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V-Security Motion Detection System for Corridor

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***Abstract*: Nowadays CCTV cameras are installed at many places for different security purpose. But these CCTV's continuously record the situations hence there is unnecessary wastage of memory if nothing is happening in front of the cameras. Also the CCTV cameras does not provide alerts of burglary happening in front of cameras to security guards. Also the CCTV cameras does not provide alerts of burglary happening in front of cameras. A low cost security surveillance with motion detection system using OpenCV for college corridor is explained in this paper. This system can be reconfigure and can also be applied to many applications. However, for the purpose of this project a system configured to monitor a corridor is explained. The motion detection system is developed from the security point of view. In this system cameras are applicable to the areas where no one is permissible to enter after college hours, also where we need to detect if any motion has been done. The cameras are used to catch the movements in the areas in which it is being implemented, if any object is moving. The captured images are stored for further use. If motion is detected message will be sent. In this way the system will provide the security against misdeed.**

***Keywords*: V-Security, Motion Detection System**

1. Introduction

Nowadays, people want a sole thing that is to make them feel secure and safe. The most commonly used security system is the CCTV (closed circuit Television) cameras.[1] Closed-circuit television monitoring system that is CCTV has now become an indispensable device in today's society. Schools, hospitals, hotels, parking lot, and companies are having their own CCTV system for 24/7 monitoring and security purpose. It provides surveillance footage, gives real time monitoring and allows the authorities to have evidences against illegal activities. Although, the CCTV cameras are used to deter the crime and camera records the footage, it is just a passive monitoring system.[2] Many systems also use video recorders to record the video footage. Smart video surveillance is a IOT-based application as the system intimates about the presence of any person in the premises, also providing more security by capturing the activity of that person. The application polls the surveillance area continuously and once an activity is detected, images of the particular activity are captured using a camera connected to a Raspberry Pi Board. This application uses OpenCV, computer vision library and detects the motion. The agenda is to monitor a surveillance area without human intervention. Presently, there are CCTV cameras and security systems to monitor the restricted areas continuously. The problem with the current systems is that humans should keep polling to see if some unusual activity is going on. To avoid the polling, we can design a system which does this automatically and alerts the user when any such activity occurs through a text message, voice output, image, etc.

2. Literature survey

Smart Surveillance System using Raspberry Pi and Face Recognition: This paper has proposed the Smart Surveillance System using Raspberry Pi and Image Processing. In this system when motion detected it checks for the faces in the image captured and with the help of face recognition send alerts if the face detected. Raspberry Pi camera module is used to capture images once the motion is detected by the PIR Sensor [4].

Smart Surveillance Camera Using Raspberry PI 2 and OpenCV: This proposed system a system which provides both face detection and face recognition with the help of Raspberry pi 2 which is a credit card sized minicomputer and a Pi camera which is made especially for the raspberry pi2. Thus, when dealing with the real-time image processing, Open source computer vision (OpenCV) software, a powerful library of image processing tools, is a good choice. With the help of a smart surveillance system, we have achieved a system that can record the event, detect and recognize the person [1].

Low Cost Smart Security Camera with Night Vision Capability Using Raspberry Pi and OpenCV: This proposed system is designed to be used inside a warehouse facility. It has human detection and smoke detection capability and it provide precaution to potential crimes and potential fire. The Raspberry Pi (RPI) with Open Source Computer Vision (OpenCV) software handles the image processing, control algorithms for the alarms and sends captured pictures to user's email via Wi-Fi [2].

Smart Motion Detection: Security System Using Raspberry Pi: In this System, the Raspberry Pi executes a Python program that starts when the Raspberry Pi is booted and waits for motion to be detected by the PIR sensor. When motion is detected, the Raspberry Pi start records video or snaps a photo and send notification and to the Smartphone through application via Wi-Fi [6].

3. Objectives

In order to maintain peace and provide security to people now-a-days, closed-circuit television(CCTV) surveillance system is being used. In this scenario, continuous recording required large amount of space for which high capacity hard disk is required and also it requires manpower to detect the unauthorized activity. The basic aim of our proposed system is to automate this entire process to save time, energy and resources and also increase the feasibility. This study focused on the design and implementation a low cost smart security camera using Raspberry Pi (RPI) and OpenCV. The credit card size Raspberry Pi (RPI) with open source computer vision (openCV) software algorithms for the alarms and sends captured pictures to user's email or send alert message. As part of its alarm system, when there is detection.

4. Proposed system

The aim is to make a smart surveillance system using Raspberry camera. As soon as motion is detected, 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 OpenCV. The features which will be in our project are object detection, capturing only limited required images, blinking LEDs of particular sensor connected in particular area at the user's end, sending alert message when intruder has been detected and displaying the video on display device which will be at user's end.
The product will have following functionality

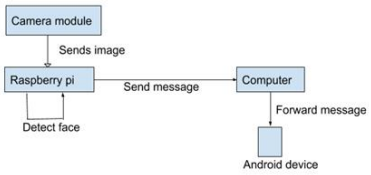

Fig. 1. Block diagram

To implement this system, the project will be divided into following phases:

- Phase 1: Raspberry pi setup, Network structure
- Phase 2: Implementing facial recognition using USB camera
- Phase 3: Implementing Push/Pull notifications over IOT
- Phase 4: Implementing mobile notifications
- Phase 5: Texting, extending functionality

A. Raspberry pi

The Model B+ is the final revision of the original Raspberry Pi. It replaced the Model B in July 2014 and was superseded by the Raspberry Pi 2 Model B. It comes with 4 USB 2.0 ports, compared to 2 on the Model B, and better hotplug and overcurrent behaviour. By replacing linear regulators with switching ones we have reduced power consumption by between 0.5W and 1W. There are two types of interfaces available on the raspberry pi, Camera interface for the pi camera and a display interface. The operating system running on Raspberry Pi Raspbian. All the used technologies have a Raspbian-supported port, therefore the operating system chosen for the Raspberry Pi is Raspbian [6].

Fig. 2. Raspberry pi

B. Open CV

OpenCV (Open-Source Computer Vision Library) is an open-source library offering computer vision and machine learning algorithms. It has been developed since 1999 and with over 47,000 community members is the biggest community-driven library for computer vision and machine learning algorithms. 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 are using OpenCV for the face detection and recognition. OpenCV was especially designed for real-time applications, meaning face recognition using a camera to get instant feedback of a camera stream.[7]

C. RASPBIAN

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 easiest way for a new user to get started with Raspberry pi. There are several versions of Raspbian including Raspbian Stretch and Raspbian Jessie.

D. Camera

Because most of the facial recognition open-source libraries support USB cameras, no Raspberry Pi camera will be used. The camera should preferably be a USB camera as it eliminates the need to bother with drivers.

5. Methodology

As per the system that is going to be implemented, we found that we have to use following algorithm and using this algorithm the proposed system will provide following functionality:

A. HOG (Histogram of Oriented Gradient):

Histogram of Oriented Gradient (HOG) was proposed by Dalal et. al. [5] in 2005 to detect pedestrians. The HOG feature is robust and has no sensitivity to both light and geometric

changes, and the computational complexity of the HOG feature is much less than that of the original data [5]. The main steps of HOG feature extraction are as follows:

- A 64 128 pixel window is divided by 8 8 pixel cell, forming 8 16 = 128 cells, as shown in Figure. The gradient components of each pixel (x, y) in X.-Y. Li and Z.-X. Lin.[5]
- A block of 16 16 pixels is composed of 2 2 = 4 cells, and 7 15 = 105 blocks are composed. The block step size of 8 pixels, the number of blocks in the horizontal direction is (64−16)/8 + 1 = 7, and the number of blocks in the vertical direction is (128−16)/8 + 1 = 15, as shown in above figure.
- Take a histogram of 9 gradient directions for each cell, as shown in Figure. Such a block has 4 9 = 36 feature vectors, and then 105 blocks of feature vectors are connected in series to form an image of 36 105 = 3780 HOG features.[5]

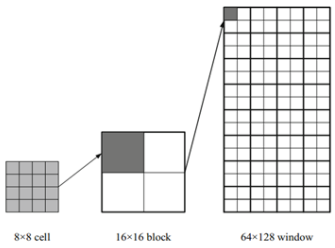

Fig. 3. Histogram of Oriented Gradient

B. Facial Recognition in OpenCV

OpenCV was started at Intel in the year 1999 by Gary Bradsky. The first release came a little later in the year 2000. OpenCV essentially stands for Open Source Computer Vision Library. Although it is written in optimized C/C++, it has interfaces for Python and Java. OpenCV-Python is the python API for OpenCV. OpenCV-Python is not only fast but is also easy to code and deploy. This makes it a great to perform computationally intensive programs.

C. Sound alarm and E-mail feature

This feature will be activated once the object is detected. This will send an email with the corresponding attachment to the receiver.

6. Conclusion

Thus the goal was implementing the low budget security system using OpenCV. Facial recognition and an IOT solution were implemented by using only one open source software, therefore the costs of system is only hardware related. For the alarm system, RPI was utilized to output the designated audio sound to the speaker and send the alert message via email which notified the user and provide the user essential time to prepare for the upcoming event.

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