Face Detection using Raspberry Pi and Python

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Abstract

Internet of Things (IOT) has initiated tremendous growth in Internet and products that are connected to Internet. IOT components are cost effective, small in size and has sufficient computational power for application oriented components. Traditional surveillance systems are rigid, infrastructure oriented and expensive. A surveillance system with Raspberry Pi and Python is flexible, adoptable and small in size.

Key words: Internet of Things (IOT), Raspberry Pi, PIR Sensor, Raspberry Pi Camera module.

Introduction

The Internet of Things (IoT) is the network of physical objects devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data.

Starting from small houses to huge industries, surveillance plays very vital role to fulfill our safety aspects as Burglary and theft have always been a problem. In big industries personal security means monitoring the people's changing information like activities, behavior for the purpose of protecting, managing and influencing confidential details. Surveillance means watching over from a distance by means of electronic equipment such as CCTV cameras but it is costly for normal residents to set up such kind of system and also it does not inform the user immediately when the burglary happens.

Motivation

The use of M2M (machine to machine) communication is an advantage over the traditional Data Acquisition System (DAS) as the monitoring and controlling can be done without human intervention. A video surveillance system (short VSS) offers the possibility of visual surveillance while the observer is not directly on site. Surveillance may be performed not only directly but may also be stored, evaluated and repeated as often as necessary. As the system becomes fully automatic so the amount of error decreases and the efficiency of the system increases drastically.

A VSS basically comprises of Camera Control/recording unit and Output device like monitor.

Main disadvantages of video surveillance system is cost of entire system and difficult to use for normal person.

Proposed Work

The proposed system describes a simple and easy hardware implementation of face detection system using Raspberry Pi [1], which itself is a minicomputer of a credit card size and is of a very low price with better resolution and low power consumption feature. The system is programmed using Python programming language. Both real time face detection and face detection from specific images, i.e,. Object

Detection, is carried out and the proposed system stored the faces detected. Here pyroelectric infrared (PIR) [2] sensors are used as a simple but powerful people presence tri block di

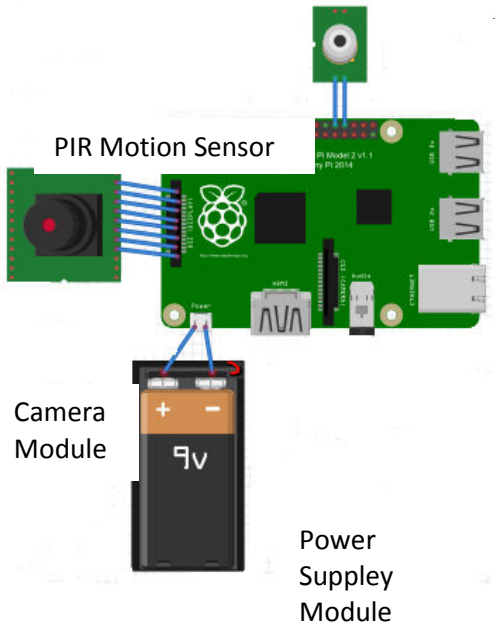

Fig. 1 System Model

Features:

- Automatic Detecting: the output will be high when objects enter the sensing range, and automatically turn low when object leaves.
- Photosensitive Control can be set.
- Temperature compensation can be used for performance compensation.
- Working mode: Non-repeatable trigger/ delay mode: the sensor will turn to low TTL after the delay, even the sensing object is still in range. Repeatable trigger: the sensor will not turn to low if the object still stays in the sensing range in the delay time.
- Wide operating system voltage range
- Micro-amp power level consumption: static current
- Output high signal: easy to achieve docking with various type of circuit.

Advantages

It offers privacy on both sides since it is being viewed by only one person. It is a simple circuit.

The operating system used here is Raspbian OS. Just because all of those weak points of the surveillance system, an energy efficient portable system is proposed, that can take pictures when the motion sense happens and send out an signal at the same time is much better than the current in use surveillance systems. It is simple to implement, small size portable stand-alone device.

Implementation

Step1: Setting up Raspberry Pi

Begin by slotting the SD card into the SD card slot on the Raspberry Pi, which will only fit one way. Next, plug the USB keyboard and USB mouse into the USB slots on the Raspberry Pi. Make sure that the monitor or TV is turned on, and that the right input is selected. Then connect the HDMI cable from your Raspberry Pi to the monitor or TV. If the Raspberry Pi is needed to be connected to the internet, plug an Ethernet cable into the Ethernet port next to the USB ports. When all the required cables and SD card are plugged then, plug in the micro USB power supply.

Step2: Sensing the Motion and Capturing the Image

PIR sensors, often referred to as, "Passive Infrared" or "IR motion" sensors, enable you to sense motion. Everything emits a small amount of infrared radiation, and the hotter something is, the more radiation is emitted. PIR sensors are able to detect a change in IR levels of their

detection zone (e.g. when a human enters a room) and hence sense motion.

Plug three of the jumper wires into the three pins on the PIR sensor. The three pins are labeled as: PIR-VCC (3-5VDC in), PIR-OUT (digital out) and PIR-GND (ground).

Use a jumper wire plugged to ground to connect GPIO GND (Pin 6) on the Pi.

Use a jumper wire plugged to VCC to connect GPIO 5V (Pin 2) on the Pi.GPIO 7 (Pin 11) as an input to sense when our PIR detects motion. Therefore the final step is to connect GPIO 7 (Pin 11) to the same rail as our PIR-OUT.

Step3: Detecting the Face

Face detection is a psychological process by which humans locate and attend faces in a visual scene. Once the camera [3] captures the image of an object the captured image is stored. OpenCV is used for facial detection [4]. OpenCV is written in C, but there are bindings for Python and actually PHP. Detecting the face from an image and cropping images, without cutting out faces. In this project, Python code is used for detecting faces. It is done by installing openCV and the Python bindings and then writing a quick script to detect faces in an image. An XML file with training data for the program is needed. Download the Haar Cascade Frontal Face package for OpenCV. This package is used for detecting face from an image.

The stored image is applied to detect faces using a face detection algorithm in python. The algorithm makes use of the coordinates and marks the detected faces in the image. The marked faces are then cropped using a cropping algorithm and are stored separately. Each time the motion sensor senses the motion of an object the image is captured and the image is

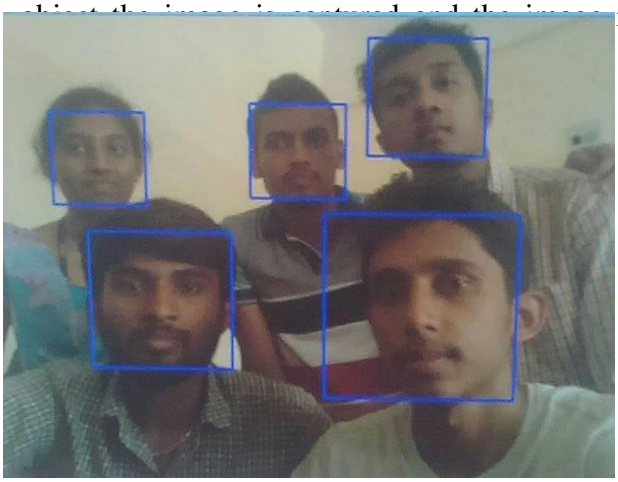

Fig 2. Detection of Face from captured Image.

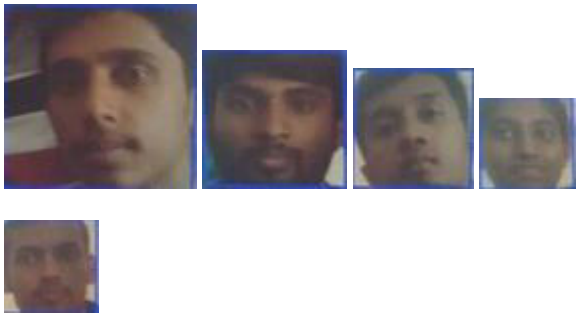

Fig 3. Cropped Faces from Captured Image

Conclusion and Future Scope

Raspberry Pi development board is a cost effective fully functional computational system can be used for many applications. PIR motion sensor and camera modules are also cost effective and can be used for surveillance systems. Using Python and OpenCV in Raspberry Pi, made our project flexible and adoptable to any required future changes.

Detected faces can be stored in cloud and can be used for recognizing the faces is the future scope.

References

[1] Raspberry Pi details
www.raspberrypi.org/

[2] Passive infrared sensor
https://en.wikipedia.org/wiki/Passive_infrared_sensor

[3] Raspberry Pi Camera Module
www.raspberrypi.org/products/camera-module

[4] Facial Recognition: OpenCV On The Camera Board.
www.raspberrypi.org/blog/facial-recognition-opencv-on-the-camera-board/

[5] Haar Cascades
http://alereimondo.no-ip.org/OpenCV/34