Motion sensor and face recognition based surveillance system Using Raspberry Pi

B. Madhuravani
Associate Professor
MLR Institute of Technology, Dundigal,
Hyderabad, India

Dr. P. Bhaskara Reddy
Director
MLR Institute of Technology, Dundigal,
Hyderabad, India

M.Rashmika
Final Year
MLR Institute of Technology, Dundigal,
Hyderabad, India

Abstract: An intelligent surveillance system is a smart monitoring system which is developed from the security point of view. The objective of this project is to develop a system that monitors the area in which it is being implemented. An Intelligent surveillance system is applicable in the area where no one is permissible to enter, also where we need to detect if any motion has been done. For this a digital camera is used. By combining the PIR sensor and camera we can use this system to detect the motion. The Camera is used to catch the live images of the area in which it is being implemented, if any object is moving. The captured images are stored in a particular folder. The stored images will be then useful to work on.. As the PIR sensor recognize the motion it uses local binary pattern histogram (LBPH) and matches his/her face with the data provided in the database. If the face is not matched with the database then he is unauthorised and the buzzer starts buzz ring including the message/mail services to the owners.

Keywords: image capturing, motion detection, monitoring, security, face detection, haar algorithm.

I. INTRODUCTION

These days, individuals need one sole thing that is to make them feel sheltered and secure. The most regularly utilized security framework is the CCTV (shut circuit Television). The cost of execution of CCTV fluctuates relying on the size and utilization of the framework. It is normally introduced in healing facilities, shopping centres, parking garages and so on… However, with the assistance of CCTV one can screen the territory every minute of every day, or the recording if put away in an area can be recovered when required. Despite the fact that, it can be utilized to stop wrongdoing and enables the experts to distinguish and settle a wrongdoing, it doesn't identify neither perceive the individual who is included. Wise reconnaissance framework is a shrewd observing framework in which a web camera and PIR sensor are utilized as a capable movement finder. Rather than utilizing different ultra-sonic or different sensors, we are utilizing camera as the face acknowledgment sensor here. By consolidating the product with PIR sensor and web camera we can utilize this framework as an Intelligent observing System. An insightful observation System can be utilized for security in confined ranges, where nobody is permitted to visit or enter the space amid specific time. For this a raspberry pi, PIR sensor, web camera are utilized. By consolidating the product and camera we can utilize this framework as a face acknowledgment calculation, .If any progressions has been found the camera catch the pictures at the rate of one picture for every 60msec and stores them in the envelope. The put away pictures will be then valuable to chip away at. At the point when the befuddle happen with the gave information then the signal begin buzz ring including a red light showing the reality of the circumstance, at the same time proprietor will get an email and sms giving all the important data.

- **PURPOSE OF THIS PROJECT**

The main aim of this project is to provide security to the people and make them feel safe. As this automatic on and off camera power consumption is very less and cost efficient. Security these days plays a crucial role but the cost of maintaining it also increases with lots of power consumption, to avoid this problem automatic on and off of camera using PIR sensor is useful.

II. LITERATURE SURVEY

There are many existing devices in market such as CCTv Cameras, IP camera, Infrared Sensor, Laser Sensor etc [2].

- **CCTV** : Implementation of CCTv cameras are very costly and has drawbacks since it require constant monitoring of every activity which is not as ease. Continuous manual visualization hampers the productivity and time. Criminals can penetrate into the CCTV system, thereby facilitating criminal acts.

- **IP camera** : Implementation of IP cameras are also very costly and not feasible. This system cause major problems as it becomes open to hackers via internet(false bomb threats, called in hoaxers while watching the cameras.) .

- **Infrared Sensor and Laser Sensor** : These devices are quite economic in comparison to above devices however they have some drawbacks too. These devices are difficult to install and rarely available.

III.OVERVIEW

Motion sensor and face recognition surveillance camera is a system where the camera will be in sleep mode, when the PIR sensor start sensing any kind of motion the camera starts

automatically and starts face recognition. It checks the face with the pictures present in the database for authentication. If the face is not matched with the database then he is unauthorised and the buzzer starts buzz ring including the message/mail services to the owners.

- **BLOCK DIAGRAM**

The block diagram of this surveillance camera is quite simple and easy to understand for the user.
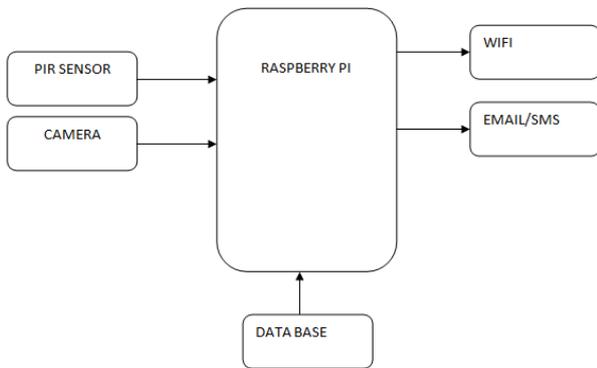

Fig1. Block diagram for surveillance camera

The PIR sensor and camera which act as the hardware devices are connected to raspberry pi. Database is used to store the images and wifi module helps us to send email/sms.

IV.HARDWARE MODULES

(1). [3] RASPBERRY PI: The raspberry pi 2 is a credit card size computer which is a 900MHz quad-core ARM Cortex-A7 CPU. It has a 1GB RAM and an additional memory is provided by using a micro SD card. It has 4 USB ports, 40

GPIO pins. A Full HDMI port is used to connect to a display and and an Ethernet port is used to interface the raspberry pi with the laptop. A combined 3.5mm audio jack and composite video jack is available. There are two types of interfaces available on the raspberry pi, Camera interface (CSI) for the pi camera and a display interface (DSI). Diagram of the raspberry pi is given below
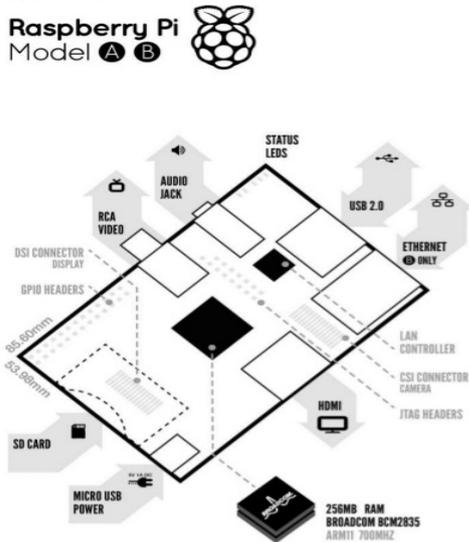

Fig2. Model of raspberry pi

(2). PIR SENSOR: **Passive Infrareds sensors** (PIRs) are electronic devices which are used in some security alarm systems to detect motion of an infrared emitting source, usually a human body. When the amount of radiation striking the crystal changes, the amount of charge also changes and can then be measured with a sensitive FET device built into the sensor. This radiation (energy) is invisible to the human eye but can be detected by electronic devices designed for such a purpose.

Fig3. Pir sensor

V.SOFTWARE MODULES [1]

(1). RASPBIAN WHEEZY: A Raspbian image is a file that you can download onto an SD card which in turn can be used to boot your Raspberry Pi into the Raspbian operating system. Using a Raspbian image is the easiest way for a new user to get started with Raspberry pi.

(2). OPENCV: OpenCV is written in C++ and its primary interface is in C++, but it still retains a lesser comprehensive though extensive older C interface. The API for these interfaces can be found in the online documentation. We have used the openCV for the face detection and recognition.

(3). LINUX: Linux is a free open source operating system and it belongs to the Unix operating systems. Actually Linux means the kernel itself which is the heart of the operating system and handles the communication between the user and hardware. Normally Linux is used to refer to the whole Linux distribution. Linux distribution is a collection of software based on the Linux Kernel. It consists of the GNU-project's components and applications. Because Linux is an open source project, anyone can modify and distribute it. That is the reason why there are many variations of Linux distributions. Most popular distributions are Ubuntu, Red Hat Linux, Debian GNU/Linux and SuSe Linux.

(4). PYTHON PROGRAMMING LANGUAGE: Python programming language is developed in the late 1980s at the National Re-search Institute by Guido van Rossum. Python has grown in popularity, and it is widely used commercially. Python is a flexible and powerful programming language but still it is easy to learn and follow. The clear syntax of Python makes it a valuable tool for users who wants to learn programming. This is one of the reasons why it is recommended by the Raspberry Pi Foundation. Python is published under an open-source license and it is available for different operating systems. Python runs on Linux, OS X and Windows computer systems.
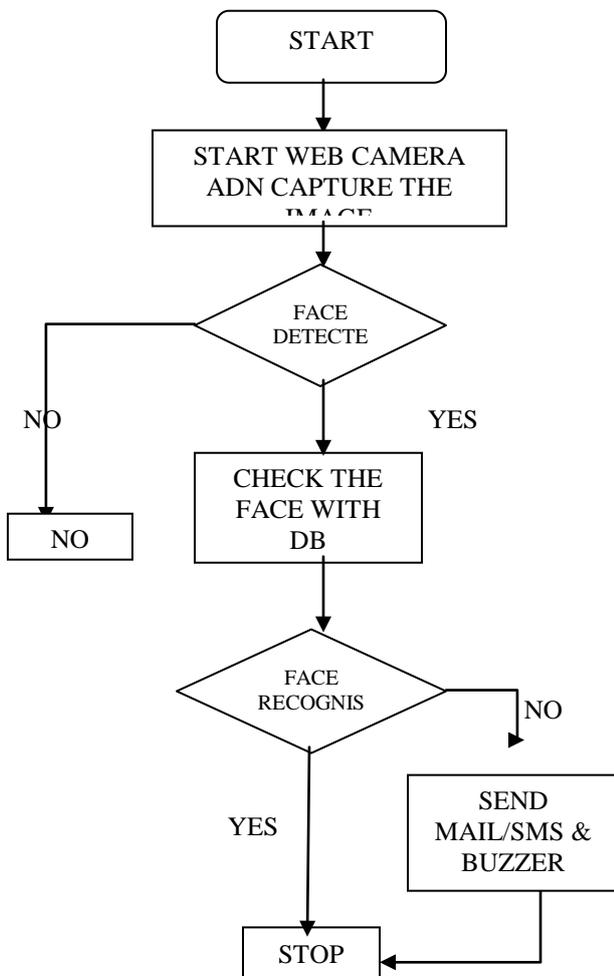
VI.WORKING MODULES

The overall working of the camera can be explained with the help of a flowchart. The image is captured by the web camera which has 5MP pixel resolution, this image is then sent to the face detection module, which checks the frame obtained for any faces that can be found with the help of the Haar like features. Once the face is compared with the well trained database, it is checked if the face is recognized.

• If the image matches with the database, then the person is an authorized user then there is nothing that is going to happen.

• However, if the face doesn't match with the database, then the person is identified as a stranger, and mail/SMS is sent alerting the user, and an audio output is produced from buzzer with a red light indicating the seriousness of the situation to warn and alarm the intruder. Haar[5] like features, if the face is detected then it is cropped out.

Christo Ananth et al. [4] proposed a system in which the cross-diamond search algorithm employs two diamond search patterns (a large and small) and a halfway-stop technique.

FLOW CHART OF THE SURVILLANCE CAMERA

```
          ┌──────────────┐
          │    START     │
          └──────┬───────┘
                 │
   ┌─────────────────────────────┐
   │  START WEB CAMERA           │
   │  ADN CAPTURE THE            │
   │  IMAGE                      │
   └─────────────┬───────────────┘
                 │
            ◇ FACE
       NO   DETECTE   YES
   ┌────┐      │
   │ NO │      │
   └────┘      │
   ┌─────────────────────────────┐
   │  CHECK THE                  │
   │  FACE WITH                  │
   │  DB                         │
   └─────────────┬───────────────┘
                 │
            ◇ FACE
              RECOGNIS    NO
                 │         │
      YES        │    ┌─────────────┐
                 │    │  SEND       │
                 │    │  MAIL/SMS & │
                 │    │  BUZZER     │
                 │    └──────┬──────┘
          ┌──────────┐       │
          │   STOP   │◄──────┘
          └──────────┘
```

Flow chart of the surveillance camera

1. FACE DETECTION

We are providing a secure system, whose input I,0captured from the web camera is sent to processor for face detection. The algorithm used for face detection is Haar [3] like feature cascade classifier.
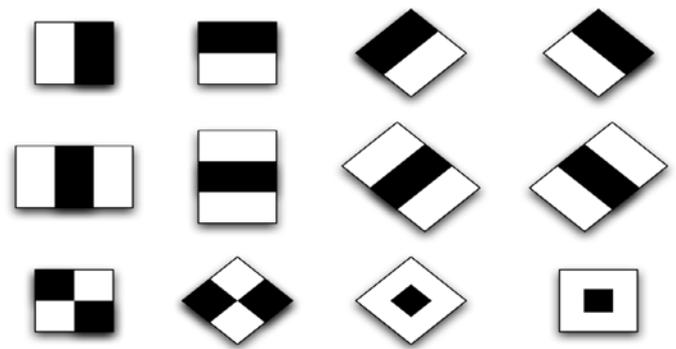

Fig 4. Haar like feature

2. FACE RECOGNITION

Recognition is the main part of any security system. Usually for a best recognition system, we require a well database, which can provide the base for our recognition. So to obtain the database, first collect the images of the subject individual for the recognition. Once we obtain and train our system, we can provide face recognition.

We use the local binary pattern histogram [3] (LBPH) for providing face recognition. This method helps us to provide a recognition model. The image is converted into a gray scale image. Then, the image pixels are compared with the neighbouring pixels in a clock-wise or anti-clock Histogram is performed and normalization is done and A feature vector is generated for every image. These feature vectors can now be processed with some algorithms to classify images which is used to identify the texture. Once the face is recognized, it is checked to see if the detected face is familiar or not. Thus we integrate the face detection and recognition to provide a smart surveillance system for the domestic purposes in our everyday life.

VII. CONCLUSION

Thus, we have developed a smart surveillance camera which is capable of providing both face detection and face recognition, rather than using different modules for performing the respective operations. Also the camera system is compact and can be implemented with low cost. The implemented face detection algorithm (Haar like cascade classifier) is very effective, with an accuracy of 88.9 % which can be increased further by effectively improving the illumination of the area. However, this system is connected with the help of a Ethernet cable to the laptop to communicate with the raspberry pi. This can be overcome by making the system wireless.

VIII. FUTURE SCOPE

This system has a wide range of uses in various fields, such as banking, forensic department, etc... The reason this system is quiet useful is due to the fact that it is highly compact and it provides face detection and recognition at once.

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