SMART TRAFFIC MANAGEMENT BASED ON EMBEDDED SIGNAL PROCESSING

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Abstract— This millennium has witnessed the biggest problems of all times, the population and along with the demands for transport. Every individual want to maintain a living standard which he or she prefers by buying a house or a vehicle. Transport of any kind is a trend or a very urgent need to this ever growing population. With this growing population we have to find an effective solution for managing the vehicles on road. Through this paper I want to propose an optimal solution to solve and balance the vehicles at the traffic to avoid a heavy congestion. Pictures through traffic cameras are captured and after that the images are subjected to edge detection process, after the process the number of vehicles are calculated and the vehicles will be redirected to different routes to avoid a huge congestion at a single place. A convenient feature, an android app designed with app- inventor II to provide live traffic update of traffic to the people for their better selection of routes.

Index terms— App-Inventor, Edge Detection, Traffic Congestion.

I. INTRODUCTION

The invention of wheel was one of the biggest invention in the human history, but invention of locomotives takes to another level. Though locomotives have served in immense number of ways but extensive use of these has cost us a lot to us. The major issues is the pollution and second most issues is the traffic congestion. With affordability and higher purchasing power, it has become very easy for a common person to own a vehicle [1]. As a daily need locomotives helps us in saving time and travelling a huge amount of distance within fraction of time, the best way is to manage them through a smart traffic system and help the vehicles serve us better.

In order to manage the traffic an effective solution has been presented through this paper. Controlling the traffic lights are not the solution, the trick is reducing the number of vehicles on a particular traffic signal. This can be done as, each signal will be equipped with cameras and traffic lights. The cameras will capture the images of the incoming traffic and the images will be processed under edge detection techniques in order to distinguish and the count the flow of number of vehicles towards a particular traffic lamp post. So after calculating certain vehicles will be redirected to other signals. And more mover the android app developed will help people to select best alternate and shortest route for their destination.

II. RELATED WORK

Priority queues, bidirectional search etc are used by many researchers for road traffic management [2]. Appert et al. [3] utilized graph theory for the measuring urban road network vulnerability. Baruahand Baruah [4] proposed cut-set of graph for the traffic control problem.

Han and Tabata [5] combined a genetic algorithm and controlling lethal gene for solving of the vehicle routine problem but the performance for the practical example was not investigated. Meshkat and Vrancken [6] used multi objective technique for the road network partitioning. This study fast and elitist Non-dominated Sorting Genetic Algorithm (NSGA-II) and Pareto Archived Evolution Strategy (PAES) were implemented.Zadeh introduced the concepts of fuzzy sets in 1965. It was shown as a very capable mathematical approach for dealing with subjectivity, ambiguity, uncertainty, and imprecision [7].

Among the different colony insects, the ant colony succeeds to find food by following the path with highest pheromone quantity deposited by other ants [8]. D'Acierno et al. [9] proposed swarm intelligence algorithm to optimize the signal setting of each intersection for the asymmetric traffic. Garcia-Nietoa et al. [10] used particle swarm intelligence to find cycle programs of traffic lights and implemented for 2 cities in Spain.

III. PROPOSED SYSTEM

The existing cameras at the traffic post with captures images of the traffic inflow and outflow. These images will be sent to webspace for storage, and the stored images will be subjected to edge detection process, so that the number of vehicles in each frame of picture could be count. After allowing a certain number of vehicles to a particular traffic post the extras vehicles will be redirected to other traffic post or on an alternate route so as to avoid a heavy traffic congestion on a single post. The rerouting through lights is controlled by ARM7 microcontroller. Furthermore in case a heavy traffic will occur due to unavoidable circumstances the signal with a large number of vehicles will glow green for a larger amount of time in comparison to the other side of the post. Another feature is that traffic signals are interconnected within themselves to share the up the information and data which will help other traffic

post to detect or predict the flow of traffic. The traffic stops are connected through Wi-Fi.

Android application designed with the help of app-inventor II to provides with the traffic updates, maps and details of the congestion on the user phone, both at they can suitably plan their way.

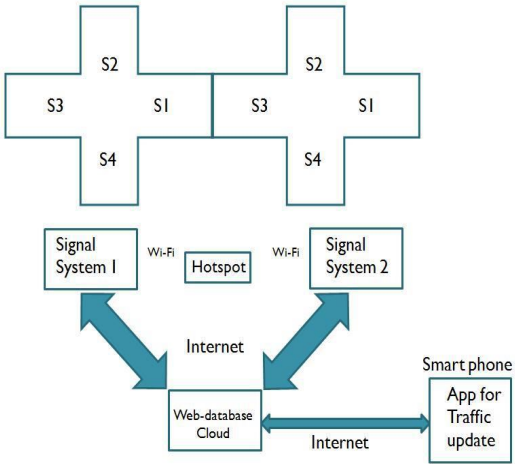

Figure 1: Block diagram of the proposed system. S1, S2, S3, S4 are traffic signals at different corners of a square.

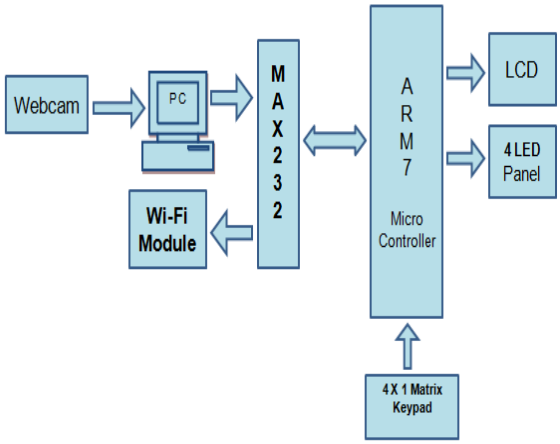

Figure 2: Block diagram of the system at unit signal 1.

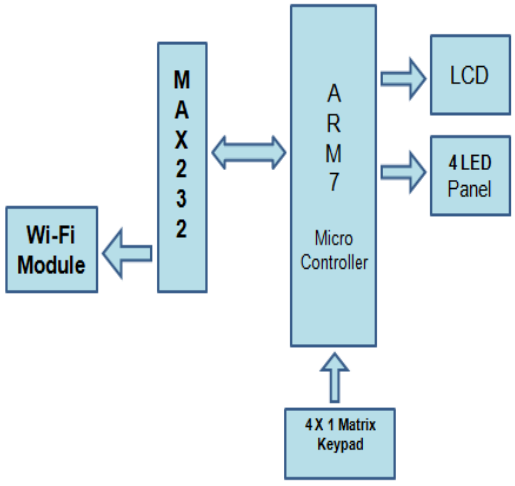

Figure 3: Block diagram of the system at unit signal 2.

1)Edge Detection: Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.[33]. There are many methods for edge detection but most of them can be grouped into two categories, search based and zero-crossing based [34]. Common edge detection algorithms include Sobel, Canny, Prewitt, Roberts, and fuzzy logic methods.

2)MAX232: It is an IC used to provide TTL to RS232 or RS232. Serial communication between two device is possible only if they are TTL compatible i.e. TTL logic levels (logic1/logic 0) must be same for both device. MAX232 converts TTL of 5v in to RS232 standard as well as TTL of 3.3v in to RS232 standard.

3) ARM7 Microcontroller: The original ARM7 was based on the earlier ARM6 design and used the same ARMv3 instruction set. It also controls the LEDS, Wi-Fi module which is responsible for the communication between the signals.

4) Wi-Fi Module (ESP8266): Serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface.

5) LED Panel: Visual part of the system, which will direct the traffic flow and will be controlled by microcontroller.

6) LCD Display: To display messages in public or suggesting direction and routes for ease of the people.

7) Android Phone: To receive the traffic updates and a map to guide for the least congestion route.

Application for android phone is designed using app-inventor II.

IV. RESULTS

Figure 4 represent the experimental setup, depicting various various vehicles on different stops. Figure 5 represents the image of the experimental setup taken through matlab. Figure 6 represents the segmented image after segregating only vehicles on the road. Figure 7 represents the processed image after using canny edge detection. Figure 8 represents the time delay at each signal after the image is processed under canny edge detection.

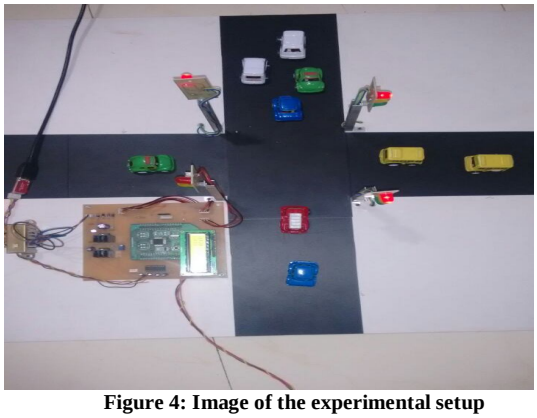

Figure 4: Image of the experimental setup

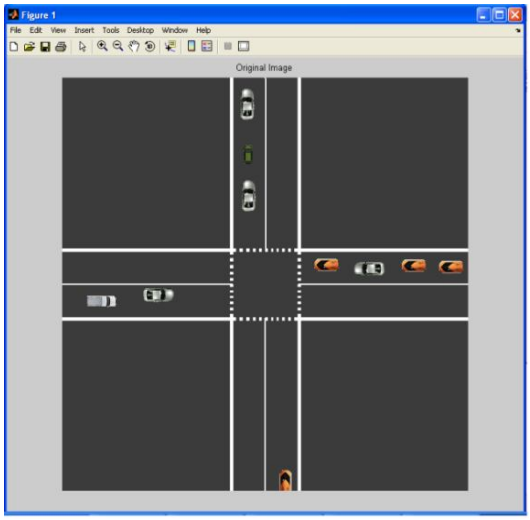

Figure 5: Image taken through camera with help of matlab

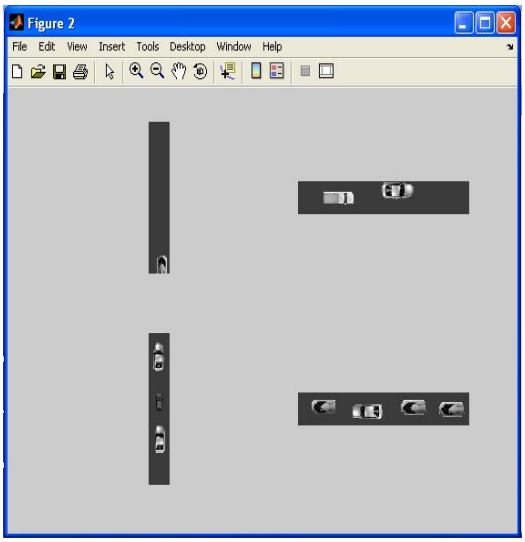

Figure 6: Image segmented using matlab

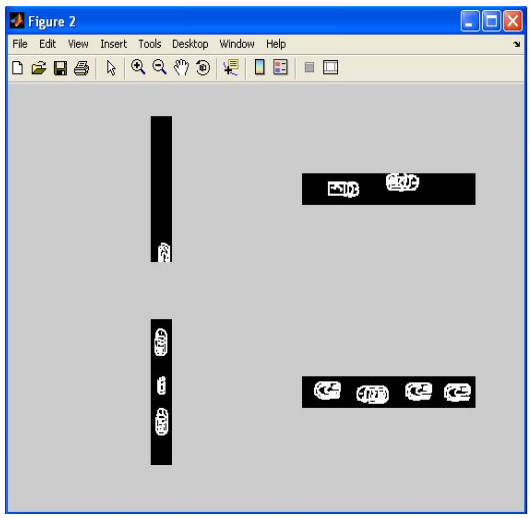

Figure 7: Image processed through canny edge detection method in matlab.

Figure 8: Time delay in seconds at each stops after image processing.

CONCLUSION

This paper provides a solution for reducing traffic congestion. It can be an integrated part for smart traffic in smart city. The above results shows how with the help of edge detection huge traffic congestion problems can be solved within minutes and at a very low cost, and more over the traffic updates data received on user mobile.

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