

Intelligent Traffic Control System Using Image Processing

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Abstract— As the population of the modern cities is increasing day by day the growth of vehicular transport is also increased which causes the problem of traffic congestion. So the smart traffic control system is required to handle traffic very efficiently depending on the density of vehicles.

This paper discusses some of the existing traffic light control system and their drawback and how they can be overcome with the help of image processing. The image sequences from a camera which are mounted at the traffic signals are analysed using various edge detection techniques and object counting. At the same time, the number of vehicles at the signal junction is evaluated and traffic is managed accordingly. This paper also proposes to implement a real-time emergency vehicle detection system. Whenever an emergency vehicle is detected, that particular lane is given priority over all the others.

Keywords— Traffic, Image Processing, Arduino, LED

I. INTRODUCTION

In modern life we have to face with many problems one of which is traffic congestion becoming more serious day after day. It is said that the high volume of vehicles, the scanty infrastructure and the irrational distribution of the development are main reasons for augmented traffic jam. The major cause leading to traffic jam is the high number of vehicle which was caused by the population and the development of economy. To unravel this problem, the government should encourage people to use public transport or vehicles with small size such as bicycles or make tax on personal vehicles. Particularly, in some Asian countries such as Viet Nam, the local authorities passed law limiting to the number of vehicles for each family. The methods mentioned above is really efficient in fact. That the inadequate infrastructure cannot handle the issue of traffic is also a decisive reason. The public conveyance is available and its quality is very bad, mostly in the establishing countries. Besides, the highway and roads are incapable of meeting the requirement of increasing number of vehicle. Instead of working on roads to accommodate the growing traffic various techniques have been devised to control the traffic on roads like embedded controllers that are installed at the junction.

II. EXISTING SYSTEM

The traffic lights used in India are basically pre-timed where in the time of each lane to have a green signal is fixed. In a four lane traffic signal one lane is given a green signal at a time. Thus, the traffic light allows the vehicles of all lanes to pass in a sequence. So, the traffic can advance in either straight direction or turn by 90 degrees. So even if the traffic density in a particular lane is the least, it has to wait unnecessarily for a long time and when it gets the green signal it unnecessarily makes other lanes wait for even longer duration. Many methods are introduced to solve the problem of traffic using sensor, but the problem real time solving the issues is still a challenge. This issue can be overcome by using Digital Signal Processing Technique i.e. Image Processing.

III. PROBLEM DEFINITION

As the population of the modern cities is increasing day by day due to which vehicular travel is increasing which lead to congestion problem. Traffic congestion has been causing many critical problems and challenges in the major and most populated cities. The increased traffic has led to more waiting times and fuel wastage. Due to these congestion problems, people lost time, miss opportunities, and get frustrated. Traffic load is highly dependent on parameters such as time, day, season, weather and unpredictable situations such as accidents, special events or constructional activities. If these parameters are not taken into account, the traffic control system will create delays. To solve congestion problem new roads are constructed. The only disadvantage of making new roads on facilities is that it makes the surroundings more congested. So for that reason there is a need to change the system rather than making new infrastructure twice. A traffic control system that can solve these problems by continuously sensing and adjusting the timing of traffic lights according to the actual traffic load is called an

Intelligent Traffic control System. The advantages of building Intelligent Traffic Control System which reduce congestion; reduce operational costs; provide alternate routes to travellers, increases capacity of infrastructure. One such traffic control system can be built by image processing technique like blob detection to calculate the traffic density, based on traffic density can regulate the traffic signal light. To avoid congestion there are so many traffic management techniques available. But no technique is perfect by itself as the real time situations are generally continuously changing and the system has to adapt itself to change in the continuously changing circumstances. We have made an attempt to provide some traffic management strategy which is self-changing in nature, so as to fit into continuously changing real time traffic scenarios. In this system, time is assigned to traffic light of particular lane according to the priority given to particular lane based on traffic density. Also we can indicate signal break in a particular lane or if there is an emergency vehicle stucked in traffic we can give first priority to that lane[1].

IV. SYSTEM ARCHITECTURE

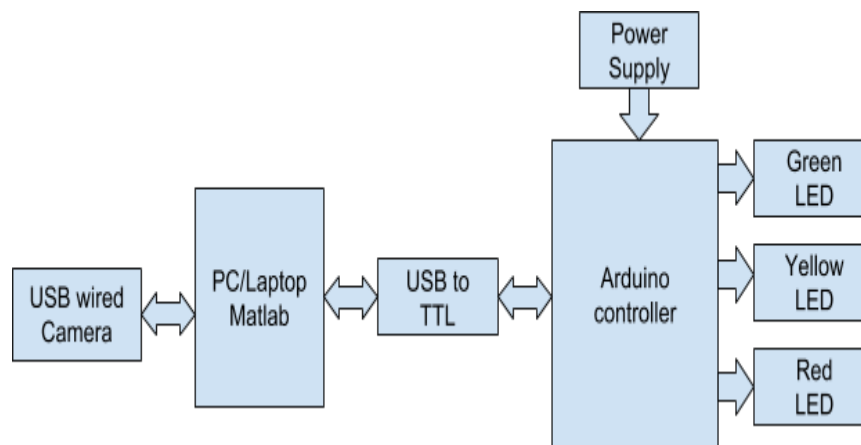


Fig. 1. Block Diagram of System Architecture

1. Hardware Module

USB wired Camera

USB to TTL

Power supply

Microcontroller Arduino Mega 2560

LED's for Traffic signal

Laptop with windows 7 or above operating system having minimum 4 GB of RAM

2. Software Module

Arduino IDE - For Arduino programming

Matlab 2018b- For Image processing

V. SYSTEM FLOW

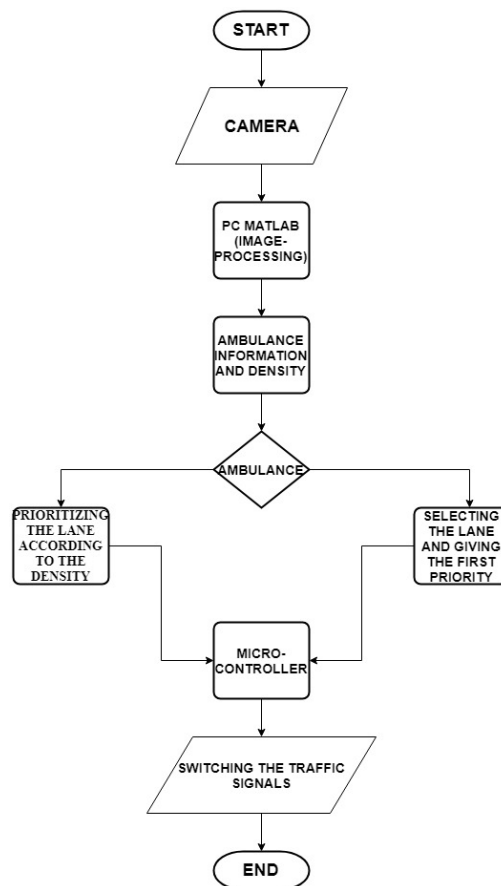


Fig. 2. Flow of the project

Project Flow:

1. The system proposed in this project consist of two part one is Traffic controller and second is traffic system. We have designed this system for a four lane traffic signal.
2. The traffic controller uses matlab for the traffic management, It has a camera connected to it for detection of traffic on road. According to traffic in the respective lane the matlab will give signal to traffic system to turn on or off the LEDs.
3. The traffic density measurement, ambulance detection and fire detection is done using image processing in matlab. Arduino will turn on or off the led according to input given by matlab through usb to ttl.
4. Once we start program, camera will turn on and capture images of four lanes in a time interval.
5. Camera will be set in a position that it will be perpendicular to the road and it will cover the whole road.
6. Road must be in black colour so as to improve image processing. Captured images will be continuously fed to Arduino Mega for image processing.
7. In image processing matlab will check the density of traffic in respective lane and also if any ambulance is present in the lane or not.
8. We will be showing 0 to 3 vehicle in the lanes for traffic and the vehicle will be boxes of bright colours.
9. As per the density of traffic in particular lane, if more traffic in lane 1 is detected then matlab will send signal to arduino controller present on the traffic system through usb to ttl to turn on the green light in that particular lane so that vehicle present in that lane will pass and traffic is reduced.
10. Same way if any of the lane has more traffic with respect to the other lanes then the arduino will turn the green light of that lane to free the traffic and remaining signal will be red.
11. If an ambulance is detected in any of the lane then also it will give signal to arduino to turn on the green signal.

VI. IMPLEMENTED TECHNIQUES AND SYSTEM DESIGN

Blob Detection:

Much of the proposed methods used to extracted traffic condition information are based on vehicle detection and tracking techniques. In these systems, robust and reliable vehicle detection and tracking is a critical step. In this paper, we describe a computer vision system to count vehicles on roads. The system involves analysing each lane of junction image which represent

the traffic for the given time period and place blob detection methods are aimed at detecting regions in a digital image that differ in properties, such as brightness or colour, compared to surrounding regions. Informally, a blob is a region of an image in which some properties are constant or approximately constant; all the points in a blob can be considered in some sense to be similar to each other approach utilized to analyse traffic videos using the following module pipeline:

- Background Subtraction.
- Blob Detection.
- Blob Analysis.
- Vehicle Counting.

The following features are implemented in our proposed system:

- Priority based traffic clearance

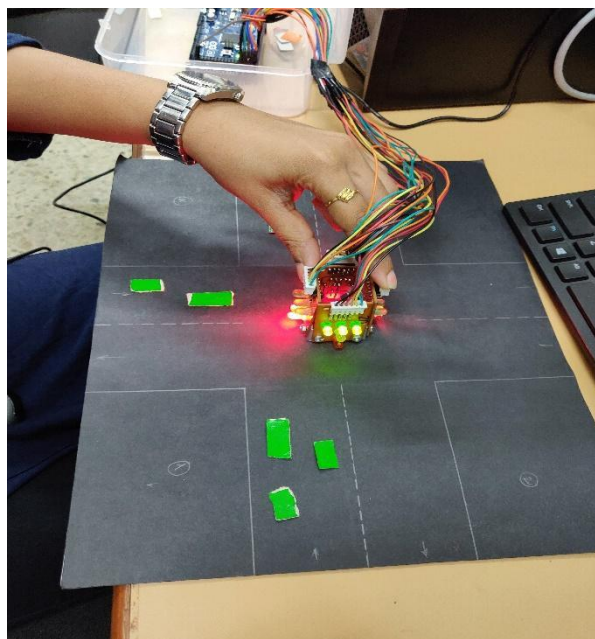


Fig. 3. Captured Image

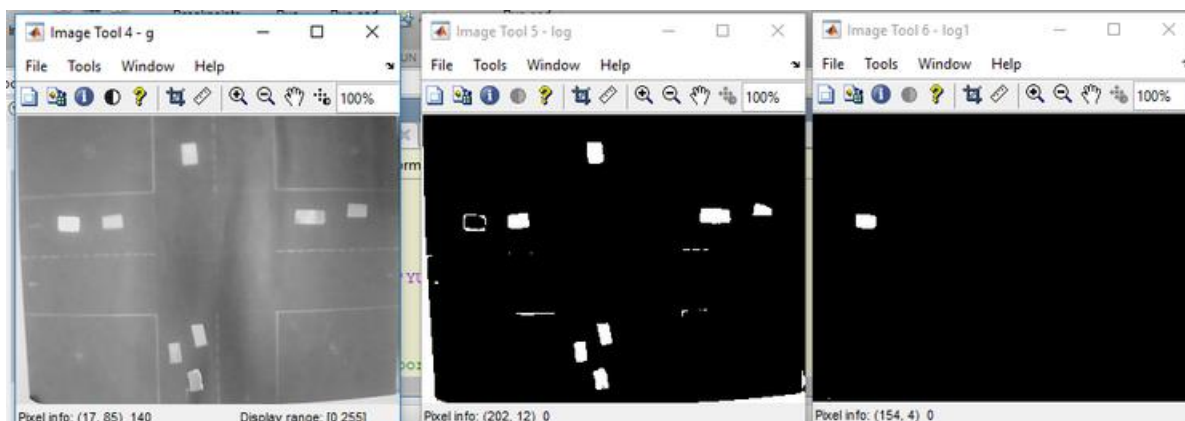


Fig. 4. Grey scale conversion and ambulance detection

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New to MATLAB? See resources for Getting Started.

The number of cars on 2nd road in side detected are 0
The number of cars on 2nd road out side detected are
1

The number of cars on 3rd road in side detected are
3

The number of cars on 3rd road out side detected are 0
Ambulance Detected at 4th road in side!
The number of cars on 4th road out side detected are
1

fx >>

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Fig. 5. Command window output

- Ambulance Detection

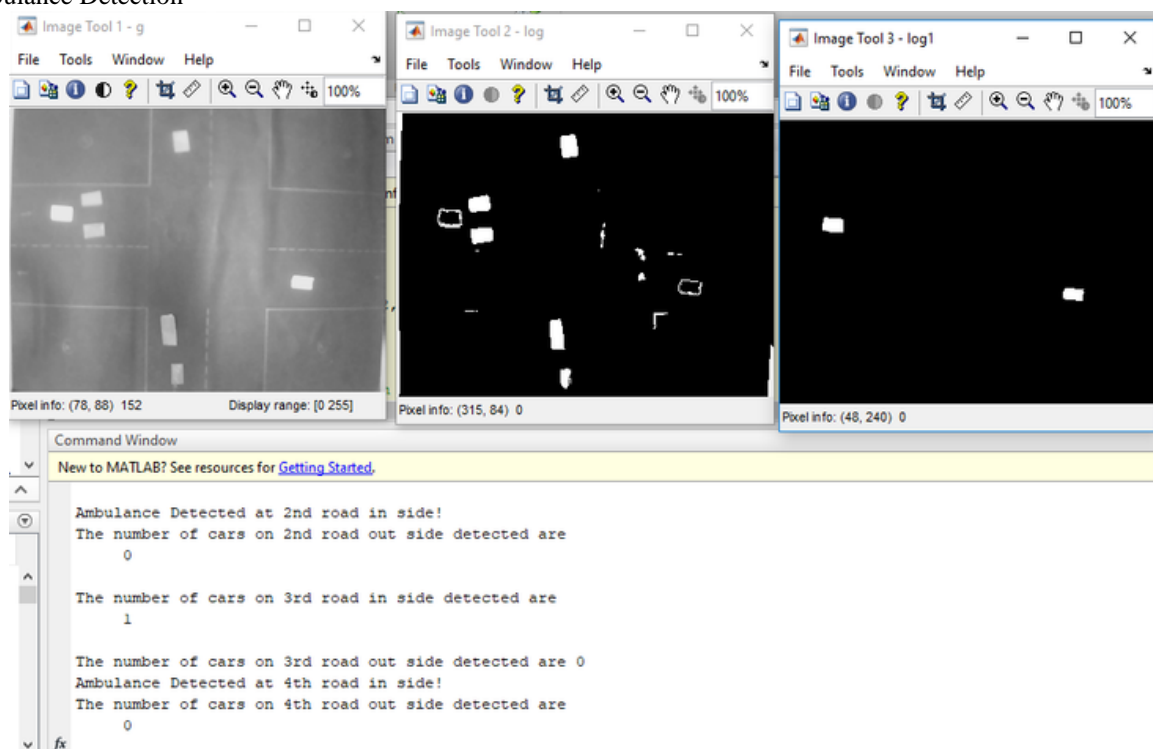


Fig. 6. MATLAB Processing.

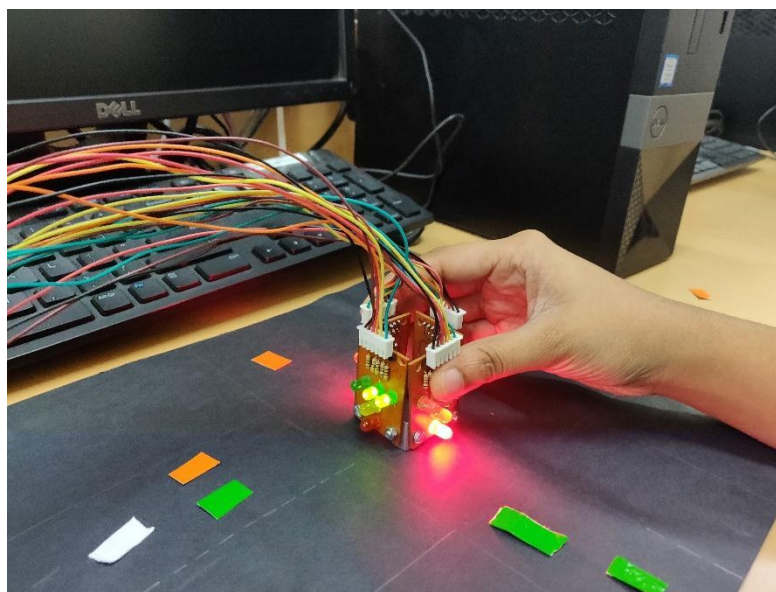


Fig. 7. Giving first Priority to the lane having ambulance

VII. CONCLUSION

This intelligent traffic control system is design to reduce traffic congestion with the help of density estimation and Emergency vehicle detection such as ambulance. Image processing technique is better and effective technique to combat the growing pressure of traffic on roads. The usage of our algorithm is cost effective and does not require the installation of complex machinery to monitor the traffic and extra hardware such as sound sensors and RFID tags can be eliminated. The proposed system can provide a new way of monitoring traffic flow that helps to improve traffic conditions and resource utilization. In addition, transport administration department, using real-time traffic monitoring information, can in time detect potentially dangerous situations and take necessary actions to prevent traffic congestion and minimize number of accidents thus ensuring safety of road traffic. this method shows that it can reduce the traffic congestion and avoids the time being wasted by green light on empty road. Deploying this system will not only save the time consumed in waiting the traffic junction, but will also conserve a lot of resources that are otherwise wasted. In general, the Ardiuno will play an important role in the traffic management enhancing the efficiency of information transmission, improving traffic conditions and management efficiency, traffic safety, and reducing management costs.

VIII. FUTURE SCOPE

The present system uses a single camera for monitoring traffic at an intersection. By using a separate camera for each road at an intersection will allow the system to use video processing which can improve the system efficiency further.

Also neural network can be used for continuous traffic control and management. The vehicle objects can also be categorized into various classes depending upon the geometrical shape of vehicle for blocking the passage of large vehicles e.g. Trucks during day times. The emergency mode can be refined further by installing a GPS receiver in ambulance so that the base station will keep track of the ambulance location on a continuous basis and clear the road whenever will be required.

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