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Computer Vision-based Image Processing System for Redundant Object Detection

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Abstract -*For With the drastic increase in image processing technology our proposal mainly focuses on utilizing this system for providing a better life standard. As an essential constituent of many association's security and safety precedence, video surveillance and tracking have established its importance and benefits numerous times by providing immediate supervising of possessions, people, environment. This proposal deals with the design approach of developing a Raspberry-pi based Real-Time Surveillance System for intruder detection providing essential security and its alert mechanisms reinforcing surveillance technology. The proposed security solution hinges on our novel integration of cameras and motion detectors into web applications.*

Key Words: Embedded System, Raspberry PI, Surveillance System, Motion Detection, tracking,video processing

1.INTRODUCTION

Raspberry Pi interfaced with USB camera operates and controls motion detectors and video cameras for remote sensing and surveillance to realize systems with immense functionality. The video capturing systems that have the ability to alert and record beside live video streaming of the intruder helps to provide further actions. In existing methods, systems had to be monitored by a person watching the monitors in a room all day to make sure everything is fine. This proposal mainly focuses on developing a surveillance system that detects an object using Image Processing and to respond back by capturing an image and passing it to a monitoring device through the internet platform. The system will require a Raspberry Pi module, camera and internet connection. It will come up with the implementation of a surveillance system that presents the idea of monitoring a particular place in remote areas. The purpose of image processing is a visualization which is to observe the objects that are not visible. Scripting of Image Processing is done by the OpenCV library providing the necessary platform for python to process videos. The development of this proposal is influenced mainly to design a cost-effective surveillance system through innovative technology. This project will design and implement a system based on the Raspberry-Pi microcomputer. The system will detect motion (intruder), activate a camera to take frames of the video after movement is sensed and then send an alert to the facility owner through a web application with an image attached.

2. LITERATURE SURVEY

Detecting objects using image processing systems can be achieved using various methods with greater efficiency levels. The background image considered as reference image may differ due to variations in light intensity levels and hence [2] has averaged few images frames at regular time intervals to reduce smaller changes. To detect an object comparison between two image frames are required for which background subtraction [4], [7] and absolute difference [1], [6] technique is implemented where the difference of the frame is obtained and identified in GrayScale. On integration with background difference, a new mechanism called Fuzzy logic where decision algorithms along with area and region-based thresholding are done is provide proper segmentation and thresholding. Also to determine differences between frames, wavelet transforms are used with which edge detection is provided for the different objects. [5] proposed a system for detecting the infrared objects by using the Mean Shift key algorithm providing an analysis of optical detection systems. Thresholding of the GrayScale image is a necessary part of object detection making it much simpler and efficient in detection where [1] performs basic binary thresholding making it simple for processing while, [2], [9] deals with Otsu's thresholding method for converting the grey into binary scale representation. After segmenting the image as background and foreground image using the thresholding method, noises will be introduced in the image frame. The noise filters like Gaussian are included in the processing by [3], [4] which smoothens the image, but with this, the efficiency of the foreground image is also reduced. Hence morphological operations included [2], [4], [6] results with better object detection. With noises being reduced now the final detection and tracking of the object are done with Sobel edge detection [5] computing the gradient magnitude. But canny edge detection algorithms [4] are more accurate since low pass filtering is done before edge detection. The geometrical shape of the object is identified using contours operations [1] by which the object tracking can be done. [8] uses wavelet transform for comparison of frames with four sub wavelet bands. By performing inverse wavelet transform, sharp edges can be

detected with which video object plane (VOP) can be detected.

3. PROPOSED SYSTEM

3.1 Framework

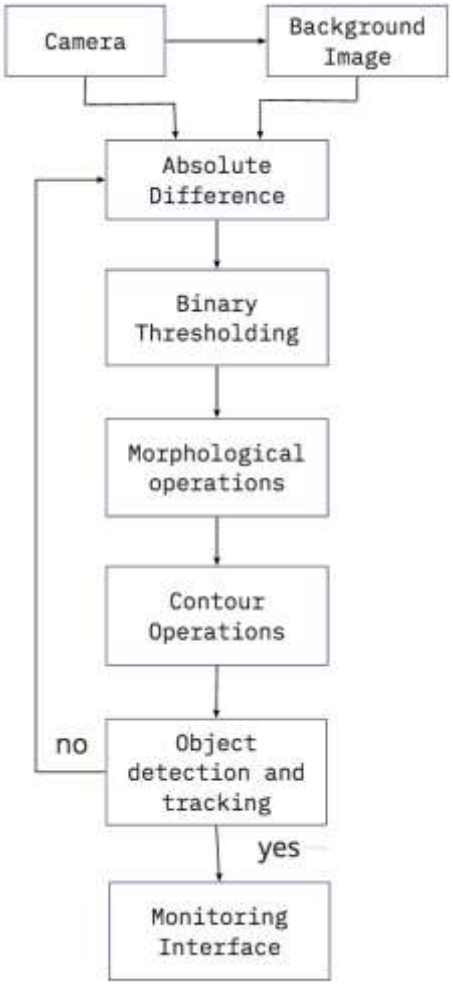
The framework of our proposal starts with the detection of an object using Raspberry-pi by processing an image and sending the information to the monitoring interface. Here the image processing systems are developed using Computer vision technology for detecting objects where the capturing of images is achieved with a USB Camera. Along with numerous operations and algorithms for processing of images by OpenCV libraries, thresholding techniques are imported to implement motion detection and video stream tracking. The threshold technique needs the extraction of an image frame from the video stream at a particular time interval, in which each frame undergoes a few processing steps.

3.2 Absolute difference between consecutive frames

With USB Camera being stationary, the new objects in a particular frame can be detected by obtaining the difference between the background image and current frame from the video. When the difference value exceeds zero on processing the image, then it is assumed as an object and further processing of image takes place to confirm the object considering the current frame as a foreground image. Utilizing the OpenCV library function the frame is then converted into GrayScale representation, simplifying the processing.

3.3Binary Thresholding

To make it much easier for detecting objects binary thresholding needs to be done. The motion detected area is segmented out from the static background region of the frame for further processing. On setting the threshold intensity value as 50 individual pixels are processed. The pixel value greater than 50 is considered as 1 and other pixels in the segmented area as zero. With this, the binary representation of the images can be achieved making it suitable for morphological operations to follow.



3.4 Morphological operations

Binary thresholding further includes noises leading to misassumptions detecting it as objects. To overcome this problem morphological operations are included in this proposal for reducing smaller level noises to zero, modifying the geometrical structure of the object providing efficient output.

The boundary expansion of the object is done by dilation filling up the holes present inside the object. Setting the kernel value as 15, the maximum value of pixels will be the value of output pixel. Further erosion operation takes place removing smaller objects in the frame. With kernel value 10 the minimum value is considered as the output pixel value.

3.5 Contour functions

A closed curve of the same intensities pixels represents the object being detected which can be achieved using OpenCV contour function. Individual curves are then

highlighted by drawing a boundary box indicating it as an object being detected.

3.6 Monitoring Interface

With the object being detected using Raspberry-pi, the detected image frame from the video stream is sent to the user using a monitoring interface by then necessary actions can be taken with the detected objects. Along with information being passed to the monitoring interface, an alert mechanism is included by which the detected objects are highlighted in the image frame for easy identification.

4. RESULTS AND DISCUSSIONS

Enabling Raspberry Pi,the camera captures the image frame between two frames are computed,when there is no motion or object detected then difference image appear as black a in fig2.When motion is detected,then there will be gray scale representation like in fig3.Then the detected image frame is segmented and the binary threshold representation is achieved in fig4.The better geometry of the object is detected by removing the noise using morphological operations such as dilation(fig5) and erosion(fig6).In fig 7,the detected object is highlighted using contour operation.With monitoring interface,the output image can be tracked as in fig 8

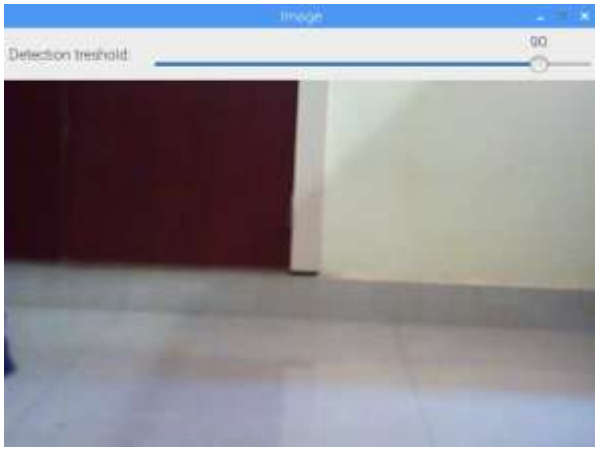


Fig 1: Background Image

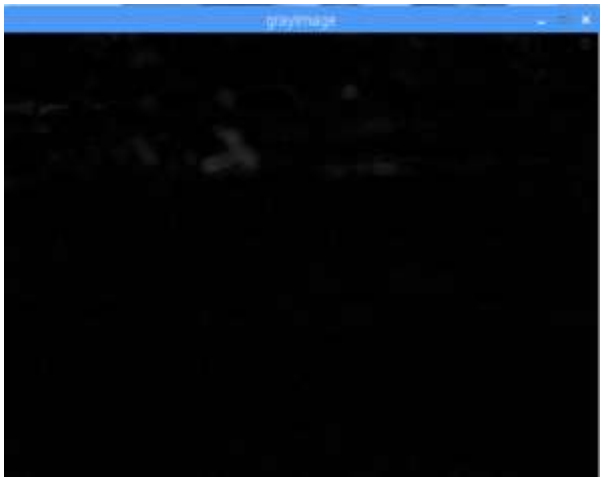


Fig 2: Difference frame

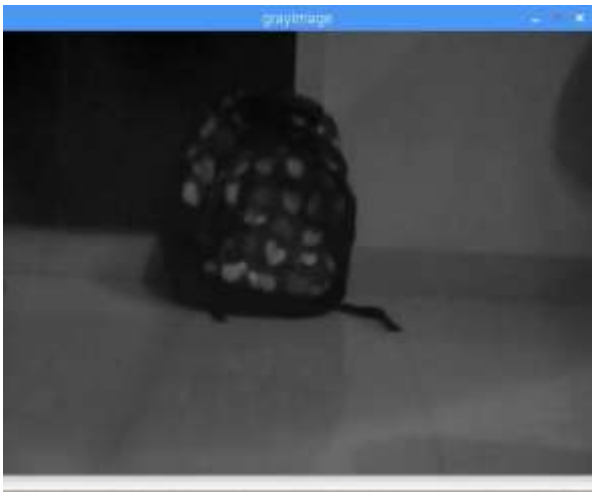


Fig 3: Gray scale Image

Fig 4: Threshold Image

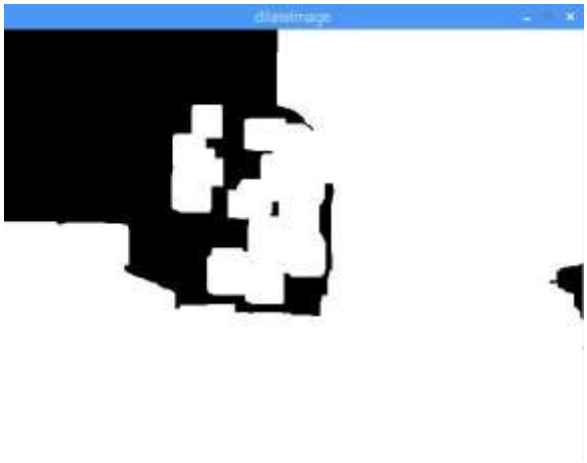


Fig 5: Dilate Image

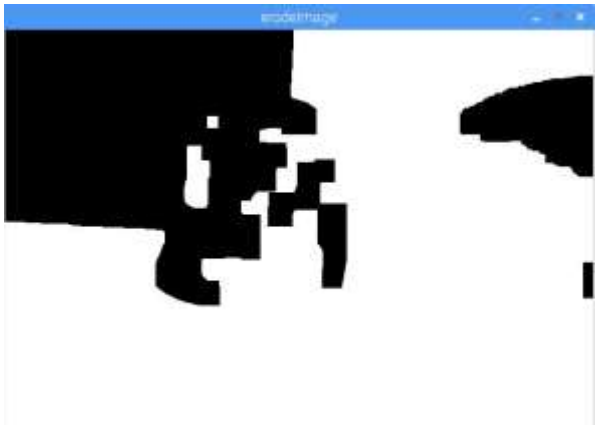


Fig 6: Erode Image

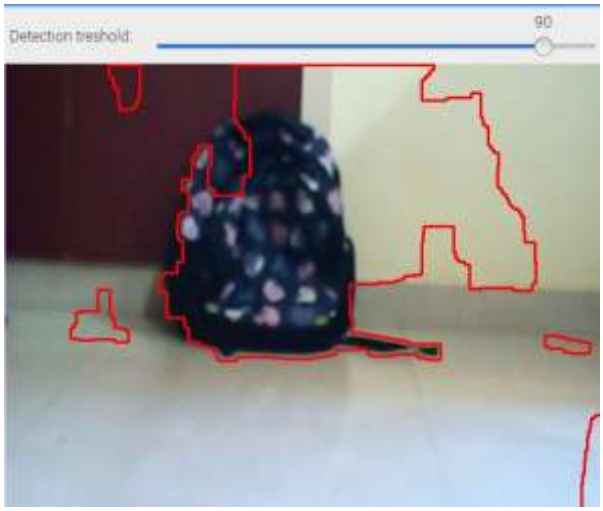


Fig 7: Detected Image with contour operation

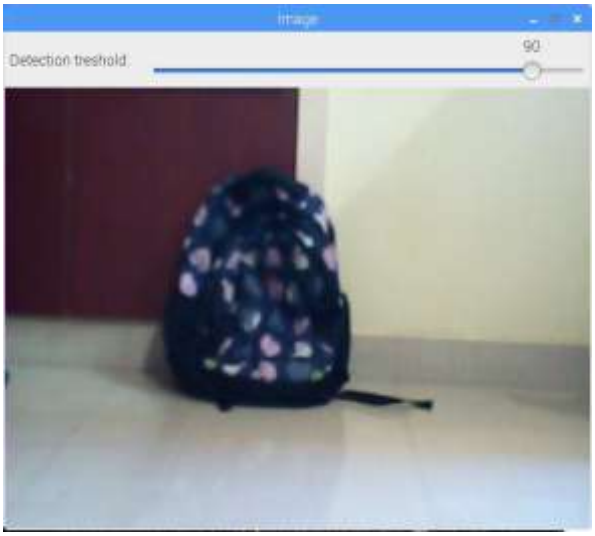


Fig 8: Output Image

5. CONCLUSIONS

This paper demonstrates the detection of motion for single and multiple object detection and also it detects both indoor and outdoor surveillance system. Frame differencing,background subtraction ,optical flow method and also adaptive background subtraction are discussed in thispaper.One of the most simplest method for motion detection is frame differencing when compared to other methods. When the motion is detected then contour is formed around the object on the resulted frame.

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