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An Automatic Motion Detection System for a Camera Surveillance Video

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Abstract

Objective: To develop image-based alert system when trespassers intrude. **Methods:** Background subtraction is applied here so that we can detect the motion. In this method, we subtract the present frame from the previous frame which results in the movement or motion as the difference. Using Python as a platform, a frame window can be generated through which the principle can be applied. **Findings:** In modern era, surveillance is playing an optimum role and has been evolved as a need for industries, companies, shopping malls and even for homes which serves as a security purpose. This project deals with a conventional automatic surveillance system which can be applied without heavy complexity. By this facility, user can know the information even though he is located somewhere else. From the results obtained, one can observe even a small movement effectively from the captured area. **Application/Improvement:** The proposed model is feasible with minimum maintenance cost. Just Dropbox account which can be accessed from anywhere is enough. Mobile alert can be an alternative.

Keywords: Unauthorised, Background Subtraction, Drop Box, Surveillance, Feasible.

1. Introduction

Surveillance basically means monitoring the behaviour deeply. A conventional surveillance system monitors specific area and constantly captures the images once powered on[1]. The footage is stored in the database which can be viewed within certain period of time.

But these systems employ greater cost and also require human intervention to a large extent to know about the unapproved persons from the footage which consumes more time. But in current generation, it is difficult for humans to spend their time for surveillance. For this reason, we prefer automation. This proposal will reduce the man power to a large extent as all the work is done in automatic fashion. In economy point of view, this is very low in cost as the devices or equipment required is very less.

In general, if the entire video footage is sent to our mail, a lot of memory is consumed and the data to be processed is very high. Hence, only images are captured when a movement occurs. These are saved in Dropbox and are uploaded into the account of the owner. Also, we can make an alert message through our mobile stating that some unauthorised person has entered into the restricted or desired area.

For these features to exist, we can use our general computer or a dedicated board and a corresponding language to run and execute the programming part of the application. Here we are using Python, a high level language for programming which performs in all kinds of platforms. This is relatively less complex compared to other programming languages as this takes only very few memory to execute the program.

Also, Python deals very effectively with videos than any other platforms. These image processing algorithms are generally programmed in Open CV (Computer Vision), which is another package. This can be interlinked to Python. This proposal deals with the video surveillance which can detect the suspicious conditions by generating mobile and email alerts.

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A small and smart portable monitoring system is designed for home application in reference paper[2]. That article uses Raspberry Pi and a Gyro sensor for detecting the movement. Then a alert is sent to mobile and a notification is sent to email. In reference paper[3], a surveillance system is designed and is implemented on Raspberry which records the motion detected and is stored for the future playback. The notification is sent from a Dongle and a web application that can be viewed in the smart phone. In this method, the motion is detected using a Passive Infrared Sensor.

In reference paper[4], the author has also proposed a method for Raspberry pi based surveillance system. Here, e-mail and message notifications are sent when a person enters the captured area. A surveillance system using multiple ultrasonic sensors was proposed in reference paper[5]. When an intruder walks in, the transmission is blocked by the human body. As the receivers will not have any signals, the web camera starts and alert signal is generated.

Proximity sensor was used for detecting the motion. In reference[6], an alert system with real time network video capturing method is proposed. The video is captured for a given period and the captured video is stored in the Raspberry Pi memory. A basic application for home automation was designed in reference paper[7], which reads the subject of the e-mail and LED (Light Emitting Diode) are used for switching action. Thus, many efforts have been made for motion detection[8]. An optimum method of video surveillance minimises human involvement to a larger extent[9].

2. Principle

In this surveillance method, the basic principle focusses on which the movement of a thing or a person can be found is through background subtraction. This is the primary method through which many security applications follow. Here, we take the consideration of two basic frames. They are present frame and previous frame.

In this method, to find a movement, we subtract the previous one from the current frame. When this is done, obviously, the change will be found. In this operation, when background subtraction operation is done, pixel by pixel subtraction takes place. This is the reason for the difference between the two frames is observed as a movement. In this case, we consider the horizontal pixels as the image width and vertical pixels as the height of the image. When it comes to programming part, height is taken as columns and the width is assumed as rows of pixels because they are necessary to have a fixed shape for a frame to capture the input.

3. Algorithm

The below operations must be executed sequentially to obtain the desired output for the required application.

Step 1: Initially, using the principle of background subtraction, the difference between previous frame and the current frame is to be found out.

Step 2: After the subtraction is done, we apply a fixed value of threshold to the resultant image. In this process, all the non- zero values are converted to the pixel value of 255.

Step 3: Now, we are left with two pixel values, 0 and 255 only. When A is taken as the image height and B as its width, and if total white pixels are more than A*B, then it is considered as a significant change from previous frame to that of the present.

Step 4: When such condition is satisfied, alert is given to our mobile and the images are saved to the Dropbox account.

By executing the above steps and if programming is done accordingly, we can successfully detect the motion from a surveillance video and can capture the images which illustrate the motion that is captured.

The flowchart for the corresponding algorithm is shown at the end of the article in "Figure 1_Aravind". In

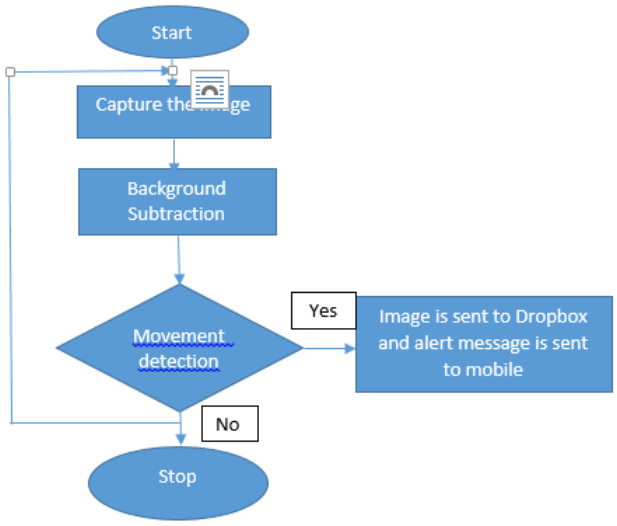

Figure 1. Flowchart with the sequence of steps involved in the process.

"Figure 1_Aravind", if any movement is detected, image is saved to Dropbox account of the owner and an alert is sent to his mobile. If no movement is detected, it waits and performs the Background Subtraction principle for the next frame.

3.1 Alert Generation:

This surveillance system is implemented with two types of alert generators. When a person moves in the room or area, an alert is sent to the mobile of the owner through a kind of warning, using some open source modules. Along with that, the images that are captured, are saved to the Dropbox account of the owner.

4. Results and Discussion

In this case, only a single camera is linked with the software. Two photos correspond to pop-up windows. One among them will display the warning message suggesting that some unauthorised person entered into our surroundings. On the other window, the thing which we wish to capture, is recognised and is taken.

In "Figure 2_Aravind", a small window pops out displaying warning message whenever a movement occurred before the camera. For each movement, a warning message is displayed and we can assign a limit to the number of messages which can be done in programming. When we give a lower limit, warnings are displayed and then the window is automatically closed. Otherwise, this process occurs continuously.

"Figure 3_Aravind" is another pop up window where the camera is capturing our image when we make any movement. Here, Background Subtraction operation is applied between the existing and previous frames. These two pop-up windows will open immediately when the corresponding program execution starts.

In the images "Figure 4_Aravind", "Figure 5_Aravind", "Figure 6_Aravind", the successive movements are captured based on the operation of background subtraction. All these successive movements are made by the person in the captured area.

Now, as an alert, images captured are sent and are stored in dropbox. Numbering is given in certain order. When the program is run again, these images will be replaced by the latest ones. "Figure 7_Aravind" shows us how the images are saved by the owner whenever a movement occur before the camera. Mobile alert can be an alternative by using Twilio software. Equipment

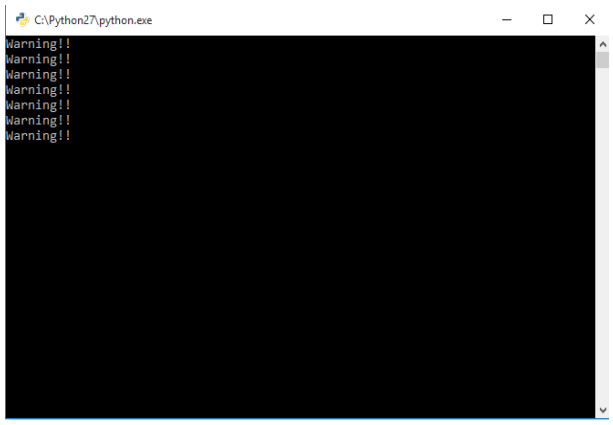

Figure 2. Pop-up python display window.

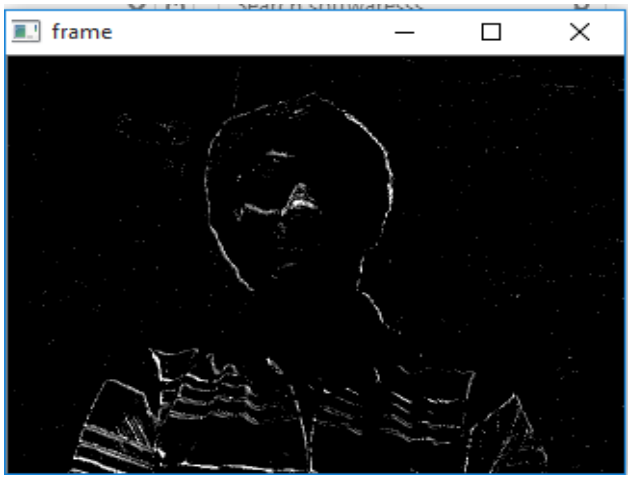

Figure 3. Frame window .

Figure 4. Initial output .

Figure 5. Output after one movement.

Figure 6. Output after two movements.

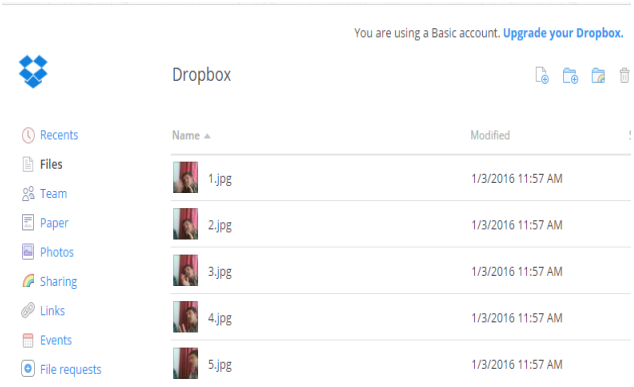

Figure 7. Images in Dropbox account .

used here is not complex and cannot be damaged by any other source. So, reliable output is obtained from very few samples. Number of samples depends on user's interest.

5. Conclusion

From the obtained results, the user is able to detect the motion even to the very slightest. Performance of the system can be adjusted to an extent by optimising the variables involved in the program. Using frame window, we detect the motion by applying the Background Subtraction principle. Immediately, successive movements are captured and are sent to Dropbox account in the form of images. All we have to do is just accessing Dropbox account so that alert can be received. In any case, if that is difficult to access, we can use mobile alert using Twilio software which displays a warning message.

The proposed method is very simple which can serve in practical conditions where surveillance is a must. Also, this does not need any human involvement as the monitoring can be done automatically. This application can be extended to multi camera environment by including another camera. For this, corresponding programming must be done.

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