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Edge Detection Based Traffic Management System with Route Updates on Android Application

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Abstract: The current 21st century's biggest problem is the ever growing population. With the increase in number of population there are a lot of things that are hampered or changed in ordered to sustain and maintain. One of the major drawbacks of the growing population is the equivalent growth of road vehicles. The increasing number of vehicles on road causes a serious problem that is traffic congestion. An idea to reduce the traffic congestion has been provided through this paper. An edge detection based traffic management system has been developed which will capture images of the traffic inflow and redirect and them in order to reduce the congestion on each signal. An android app has been developed using app inventor II to provide route updates and traffic congestion details to the users, so to find a better route for their travel.

Keywords: App-Inventor, Edge Detection, Traffic Congestion

I. INTRODUCTION

With affordability and higher purchasing power, it has become very easy for a common person to own a vehicle [1]. Vehicles have made our lives easier, comfortable and made our travel faster. Adapting the current lifestyle maintaining a personal vehicle is a need as well as style statement now a days. But all this comes at a very larger cost, we all seemingly agree with the increasing number of vehicles traffic congestion has also increased along with that pollution.

Day by day the number of vehicles is increasing, in order to save time people travel by their own transport rather using a public transport. This leads to a serious problem of traffic congestion. As we all know time is money, so reducing this traffic congestion is a major area to work for. Most of the cities around the globe big or small are facing traffic issues. This serious problems need to be addressed to very quickly and immediately.

Traffic management system implies to control the flow of vehicles on each traffic signal so that the waiting period per vehicle could be reduced. Managing traffic at only signals will also not allow or completely eradicate the problem, the traffic flow has to be controlled before reaching the signal, in order to reduce the traffic density at each signals. This intern will reduce the waiting time. This is the concept of a smart city. With the population of vehicles being doubled each year an urgent approach or remedy has to implement in order to make a smart city. This paper describes and traffic management system which is based on edge detection processes. Through traffic cameras pictures will be taken and edge detection image processing technique will be implemented in order to detect the number of vehicles flow per signal, so that we can redirect them to different routes or take appropriate measures in order to reduce the traffic density per signal. Further an android application is developed in order to provide an aid to the user to find the shortest and least congested route.

II. RELATED WORK

The most famous algorithm was Dijkstra algorithm, it calculates the shortest route, 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. Baruah and Baruah [4] proposed cut-set of graph for the traffic control problem.

Genetic Algorithms (GAs) has been successfully applied to system identification and a wide range of applications including filter design, scheduling, routing, control, and others. Applying Gas to complex problems has always been conceptual and time consuming. 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

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imprecision [7]. Fuzzy frame work was used for solving transportation problem like traffic assignment, accident analysis and traffic light control.

Swarm intelligence is the most effective and has been used to model complex traffic and transportation processes. The fact that it is based on the insect's behaviour makes it difficult to code and implement. 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

Each traffic signal will be equipped with cameras along with traffic lights. The images of the incoming and outgoing traffic will be captured and the images will be sent to webspace for storage. Edge detection technique will be applied and intensity of incoming traffic is observed from the stored images, then a ARM7 microcontroller based traffic light management system will control the traffic light according to the results from the edge detection processes. For instance if a heavy flow of incoming traffic is detected then the vehicles will be rerouted to different routes to reduce traffic congestion on one signal. Traffic rerouting will be done in such a way that no other signal will affect or traffic density ant any signal shall increase. Further even after rerouting a heavy traffic is found at any signal then the signal will be green for a longer period of time and if the traffic density is less, then the signal will be green for a shorter period of time. Secondly it will also communicate with the adjacent junction signal. Both the signals will collectively manage the traffic depending on the density. Furthermore message can be send with the use of panic key All the signals over the city will be interconnected through internet or over Wi-Fi for redirecting traffic through the city.

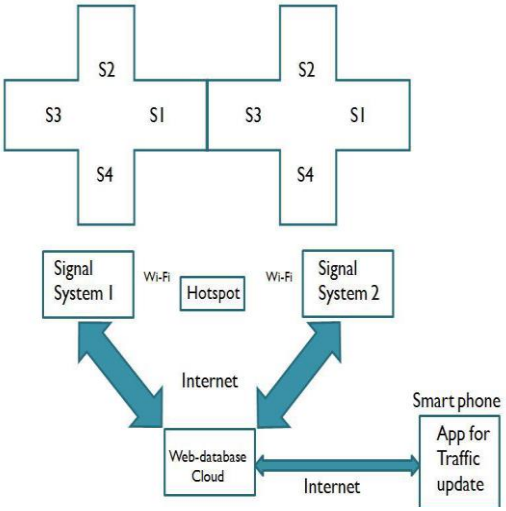

Fig. 1. Block diagram of the proposed system. S1, S2, S3, S4 are traffic signals at different corners of a square.

An android application is designed using App-inventor II which provides a map and with data, this map and data is accessible to all registered users. The data will help the user to choose the less congestion route to reach his or her destination at ease.

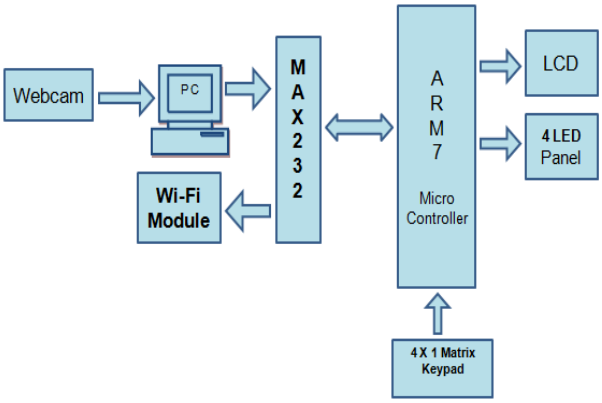

Fig. 2. Block diagram of the system at unit signal 1.

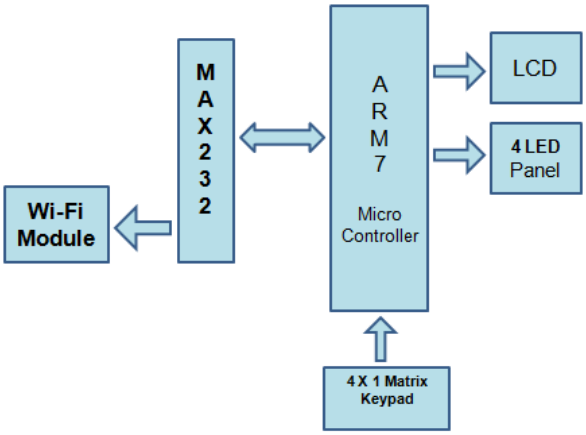

Fig. 3. Block diagram of the system at unit signal 2.

A. Edge Detection

It is a technique of finding the boundaries of objects in an image. It works by detecting discontinuities in brightness. 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.

B. MAX232

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

C. 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.

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D. 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.

E. LED Panel
Visual part of the system to direct the traffic flow and will be controlled by microcontroller.

F. LCD Display
To display messages or suggestions to guide the people.

G. 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

The image processing using edge detection was done in MATLAB. The ARM7 microcontroller was programmed using 'C' language. Fig.4 and Fig.5 are images of the experimental setup.

Fig.4 represents the traffic lights on different squares and

Fig.5 represents the experimental setup with a camera.

Fig.6 is the application to take pictures at every signal.

Fig.7 is an image of traffic square.

Fig.8 represents only the vehicles on the road.

Fig.9 is the processed image after edge detection by canny method.

Fig.10 represents the block codes, the android application is written in form of block codes on app-inventor II. The primary work has been completed and the block programming for android application is under process.

Fig. 5.Image of experimental setup II

Fig. 4. Image of the experimental setup I

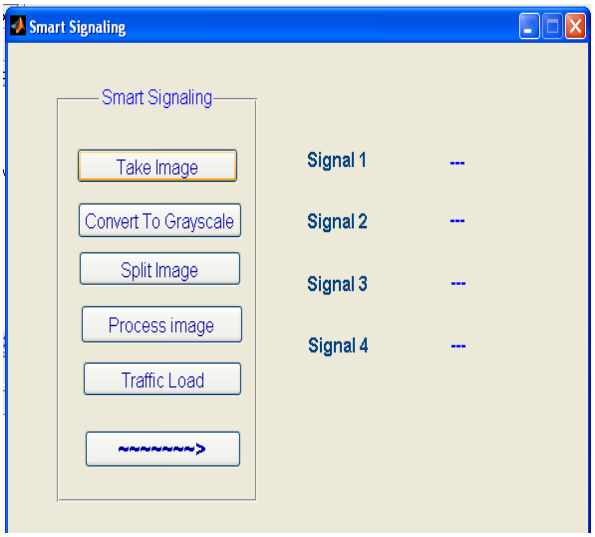

Fig. 6. MATLAB application to take picture

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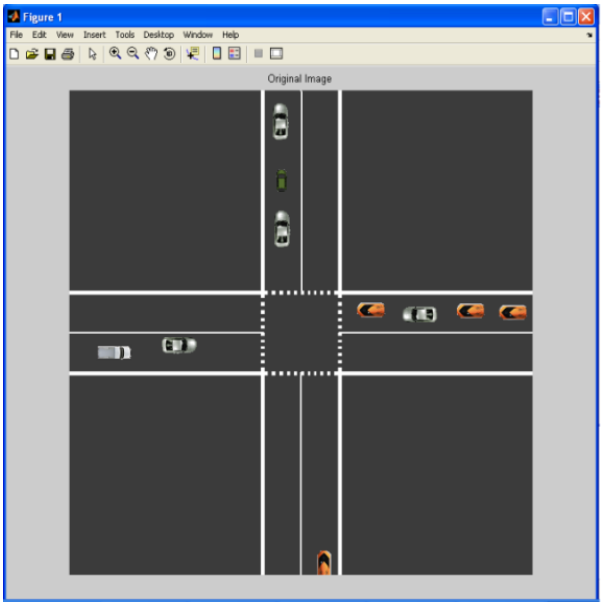

Fig. 7. Image of traffic square

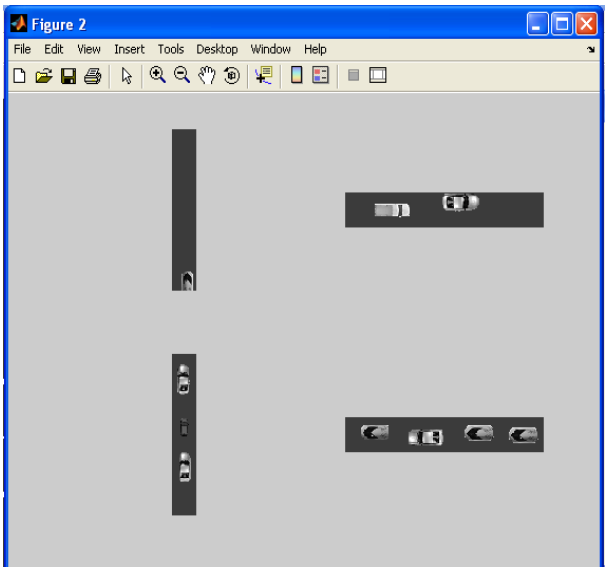

Fig. 8. Segregated images of vehicles on road

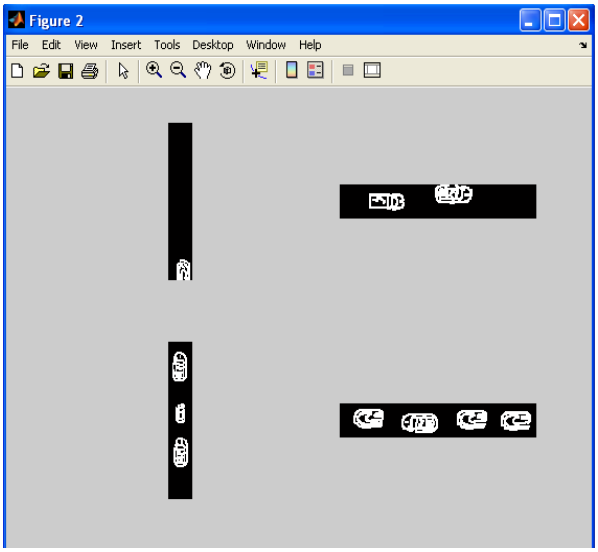

Fig. 9. Processed image after edge detection using canny's methods

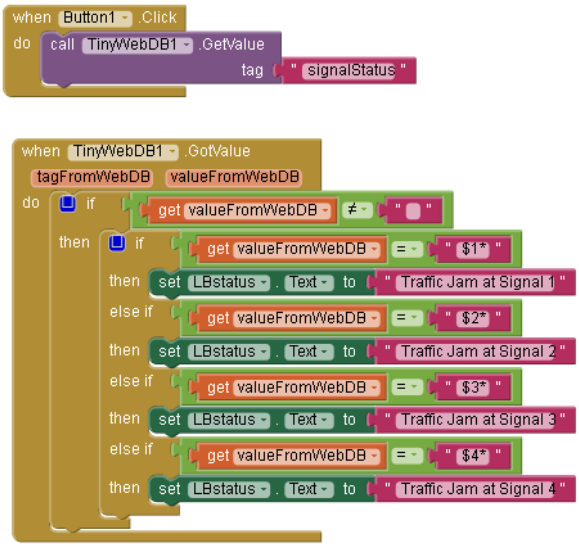

Fig. 10. Block programming on APP-Inventor II for android application.

V. CONCLUSION

This paper provides a solution for reducing traffic congestion. It can be n 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 will be a tremendous help to find the best route to his or her destination.

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