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Wireless Network for Road Traffic Monitoring With Vision System

Ruby Verma[1], Mr.Ravi Mishra[2]
[1]Department of Electronics and communication, Shri Shankaracharaya Technical Campus,Bhilai
[2] Department of Electrical and Electronics, Shri Shankaracharaya Technical Campus, Bhilai, Chhattisgarh,India

Abstract – Road network of a country is one of the most important mean of overall development. With the rise in population, the transportation sector is also contributing an increased share in the overall economy. Now-a-days roads are getting overcrowded and number of vehicles on the road is increasing at a terrific speed. Traffic congestion and incident detection are the serious issues in Traffic engineering applications and Intelligent Transport system. This paper proposes computer vision based vehicle detection, tracking and counting. In this paper, a system that estimates the size of traffic at the highway and further helped to choose the free lane displayed on the displaying unit. The project has been implemented using the MATLAB software and hardware for displaying the alternate route which aims to prevent heavy traffic at the road.

I. INTRODUCTION

According to the survey in India near about 60,000 crore rupees is wasted yearly due to traffic delays(including fuel wastage). This has given traffic monitoring significant important. Traffic control has been a topic of research from the last few decades. Management of heavy traffic in cities is not a big problem and requires a systematic planning and control. In managing the city traffic, congestion is a major challenge. In case of congestion problem in the road-network, a city has to find a least-cost solution to improve the situation without expanding the infrastructure i.e. without extra investment. In order to smoother the transportation system, expansion of road infrastructures may not be a sustainable solution to the city authority because of costs, space constraints, or the degradation of the environmental standards. As an alternative way, city has to consider the possible ways to optimize the existing transportation facilities and reduce the congestion level on the road. Traditionally, lamps are used to control the traffic at intersection. Every lane is allocated a fix timer in which the vehicles are queued and when the timer expires vehicles are allowed to pass by. There is limited intelligence involved in such systems. Magnetic loops were another method to detect the presence of vehicles on the road.

When controlling the traffic using camera controlled systems there are some of the important factor that must be taken into considerations: Detecting vehicles in the scene require description and discrimination from the background. This is normally called in literature as, defining Object of Interest (OOI). For controlling the process, requires background modeling techniques [3]. Other constraints are environmental variations such as illumination, fog, temperature, wind blows etc.

Previous approaches process the whole two or three dimensional plane for object detection and isolation from the background [4, 5]. Background subtraction for object detection was therefore the main constitute. However background subtraction performs poorly in case of outdoor environment where environmental variations demand a robust background update algorithm [14].Ultimately, a vigorous background model need to adapt quickly to environmental variations and therefore it is a separate research field in its own [15].To tackle the aforementioned constraints, in this paper we propose an intelligent system for the control of traffic. The system incorporates the integration of digital image processing techniques and a hardware i.e. displaying unit. It is capable of controlling the traffic.

II. RELATED WORK

Many papers have been published related with vehicle detection, tracking and classification. Basically they focused on controlling the traffic signal.

In[16] presents a new developed Matlab Simulink model to compute traffic load for real time traffic signal control. Signal processing Block set and video and image processing Block set have been used for traffic load computation. The approach used is corner detection operation, wherein, corners are extracted to count the number of vehicles. This block finds the location of the corners, the number of corners, and the corner metric values. The developed model computes the results with greater degrees of

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accuracy and is capable of being used to set the green signal duration so as to release the traffic dynamically on traffic junctions.
In [1] Morphological change detection system for real time traffic analysis was proposed. This is able to detect and track the vehicles from the real time video of traffic and displays a message to the traffic control station. The input to the semi automated system is the traffic video of the highway and the analysis is done on each frame of the image sequence separately by setting the threshold. The output of the system is alert message extracted from the attributes of the traffic patterns. Two messages are displayed to control the traffic i.e. "Traffic" and "Normal" based on the total number of vehicles more than the set threshold or less than the set threshold respectively. The proposed algorithm is efficient and yields good result as it is suitable to monitor the traffic under different weather conditions and illumination changes.

III. SYSTEM MODEL AND METHODOLOGY

Mainly our system consists of two sections:

Software (MATLAB)
Hardware (transmitter, receiver and display)

A. Processing of Video Signal and Image Acquisition

The work starts with processing the live video using stationary camera, which is to extract the frames continuously from the real time video coming from the stationary camera. This raw digital data is further processed by converting the images from RGB(Red-Green-Blue) to grayscale in order to further process the images. Intially we captured the image of a vacant road when there is no vehicle present; this image is reference image. The next section explains the procedure to select region of interest where the vehicles are present.

B. Image Cropping

The second step is to select the targeted area by designing in MATLAB. The purpose of cropping is to identify the road region where the vehicles are present and exclude the unnecessary background information is fixed in every frame of the live video because the camera is stationary. To crop the required area, we used the reference image, First we created a binary image of having then shaded white the road area, and shaded black the leftover region.

C. Object Detection

The third step is the vehicle detection in order to identify and count the vehicles presented in targeted area. To perform the object detection, first we extracted the frame from the real time video sequence. The next step is to convert both images; the reference image and the real time image into greyscale and then we determined the absolute difference of two image. Since the dimensions of the road are fixed therefore the difference image only highlights the presence of vehicles in the desired target area.

D. Traffic Density

The next step is to calculate the traffic density in the desired target area. In order to determine the traffic density, first we marked the vehicles and then counted their numbers. In order to count the number of vehicles, we searched for connecting pixels. In order to consider a connected region as a vehicle, we defined a minimum threshold. However, it is possible that more than one region of a vehicle is detected using the above criteria. To overcome this problem, we find the overlapping bounding boxes of the selected regions and thus filtered out smaller and highly overlapping regions.

E. Transmission and Reception of data

RF module is used for transmission and reception of data which includes traffic density of highways.

F. Displaying Unit

The number of vehicles is displayed in LCD. If traffic density is high then changing of routes also displayed.

IV. EXPERIMENTAL RESULT

The main aim of the paper is to find the alternative route if the density of vehicles crosses the threshold value. This is fulfilled by

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using the display unit which is incorporated at particular distance.

Figure 1 Sample video without processing

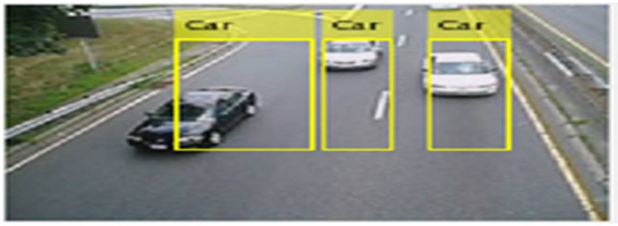

Figure 2 Sample video after processing

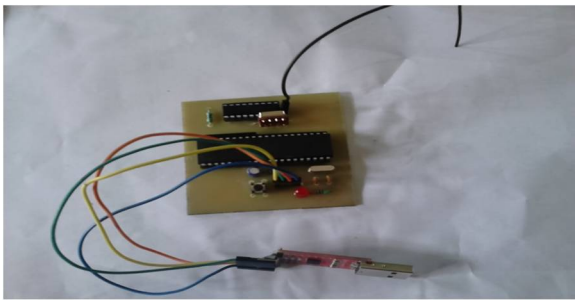

Figure 3 -RF Transmitter module

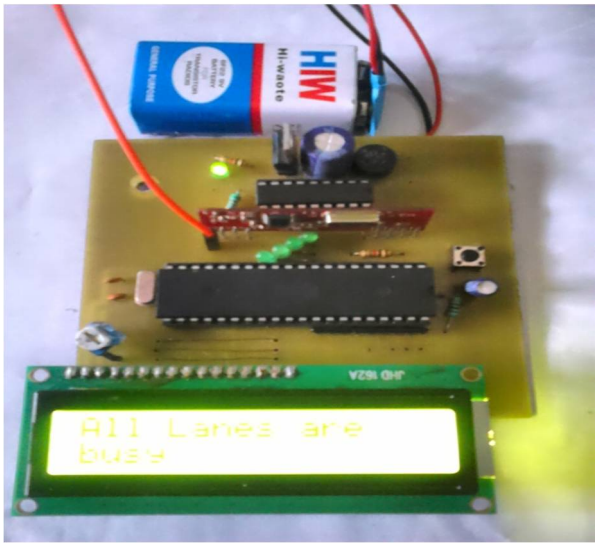

Figure 4 RF module for reception and display unit

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V. CONCLUSION

In this paper, an intelligent traffic control system is proposed for monitoring and control the traffic of a city. The system proposed is very cost effective as we do not need to install any additional devices. Although the system is robust for vehicle detection, further work is still required to resolve the occlusion issue, illumination and destabilization of camera.

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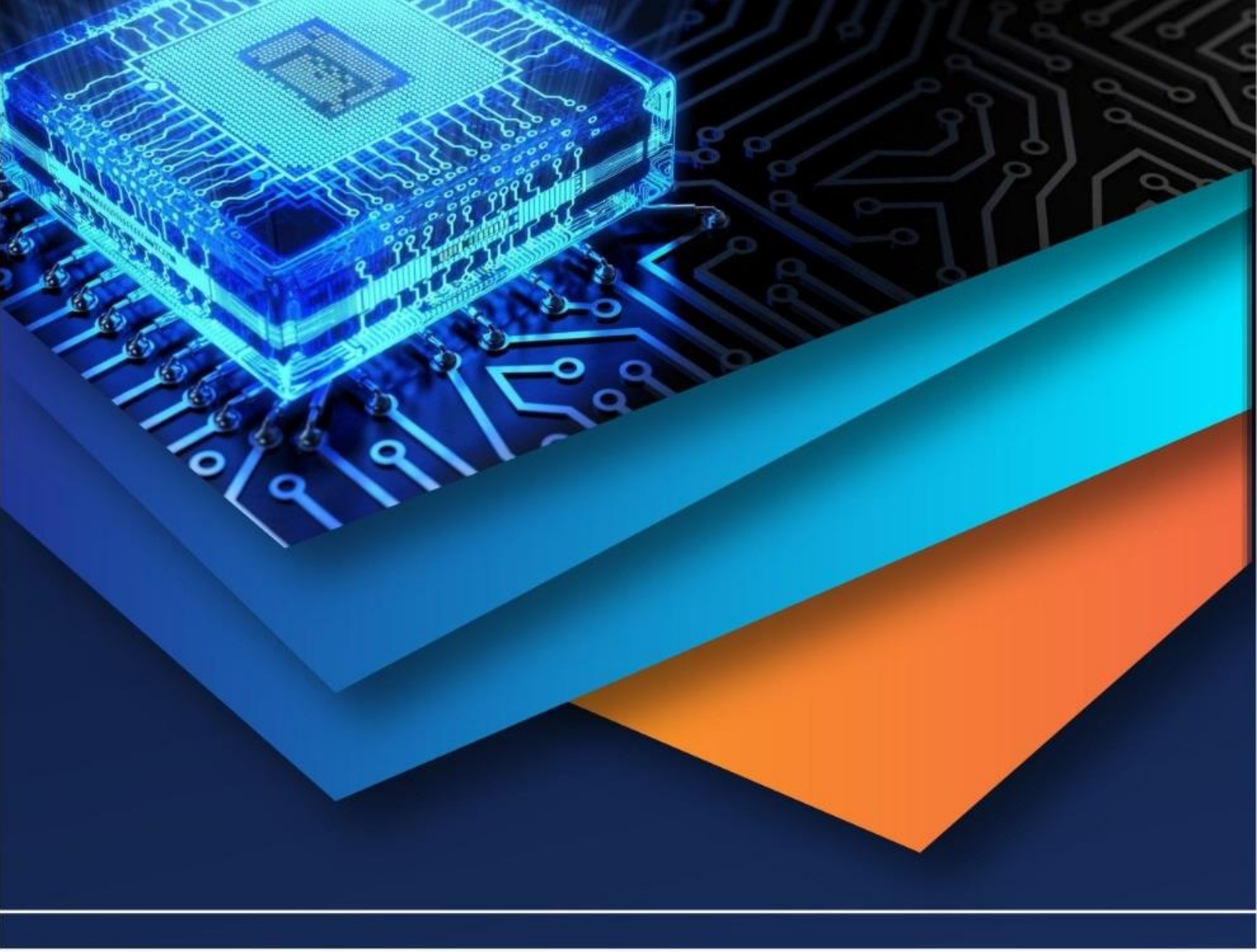

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