Traffic Control System Using Image Processing

Jaywant Kamble, Pratik Kothawade, Abhijeet Kumbhar, Prof. Rajani P.K.

Abstract - **Traffic problems nowadays are increasing because of the growing number of vehicles and the limited resources provided by current infrastructures. On intersecting roads, huge number of vehicles leading to congestion and heavy traffic occurs. Traditional traffic controls (warning signs, stop signs, etc.) are used in most areas but these are sometimes inadequate to address the problem. Since the expansion of the traffic network is no longer a socially attainable solution, the existing control systems have to be used in a more intelligent way in order to increase the traffic throughput and decrease total travel times. Our aim is to develop the system at signals. This system will have multifunctional operations. The system will firstly measure the traffic density at different signals and accordingly change the time delays for traffic lights viz. the side at which the traffic is high the signal will remain green for more time. Secondly it will also communicate with the adjacent junction signal. Both the signals will collectively manage the traffic depending on the density.**

Keywords – ***AVR, AvrStudio4, Image Processing, MATLAB, RF-TRANSCEIVER..***

I. INTRODUCTION

Traffic problems nowadays are increasing because of the growing number of vehicles and the limited resources provided by current infrastructures. On intersecting roads, huge number of vehicles leading to congestion and heavy traffic. Traditional traffic controls (warning signs, stop signs, etc.) are used in most areas but these are sometimes inadequate to address the problem. Since the expansion of the traffic network is no longer a socially attainable solution, the existing control systems have to be used in a more intelligent way in order to increase the traffic throughput and decrease total travel times. Hence, reducing waiting times before traffic lights can save our society billions of rupees annually. To make traffic light controllers more intelligent, we exploit the emergence of novel technologies such as communication networks and Image processing by regulating the traffic demand at each intersection in the network. The goal is to avoid traffic conflicts and shorten the queue length at a stop line. Our aim is to develop the system at signals. This system will have multifunctional operations. The system will firstly measure the traffic density at different signals and accordingly change the time delays for traffic lights the side at which the traffic is high the signal will remain green for more time. Secondly it will also communicate with the adjacent junction signal. Both the signals will collectively manage the traffic depending on the density.

II. LITERATURE SURVEY

In 1868 illuminated traffic signal was installed in London near the Houses of Parliament. The device had semaphore arms to signal drivers and pedestrians during the day and it had red and green lenses illuminated by gas for viewing at night. The police officer would turn the signal 90 degrees to position the semaphore arms and the coloured lenses towards traffic as needed. This was the first recorded use of illuminated red and green colours to control traffic. In 1912 Salt Lake City, UT police detective Lester Wire built a two-colour traffic signal that used electric illumination. In 1914 the American Traffic Signal Company installed two-colour signals in Cleveland, Ohio.

In 1920 William Potts, a Detroit Traffic Police Superintendent, designed the first 4-way three-color traffic control device that is recognized as the basis for the modern traffic signal. In India, Mumbai`s traffic system is controlled by "Real Time Intelligent Urban Traffic Management Technology".

Sr No	Type	System	Country
1	Fixed time systems	TRANSYT	UK
2	Plan generation systems	SCATS	AUSTRALIA
3	Traffic responsive centralized systems	SCOOT	UK
4	Traffic responsive systems with distributed processing	OPAC	USA

Table 1 : Different types of traffic control systems used.

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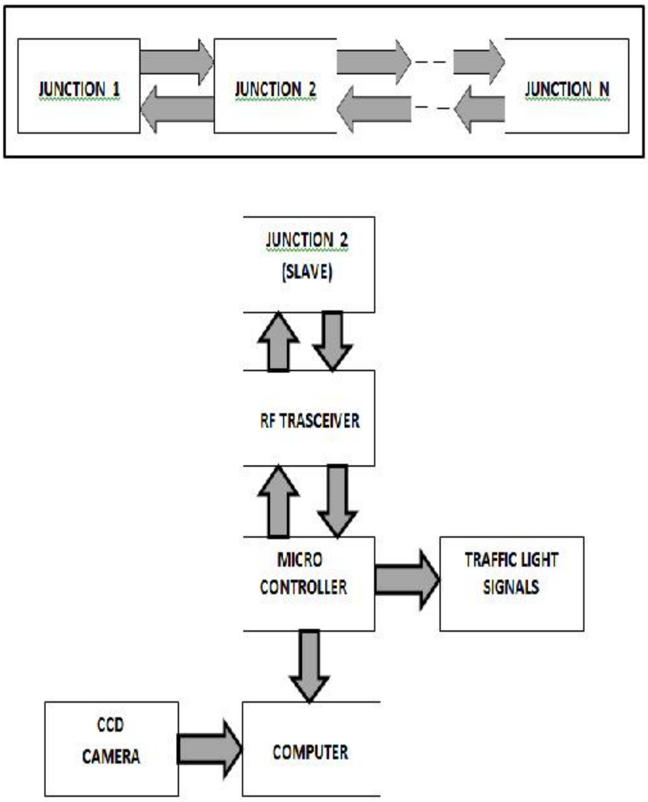

Figure 1 : Block Diagram of Traffic Control System at Master Side

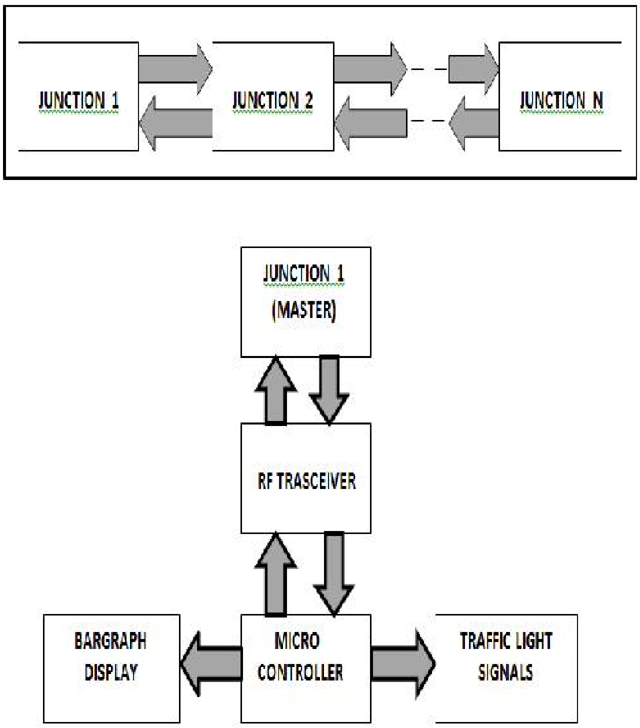

Figure 2 : Block Diagram of Traffic Control System at Slave Side

The block diagram shown above consists of Microcontroller, LCD, RF trans-receiver, CCD camera, computer, traffic light and bar graph display.

As shown in figure all junctions connect to each other using wireless RF transceiver. Webcam, Computer, Microcontroller & LCD display installed in each junction. The image sensor senses image of Traffic & onboard processor of image sensor performs compression & converts the image into its own format & through USB transmit to the processor using Image processor software which process the image & detect the number of vehicles in image.

CCD CAMERA:

A **webcam** is a video camera which feeds its images in real time to a computer or computer network, often via USB, Ethernet or Wi-Fi.Webcams typically include a lens, an image sensor, and some support electronics. Image sensors can be CMOS or CCD, the former being dominant for low-cost cameras, but CCD cameras do not necessarily outperform CMOS-based cameras in the low cost price range. Most webcams feature built-in microphones to make video calling and videoconferencing more convenient.

COMPUTER:

Computer contains the hyper terminal through which we can monitor various parameters in the microcontroller. computer takes the image from CCD camera and processed this image digitally trough a MATLAB software installed in it and transfer information to the microcontroller.

MICROCONTROLLER:

This block is the main part of the system. It controls the working of different components. It takes various control action for different parameters. Microcontroller keeps a check on all the parameters continuously and if changes occur, it maintains a record of it. It takes the information from computer, trans-receiver and through that controls the traffic light, diversion and trans-receiver.

RF TRANSCEIVER:

A transceiver is a device that has both a Transmitter and Receiver which are combined and share common circuitry or a single housing. If no circuitry is common between transmit and receive functions, the device is a transmitter-receiver. The RF Trans-receiver uses RF modules for high speed Data Transmission. The microelectronic in the digital-RF architecture work at speeds up to 100 GHz. The objective in the design was to bring digital domain closer to the antenna, both at the receiver and transmit ends using software defined radio (SDR). The software-programmable Digital Processors used in the circuits permit conversion between digital baseband signals and analog RF.

Here trans-receiver is used to transmit information about the traffic to other junction and vice versa.

III. IMAGE PROCESSING CONCEPT

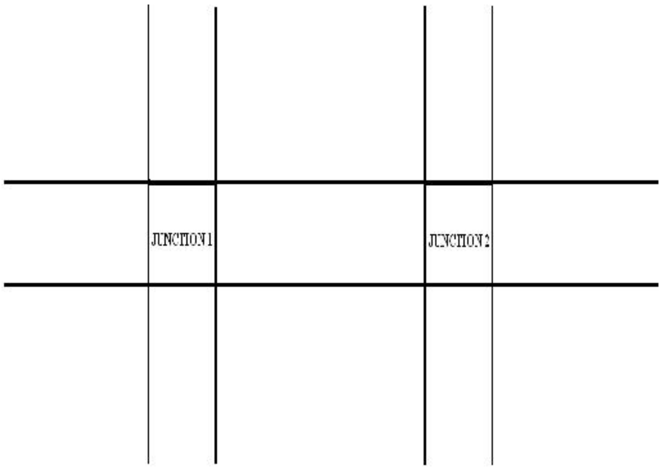

Figure 3 : Junction diagram

A camera will be mounted on the each lane of the signal on a junction. CCD Cameras will feed the video to a COMPUTER. A MATLAB based digital image processing will be done on the video frames to calculate the amount of traffic. The process of digital image processing is done in following steps:

1) Image acquisition:

One or several image sensor produces digital image. The image may be 2D or 3D from depending on the type of sensor used. Image sensor types include light-sensitive cameras, range sensors, tomography devices, ultra-sonic cameras, etc.

2) Image Segmentation:

In the analysis of the objects in images it is essential to distinguish between the objects of interest and “the rest”. This latter group is also referred to as the background. The pixels in the image will be converted into a series of 0’s and l’s. This can be done by getting the grayscale value of a pixel and comparing it to a certain pixel value. Segmentation lessens the area of concern and makes the system run faster.

3) Motion Tracking:

Can be off-line or real-time. In offline, the entire image sequence is stored. The tracking uses frame differencing algorithm to generate a motion map.

4) Background Subtraction:

The process of finding the transient objects by comparing the current frame to the background image.

5) Morphological Operations: (i) Opening: Removes foreground details that are smaller than the structuring element. It is also used as a noise removal operator;

(ii) Closing: Removes background details–holes, gaps, inside corners, etc.–that are smaller than the structuring element. It is also used to link components (i.e., broken lines) that should be connected.

6) Image Correlation:

The process of computing the correlation for each Region Of Interest (ROI) of the current image to the ROI of the background image.

IV. RESULTS

Figure 4 : Real Time Image

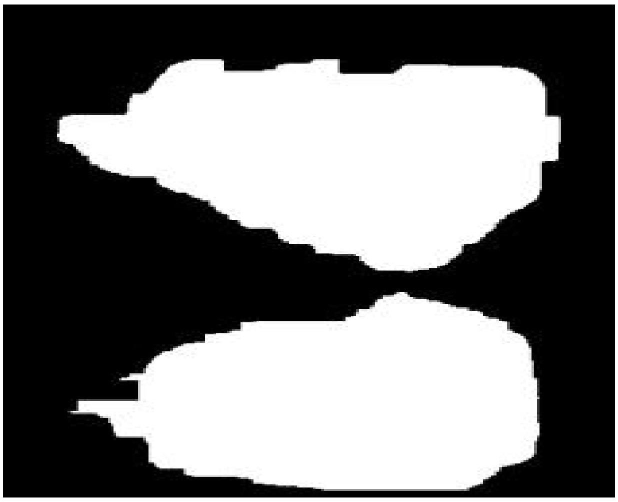

Figure 5. Resultant Image

Real time image is captured and processed using image processing. Various operations are performes such as subtraction operation, gray scale operation, binary operation, opening operation, fill hole operation, erosion operation and after that get total number of vehicles present on junction.

NO of objects = 2.

Final count of vehicles present equal to 2.

This final count is given to master microcontroller through serial communication using RS232.

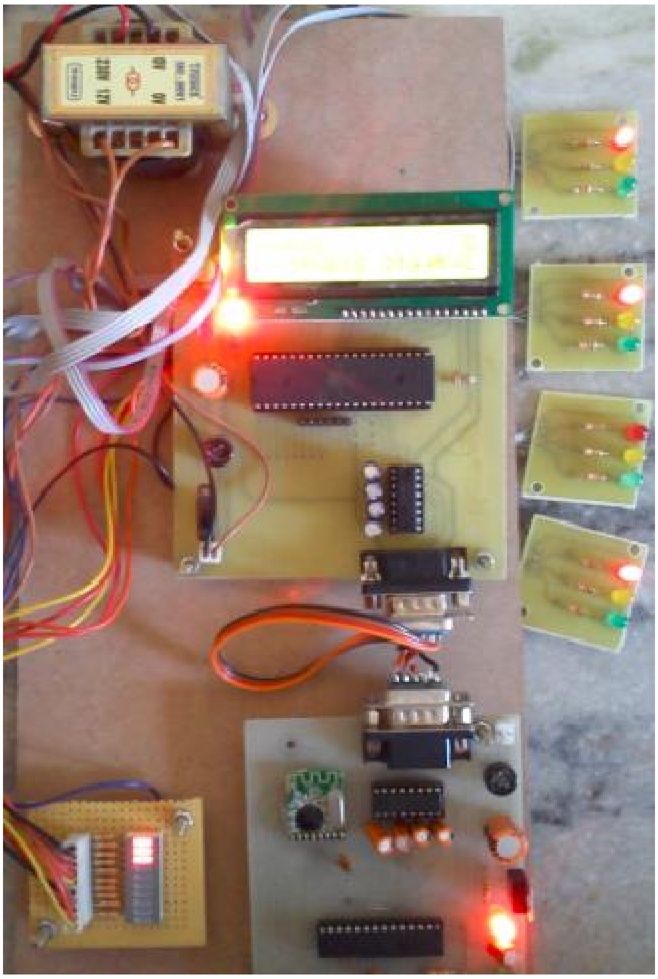

Figure 4 : Hardware Implementation

V. CONCLUSION

Designed system has achieved targeted specifications. System successfully processes road images during daytime only, and signal the result to a simulated traffic light system. Display the traffic of next junction (whether LOW, MEDIUM or HIGH). Distinguish the presence and absence of vehicles in road images. Signal the traffic light to go green if the road is empty. In this project one module of Digital Image Processing is successfully completed. This module calculates number of vehicles using Object Detection Algorithm. Another module calculates and displays variable signal timings and communication between the traffic signals is also successfully completed.

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