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Internet of Things - Smart Surveillance System using PIR Sensor with Raspberry Pi

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***Abstract*—** This paper describes our first research experience in Smart Surveillance System using PIR Sensor with Raspberry pi, by using open-source software tools such as Python, Raspbian OS and etc.Smart Surveillance System using PIR Sensor with Raspberry piemerged with the development of the Internet of Things. The basic concept of the application is to allow the client to uses wireless technology to provide essential security using Surveillance system. The proposed security system captures information and transmit it via a Wi-Fi to static IP, which is viewed using a web browser from any smart devices. Raspberry pi controls a video camera for surveillance. It streams live video and records the motion detected part in the cloud and/or in the window shared folder for future playback. The cameras automatically initiate recording when motion is sensed and Raspberry pi devices stores it in a secured folder.

Keywords—*Internet of Things (IOT),Raspberry Pi, Python, Surveillance System,PIR Sensor, Feature Base Detection,Network, Modules.*

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I. INTRODUCTION

In today's fast paced world, it has become difficult to monitor our workplaces and homes for security. Thus, there is an increased need for camera surveillance systems. By using these systems, it is possible to continuously monitor the workplaces and homes for security purposes and store it for future references. But the main drawback of these system are-manual monitoring, huge storage requirements and extensive power consumption. To overcome these problems, we have come up with an automated smart surveillance system. For this system, we are using Raspberry Pi with Passive Infrared (PIR) Sensor for motion detection and a remote camera for video recording. The camera is connected to Raspberry Pi via the USB port and the PIR Sensor is connected through General Purpose Input Output (GPIO) pins of the Raspberry Pi. Motion is detected using PIR sensor which turns on the camera for surveillance. The duration for recording can be set according to the user convenience. While the video is being recorded, using image processing we are diagnosing a particular area termed as red-alert zone for any suspicious activity. The whole recording is sent to the server in an encrypted form. If any suspicious activity happens in the red-alert zone, then a special signal is sent to the user. Current camera surveillance systems can be used for monitoring but they require a huge amount of data storage due to continuous video recording. However, our system only monitors the area when motion is detected and there is a possibility of certain activity. Our system also sends a notification, in case of suspicious activity as it is not possible to continuously keep a watch on such activities. Raspberry pi is a credit- card sized computer .It functions almost as a computer. There are various surveillance systems such as camera, CCTV etc. In these types of surveillance systems, the person who is stationary and is located in that particular area can only view what is happening in that place .Whereas, here ,even if the user is moving from one place to another ,he/she can keep track of what is happening in that particular place. Also another advantage is that it offers privacy on both sides since it is being viewed by only one person .The other major advantage is that it is a simple circuit .the operating system used here is Raspbian OS.Raspbian OS has to be installed So that the image can be transmitted to the smartphone.

II. LITERATURE SURVEY

I. Existing System:

1. Wireless Security:

Wireless home security systems use battery-powered radio transmitters and receivers to connect the various components such as cameras, sensors. These types of security systems are usually available at a local hardware store or on the Internet and are often designed for do-it-yourself installation.

2. Hard-wired Security and Surveillance Systems:

Hardwired security and surveillance systems use wires installed inside the walls, attics, crawl spaces, and underground to connect the sensors to a central controller.

A. In the present existing system, the CCTV camera captures video and stores it in the memory of the computer.

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B. For reference the user can view the video but it is a tedious process.
C. Sometimes PC can be hacked, stolen or even have technical issues, which results in loss of data.

I.I Issues in Existing System:

A. Wireless system design specifications can limit the distance between sensors, cameras, and the central controller, they require periodic replacement of batteries.
B. Hard-wired systems are more expensive than wireless systems, problems can arise in the installation of sensors in existing homes where some areas are not accessible for pulling wires inside the walls
C. Power consumption and cost of maintenance is high.

II. Proposed System:

The aim is to make a smart surveillance system using Raspberry Pi along with PIR sensor and Raspberry Pi-Camera. PIR sensor is used to detect the motion whenever someone comes within its range. As soon as PIR Sensor detects the motion, Pi-Camera activates and captures an image. This image is then stored in the system and finds for a human face in the captured image using Python.

This system helps to identify only unauthorized persons. This helps to overcome the drawback of CCTV and Motion Detection systems which only monitor or alert host based on motion detection, whether it is authorized person or not.

Motion detection surveillance technology gives ease for time-consuming reviewing process that a normal video surveillance system offers. By using motion detection, it save the monitoring time and cost. It has gained a lot of interests over the past few years. The system uses GSM/GPRS technology, so we can use long haul communication for the monitoring section. The system can be applied in real time.

The PIR sensor is used to detect the humans.

II.1. Advantages of Proposed System

a) In CCTV systems there should be a dedicated PC for the module which is eliminated here.
b) A PC can be hacked and the files can be erased while this system overcomes these problems.
c) Authentication is required on the user side inorder to view the streamed video in the browser and the camera captures a wide area.
d) Less expensive when compared to the other existing systems.
e) The camera motion can be controlled by the user.
f) It doesn't require more power, and battery can be used as a source of power also.

III. SYSTEM ANALYSIS AND DESIGN

1 Introduction

Surveillance camera are capable of security monitoring in a workplace, home, schools, hospital and etc. The monitoring can be watched anytime through online streaming video which is linked via YouTube or by mail. The software can be run in any platform.

2 Analysis of the problem

A. The top common issues in security camera system:

Different security Products, default password or easy code password, Incomplete Alarm coverage, False alarm, Lacks regular maintenance, leaving your system open to hackers.

B. The top common issues in Raspberry Pi:

Avoiding a corrupted SD card, rely only on the main power, check the cables.

3. System architecture:

The functions of the various components are given below:

A. USB Camera:

USB Camera captures the image and sends it to the USB port of the Raspberry Pi board. The camera model used here is USB Camera model 2.0.

B. Raspberry Pi:

Raspberry pi is a small credit-card sized computer capable of performing various functionalities such as in surveillance systems, military applications, etc.

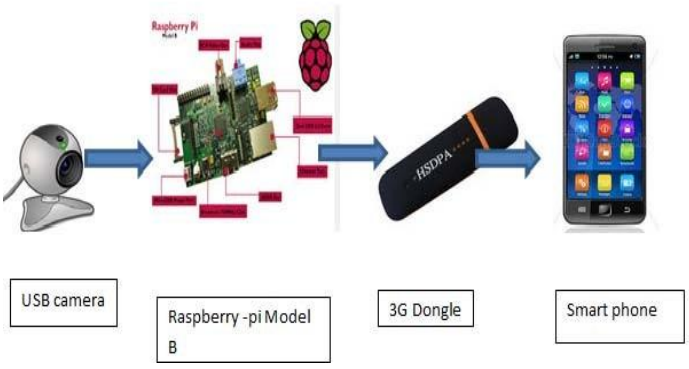

Figure 1: System Design

IV.MODULE DESCRIPTION

1 Introduction

Our complete project deals with the different modules based on the working. The workings are based on the design and implementation. The Smart Surveillance system using PIR sensor with Raspberry Pi consists of various modules as described below,

1. Data Collection Module
2. Data Storage Module
3. Data Process Module
4. Decision Making Module
5. Output Module

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2IMPLEMENTATIONOverview:

A. *Data Collection Module:* The administrator has all the information about all the users, it consists of sensor and camera. Which is mainly used for monitoring.
B. *Data Storage Module:* It consists of Raspberry Pi and SD card, for processing and recording data's in the storage for future use.
C. *Data Process Module:* This module consist of Face Recognition, which is based in Feature Based Algorithm, for recognising authorized persons. The coding for the main program is done using Python.
D. Decision Making Module: This module contains about Face Recognition Algorithm and its process.
E. Output Module: The output of the surveillance camera is been shown and the processed details are also shown.

3. *USE CASE DIAGRAM:Description*: the use case diagram gives an explained process of how the user is been interacted with the Surveillance system.

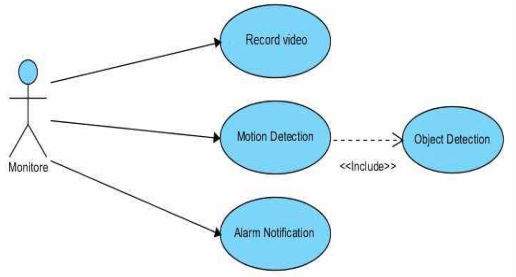

Figure 2: Use Case Diagram

CODE:

For executing the main program in terminal,
cd face live recon/
sudo python main.py

Screenshots:

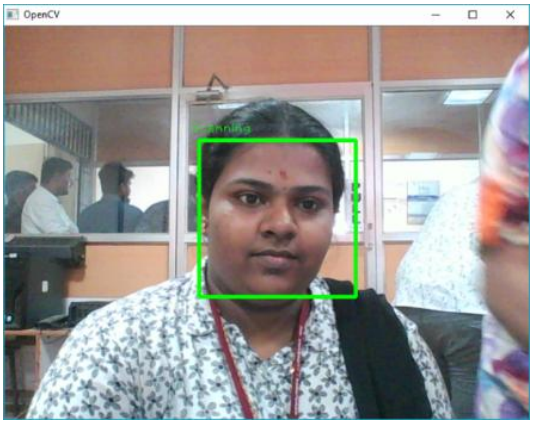

Figure 3: OpenCV Output

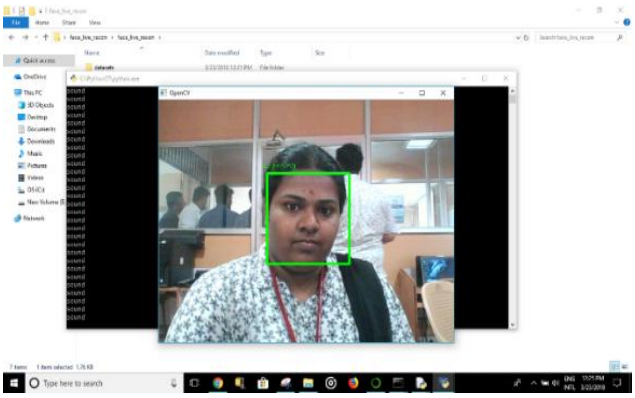

Figure 4: Final Output

V. CONCLUSION AND FUTURE WORK

The project was done successfully with all the requirements. The future work is improving the algorithm and making the work more optimize for use.

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