A NOVEL SMART TRAFFIC LIGHT CONTROLLING SYSTEM BY IMAGE PROCESSING TECHNIQUE

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ABSTRACT:

Traffic is the important trouble going through all over the world. Today as a result there is an amplification in the range of the cars. The proliferation in the wide variety of the cars resulted from the need of a smart system that should correctly manages the traffic congestion on the ground work of its density. In the growth of the public population electronic transport system plays a major role. The smart road traffic control can be used in real time. This paper includes an introduction to the electronic traffic control process. The objective of the system proposed is to provide emergency services with the least traffic routes. This system often detects and tracks emergency vehicles location in real time and warns the TCC (Traffic control centre). The proposed approach is also used for controlling the traffic light system in the emergency situations.

1. INTRODUCTION

Various studies and surveys estimated the bulk traffic congestion on a daily basis or traffic jams occur because of traffic light system. Traffic congestion is nothing but an additional waste of time from one's daily routine. It is noticed that most of the traffic congestion is occur during the morning and late afternoon. Basically during that time the students and employers go to school, college, University or office so they also be late for their office or institutions at traffic light spot . When time and resources from the current infrastructures are steadily increasing, sophisticated traffic management becomes increasingly common in the future. The reality that road users are constantly rising. Preventing unnecessary traffic jams would be both socially and economically beneficial. Our novel smart traffic light network has been designed to address the congestion problem of the country's metropolitan cities for reducing the economic cost and saving time. By decreasing the congestion of cities we can also decrease the extra waste of energy like CNG, Petroleum for special case electricity also. Developing countries such as India have extremely high population with an estimated GDP of 6 billion and whose resources spend the majority on imports of oil and energy, it cannot waste a commodity of this value.

1.1 TRAFFIC CONGESTIONS

Traffic congestion happens when more cars are available than the path can accommodate. This condition lengthens the trip as the congestion rises. Congestions in traffic can be a result of accident, going through wrong way, for VIP passing, unauthorized parking etc. it can be happened due to bad road layout, misunderstanding traffic rules also. A variety of negative effects are induced by traffic congestion.

- There of warning time.
- Delay that can give rise to late work departures,
- office, school.
- Inability to guess accurate travelling time.
- Increased wasting of fuel and air pollution also.
- Congestion of traffic may block the passage of emergency vehicles travelling.
- Increased risk of collision because of the narrow gap and the permanent stop and go.

1.2 DIGITAL IMAGE PROCESSING

The image is created using digital machines. By using the scanner and digitalizer the image can be process into a digital form. This is characterized as the exposing of numerical images of objects to a number of operations to achieve the desired outcome. It begins by producing one picture and a revised version. It is thus a process in which an image is taken into the other.

The word digital image processing relates to a digital computer processing of a two-dimensional image. This includes virtual storage of any two-dimensional information in a broader context. A digital image is a compilation of real numbers with a limited number of bytes. Digital image processing technologies give the main advantage of their simplicity, repeatability and conservation of original data accuracy.

The different types of the image processing techniques are

• Image depiction
• pre-processing of images
• Image improvement
• Restore of images
• Image parsing
• Image reproduction
• Image rebuilding
• Image compression

The paper was arranged in the form of literature works gets depicted in the part 2.The statement of the problem was analyzed in part3.The overall implemented work was depicted on part 4.The work results gets projected on part 5.

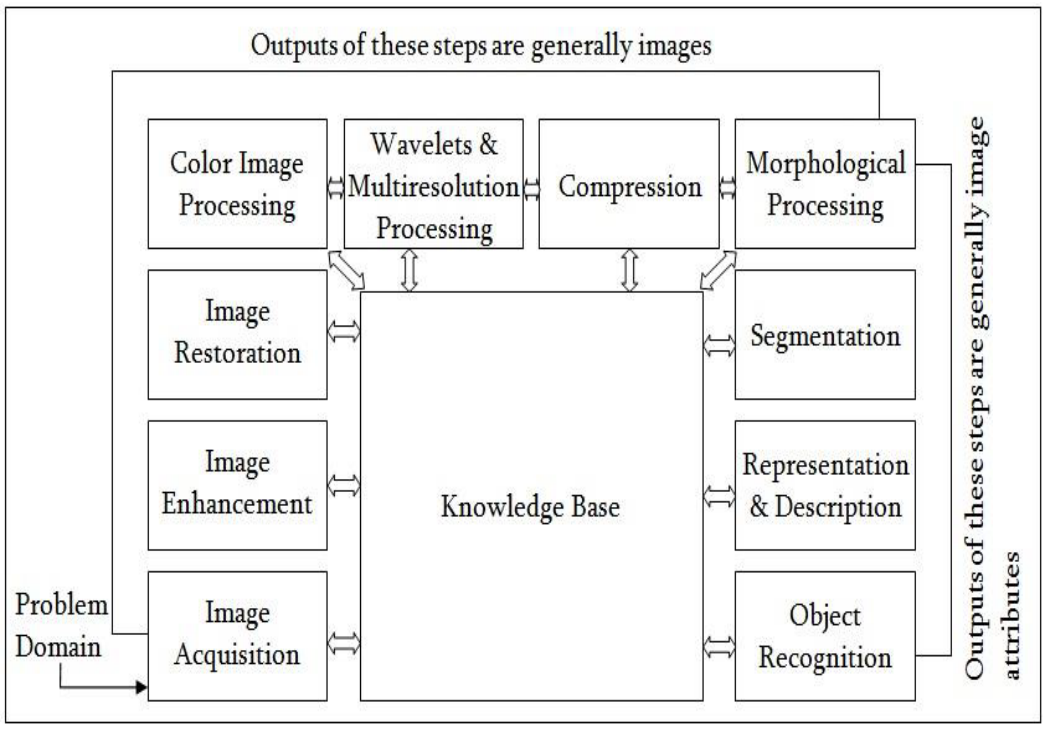


Figure1. Online image processing diagram

The whole digital image storage system was shown in Figure 1.

2.LITERATURE REVIEW

Parekh et al.[6] Proposed a newer technique for traffic volume detection utilizing IR sensors and therefore a traffic lights switch control microcontroller. This document thus shows the dynamic system of traffic control over the static and traditional systems of traffic control. Salerno proposed a new way of detecting and segmenting the object[1]. Hossain et al. [2] Proposed the new moving object detection method. The automatic identification technique for moving vehicles was introduced by Saad et al.[3]. Yoichiro Iwasaki and Hisato Itoyama[4] used a real-time moving vehicle detection method. P. and Shibasiki R. Sompoch. [5] suggested Super-high-Resolution Aerial Image Vehicle Detection System. Wang Weihua,[6] proposed a technique termed Sobel Operator intended for Vehicle Recognition[6]. Kumar, [7] projected a independent Traffic Light Control System for Smart Cities. Rath, [8]. anticipated a improved traffic control system based on Mobile agent in VANET. Rajak, B., & Kushwaha, D. [9] presented a Traffic Management and Control Over IoT for Emergency Vehicle Clearance in Smart Cities. Kuppusamy [10]. suggested a Optimized traffic control in addition to data dispensation with the use of IoT. Banerjee, S., Chakraborty, C., & Chatterjee, [11] Analyzed some existing works on IoT Based Prediction Mechanism and Traffic Control. Chen, [12]. considered Offloading of Smart Traffic by Mobile Edge Computing for the Communication of Disaster-Resilient Networks. Hardy, [13] stated a System of Traffic Control Signal for decreasing the Traffic Congestion in Urban environment. Priya, et al. [14] analyzed a System based on IoT Smart Office Architecture by means of Smart Wears and Smartphones with Raspberry and MQTT. Pelton, J. N., & Singh, [15] suggested a Safe and Smart Control Systems for Smart City.

3. PROBLEM STATEMENT

Because of rapid population growth and vehicles in smart and urban cities public face huge issues at the foremost traffic point of business towns. Not only it cause delay in travelling, this in turn leads to the pollution of environment with some health hazard because of pollution occurred by vehicle fuels. So as to hold off such rigorous problems several radiant urban communities are now executing frameworks of smart traffic control that works on the traffic automation standards through avoidance of the before mentioned problems.

4. PROPOSED METHODOLOGY:

The Framework of an Intelligent Traffic Management has been projected in this sector as shown in figure 3. The intended structure is capable of dealing the traffic control system.

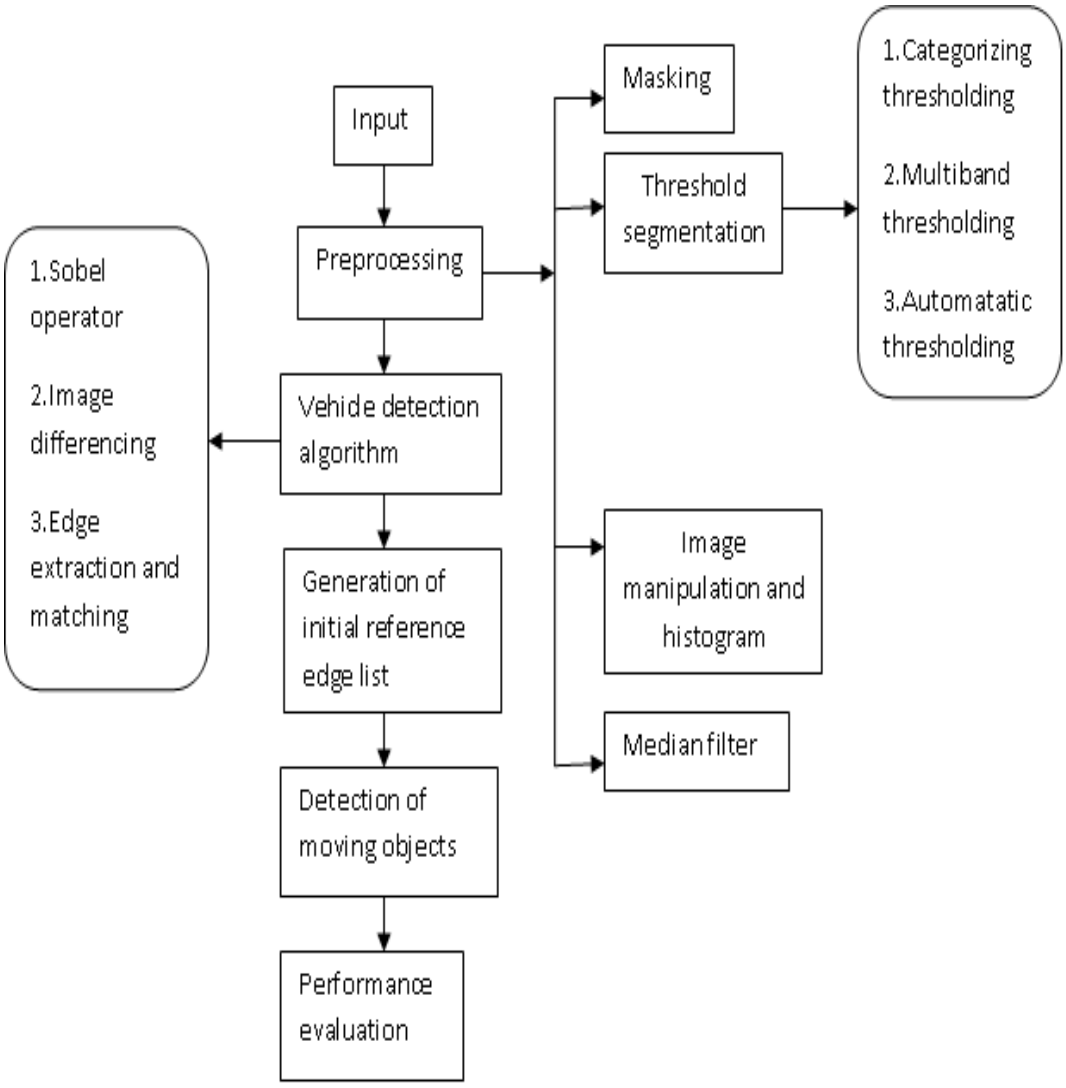


Figure 2 The graphic depiction of proposed flow. The figure 2 signifies the graphic illustration of the proposed scheme.

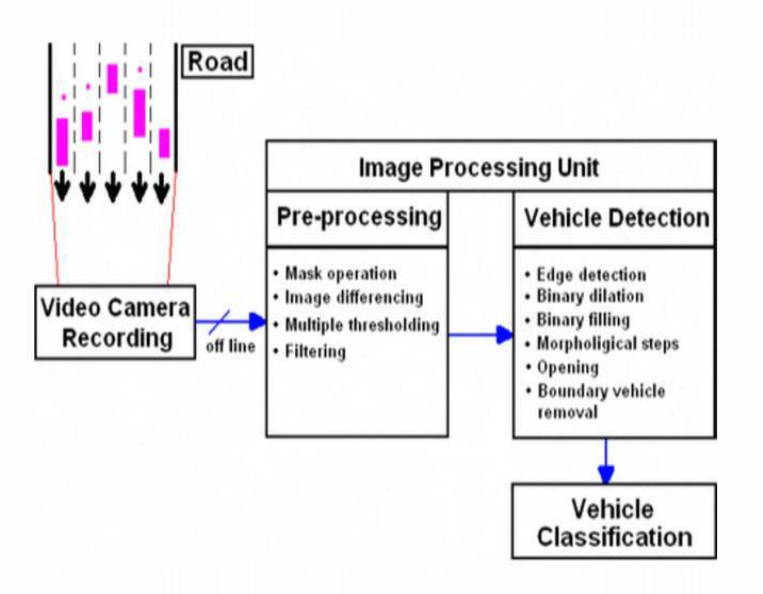


Figure:3 Section of image processing and classification

1.PRE-PROCESSING:

The position of camera plays a significant part in the process of vehicle detection. This work mainly concerns with classification and counting of vehicles on the near vertical camera position or road vertical is selected to wrap the entire region of interest. A few positions of camera and the consequent imagery taken through these places are depicted in Figure 4. Typically, Video cameras were employed for monitoring the road at some specified duration of time. The attained video is broken down into frames at some fixed time intervals. The resulting imagery is individually processed to acquire information about the number of vehicles and their categorization at a specified time instant. Figure 4 signifies a block diagram of the proposed mechanism for the classification and detection of vehicle. The frames are conceded in the course of two phase, preprocessing and vehicle extraction phase. The phases are as follows; for a specific segment of road on which the vehicles are to be detected.

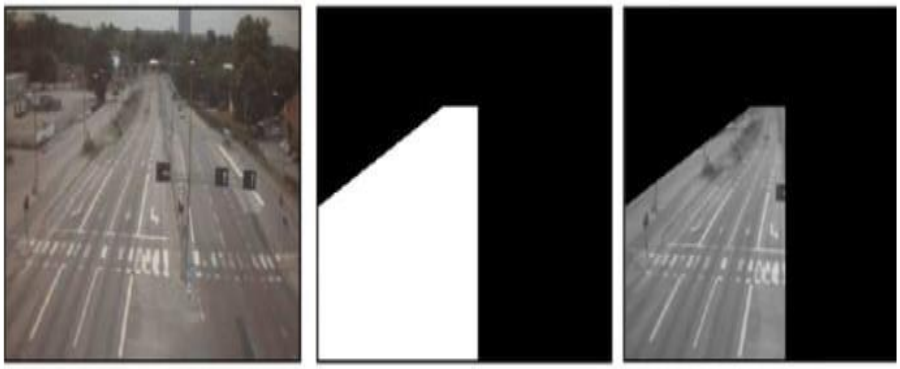


Figure 4 Grayscale images

4(a) Reference image representation (b) Grayscale image representation (c) After applying mask

One with vehicles and other without vehicles. The former image is specified as the reference image and the second one as the current image. These two images are transformed into grayscale imagery as shown in Figure 4 (a,b). The mask is employed on two images for isolating the ROI (for e.g., roads at which the vehicles located) and take away unnecessary information (like fixed objects and paths). An image with mask and a mask is being applied on as shown in Figure 4 (c). Together these images are shown as binary images as mask applying is done as binary process. On the way to transfer both images into binary forms, a thresholding series is functional on both imagery. The value of threshold is properly selected in accordance with the image brightness to be processed. The threshold aspect can be selected with the use of histogram image characteristic. A series is applied one after the other on two images which outcome in several binary images. The accumulation of the entire images offers a comprehensive advanced binary image. The Four values of threshold are employed: 0.2, 0.4, 0.6 and 0.8 correspondingly. Subsequent to applying the mask on two images, differencing of image happens followed by the resultant filtering image by means of a median filter for removing noise produced by differencing of image. At last this image is feed into the system of vehicle detection.

2.VEHICLE DETECTION ALGORITHM

In this section the actual processing of vehicle detection is carried out, the steps are exposed in Figure 5: initially, detection of edge is functional on the obtained image from the pre-processed algorithm as shown in Figure 5(a). The motive for employing this type of edge detection method is to attain vehicles contour. In this, the 'Sobel' edge detection is carried out for creating least amount of edges because our purpose is to cover the external vehicle edges as the inner edges are unrelated for general vehicle detection. Next, the series of linear dual morphological dilations in three information vertically, horizontally and in the course of 45 degrees are carried out, the consequence of three dilations are represented in Figure 5 (b). It is evident that the vehicles are flattering more important however at the same time, a number of noise items are becoming superior. Therefore, these unnecessary objects are capable of offering fake recognition. Also, dual holes filling are carried out as shown in Figure 5 (c). Holes are termed as background set pixels that might not be achieved on satisfying the edge of background image. Note that then required tiny object did not enlarge.

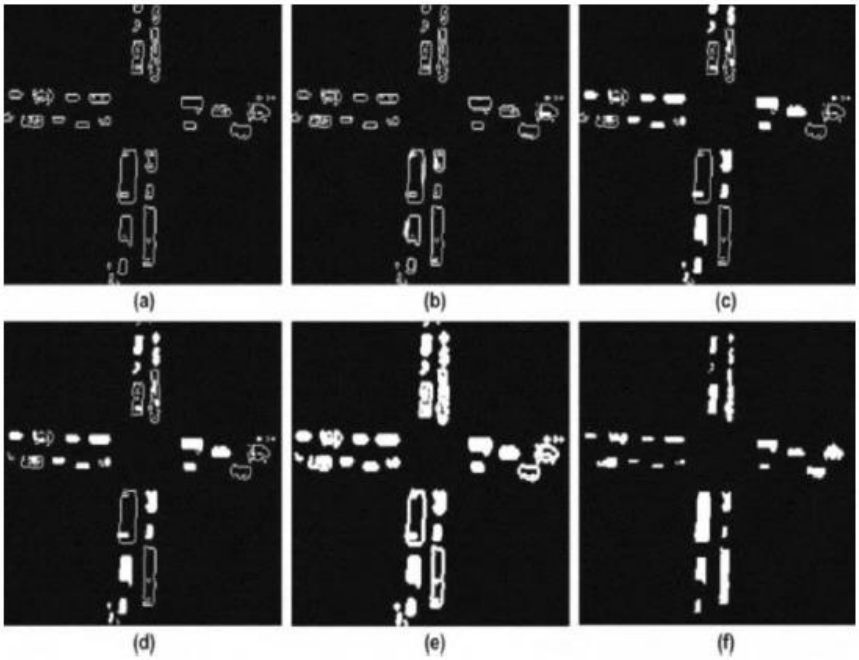


Figure 5. (a) Edge detection (b) First dilation (c) Filling
(d) Border object removal (e) Second dilation (f) Opening in size as consequence of filling process. So as to decrease the algorithm complexity, those objects that handle the border of image are separated as shown in Figure 5(d).

In some situations, once a single medium is wrecked into neighboring part because of the preceding processing stages, it is necessary to attach them or else they might be recognized as separate vehicles and give fake discovery. Therefore, a subsequent level dilation ensures such disconnected parts connectivity. The element of structure employed for this dilation is the diamond configuration which is the most competent morphological dilation and erosion structures.

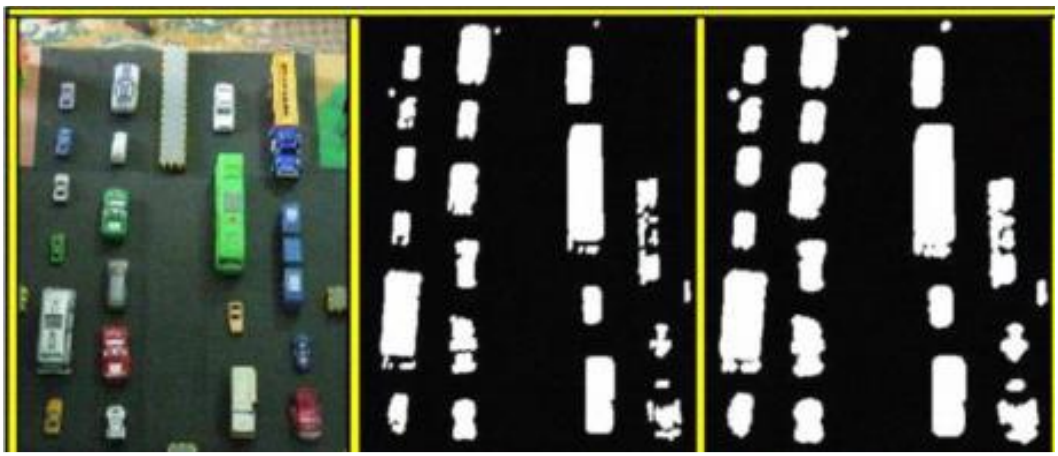


Figure 6 (a) Original image (b) Before applying second level dilation
(c) After applying second level dilation.

The dilation effect is clear a different frame exposed in Figure 6 The blue bus on the intense correct path in Figure 6(a) has black cover at three diverse places. On applying the next dilation level as specified by Figure 6 (b), the bus was to be divided as three portions. Obviously after providing the dilation in second level as shown in Figure 6 (c), these sections are associated to be a single vehicle. Even though the next dilations level outcome in the amplification of unwanted objects size, the amount of target vehicles size increase and unnecessary things are similar. Therefore redundant objects might be detected easily. The process we have employed for removing little unnecessary things is the dual open process depending on the objects size. The range of sizes will be based on the height of camera. For instance, selected different opening sizes were selected. Objects that are related area and have smaller sizes than the distinct entry are detached by using binary opening. Then, the objects of vehicle are important with no noise or unnecessary items and all set for classification. The process of Vehicle classification begins with the isolation of each object and reforming it into a near shape of polygon hence it reflect the real dimensions of the vehicles as of the aerial camera. The isolated objects will use eight neighborhood connectivity. Thus, the object detected will be assigned by on label which indicates the vehicle location. Furthermore, each object's Convex Hull was computed and the target objects will then retransformed to the shape of polygon. In order to perform classification, the type of vehicle is assigned with the range of size measurement. This dimension depends on the circumference and area of vehicles. The falling object in any of this range might be categorized as medium, big or small vehicle. The concluding consequence is exposed in Figure 10 after classification and detection of vehicles. The vehicles detected are represented by rectangular borders in the order of them.

3.GENERATION OF INITIAL REFERENCE EDGE LIST

In process of edge extraction, some of the major background scene edges may not be taken out in an exacting enlightenment. For this purpose, if edge list reference is created from a single image environment, the generation of false alarm is carried out once the background edges appear as a result of illumination. Thus, initial reference edge list is generated from a training images set. The accomplished procedure with reference edges extraction is applied through extraction of canny edge algorithm after that the edges as segments representation. There are several accumulated edge image, which are not established within the specified sample and therefore they are contributed as of some other images of background sample. It is too found that several weak edges are not incorporated to the reference edge image that was accumulated. They were present in two sample images edge. These edges are not often recognized in remaining training images.

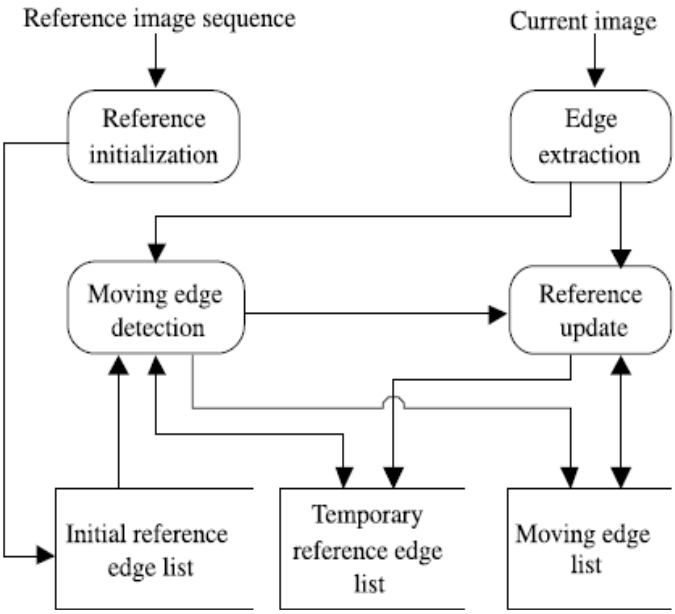


Figure7 edge detection Process

Figure 7 depicts the process of the edge detection using canny edge detection.

4. DETECTION OF MOVING OBJECTS

The detection of moving object is carried out by edge information which is more robust and therefore it releases the processing burden in all pixels of image that were more prone for the noise and variation of illumination. The segments of input edges are being extracted from the formation of current image from the present image list. A segment of input edge which does not matches the registered one is the moving edge list. The matching confidence flexibility grants a small disparity bit among the two segments of edges. Thus minor movement toleration or fluctuation occurs in camera focus.

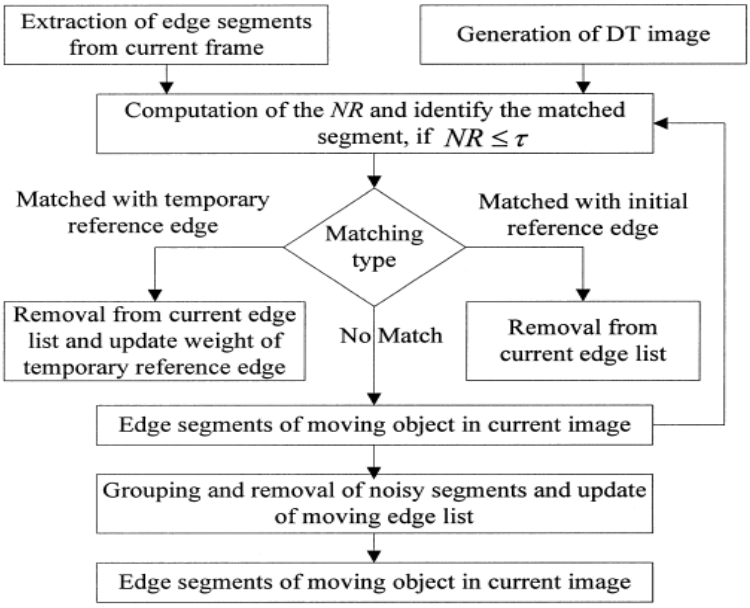


Figure8. Detection of moving object.

The figure 8 represents the process of the detection of the moving object.

5.RESULT AND DISCUSSION

In this, the part of image processing is carried out by using MATLAB, through acquiring the imagery in the course of webcam and to segment the images for identifying the total amount of vehicles. Arduino Mega board will be employed in this for controlling the signal. Image processing shows a vital role in the application of various real-time based that ranges from medical imaging to object and pattern recognition. One such function is object recognition of portable targets in a specified environment. The detection of Vehicle detection is an example of such detection of object that is employed for the analysis of traffic, monitor and control. Therefore, an early traffic controlling step is vehicle classification and detection by means of traffic measuring approaches. Techniques based on Image processing are one the most used techniques widely which attain this intention. A lot of algorithms have been projected that is correlated with vehicle detection and classification.

In segmentation of image and edge detection approaches were employed. Estimation techniques are used in background extraction for the isolation of interest vehicles. Likewise detection of vehicle can be attained using vehicle shadows. Morphological process will be helpful for vehicle classification.

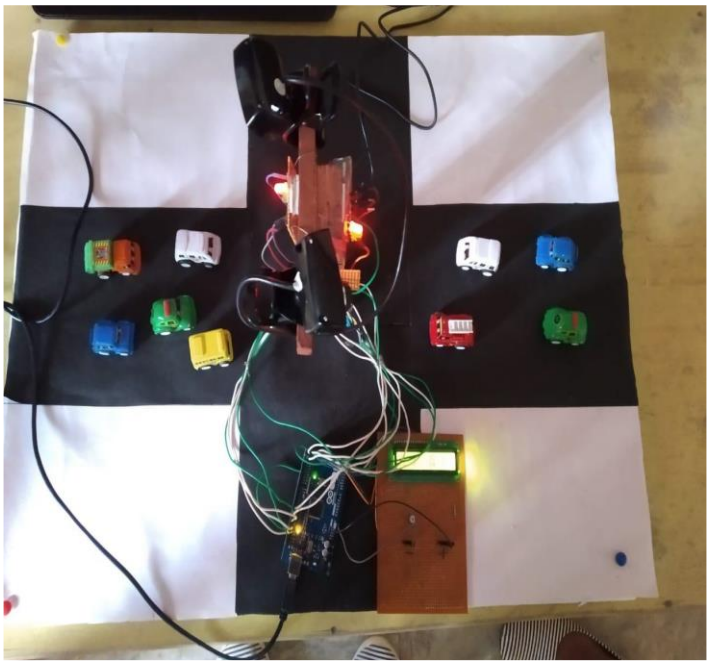
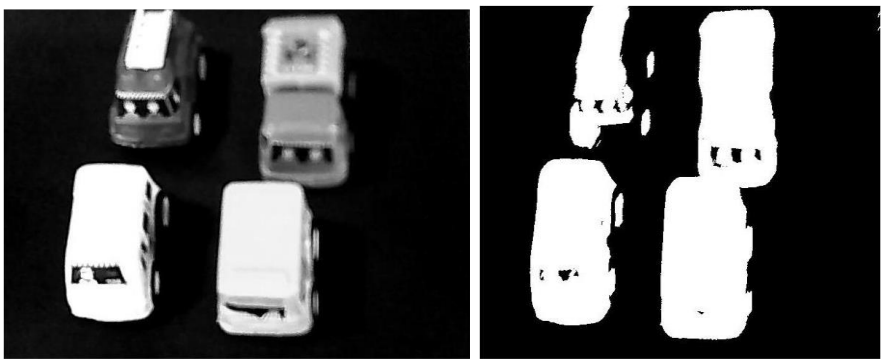


Figure 9Hardware setup

Figure 9 represent the hardware set up of the proposed method. The Video cameras are employed for the purpose of monitoring a road at some specified time duration. The attained video will be broken down into frames at some rigid time intervals. The resulting images are individually processed for attaining the information related to vehicles and the classification at some instant segment of time. For segmenting a particular road where the vehicles are to be detected, the two image (with and without vehicle) are taken.

Figure 10 Original Image



(a) (b)

Figure 11 (a,b) Grey scale and black and white image

The figure 11 represents the implemented result.

6. CONCLUSION

In this paper, a system of smart traffic light time controlling was presented with the use of image processing technique. The lanes with highest rate of vehicles will take much time of green light signal. Through integrating methods of thresholding, edge detection, image differencing, and a range of morphological processes, the presented algorithm offers a high rate of success more than 85% by means of both vehicle detection and classification that might be helpful in the analysis of traffic and management.

This proposed system offers the following benefits providing easy method to control traffic light, adding intelligent to the traffic light to be more efficient, reducing the average waiting time at red lights, reducing the wastage of time for empty roads and saving energy wastage during wait at red light. As a result, this leads to greener environment and reducing the rates of accidents.

7.REFERENCES

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