Indoor Surveillance System Using Android Platform

[1] Mandar Bhamare, [2] Sushil Dubey, [3] Praharsh Fulzele, [4] Rupali Deshmukh, [5] Dr. Shashi Dugad

[1,2,3,4,5] Department of Computer Engineering,
Fr. Conceicao Rodrigues Institute of Technology
Vashi, Navi Mumbai. 400708, India

Abstract - This paper is about an automated indoor surveillance system on android that works without the need of any human intervention. An android phone is mounted on the wall, which monitors a closed room. If any moving object (i.e. intruder) enters the room, then the System automatically alerts the remote registered user by sending a warning SMS and photograph of the intruder. After alerting the user, Video is recorded and an alarm starts ringing. The System detects Intrusion through image processing. The motion is detected using the Background Subtraction Algorithm of Image Processing. Computational power and Camera of an android phone is used to perform the video processing on the phone itself.

Keywords - **Indoor Surveillance, Image Processing, Android, Opencv, Motion Detection, Background Subtraction.**

1. Introduction

There are various Video surveillance system and sensor devices for security in public and private places which ensures security. The existing systems like CCTV camera require human intervention, where a person sitting at master computer needs to operate [1]. It may be effective if very high level of monitoring is needed. But it may not be useful for a place where no one is allowed to enter like bank locker, server room and closed room. The existing systems require large storage space for video and human to monitor. These systems are inefficient for indoor surveillance which requires to alert remote user instantly. Video surveillance system using Image processing is an intelligent system which detects any moving objects [2]. It performs image processing on the video, to detect the objects or person and stores the video.

This intelligent system requires a computer to perform the Image processing tasks. Installation of such a system is cumbersome job and the System needs many components. These existing systems mentioned above are unable to provide real time intrusion alert to the user.

Indoor surveillance system using android platform is an application which monitors a closed room or some private room with static background. The Indoor surveillance system utilizes the camera of an android phone to monitor a room. On detection of the Intruder, the System sends an SMS and a Photograph of the room and thus alerts the remote user about suspicious activities.

The Android smartphone is used to perform image processing tasks. The system is completely automatic and no Human intervention is required except to start the system itself. There is no need for any extra connectivity to the android phone. The System utilizes the computational power, camera and Wi-Fi feature of the phone. Since the system is developed considering high security environment particularly in unmanned areas of surveillance, such as bank locker rooms, where ideally there shouldn't be any kind of motion, the key aspect in implementation of the System is Motion Detection. Any kind of Motion in the room is assumed to be caused by an Intruder, which needs to be recorded and informed to the remote user.

2. Proposed System

The proposed solution is to create an "Indoor Surveillance system" using Android Platform. The System will help to detect any kind of intruder in a closed room with Single entry point. The System plans on using the android phone's camera and immense computational power of the phone to do so. This system will need a basic android smartphone with a camera.

The device will be mounted at a proper place with its camera facing towards the entry point of the room. Android smart-phones provide features like Video Recording, in-built Networking, Memory Storage facility, Computation center (CPU). If any kind of intrusion occurs then it will alert to the remote user by sending message.

2.1 Advantages over Existing System

1. **Fully Automated**
   The system will not require any human intervention at any point of time except while starting the system. No need to hire a human to continuously observe the video feed.
2. **Wireless system**
   Since every task is performed by a single compact device, there will be no mesh of wires. User can setup the mobile device on his own without the need to depend on anyone else.
3. **Easy to install**
   Setting up the System requires just Installation of the "Indoor Surveillance" app on the Android Smart-phone and placing up the phone at a suitable place from where it can Record activities of entire room. No wiring, No Server Installation, No CCTV setup required.
4. **Battery powered**
   Since the mobile phones use phones Battery they can continue to function even in case of power loss for a small period of time (expected to work on battery power for at least 2 hours).
5. **Quick to response and raise alert**
   As soon as there is any suspicious movement, User gets to know about it via an Email and SMS on his phone. Further action can be taken by the user, to quickly &immediately catch the person responsible for breaking in.
6. **Cheap**
   All it takes is a Smart Phone with a SIM card andWi-Fi Enabled network. No need to buy a Server, or any person to continuously monitor the room. No wiring cost, No CCTV cost.
7. **On-The-Go Solution:**
   Someone looking for a temporary surveillance can use the proposed system on the go.
8. **Offers real time tracking:**
   User can be notified immediately without any delay with the picture of intruder.
9. **Portability:**
   System can be mountedby installing the application on the android phone.

The Intrusion detection is done using image processing techniques. Initially a frame is captured which serves as background image for future. The systemkeeps on capturing frames and compares it with initial frame. Using image subtraction these two images will be compared pixel wise, if there is any difference above the threshold value then the situationis concluded as motion in the background. Thecomputational part is performed on android phone and it makes use of android phone's processing power.

Once if any intrusion occurs, then that set of frames and video is saved for future proof. System will immediately inform the remote user through messaging and will send a photograph of the room via Email.
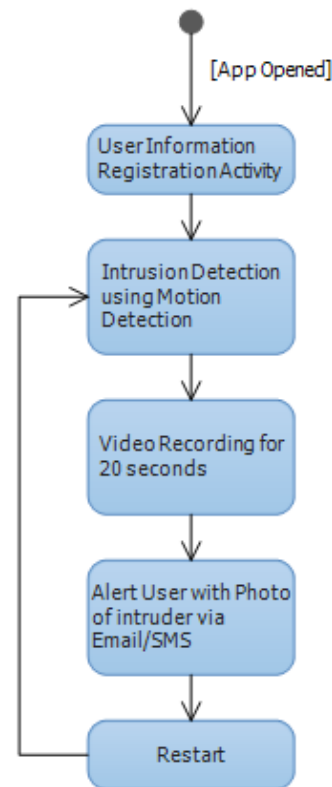
2.2 Application Flow

Fig 2.1: Overall workflow of the System

3. Implementation

3.1 System Modules

1. Login and Signup module/User Information registration Activity :

In this module the new user can register with the application by entering his/her details while the already registered users can login to the application

2. Surveillance module/Motion detection using Opencv:

In this module the area which is to be monitored will be continuously inspected or observed for any kind of intrusion or suspicious activity. This is done using Opencv that process the input from the camera to find any kind of

intrusion. Opencv accomplishes this task using the Background subtraction method.

Image Processing Tasks for Motion Detection:

A.   Capture Background Image

The processing tasks begin with capturing the first background image. This background image shows how the environment without the intruder should look like. The background image acts as reference image to compare the further images for detecting new objects in the room that were not present in the before.

Image 3.1 Background image

B.   Apply Background Subtraction technique to the captured Image

Start capturing images for comparison with the previously captured background image.Using image processing function *absdiff, [3]* find the difference between the current image and background image. The Subtracted image result is as shown below:

Image 3.2 RGB Image with Human Intrusion

Image 3.3 Result of *absdiff ()* with Human Intrusion

C.   Apply Binary Thresholding Algorithm

Thresholding segments the gray-scale image and transforms it to a binary image[4]. We use Binary Thresholding to segment the result of *absdiff*. The Binary Image consists of Black and White pixels only. Apply Dilation iteratively to the threshold image to enhance foreground object and to remove internal noise from the image.

Image 3.4 Result after application of Binary Thresholding

D.   Finding Contours

Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition.In Image processing, finding contours is like finding white object from black background. Thus, object to be found should be white and background should be black [5].The Binary Image has background of room in Black Pixels & Extracted moving object in White pixels. We find such

White continuous areas in the threshold image. Presence of White pixels indicates there is motion in the environment. To reduce the false negatives, minimum area is set to 2 percent of the total image pixel. If the area of the contour is more than 2 percent of the area of the image, only then the system calls it as a contour. This eliminates detection of very small changes in the

E.   Checking for Contours in 15 Consecutive frames

To further improve the algorithm, the system checks for contours in 20 consecutive frames. Thus small motions which are not detected in consecutive 20 frames are ignored by the system.

F.   Contours found in 20 Consecutive Frames

In such a case the system can conclude there is a definite solid motion in the room. Thus intruder is detected and further tasks of Video Recording and sending notification to the user can begin.
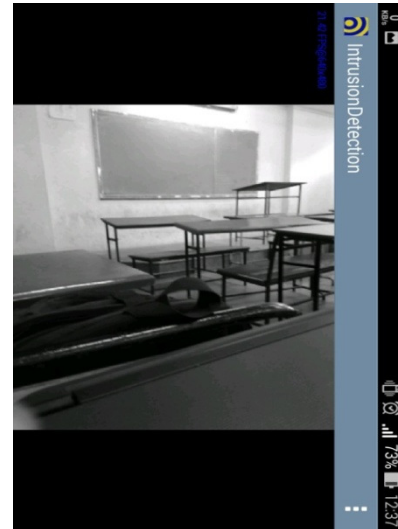
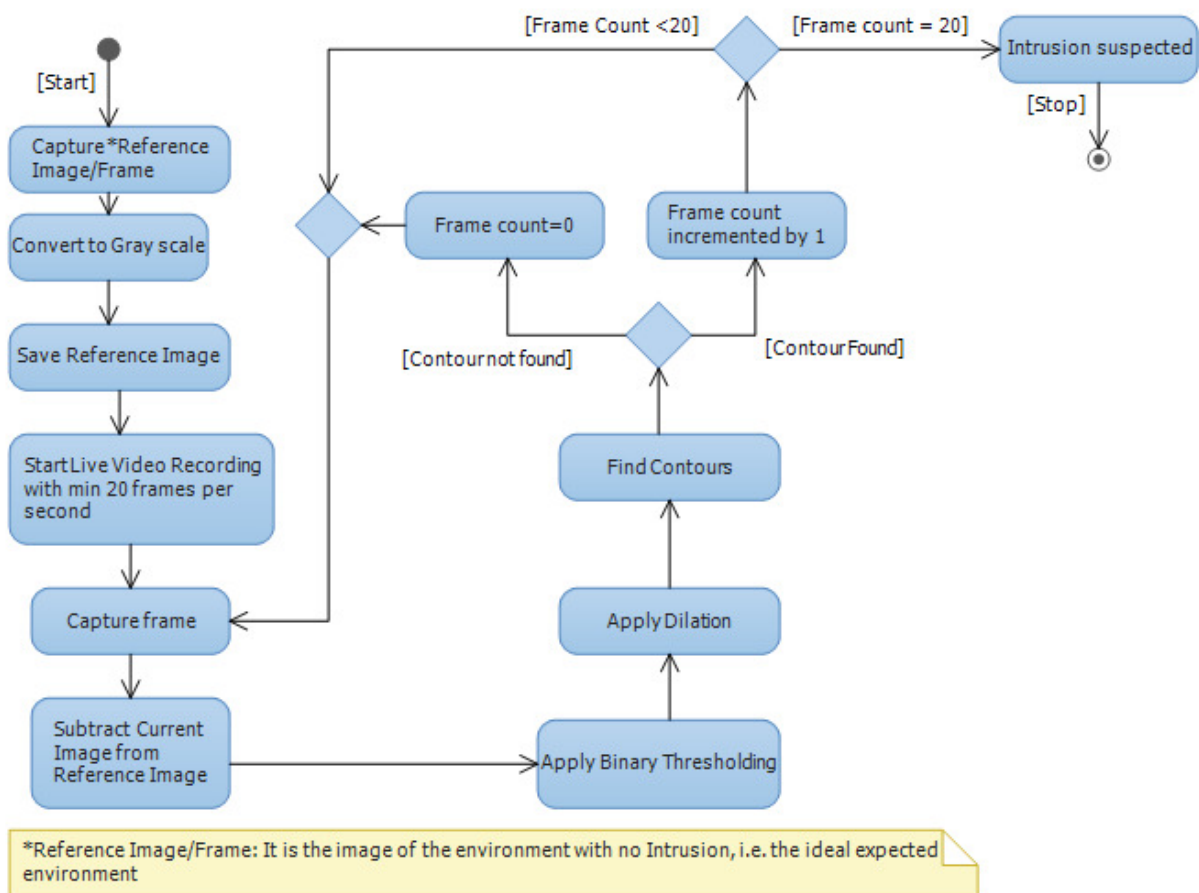Fig 3.5: Surveillance using Opencv

Flow of Image processing steps:

Fig 3.6: Motion detection Flowchart.

3. Automatic Video Recording:

As soon as the intrusion is detected this activity is initialized. In this activity the video of the intrusion is recorded and stored as a proof.
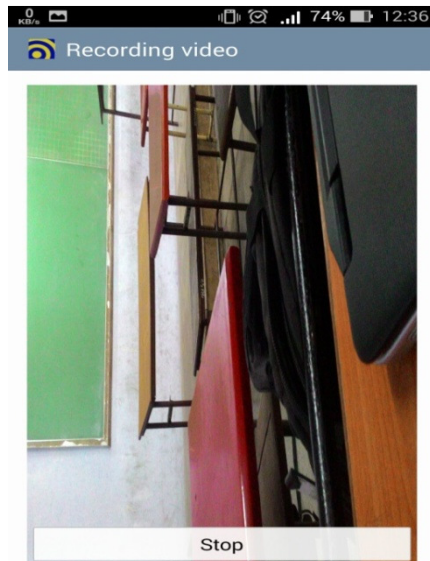

Fig 3.7: Video Recording Activity

4. Sending Alerts:

This is one of the important modules as it helps to notify the user about the intrusion asandwhen the intrusion occurs. Thus gives a real-time intrusion alert to the remote user
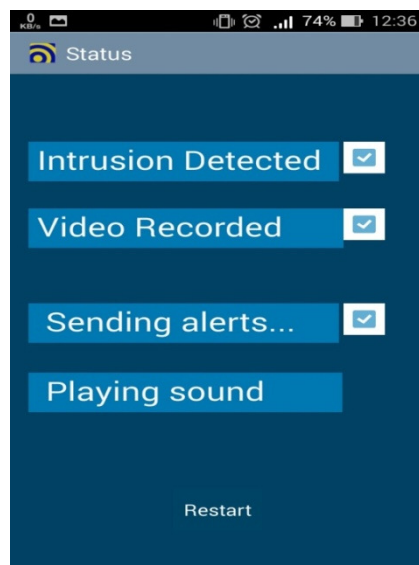

Fig 3.8: Status activity.

5. Buzzer Alarm:

The System Rings a buzzer if intrusion has occurred. This action is performed so as to warn the intruder.

4. Conclusion

"Indoor Surveillance Using Android Platform" will be a user friendly android application which will allow the user to detect any kind of intrusion in a static background. This application will overcome the drawbacks of the existing system, thus making it more efficient than the once that are already present. The aspects of the system that will actually fascinate users are the reusability, real time information about intrusion and the most important of all cost of the system. An algorithm which gives highly accurate results in less time and comparatively less cost than the existing systems has been presented. This system was built keeping in mind every possible behavior of the intruder thereby enhancing the efficiency of the system. Hence the system developed provides high efficiency in less cost since no hardware complex connection is needed and also because of less storage requirements.

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