INTELLIGENT ALARM SYSTEM FOR MONITORING AT LRT STATION

NORSHAKILA MOHAMMAD SHARIF

This thesis is submitted as partial fulfillment of the requirement for the

Award of the Bachelor Degree of Electrical Engineering (Electronics)

Faculty of Electrical & Electronics

Engineering

university malaysia pahang

JULY 2010

"I hereby acknowledge that the scope and quality of this thesis is qualified for the award of the Bachelor Degree of Electrical Engineering (Electronics)"

Signature : ____

Name : DR KAMARUL HAWARI GHAZALi

Date : 29 NOVEMBER 2010

“All the trademark and copyrights use herein are property of their respective owner. References of information from other sources are quoted accordingly; otherwise the information presented in this report is solely work of the author.”

Signature : ______________________________

Author : NORSHAKILA MOHAMMAD SHARIF

Date : 29 NOVEMBER 2010

ACKNOWLEDGEMENTS

I am heartily thankful to my supervisor, Dr Kamarul Hawari Ghazali, whose encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the project.

I would like to take the opportunity to thank those people who spent their time and shared their knowledge especially to the friends of the same supervisor for helping me to complete my thesis with the best possible result.

My parents, Encik Mohammad Sharif Mansor and Puan Norasmah Man , have been a constant source of support – emotional, moral and of course financial – during my postgraduate years, and this thesis would certainly not have existed without them.

Lastly, once again I offer my regards and blessings to all of those who supported me in any respect during the completion of the project.

Thank You.

ABSTRACT

Objective of this project was to explore how the advantages of new technological solutions can be fully exploited and provide opportunities for the enhancement of security management. Every day millions of commuters use rail public transportation to get to work, and businesses rely on millions of miles of railroad track for transporting goods efficiently and safely. Users of rail public transport demand a safe and secure environment, one without any feeling of threat. Unfortunately, that is not the reality in many places. While safety is usually of a high standard, the feeling of personal security is often diminished. This discourages people from using rail public transport, and for many people it restricts their mobility. Traditionally, this has meant an operating company deploying staff and monitoring systems to carry at manual based surveillance of the environment to prevent undesirable events and to reassure the travelling public that they are in a safe and secure environment. By using some methods to detect situations of interest using automated image processing, the result show the capability of automatic systems to detect potentially dangerous situations and of a distributed system that can promptly alert operators providing multiple sensor views of event.

ABSTRAK

Tujuan projek ini adalah untuk menyelidik bagaimana kelebihan yang terdapat pada teknologi baru kini dapat memberikan peluang sepenuhnya untuk meningkatkan pengurusan keselamatannya. Setiap hari penggunaan ‘”rail public transportation” menjadi keutamaan orang awam untuk melakukan urusan harian. Dengan itu permintaan utama pengguna yang menggunakan perkhidmatan “rail public transportation” adalah memerlukan persekitaran yang selamat dan aman yang terjamin tanpa perasaan ancaman atau bahaya. Malangnya, pada realitinya tidak sebegitu. Walaupun tahap keselamatan berada pada tahap yang berkualiti, tetapi perasaan kurang selamat tetap ada. Hal ini penyebab utama menghalang orang awam dari menggunakan “rail public transportation”, dan mereka lebih selesa menggunakan kenderaan sendiri. Tradisional, dalam hal ini pihak pengurusan akan mengambil tindakan dengan membuat kawalan pada kawasan-kawasan yang telibat supaya tidak berlaku kejadian yang tidak diingini kepada pengguna dan sekaligus untuk meyakinkan pengguna bahawa keselamatan mereka terjamin atas pantauan yang dijalankan .Oleh itu dengan menggunakan beberapa kaedah “image processing” untuk mengesan situasi yang membahayakan keselamatan pengguna langkah berjaga-jaga digunakan untuk meningkatkan kawalan keselamatan terhadap pengguna “rail public transportation”.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This project was to explore how the advantages of new technological solution can be fully exploited and provide opportunities for the enhancement of security management. The Intelligent Alarm System for Monitoring at Light Rail Transit (LRT) Station is about detection of potentially danger situations involving in Light Rail Transit (LRT) station sites. Traditionally, the monitoring systems carry at manual based surveillance of the environment to prevent undesirable events and to reassure the travelling public that passenger are in a safe and secure environment. But nowadays because of the increasing of public safety demand, the monitoring at Light Rail Transit (LRT) station areas need to be improve for safety and security of the passengers. This system is designed to use existing closed circuit television (CCTV) cameras for acquiring images of the platforms.

By using Closed Circuit Television (CCTV) to monitor an area of dangerous at the Light Rail Transit (LRT) corridor and it should be able to interact with various alarm, the system will notify the station operators to take appropriate actions to prevent accidents, such as people falling off or being pushed onto the tracks in the context of monitoring in Light Rail Transit (LRT) station corridors. From the automatic continuous monitoring the system will describes automatically the video sequences processing techniques for detecting suspect and dangerous situations within rail public transportations. Proposed surveillance system is able to raise different kind of warnings and alarms on the basis of the particular detected situation. Several applications of image processing and advanced data transmission techniques to the surveillance of transport environments have been presented in the literature.

Image Processing are the main idea in this project. Generally Image processing is a physical process used to convert an image signal into a physical image. The image signal can be either digital or analog. The actual output itself can be an actual physical image or the characteristics of an image. By applying MATLAB software in this project, the monitoring focuses more at danger area for Light Rail Transit (LRT) passenger. To monitoring at the focus area the process on image involves partitioning an image into regions or object. Generally the inputs will be a image and the output are attributes extracted from the image, means that by setting the regions (danger area) the detection can be make if there some interruption in the image. There some processing of an image analysis such as ensemble of recognized objects will be involves before getting the output image.

1.2 Problem Statement

To monitoring and detection of person standing in ‘danger area’, using image processing methods to make detection of person at the danger area or marked region. The information is then processed by *a local PC-based image processing system,* which are devoted to detecting the variations occurring in a guarded scene. And at the same time it will trigged an alarm to warn the operators.

1.3 Objective

The objective of this project is to;

i. To improve the safety and confidence of the travel Light Rail Transit (LRT) station.

   The improvement can be make are by upgraded the monitoring system. By upgraded the level for the safety conditions at the Light Rail Transit (LRT) station more guaranteed to the passengers. And indirectly make the passengers more confident using the travel Light Rail Transit (LRT) in daily work.

ii. To build program system monitoring and detection image in MATLAB

   By using MATLAB software to generate program for monitoring and detection system by involve some method that provided in MATLAB software.

iii. To develop a method to detect and track humans in the danger situation locate at danger area image.

   Using MATLAB software and image processing techniques that provided in MATLAB, the image will be analyzed and results will show whether the situation are in danger or otherwise.

1.4 Scope of Project

i. Focus only on route passenger areas that have been marked as danger zone.

ii. Use Image processing methods to detect situations of interest and the result will show the capability of automatic systems to detect potentially dangerous situations.

1.5 Research Outline

The organization of this research study is as follows. Chapter 2 describes the literature review; chapter 3 describes the methodology.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

As we should know, even though current technology is expanding with the Light Rail Transit (LRT) which enables users to move from one place to another without thinking about smooth roads and safety on the road. However even though such facilities have security remains a priority user. Hence the existence of monitoring the safety of consumers each time at least it can prevent and reduce problems that arise about the safety of consumers. This paper presents ideally suited to the monitoring of a high density of people and/or objects in such a situation [1]. In ordering to monitor the flow of passengers, possible to enable the staff to be informed of possible congestion, and detect incidents without delay. In the recent years, image-processing solutions have been found to automatically detect incidents and make measurements on the video images issued of the cameras, relieving the staff in the control room of much of the hassle to find out where interesting events are happening [2], an alarm issue is transmitted to a remote control centre located few miles far from the guarded stations [3].

2.2 Image Segmentation

The goal of segmentation was to simplify and/or change the representation of an image into something that more meaningful and easier to analyze [4]. Typically image segmentation used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation was the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

Segmentation subdivides an image into its constituent regions or objects. Segmentation is the operation at the threshold between *low-level image processing* and *image analysis.* There a several types of elementary segmentation methods. Pixel-based methods only use the gray values of the individual pixels. Region-based methods analyze the gray values in larger areas. Finally, edge-based methods detect edges and then try to follow them.

2.2.1 Line Detection

To count people crossing a region, maintaining two counters, one for each direction, positive and negative are the goal of the counting method [5]. On each detection line detection of people was done individually [5].

(a)

(b)

Figure 2.1 (a),(b) :View of the counting configuration Using Line Detection

As shown above, Figure 2.1 (a) and (b) using the line detection method to making the counting configuration easier. By setting the starting line as the reference point to detect the object and start counting the wanted object. Figure 2.1 (b) shown the reference line applied in levels because to decrease the error. The error in this method should show the incorrect counting result. Indirectly if the result is displayed incorrect result it will effect to get an accurate analysis of application.

2.2.2 Edge Detection

The task of *edge detection* requires neighborhood operators that are sensitive to changes and suppress areas of constant gray values. In this way, a feature image are formed in which those parts of the image appear bright where changes occur while all other parts remain dark. Mathematically speaking, an ideal edge is a discontinuity of the spatial gray value function $g(\mathbf{x})$ of the image plane. It is obvious that these are only an abstraction, which often does not match the reality. Thus, the first task of edge detection is to find out the properties of the edges contained in the image to be analyzed. Only if we can formulate a model of the edges, can we determine how accurately and under what conditions it will be possible to detect an edge and to optimize edge detection.

Edge detection always based on *differentiation* in one or the other form. In discrete images, differentiation is replaced by *discrete differences*, which only approximate to differentiation. There are several advantages in creating an image of the background edges for the detection of moving objects [6]. The errors associated with these approximations require careful consideration. They cause effects that are not expected in the first place. The two most serious errors are: anisotropic edge detection, edges are not detected equally well in all directions, and erroneous estimation of the direction of the edges.

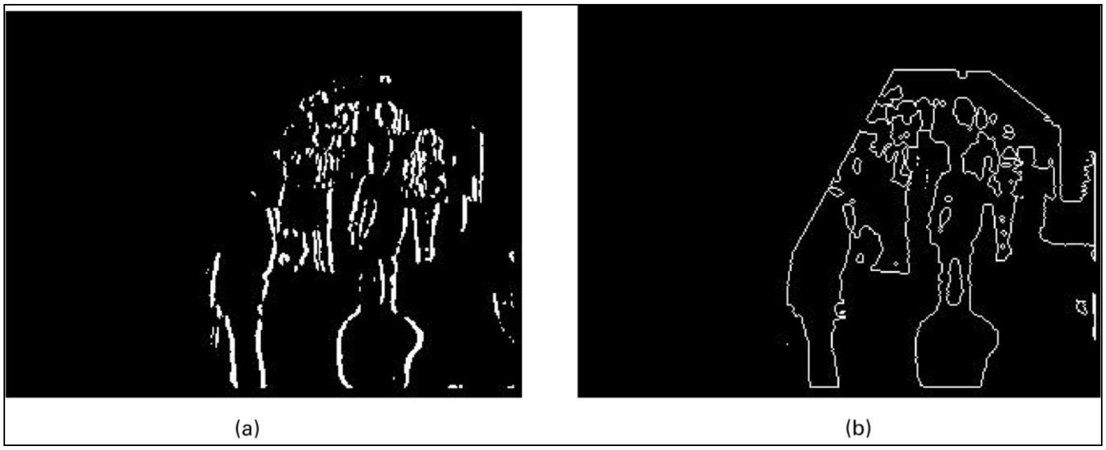

Figure 2.2 (a),(b) :The images of the passengers edges have been extractes by different types of the edge detectors: a) sobel filter, b) proposed fast edge detector.

Edge detection methods often involve setting the interest region, by state sets the interest region and follow by edge detection method the result will be displayed in some application. The output shown in Black and White format (BW) only displayed value ‘0’ and ‘1’ in histogram.

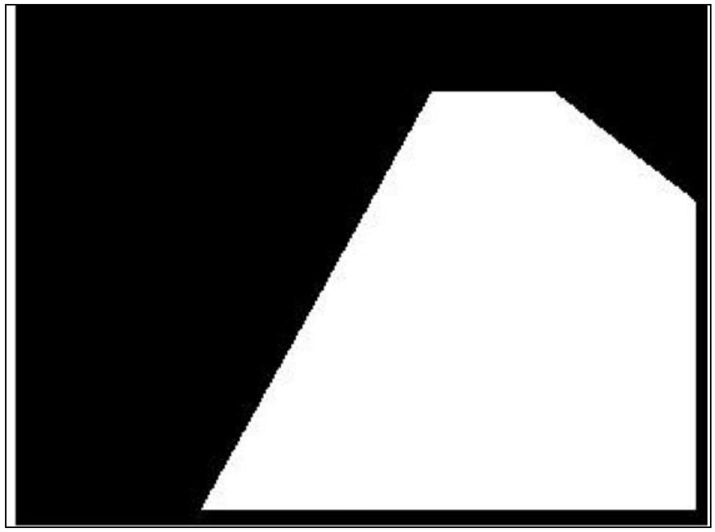

Figure 2.3 :A typical masked image as a ‘ reference ‘ for either extraction of background removal

Figure 2.3 shown the selected interest region in black and white format or in other words the value displayed only ‘1’ and ‘0’. Value ‘1’ represent in white color as the selected interest region. For value ‘1’ represent in black color that display the unwanted region.

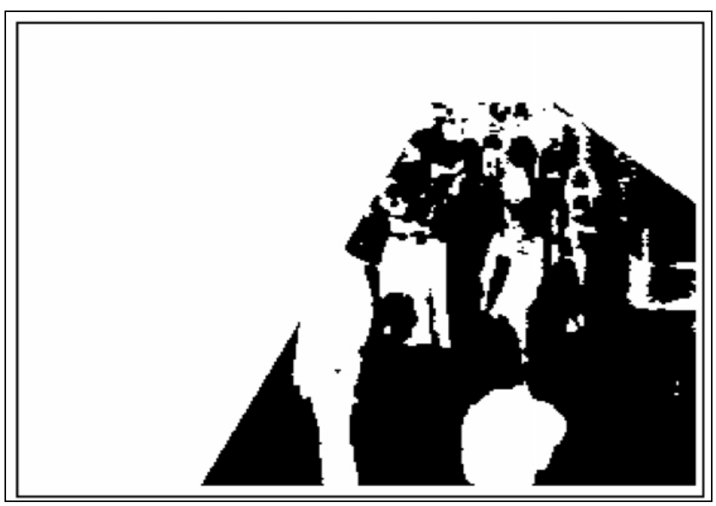

Figure 2.4 :The resulting image evaluated by background density evaluation

For Figure 2.4 shown the result for the image evaluated by using the subtraction method. Somehow figure 2.3 and figure 2.4 is related, the reference image or original image are shown in figure 2.3 and the output or result will displayed as figure 2.4.

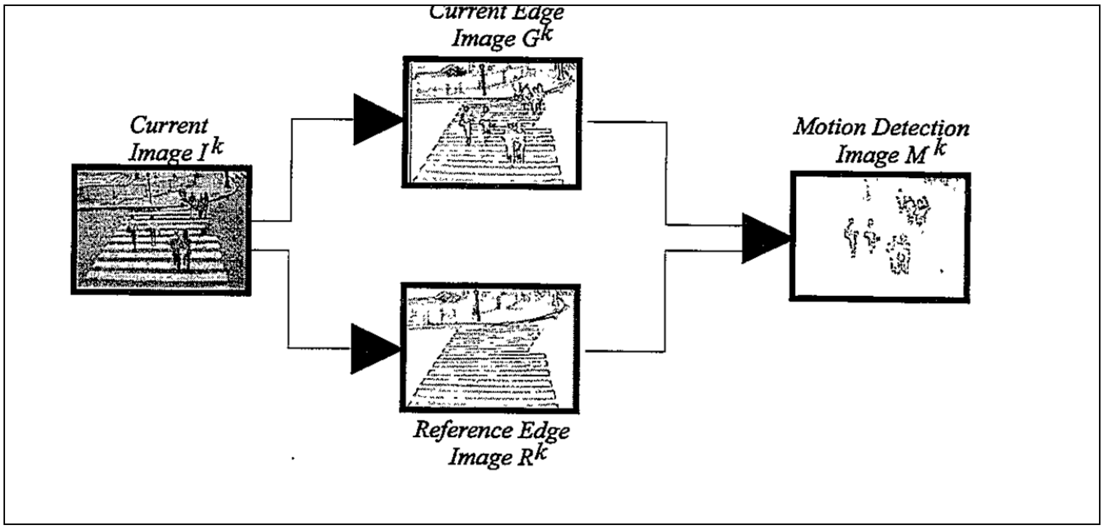

Figure 2.5 : Edge Detection Method

In figure 2.5 have shown the flow of the Edge Detection Method to detect motion in image. As mention before, by make the selected region the Edge detection method can be proceed smoothly. An also the reference image as the reference to detect motion in image using subtraction method.

In order to solve the problem of shadow corruption, the Sobel filter edge detector has to be used [7]. The Sobel filter can be used for edge detection. Applying Sobel edge detector over the absolute difference image between the current frame and the reference frame, a Sobel edge extractor provides thick edges which are useful for application in foreground detection by allowing lightening the post-processing for filling the contours [8]. There are two 3×3 mask matrices that convolve with the image data (matrix). The images are grayscale. It is one of the image segmentation techniques used in Computer Vision (CV) software in its initial preprocessing steps called early vision. After the early vision preprocessing a CV system can, for example, use artificial intelligence to identify, classify, or count objects in an image. Sobel gradient edge operator:

Vertical matrix:

$$\begin{pmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{pmatrix}$$

Horizontal matrix:

$$\begin{pmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{pmatrix}$$

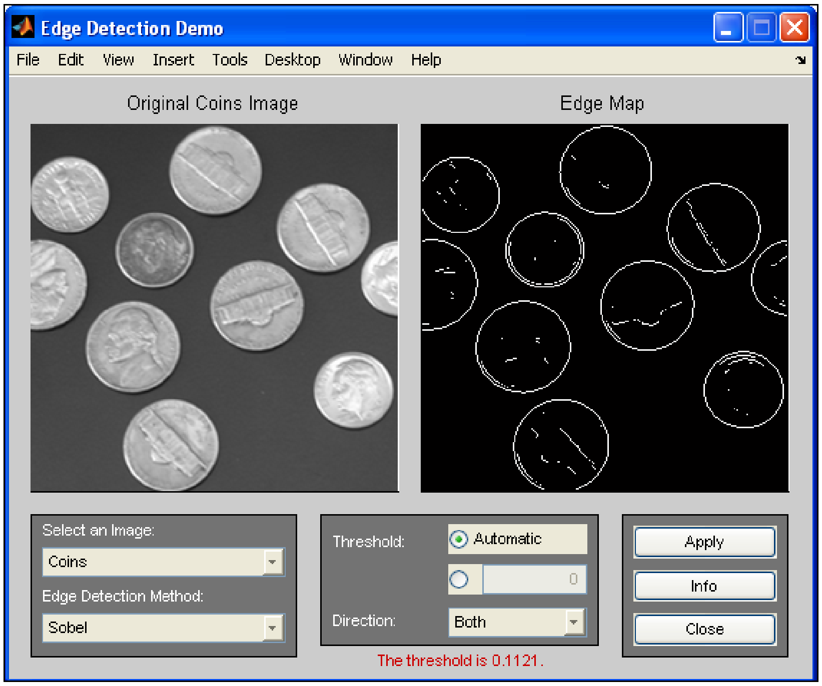

Figure 2.6 : Sobel Edge Detection

Edge detection also known as filter, figure 2.6 shown one of the edge detection filter. Every edge filter will displayed difference result. Therefore the suitable edge filter must been choose correctly according to the application.

2.3 Enhancement Using Arithmetic / Logic Operations

By change its brightness and its contrast are the basic ways to enhance an image. These can be done by Stretching the color distribution, Equalizing the distribution of color to use the full range and Adjusting the scaling of the colors. Arithmetic / Logic operations involving images are performed on a pixel-by-pixel basis between two or more images. Logic operations operate on a ability to implement the AND (Masking, region of interest, ROI), OR (Returns a 1 if both pixels are logically different, otherwise 0), and NOT (Performs negative transformation) logic operators because these three operators are functionally complete. In the other words, any other logic operator can be implemented by using only these three basic functions.

2.3.1 Image Subtraction

Masking sometimes is referred to as region of interest (ROI) filter which its built from a simple background model and motion detection, are the core of proposed people tracking system [9]. In terms of enhancement, masking is used primarily to isolate an area for processing. In background subtraction are used as a focus-of-attention method for example, further processing for tracking and activity recognition is limited to the regions of the image consisting of foreground pixels only [10]. Background subtraction is a popular method for motion segmentation, especially under those situations with a relatively static background. One of the simplest approaches for detecting changes between two image frames f (x,y,ti) and f (x,y,tj) taken at times ti and tj, respectively is to compare the two images pixel by pixel. One procedure for doing this is to form a difference image.

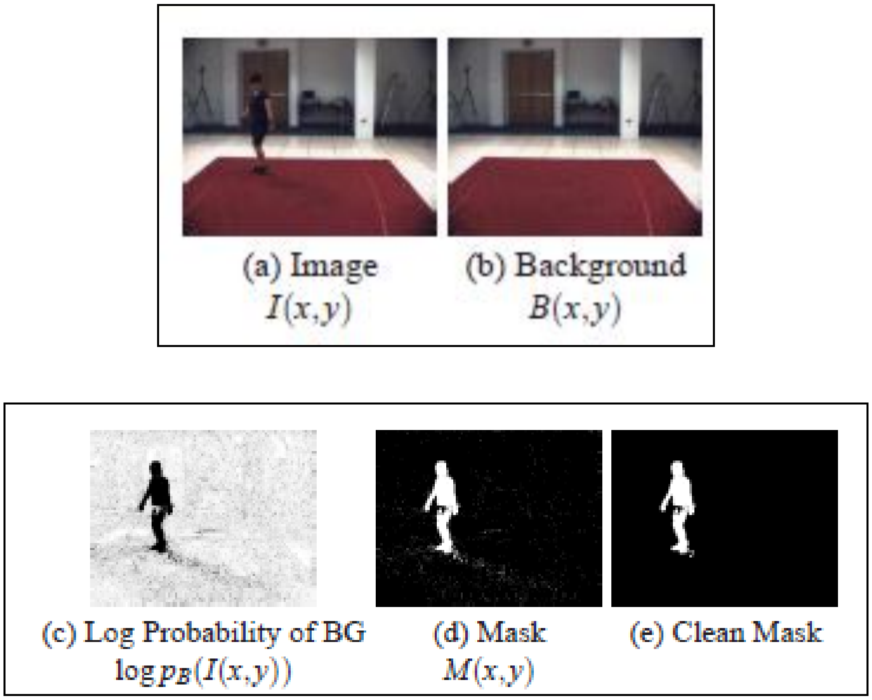

Figure 2.7 : Background subtraction. Original image is illustrated in (a); the corresponding background image of the scene, *B*(*x*, *y*), in (b); (c) shows the log probability of each pixel *I*(*x*, *y*) belonging to the background (with light color corresponding to high probability); (d) illustrates the foreground mask (silhouette image) obtained by thresholding the probabilities in (c); in (e) a cleaned up version of the foreground mask in (d) obtained by simple morphological operations.

For figure 2.7 are applied background subtraction method to shown the object or motion detection. To display the result, current image will subtract with reference image.