insecurity. The system created in this project offers security while maintaining the privacy of individuals since only one person can view it through an app. The traditional surveillance system is associated with various challenges and costs associated with energy use. An energy effective moveable system is preferable, and it can capture images during an occurrence of burglary. The system, therefore, allows people be more independent and feel secure in their everyday activities.

The primary objective of this study is:

To create a security-based system which is more affordable and flexible as far as location is a concern.

And the specific goals are:

a. To design a simple, cost-effective and easy to implement PIR security-based system using the existing technology.

b. To design PIR security-based system for persons who might want to control their work, office, or home from a distance.

c. To fabricate PIR security-based system. The system is small in size, portable, and stand-alone with its power source making it simple to implement. It also possesses energy for instant alert and is cost-effective for both residential and personal use.

2. PROJECT DESIGN AND IMPLEMENTATION

2.1 BLOCK DIAGRAM
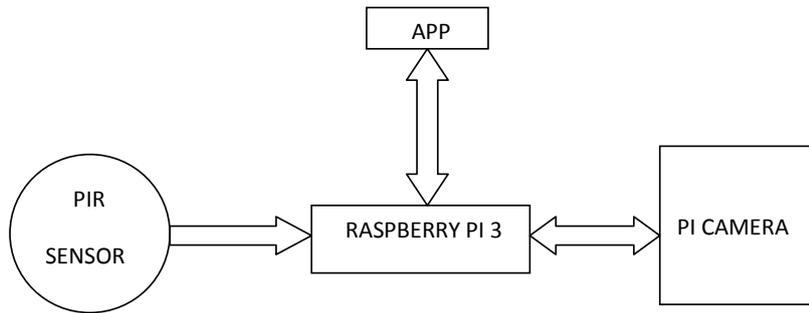
2.1.1 PIR SENSOR

FIG 2.1. PIR SENSOR

Passive Infrared (PIR) sensor is the foundation of the security system. The sensor's functionality is based on infrared radiations emitted from the human body. It is a useful 20 tool for detection of human movement as it detects a change in infrared radiations as a result of moving warm-blooded objects within their range. All objects, including human beings, produce electromagnetic radiations. The wavelengths of these radiations are dependent on the temperature of objects. Human beings emit infrared radiation with wavelengths ranging between 0.7 and 300 micrometres.
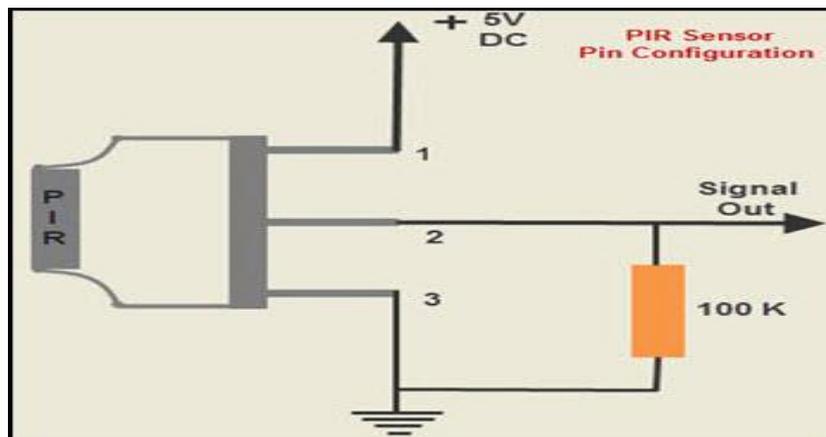

FIG 2.2. PIN CONFIGURATION OF PIR SENSOR

The PIR sensors consist of three pins and a functional description of each of these pins is as described hereunder:

1. **Pin1** correlates with the drain terminal of the device and is connected to the positive supply of 5V DC.

2. **Pin2** correlates with the device's source terminal, and should be connected to the ground terminal using a 47K or a 100K resistor. The pin is the sensor's output pin and it carries the Infrared signal detected to the amplifier.

3. **Pin3** is connected to the ground.

2.1.2 PI CAMERA

Fig 2.3. PI CAMERA

The pi camera is a device which can capture image and video. In this project, the pi camera has been used to capture video when there is an intruder and rest when there is none due to its capabilities for capturing still images and videos. The camera module in this project is an image sensor well connected with control electronics, a lens, the Ethernet and an interface such as Camera Serial Interface (CSI). Raspberry Pi camera is attached to a small printed circuit board which is then connected to the raspberry pi via a camera board. The camera can deliver a clear image, 5mp resolution and video recording at 1080HD. It is connected to the port opposite of Ethernet port in the raspberry pi. The ribbon cable which is extendable enables the attachment of Printed Circuit Board (PCB) and allows for the connection of the camera to the pi via its port. The device is enabled by importing and installing the camera from the Raspbian operating system. The camera on the board is small with specifications of 5 MP which are explicitly made for the pi. The camera uses 250 mA; therefore, an external powering of the pi is sufficient for use in this surveillance system. Raspberry pi enables a configuration of the threshold to the number of pixels needed for proper detection of movement by the pi camera. An increase in the limit to 3000 pixels ensures that the camera takes pictures only when an adequate movement has taken place.

2.1.3 SD CARD

In this project, 8GB card is used. SD card is used for installation of the operating system, booting, and a storage/memory for the operating system, that is, for storage of recorded videos. Raspbian software is being installed in this project to interface pi camera and PIR sensor through raspberry pi.

2.1.4 RASPBERRY PI 3

FIG 2.4. RASPBERRY PI 3

Raspberry Pi 3 is a cheap single-board computer manufactured by Raspberry Pi foundation. It is an improved model from the previous versions and is based on Broadcom system-on-a-chip. The model has both a higher clock speed and an onboard Wi-Fi and with built-in Bluetooth. Raspberry pi 3 runs at 1.2 GHz and has an upgraded power system as well as four USB ports. Raspberry Pi 3 used in my design system and its hardware is as shown in figure below

Different OS for the Raspberry Pi can be installed on a Micro SD, Mini SD or SD card, dependent on the board and available adapters. Raspberry pi is a minicomputer, hence has ports which necessitate the wiring of the project. Powering source comes from the PIR sensor, that is, only the sensor is powered, and it relays the power to the other devices in the connections like the raspberry module and pi camera. Starting from the PIR sensor, positive terminal is connected to pin 2 of raspberry pi, ground to pin 6, and the third terminal to pin 11. The project responds positively when powered on. Several pins of the raspberry pi module make it possible to integrate several devices according to the objective.

2.1.5 DROP BOX APP

After capturing the images and video it will automatically gets stored in the Drop Box app and it sends an notification e-mail to the user. Moreover it also gets recorded in the SD card.

3. RESULTS

3.1 HUMAN DETECTION

Human detection part of the project entirely depended on the program responsible for the subtraction of any background noises. The PIR sensor responsible for the detection of motion adjusts itself to the infrared signature of its surroundings and keeps watching for any changes. In the absence of motion, the LED indicator will remain dim, and the program will continue updating the surroundings. If the sensor detects movement, the frame for motion

detected will be the input frame to the process of human detection, and consequently, the motion detection indicator will light up.

3.2 IMAGE CAPTURE AND VIDEO RECORDING

Upon confirmation of intrusion of a human in the field of view of the sensor, the Passive Infrared sensor triggers the pi camera through the Raspberry pi. RPI directs instructions to the pi camera to click the picture and consequently save it. While capturing the image of the intruder, the pi camera records video of the occurrence.

3.3 E-MAIL NOTIFICATION

The system functions in a manner that every time motion is detected, the pi camera takes a picture and a video of the occurrence. The email algorithm obtained from the pi configuration file enables a command on the system to send an email with the photo attached to a specified email address. For this project, the homeowner, whose email has been specified during the program design and implementation, receives a notification.

4. CONCLUSION

With an improved awareness of the importance of security, people are on the lookout for an efficient surveillance system which is cost-friendly. This design covers all the vital areas of a security system. The sensor uses the infrared radiations changes as a result of human motion across its field of movement. When movement is detected, the pi camera, with the capabilities for taking pictures is enabled. The picture is then sent to an app. The system designed is energy efficient and is applicable particularly in areas with low energy supply as a result of inadequate electricity supply. The method additionally offers flexibility and reliability. It enables the owner to be aware of the security situation at home provided he/she is connected to the internet.

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RESULT IMAGE