CCTV Based Surveillance System for Railway Station Security

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Abstract—This paper proposed the image enhancement method using the data matching with histogram shaping technique. The experiments were conducted using images with 1,280 × 720 pixel collected from CCTV surveillance video system. Type of images (.jpg) is in RGB24 form and first frame's surveillance video file (.avi). The results showed that the proposed method using images enhancement technique can improve the quality of images from surveillance video system using the proposed image enhancement based on histogram shaping technique.

Keywords— CCTV; Image Enhancement; Histogram Shapes; Data Matching

I. INTRODUCTION

In 2017 research survey on risky train station in Melbourne, Australia participated by woman passengers, it turns out that Flinders Street railway station in the heart of Melbourne was found to be the highest risky station with the lowest security. Between October and December of last year 2016, Melbourne girls and women have been voluntarily asked to cooperate in sharing the good and bad experiences of using Melbourne's public places in free to be, an online map developed by Plan International Australia or Plan, an independent humanitarian development and humanitarian organization based in 71 countries around the world as the photo sample of risky rail-roadside shows in Fig.1 and train passenger accidently fell into the train tracks shown in Fig.2. This study has an aim to develop the automated accident alerting system based on the surveillance camera system and to maximize the coverage efficiency. The system we proposed consists sets of CCTVs, motion sensors, recorder kits and alarming system. The motion of object will be detected by our system when an object or human appears in the danger zone. The detection then commands the alarm system to alert the station security to notify or until the detected object or human steps out of the danger zone. The researcher has aimed to the benefit and analyzed to minimize the risk of the accident. The purposes of our system are to enhance the security and safety system for railway passengers with minimizing the risk of accident, to protect the property of railway system, and to provide the benefits to development of the railway transportation system. Moreover, our study focuses on evident recording in case of investigation and incident protection on time to save passengers' life.

Fig.1. Dangerous scene with approaching train.

Fig.2. Train commuter accidently fell into the railroad tracks.

The organization of paper is described in sections following by related literature, proposed method, experimental results and finally conclusion.

II. RELATED LITERATURE

A. CCTV principle process

CCTV works beginning with the camera receiving the image which is the reflection back of the light projection onto the object. Performance of the camera depends on the light sensitivity resulting in a different quality of videos and images. In CCTV system, there will be a video signal transmitted in the cable connected between camera and digital video receiver (DVR), and video signal sent to the monitor to display the image captured by camera. The camera and monitor are usually placed in remotely different locations. The CCTV system is shown in Fig.3.

Fig. 3. CCTV System.

Ahmad et al. [1] discusses a new type of closed-loop television camera system with functions generated from innovations in modern science. The use of closed-loop system was applied in work of tracking and monitoring the human activities, movements or objects. In public environment, both safety and crime are monitored for both indoor and outdoor areas by means of infrastructure such as on highway. The parking lot and the shopping mall were found to be the most vulnerable areas that have been researched for disaster alert, crime prevention and management by a group of researchers at the Hibell Research Institute [2] for improving image quality.

B. Illumination - Reflectance Model

Pang et al. [3] found that Illumination -Reflectance Model is a function image. The 2-dimensional model of the function image F(x, y) with positive values (x, y) is the positive number of scales. The physical meaning, which is determined by the source. The image is an array of light intensity and a function of the amount of light reflected from the object in the scene that can be used in the development of frequency shown in Fig.4. F(x, y) can be represented by a product of illumination and reflectance components reported by A. Ein-shoka et al. [4]. The illumination is an amount of light from sources that arise from the perspective scene, displaying in value of I(x, y) and the reflectance is an amount of light reflected from the object defined by R (x, y). The product can be formulated according to (1).

$$F(x,y) = I(x,y)*R(x,y) \quad (1)$$

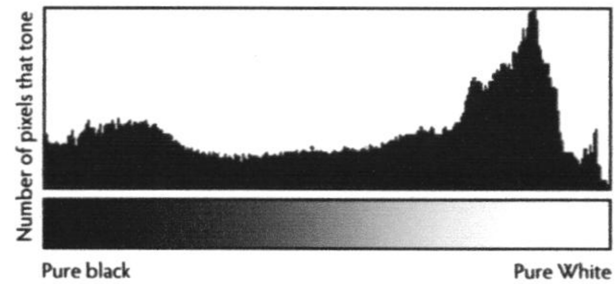

Fig. 4. Histogram depicting the frequency distribution.

C. Homomorphic Filtering

P. S. Vikhe and V. R. Thoo [5] said that homomorphic filters are generally the techniques for signal processing and image processing that convert image to different domains and inversely transform back to the original domain. It works simultaneously to add full-frame imaging and sharpening. The procedure of homomorphic filter can be implemented in five steps depicted in Fig. 5 that can be described as following.

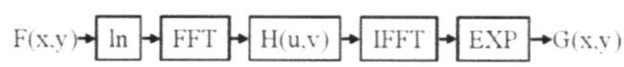

Fig. 5. Steps of Homomorphic Filtration.

Step 1: Taking logarithm on both sides of Z(x,y) to separate two elements of I (x, y) and R (x, y).

$$Z(x,y) = \ln[I(x,y)] + \ln[R(x,y)] \quad (2)$$

Step 2: Converting the imported image into a frequency domain by Fourier Transforming according to (3).

$$Z(u,v) = FFTi(u,v) + FFTr(u,v) \quad (3)$$

When FFTi (u, v) and FFTr (u, v) are the Fourier transformation of ln[I (x, y)] and ln[R (x, y)], respectively.

Step 3: Filtering the High Pass of Z(u, v) by using a filtering function of H(u,v) in frequency domain, obtaining the filtered S(u, v) as following.

$$\begin{aligned} S(u,v) &= H(u,v)Z(u,v) \\ &= H(u,v)FFTi(u,v)+H(u,v)FFTr(u,v) \quad (4) \end{aligned}$$

Step 4: Inverting the filtered image in the spatial domain S (x, y) by Inverse Fourier Transform according to (5).