Real Time Smart Security System for Motion Detection

Sanjay P N[#1], Vijaya Krishna [#2], Dr. Naveen Kumar S K[#3]

Abstract—Security is increasingly viewed at all encompassing condition in which people and community lives in freedom, peace and safety.

Object security is an important issue in all remote monitoring of confidential areas like museum or archaeological department.In general cases object security is ensured using human power, the work addresses the issue of video based security system for the security of the object in public area.

This paper describe the Video processing technique is applied to extract the video frames and morphological operations is applied to the extracted frames together with threshold technique to ensure the security of the object, and also it gives security to sensitive area, if intersection comes it shows message (ON/OFF) and sounds the alarm. Video camera can be accessed local as well as from remote and it perform 24 hours verification with of alarm accuracy and displaying the message.

Index Terms—Alarm, Image Change-Detection, pixel, Security Alerts.

1. INTRODUCTION

In today's world of growing technology security is of utmost concern[1].Security is increasingly viewed as an encompassing condition in which people and communities live in freedom, peace and safety, participate fully in the governance of their countries, enjoy the protection of fundamental rights, have access to resource and the basic necessities of life, and inhabit an environment which is not detrimental to their health and wellbeing, the security of the people and the security of the state are mutually reinforcing.

Like the public places there are some other places such as historical and ancient jewels museum, the banks, the big corporations and the big companies always have the threat of being robbed or being attacked by anti-social peoples. We have CCTV's, surveillance cameras everywhere but less man power to supervise this system and even though we will have enough man power then also it is not possible to supervise perfectly. As a result we are not perfectly secured but still thinking that we are secured. Digital Image Processing provides a solution for all these issues[2].

Mandaret.al[3] describes video security system which monitors a premise to detect unwanted intrusionsit. A plurality of cameras located about the premise, supply video images of scenes to a processor located which processes the images to detect the motions in a scene and classify the source of motion. Only if the source is determined is one of a pre-determined class of causes, in an indication provided to an alarm unit. The alarm unit, which is also connected to a plurality of conventional sensors, is responsive to the indication to cause the processor to transmit authenticated video images of the scene in which the motion is detected to a central station. There, a video server in conjunction with an alarm computer enables the images to be displayed at a selected workstation for viewing by an operator. Besides video, audio and relevant site data is also made available to the operator at the work station.

Anithaet.al[4] presented a moving object detection, which is achieved by comparing two subsequent still images from a surveillance camera, captured every two seconds. The difference between the pixel values is calculated and the output is obtained using a deterministic rule.

The objective of video tracking is to associate target objects in consecutive video frames. The association can be especially difficult when the objects are moving fast relative to the frame rate. Another situation that increases the complexity of the problem is when the tracked object changes orientation over time. For these situations video tracking systems usually employ a motion model which describes how the image of the target might change for different possible motions of the object Suneelet. al[5].

The organization of the paper is as follows:

- *Sanjay. P. N is currently pursuing post-graduation degree program in Electronics in Mangalore University, INDIA, PH-+919886330310. E-mail: sanjay.paramale@gmail.com*
- *Vijaya Krishna is currently pursuing post-graduation degree program in Electronics in Mangalore University, INDIA, PH-+919481194676. E-mail: vijaykrishnavj92@gmail.com*
- *Dr. Naveen Kumar S K is professor in department of Electronics, Mangalore university, INDIA, PH- +919448318252. E-mail: nave12@gmail.com.*

Section 2 explains system methodology about the video capturing technique and results are discussed in section 3. Finally the paper concluded in section 4 and future scope explained in section 5.

2. SYSTEM METHODOLOGY

The proposed system uses MATLAB environment to detect motion for real time security purpose as shown in flow diagram below Figure.1.

Figure. 1. Component required for overall System

Camera starts capturing images for the monitored area at regular intervals using a USB web camera attached to the computer system. These images are then processed using MATLAB software. In this method,first image which is a reference image represents the reference pixel values for comparison. Second image, which is called the input image, contains the entering object. Finally two images are compared and the differences in pixel values are determined. Frame difference which calculates the differences between two frames at every pixel position and store the absolute difference. It is used to visualize the moving objects in a sequence of frames. Third image, which is called output image[4,6]. The reference and input images are compared by taking their difference where the output of this comparison *D*RI*(x,y)* is determined by the following rule:

$$\boldsymbol{D}R(x,y) = \begin{cases} 0 & if\ R(x,y) = I(x,y) \\ I(x,y) & if\ R(x,y) \neq I(x,y) \end{cases}$$

Where *R(x, y)* and *I(x,y)* are the reference and input images, respectively at image coordinates *(x,y)*.

The obtained difference matrix is then threshold in order to determine the third image output image *O(x,y)*, which contains the entering object. To threshold the difference matrix, we first calculate its average pixel value using:

$$\boldsymbol{D}avg = \frac{\sum_{x=1}^{nx}\sum_{x=1}^{ny}\boldsymbol{D}R1(x,y)}{\boldsymbol{nxny}}$$

2.1Flow chart

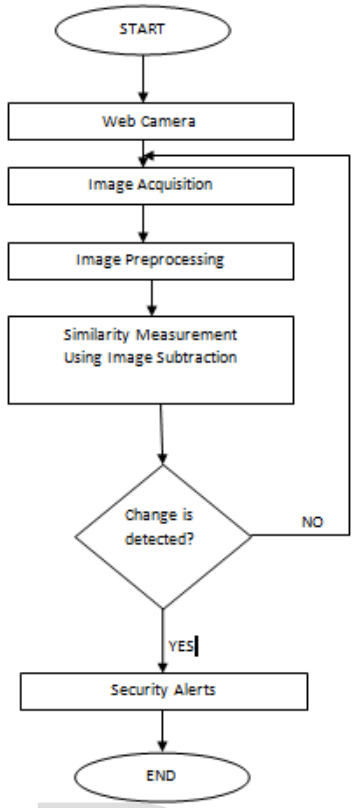

Figure. 2. Flow chart of security system

Image is captured through the web camera. The next section illustrates the basic steps required to create an image acquisition application by implementing a simple motion detection application. The application detects simple movements in a scene by performing a pixel-to-pixel comparison in pairs of incoming image frames. If nothing moves in the scene, pixel value remains same in each frame. When something moves in the image, the application displays the pixels that have changed values. Image acquisition toolbox software is used to acquire image data.

The image pre-processing step is used to remove the noise and gamma correction. A similarity measurement is used to decide how close the original image is to the captured image and depending on the calculated similarity measurement our system will decide if there is any change. The absolute image differencing is used for change detection. Images are obtained as frames. We obtain 5 frames in 1 second. The first frame is kept as reference and the successive frames are subtracted from the reference. This will detect the changes in the frame.If there is no change in the scene, then the output pixels will mostly be zero values. If however, there is a change, then pixels in

regions of the image where the intensity changes spatially, will exhibit significant absolute differences between the two images [7]. If we set this to zero, then it will produce error, so we should set it to some threshold value such as Γ.If there is difference between two images is greater than the threshold value then alarm gets on with the message '*object enters*', else alarm will be in off state and it will display '*no*' in the message.

3. RESULT AND DISCUSSION

The object of interest is a stationary object for which the security is to be ensured, is focused with a fixed web camera. The camera captures the video of the stationary object in a regular interval. A set of properties of a captured video such as frames/second, number of frames, width, height, compression type, image size and file size which forms an example of a set of input video information. The video file frames has to be extracted for further processing. Several interpolated frames may be synthesized between each pair of original frames. An important advantage of using true motion estimation is that it results in better video quality.

Next stage is to convert the single movie frame F into the indexed image X and associated color map 'MAP' and stored in an array of image structure. If the frame contains true color data, then MAP is empty. It is important that the camera must be fixed because the motion of foreground video object not only disturbs the accuracy of motion sequence but also blurs the generated image.

Morphological operation is applied to the external frames (images) to identify the new object (person) entry into the video sequence. As in this case, the stationary object being the computer system, the new object a person is encountered from the frame numberX0 to frame number X29out of X30 frames. In order to make the system recognize the new object entry (person) in a video sequence, the basic change detection algorithm is implemented. A basic change detection algorithm takes the image sequence as input and generates a binary image B:R→[0,1] called a change mask that identifies changed regions in the last image according to the following generic rule:

$$B(x) = \begin{cases} 1, & if\ there\ is\ a\ significant\ change\ at\ pixel\ x\ of\ I\mathrm{m} \\ 0, & otherwise \end{cases}$$

Where {I1,I2…….Im} be a large sequence in which each image maps a pixel coordinate xЄR to an intensity or color. Compute the image difference with the help of morphological operation.

$D(X)=I_2(X)-I_1(X)$.

Considering the image of the frame no. 105& frame no. 90 as $I_2(X)$ & $I_1(X)$ respectively.The image morphological operation is applied the resultant change mask image frames is shown.

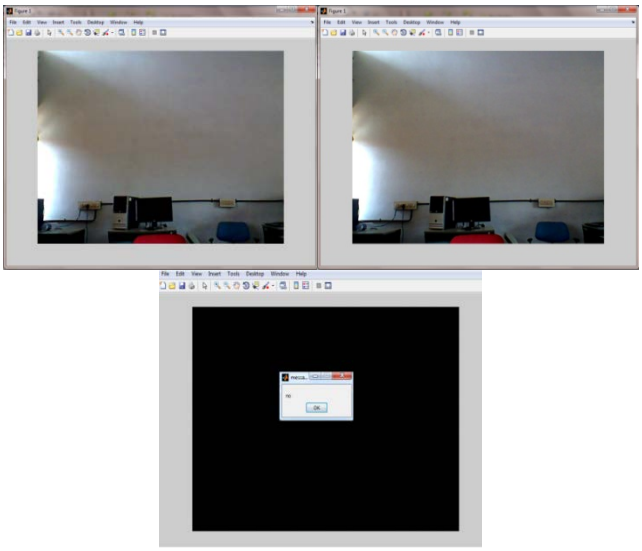

Figure.3. Security testing without object a) Frame 90 b) Frame 105 c) Resultant image

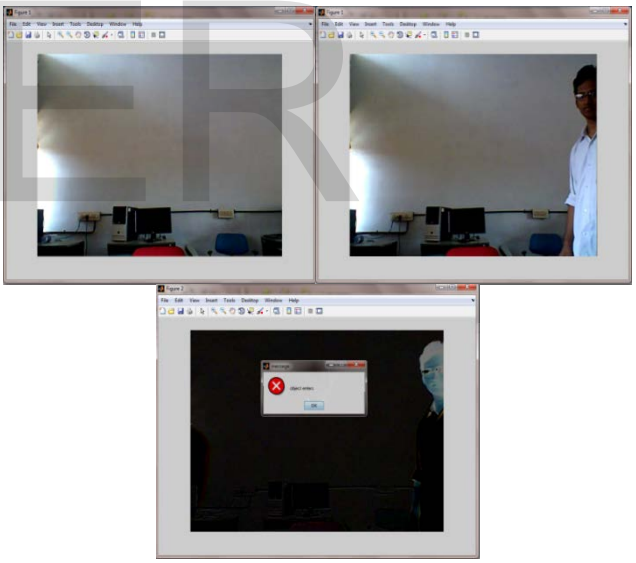

Figure.4. Security testing with object a) Frame 135b) Frame 150 c) Resultant image

The threshold operation is done with the gray scale morphological image difference. The change mask B(X) is generated according to the following rule:

$$B(X) = \begin{cases} 1, & if\ |D(x)| > \Gamma \\ 0, & otherwise \end{cases}$$

The threshold *Γ* is chosen randomly based on specific requirements that generates an alarm signal and also displays the message (ON) when B(x) attains the value 1.

Premise can be monitored without recording the events and it would be helpful in saving systems memory.

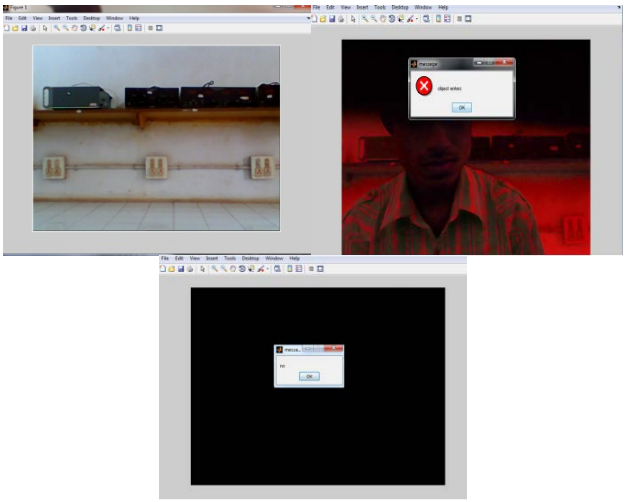

Figure.5. Resultant images for security testing with and without object.

4. CONCLUSIONS

In this paper we have developed a video based security system. This system can be implemented in the places like bank safety lockers, museums, Archaeological departments, night security at home etc. The system mainly consists of a web camera, a processor which contains MATLAB software, and an alarm unit.

This proposal can be implemented in fields like Archaeological departments, Museum, Safety lockers in banks etc. where the things or objects are stationary. Any movement of an object can be detected. Hence this project can be a very good candidate for such fields.

5. FUTURE WORKS

In future works, the system can be modified by inclusion of Arduino microcontroller, and high accuracy wireless cameras to make use of system to large extent. It will also reduce the overall cost of the system.

Various aspects of the developed system, such as hardware components (i.e. distributed wireless high-quality cameras can be used instead of a single web camera to monitor a large area), system requirements, and others can be further studied to improve the quality. Future efforts can concentrate on improving the reliability and robustness of both detection and security alerts tasks to achieve better performance.

6. REFERENCES

1. JyotikaKapur, Akshay J Baregar, "Security Using Image Processing", *International Journal of Managing Information Technology (IJMIT)* Vol. 5, May 2013, pp. 13-21.
2. Shafiqua T. Pathan, Sharyu S. Waghmare, Pranali P. Khadse, et.al., "A Survey Paper On A Novel Approach For Image Classification Based On SUSAN Low Level Image Processing Algorithm From Real Time Video", *International Journal of Scientific & technology Research*, Vol. 3, February 2014, pp. 201-205.
3. Mandar P. Pathrikar, Suhas J. Bhosale, DurgeshPatil, et.al., "Smart Security System For Sensitive Area by Using Image Processing",*Proc of 3rd IRF International Conference*, 2nd March 2014, pp. 50-54.
4. Anitha A, Gayatri J and Ashwini K, "Automatic Recognition Of Object Detection Using MATLAB", *International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)* Vol. 2, September 2013, pp. 749-756.
5. A.SAI SUNEEL, "Person Or Object Tracking And Velocity Estimation in Real Time Videos", *Publications Of Problems & Application In Engineering Research*, Vol 04, 2013, pp. 292-299.
6. Furat N. Tawfeeq, "Real Time Motion Detection in Surveillance Camera Using MATLAB", *International Journal of Advanced Research in Computer Science and Software Engineering*, Vol. 3, September 2013, pp. 622-626.
7. QusayIdreesSarhan, "An Integrated Real-Time Vision Based Home Security System", *International Journal of Advancements in Research & Technology*, Vol. 2, May 2013, pp. 331-336.