SECURITY ENHANCEMENT USING MOTION DETECTION

Dr.T.Prem Jacob

Faculty,
Dept Of Computer Science,
Sathyabama University,
Chennai , India.
premjac@yahoo.com

K.N.Karthick Kumar

UG Scholar,
Dept Of Computer Science,
Sathyabama University, Chennai ,
India.
karthickkatta12@gmail.com

H.Natraj,

UG Scholar,
Dept Of Computer Science,
Sathyabama University,
Chennai , India.
hulinatraj@gmail.com

Abstract—**Technological advancements have paved way in residential dwellings also. Smart homes are becoming more of a necessity in today's world. Control, monitoring and security are the crucial features of a smart home and smart devices play a major part in appliance control. This paper focusses on the conception and execution of a compendious real time home security system that is smart and completely takes care of home security. This home security system is named as Raspberry Pi (RPI) and Open CV with Haar Cascade. This device can perceive any movement and send notifications on the user's dashboard which in turn notifies the monitoring centre. Sensors are activated during your absence or when you notify the system of your absence at home.It is possible to program the security system to record activities through the security camera when a movement is detected. The Raspberry Pi, a credit card sized computer with an inbuilt camera board can turn into a camera security system when the camera board is put to use. This system makes use of OpenCV. The sensors detecting movements have the ability to react to various scenarios such as activity in the living room, opening and closing of doors, breaking a window.**

Keywords: *Raspicamera, Opencv, Computer Vision, Embeded Systems.*

I. INTRODUCTION

The user is warned as soon as the sensors detect a trespasser. This monitoring system will tighten home security and with the increasing crime rates, houses are not an exception. People are aware of the various security systems available in the market that targets intruders and keeps tabs on them. [1] These systems inculcate a sense of security when the owner is away from home either at work or travelling. These systems are confined to their boundaries. To cite an example; CCTV footage can be viewed only in the presence of the user or the guard in the control room. One of the major goals of today's research is to prevent crime with distant supervision. The ultimate aim is to save money, value, time and lives [2]. Raspberry Pi comes in different models and the literature charts out comparisons between Pi's performances with contemporary blueprint platforms. Open CV is open source computer vision software with a powerful library of image processing tools. C, C++ and Python languages are used to write the library and Open CV is compatible with Linux, Windows & Mac OS X. [3] Open CV being a free software optimizes the code for basic image processing infrastructure. Secured atmosphere is inevitable for protecting invaluable lives and assets. People and property security is crucial. Gate security or entrance door security is necessary to prevent further issues in the controlled area. [4] A conventional monitoring device makes use of expensive equipment, involves high power consumption, and requires constant disk access which obviously requires huge space. [5] The embedded solutions overcome these shortcomings and provide live feeds from webcam operating on cloud without the need for a personal computer. Algorithms are added to the embedded systems to augment their efficiency. By making use of the open source libraries, the movement detection algorithms [6] allow Raspberry Pi to detect movement; the object detection algorithms detect real world entities such as face, car, and images. The enhanced security features like live feed encrypting, real-time notifications, and cloud storage cannot be used in a conventional security camera. Raspberry Pi, is an economical hardware piece combined with inbuilt camera module, costs less when compared with conventional security camera models. Raspberry Pi is combined with OpenCV libraries, contains several modules making it the smartest monitoring system. This paper highlights on the motion detection achievements, keeps a track on human beings usage of Raspberry Pi camera module, PIR sensor and stores them in the database. Movement detection senses trespassing and sends alert signals to the dashboard. The automatic sensors start functioning during your absence. Movement sensors can also track and notify you of trespasser presence in the restricted areas of your home.

II. RELATED WORK

Smart security system has capability to detect both motion and face. For motion detection it uses background subtraction, at minimal processing speed except complex background environment [7]. This algorithm uses highly variable lighting conditions that uses 120 frames as default for background modeling. Algorithm operates on foreground segmentation algorithm which detects the problems [8]. GSM is mainly used in door lock security system. In case of emergency the GSM module send SMS to owners and the authorities. [9] Sensors used in detecting obstacles collects data from al the sensors and finds the solution. [10] The newer model of door security system is controlled by GSM handset that acts as the transmitter along with the GSM phone that controls the door via

- DTMF decoder
- A stepper
- Microcontroller unit

[11]. The owners are constantly worried about their home and valuables when their away from home.

[12] Two frameworks were created which works on GSM based technology. Web camera, captures images to avoid gate-crashes. SMS are sent to the owners in case of emergency. [13] With a simple login, the owners can see and listen to their guest recorded messages and lock doors. An integrated combinational type lock uses digital number lock that operates with the correct digits. One such example is Electronic Safe. [14] Password for these digital locks can be changed, as it is stored in PROM. It operates best with GSM/CDMA. The door will be open only when the call is originated from a specific user, which is received by the system.

Bluetooth based system is a clever house innovations uses Bluetooth function available in smart devices. [15] The framework using Bluetooth systems are generally based on Arduino platform that are more simple and productive for proper utilization. The hardware of Bluetooth framework comprises of android smart phone and Bluetooth module. Arduino microcontroller acts as a controller and solenoid acts as an output of locking system. [16] The newly designed digital door lock system, informs the owner's smartphone when it detects any unknown physical contact of a visitant. Number of wrong password tries at the digital lock, captures the picture of the unknown visitant and send it to the owners. Thereby, strengthening the security system.

The locker security system has RFID, FINGERPRINT, PASSWORD and GSM technology. [17] Their door locking frameworks is without much of a stretch, initiated, authenticated and validated by the authorized person. It unlocks the locker door in real time manner.

III. MOTIVATION OF THE PROJECT

To optimize the algorithm it is separated into two parts,

- Motion detection
- Motion reorganization

Raspberry Pi is the central platform for image processing and signal alerting. Pi camera captures the images and uses background subtraction algorithm to detect motion. The system detects the face of moving objects and stores the images on local drive. System also has remote monitoring facility that uses configuration of Wi-Fi router for port forwarding is required for this purpose. Raspberry Pi is a new hardware platform has functionalities similar to personal computer orlaptops. The Raspberry Pi 2 delivers 6 times the processing capacity compare to previous models and upgraded Broadcom BCM2836 processor, which is a powerful ARM Cortex-A7 based quad-core processor that runs at 900MHz. Raspberry Pi 2 has memory capacity of 1GB. Raspbian is a free operating system based on Debian, optimized for the Raspberry Pi hardware. Raspbian provides more than a pure OS with over 35,000 packages. It has pre-compiled software bundled in a nice format for easy installation on Raspberry Pi board. Haar like features is one of the common ways used for object detection.

OpenCV has available Haar Cascade file "haarcascade_frontalface_default.xml" covering face features which is used in this study. Following are the steps to load the face detection Cascade,

Step 1: Detect the face in each image.

Step 2: We use the region of interest containing the face in the imagefor training the recognizer.

Step 3: For the purpose of face detection, we use the Haar provided by OpenCV. The Haar Cascades that come with OpenCV are located in the directory of OpenCV installation. Haar Cascade frontal face default.xml is used for detecting the face.

Step 4: Cascade is loaded using the CV2 Cascade Classifier function which takes the path to the Cascade XML file. If the XML file is in the current working directory, then the relative path is used.

Two PIR sensors marketed by different manufacturers were chosen, to establish baseline occupancy detection performance, each sensor was wired to the EMS according to the manufacturer's recommendations. PIR/PIDhas home security feature like capturing the

photo. A PIR-basedmotion detectors used to sense movement of people, animals, or other objects, used in burglar alarm and automatically-activated lighting systems. The aim of this paper is to provide high level security and automation of appliances. The camera detects movement in the room and takes pictures and the owners are sent pictures via Ethernet and Wi-Fi. The user is alerted by sending an SMS with the link using Ethernet and Wi-Fi. The images can be viewed by clicking the link. The door will remain closed in absence of the person.

IV. PROPOSED WORK

Raspberry Pi is the latest minicomputer with an affordable price tag. The credit card size processing computer with high resolution and low power consumption is a Python-based system. The proposed system is designed to be able to detect faces accurately, in real-time, as well as from an image.

The following steps will enable you to setup your Raspberry Pi based system to detect faces.

(1) Place the camera module into the board as outlined in the PiCamera website

(2) Now connect the PIR sensor. The three female-to-female jumper cables must be connected to each of the PIR sensor's connectors, as well as the corresponding pins on the Raspberry Pi.

    i. The top pin with the label VCC on the PIR sensor must be connected to the 5V pin on the Raspberry Pi

    ii. The middle pin labeled OUT must be connected to the GPIO pin 4

    iii. The bottom pin with the label GND must be connected to a ground pin labeled GND

A. PIR Sensors Work

PIR sensors are also referred to as "IR Motion" or "Passive Infrared" sensors. PIR sensors enable you to sense motion. The principle of PIR sensors is based on the fact that everything emits a small amount of infrared radiation. The amount of radiation emitted by a particular object is directly related to the heat produced by it. PIR sensors can detect a change in the infrared radiation levels. PIR sensors together with PIR motion sensor cameras measure infrared radiation levels to detect changes in the surroundings and can detect motion. For example, a PIR sensor can detect when a person enters a room.

B. Connect the PIR Camera Module

To setup the PIR camera module, follow the basic steps outlined below:

(1) Plug the three pins on the jumper wires, with the labels PIR-VCC (3-5VDC in), PIR-OUT (digital out), and PIR-GND (ground) to the three pins on the PIR sensor.

(2) Connect the GPIO GND (Pin 6) on the Raspberry Pi to the jumper wire plugged to the ground.

(3) Connect the GPIO 5V (Pin 2) on the Raspberry Pi with the jumper wire plugged to the VCC.

(4) Connect the GPIO 7 (Pin 11) to the same rail as our PIR-OUT to be able to detect motion.

C. Face Detection Process Works

A camera captures the image and OpenCV executes the face detection algorithm. OpenCV is C language program at the core with Python and PHP bindings.

The program helps detect a face from an image and can automatically crop images without cutting out faces. The face detection mechanism is internally coded using the Python programming language. Open CV along with Python bindings is used as a script to detect the faces in an image.

The program requires training data from an XML file. Successful face detection requires that you download the Haar Cascade Frontal Face package for OpenCV. When a captured image is available, you will be able to see it on your screen and your Parse database will also feature a new item corresponding to the captured image.

When your camera detects the person's face, you will be able to see the photo on your web console. In the case of moving objects, the system has the capability to ascertain whether the face was detected or not. Once the face detection is complete, the image is stored on the local hard drive.

The system is also equipped with a remote monitoring facility. To enable remote monitoring, you must configure the Wi-Fi router. The paper entitled "Automated Home Security Surveillance using Raspberry Pi" explains the process of connecting and controlling appliances through the Internet.

V. CONCLUSION

In conclusion, PIR motion sensors and camera modules are a cost-effective surveillance mechanism. Python and Open CV backed by Raspberry Pi can be used develop flexible and adaptable projects, which are extendable in future. The present system is encoded to send SMS and email to the user when motion is detected. This functionality enables the user to analyze the different parameters at home anytime.

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