IMPLEMENTATION OF MOTION DETECTION IN SELECTED AREA

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Abstract

Digital image processing is the use of computer algorithms to perform image processing on digital images. Image Processing can be used in many application contexts such as Motion Detection, Feature extraction, Pattern recognition. Detecting moving objects is very interested area in digital image processing. Motion can be detected by measuring changes in speed of an object or objects. The process of motion detection can be accomplished by comparing the continuous image frames captured by video camera and simply counts the number of different pixels. If the pixels different are greater than the predefined alarm level, the alarm will go off. And this system is implemented to know the sensitive region to detect. So, this system doesn't detect all motion. It will detect only in dedicated area. Moreover, it can express the motion sizes after detecting motion in selected area. This system uses several various filters to implement motion detection process.
Keywords: motion detector, Thresholding , Pixel difference, Erosion filter.

3. Image Filtering

In image processing, filters are mainly used to smooth the image or to enhance or to detect edges in the image. There are many filters used in digital image processing applications. It intends to detect the motion objects by using image processing filters. To do so, difference filter is used to compare the current frame to the previous one to get difference between two frames. In the case of motion, there is more than one image to be considered. If the system has two images obtained at different time, the way to detect motion is the use of image differencing. Changes of motion can be obtained by subtracting the intensity values. There is no motion; the subtraction gives a zero value. When an object in the images changes their pixel's intensity, the subtraction will give a different value between two frames. Threshold process is the simple shape extraction technique. This technique is used to separate the shape of motion object from the background by its brightness level. It can be used to find shape of objects within an image. In threshold process, pixels above a specified level are set to white and those below the specified level are set to black. Threshold provides an easy and convenient way to perform this segmentation on the basis of the difference intensities in the foreground and background regions of an image [6].
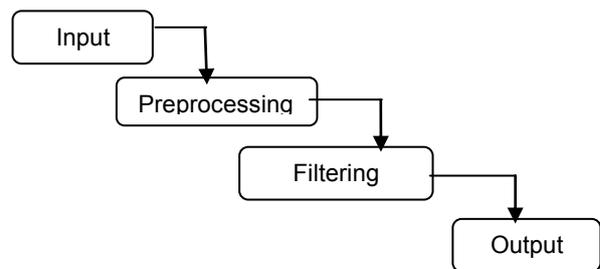

Figure 1. Block Diagram of the System

3.1 Grayscale Converting

The Grayscale module converts a color RGB image to grayscale values using the following formula technique [4].

Pixel=0.299R+ 0.587G + 0.114B

In this system, figure2 show the grayscale converting.

Figure 2. Grayscale Converting

3.2 Pixel Difference

The pixel difference or pixel subtraction takes two images as input and produces as output a third whole pixel values are simply those of first image minus the corresponding pixel values from the second image. In mage difference process, if the image format does not support negative numbers then often such pixel are set to zero (black). The negative -30 appears in the output as 226. To overcome this problem, the different filter module calculates absolute differences and the two input images use the same pixel value type. The absolute difference between the two input images is calculated with the below formula [3].

$$Q = | P1 (i, j) - P2 (i, j)|$$

The pixel values in the input images are RGB vectors. The individual components (e.g. red, blue and green components) are simply subtracted separately to produce the output value [3].Pixel difference between two images is shown in figure 3.

Figure 3. Pixel Difference between Two Images

3.3 Thresholding

Thresholding is used to segment an image by setting all pixels whose intensity values are above a threshold to a foreground value and all the remaining pixels to a background value. In this process, adaptive thresholding technique is used together with image difference process. Adaptive thresholding takes a grayscale image as input and outputs a binary image. For each pixel in the image, a threshold has to be calculated. If the pixel value is below the threshold, it is set to the background value (black). Otherwise it assumes the foreground value (white). Binary images are image whose pixels have only two possible intensity values. They are normally displayed as black and white. Numerically, the two values are often 0 for black and 1 for white. Binary images are produced by thresholding a grayscale image in order to separate an object in the image from the background [5]. Binary image using thresholding process is shown in figure 4.

Figure 4. Binary Image using Thresholding Process

3.4 Algorithm for Thresholding

```
int thres(a, b, t, N1, M1, N2, M2)
image a, b;
int t;
int N1, M1, N2, M2;
/* Subroutine to threshold an image
   a, b: buffers
   t: threshold (integer)
```

```
   N1, M1: start coordinates
   N2, M2: end coordinates  */
{      int i, j;
       for (i=N1; i<N2; i++)
         for (j=M1; j<M2; j++)
              if (a[i][j] <t) b[i][j]=0;
else
       b[i][j]=1;
       return (0);
}
 else
       b [i][j]=1;
       return (0);
} [1].
```

3.5 Erosion Filter

Erosion process is used to reduce noise to get now mostly only the regions where the actual motion was. The basic effect of this operator on a binary image is to erode away the boundaries of regions of foreground pixels (white pixels). The erosion module takes two pieces of data as inputs. The first is the image which is to be eroded. The second is a set of coordinate points known as a structuring element (kernel). It is this structuring element that determines the precise effect of the erosion on the input image. The mathematical definition of erosion for binary images is as follows: Suppose that X is the set of Euclidean coordinates corresponding to the input binary image, and that K is the set of coordinates for the structuring element. Let Kx denote the translation of K so that its origin is at x. Then the erosion of X by K is simply the set of all points x such that Kx is a subset of X.

Figure 5. A 3*3 square structuring element

The structuring element contains only foreground pixels (i.e. ones) which gives the shrinking effect. To compute the erosion of a binary input image by the structuring element, which consider each of the foreground pixels in the input image in turn.For each foreground pixel (input pixel) is superimposed the structuring element on top of the input image so that the origin of the structuring element coincides with the input pixel coordinates[2].

If for every pixel in the structuring element, the corresponding pixel in the image underneath is a foreground pixel (1) , then the input pixel is left as it is. If any of the corresponding pixels in the image are

background, the input pixel is also set to background value(0) [2].The final image result from erosion process is shown in figure 7.
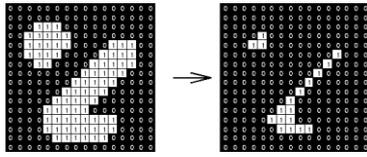

Figure 6. Demonstration of erosion process

Figure 7. Final Image Result from Erosion Process

4. System Design

This system intends to detect the motion in video stream for selected region area from the camera. Detecting moving objects is very interested area in image processing. The system takes video stream from video camera as its input. Then the system separates it as several image frames. When the first frame is received, the system converts it as a grayscale image and then stores it as the background frame. When the next frame is received, its gray scale copy is placed as a current frame.

The system uses difference filter to those two grayscale image (background and current image). The different filter produces the image that is difference between two input images. Then the threshold filters is used to transform the output of different filter to binary image. Then the Erosion filter is used to remove random noisy pixels. In this step, the system produces an image with white pixels. Then count the numbers of white pixels in the dedicated area. If the number of white pixels counted will be greater than the predefined alarm level, the system make the alarm goes off. If the number of white pixels is less than the predefined alarm level, the process will be executed continuously. The system design is shown in figure 8.
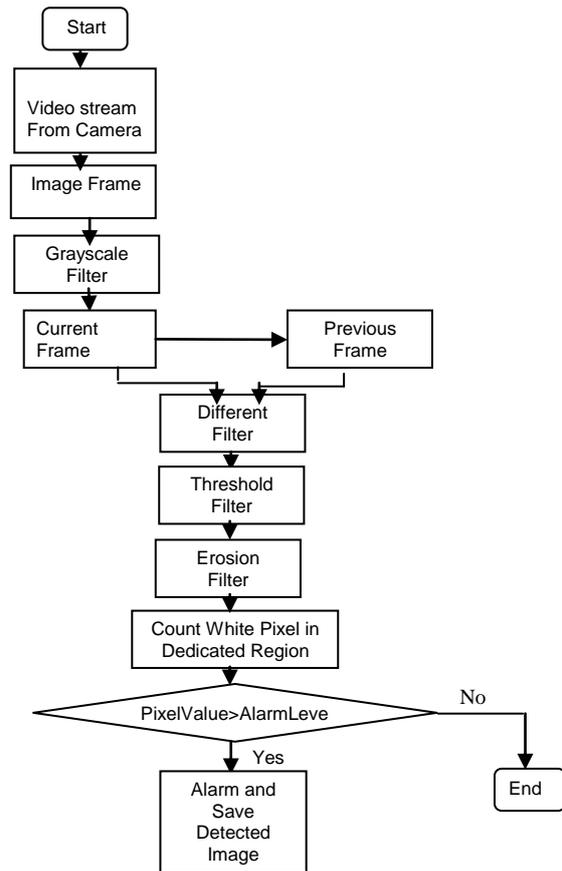

Figure 8. System Design

4.1 Implementation

In the system, the motion is detected in predefined alarm level of 0.01. The system beeps the alarm once in 5000 millisecond. The greater the alarm level, the more the motion has to be in the scanned area to detect. The user can change the various alarm level to detect motion. When the alarm level is greater, the system can only detect the image with fully motion in sensitive area regardless of threshold values. And the user can change the region to detect. Camera can be played after selecting security area. If an object through the security area, the alarm will go on. So, the user can detect only the sensitive area and can also detect why the alarm signal by captured image. The detection form (outside the region) is shown in figure 9 and detection form (inside the region) is shown in figure 10.The step detail process is shown in figure 11.
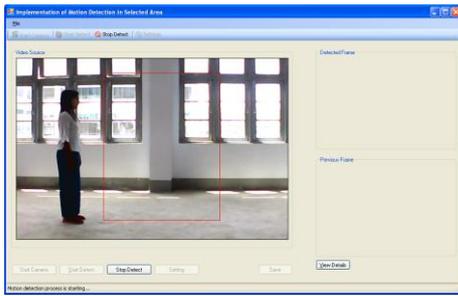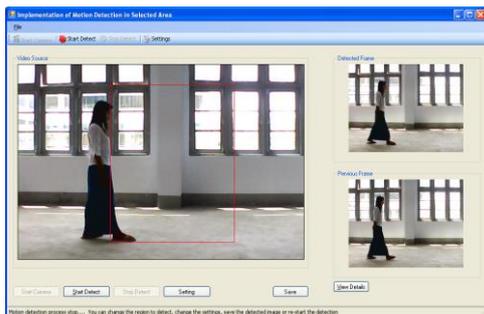
Figure 9. Detection Form (outside the region)

Figure 10. Detection Form (inside the region)
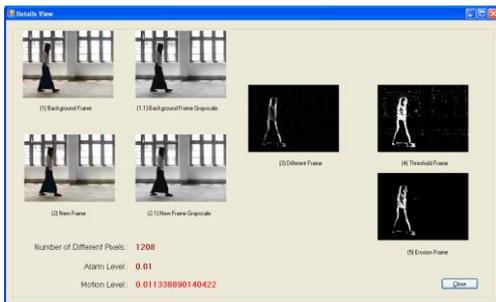

Figure 11. Step Detail Process

4.2 Performance Evaluation

The performance of the experimental results is calculated by the following equation.

$$\text{True detected motion}(\%) = \frac{\text{no: of correct detected motion frames}}{\text{Total no: of motion frames}} * 100\%$$

$$\text{Total detect motion}(\%) = \frac{46}{50} * 100\%$$
$$= 92\%$$

5. Conclusion

In this system, the difference filter, threshold filter and erosion filter are applied to accomplish the motion detection process. The system intends to enhance the area of security and extends to further studies in image processing with different approaches and filters. The system proposed a new contribution system of an image counter using image processing based on filters. The implementation of the filters is more efficient, so the filter produce better performance.

5.1 Limitation

This system cannot detect the objects in motion area in situation without getting enough light. The system can track not only all motion objects in the detected area but also motion such as human, thief that is required to investigate. So the system can face unnecessary problems of alarming in everything of motion in the security area.

5.2 Further Extensions

Several image processing approaches and detection methods have been applied to track object from the camera. Motion detection is a relatively research area the intersection of electrical processing, security area, road traffic and physical controls. By appropriately integrating techniques from each of these disciplines, useful new methods for detecting object from motion area can be developed. In particular, other techniques in image processing is critical to the development of effective image process.

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