

# Image Processing Based Smart Traffic Controlling and Monitoring System Using Arduino

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**ABSTRACT:** *This paper concentrates on the necessity of intelligent traffic system and the peculiar way of implementation with embedded system tools. Here it is implemented by utilizing an object counting methods and detection of emergency vehicles simultaneously thereby controls the traffic signals depends on the priority outcome. This method utilizes image acquisition method using a real time live video stream and the algorithm is processed by utilizing MATLAB. The results obtained with the prototype are much encouraging and the system does help the present traffic control system to be more efficient. Computer Vision being one of the most researched are for the future technologies, this system will add gain to this sector with efficient operation replacing the current primitive timer traffic control system. This helps the emergency casualties to be attended quickly without panic of traffic congestion.*

**Index Terms:** ARDUINO, MATLAB, Camera, Image Processing, Traffic Congestion, Traffic Monitoring, Priority

## I.INTRODUCTION

Road transport is one of the primitive modes of transport in many parts of the world today. The number of vehicles using the road is increasing exponentially every day. Due to this reason, traffic congestion in urban areas is becoming unavoidable these days. Inefficient management of traffic causes wastage of invaluable time, pollution, wastage of fuel, cost of transportation and stress to drivers, etc.

but more importantly emergency vehicles like ambulance get stuck in traffic. Our research is on density based traffic control with priority to emergency vehicles like ambulance and fire brigade. So, it is very much necessary to design a system to avoid the above casualties thus preventing accidents, collisions, and traffic jams. The common reason for traffic congestion is due to poor traffic prioritization, where there are situations some lane have less traffic than the other and the equal green signal duration for both affect the wastage of resources and drivers are stressed.

In current life we need to confront with numerous issues one of which is traffic congestion ending up noticeably more genuine for quite a while. It is said that the high volume of vehicles, the insufficient foundation and the unreasonable conveyance of the advancement are principle purposes behind expanding congested road. The significant make driving traffic jam is the high number of vehicle which was created by the populace and the improvement of economy. Traffic congestion on street organizes that happens as utilize increments, and is portrayed by slow speeds, longer excursion times and expanded vehicular lining. The most widely recognized

illustration is the physical utilization of streets by vehicles. At the point when activity request is sufficiently extraordinary that the communication among vehicles moderates the speed of the movement stream, these results in some clog. At the point when vehicles are completely ceased for time frames, this is informally known as a congested driving conditions or movement growl up. Congested roads may emerge because of substantial red light defers which are hard corded and is autonomous of activity.

## II. PROPOSED SYSTEM

This project focuses on a firmware-based novel technique for vehicle detection. This approach detects the vehicles in the source image, and applies an existing identifier for each of the vehicle. Later it classifies each vehicle on its vehicle-type group and counts them all by individually. The developed approach was implemented in a firmware platform which results is better accuracy, high reliability and less errors.

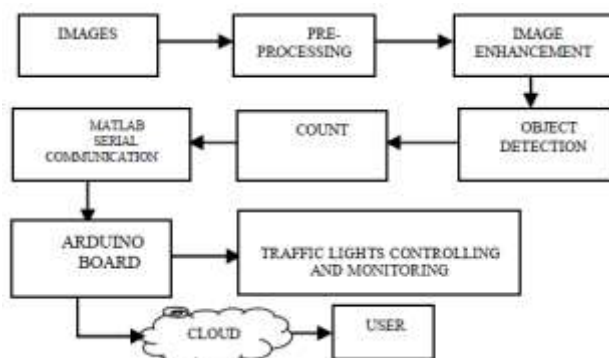


Fig 1: Block Diagram

### A. IMAGE ACQUISITION

The image is captured by a webcam. It is then transferred to the computer via a USB cable. The image acquisition and further processing is done by using MATLAB.

### B. IMAGE PROCESSING

The image is captured by utilizing a webcam placed at the road junction. It has the capability of taking images of all the roads meeting at the junction. The webcam is mounted. The motor is responsible for capturing images from all directions in steps of fixed time interval. The speed of rotation of the camera is designed to be such that it is greater than the click-to-capture time of the camera. The acquired image is converted to grey scale image for further processing. The grey scale image is then converted to a binary image that contains only two colors, black and white. This image is known as the threshold image. The main purpose of thresholding the image is a radical reduction of information in order to simplify further processing. The thresholded image is then complemented for further image processing.

**1) Image cropping:** The desired portion of the image is retained and the rest is cropped. Only the lane at which there is an incoming traffic at the junction is to be processed. Hence the image is cropped to select that section of the lane.

**2) Image Enhancement:** In this process the images are adjusted that the results are more suitable for further processing. In this, obtained image is converted into a grey scale image.

**3) Thresholding:** Thresholding is transforming the grey scale image into black and white image (binary: white=1, black=0). The main purpose of thresholding is a radical reduction of information in order to simplify further processing. White color is assigned to all the pixels that have luminosity greater than the threshold level and the others are referred as black.

**4) Edge detection:** Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensities which characterize the object boundaries in an image. It filters out useless information, while keeping the important structural properties of an image. The boundaries of each image are found and the number of objects is calculated.

**5) Object Counting:** To count the objects present in the image, the close boundaries of the objects are identified. The exterior boundaries of the objects as well as the boundaries of holes inside these objects in the binary image are counted.

### **C. CHANGING THE DURATION OF TRAFFIC LIGHT**

The duration of the traffic signal is monitored as follows:

- 1) The camera controlled by Arduino microcontroller rotates in clockwise direction and stops to take pictures of each lane. The clicked pictures are sent to MATLAB for image processing.
- 2) Then the camera rotates in anticlockwise direction and repeats the above step.

3) The images are processed in MATLAB and the priority of each lane is decided as per its traffic density.

4) The lane with the highest relative traffic density is given the highest priority and the lane with the lowest traffic density is given the least priority.

5) The lanes are arranged in the descending order of their priorities.

6) The duration of green signal of the lane with the highest priority is more as compared to others, so that the traffic in that lane can pass and reduce the congestion. The other lanes have their green signals as per their decreasing priorities.

7) After all the lanes have given their green signals; the traffic light completes its one cycle of traffic monitoring and congestion control.

8) This process repeats and the duration of green signal given to each lanes keeps adjusting itself after every rotation of the camera.

### **D.COMMUNICATION BETWEEN ARDUINO AND MATLAB INTERFACE**

The procedure for connecting the Arduino to MATLAB through the USB port for serial communication is as follows: The first step is to establish serial connection between the Arduino board and MATLAB via the USB port. The code for the Arduino board is written in the software Arduino and loaded on the board. In MATLAB the COM port is first configured. The configuration settings of serial port should match to that of Arduino. Then the data is sent serially from MATLAB to Arduino. This data is then

processed by the Arduino board. After processing the output is given to the traffic light to change its duration as per the priority of the lanes.

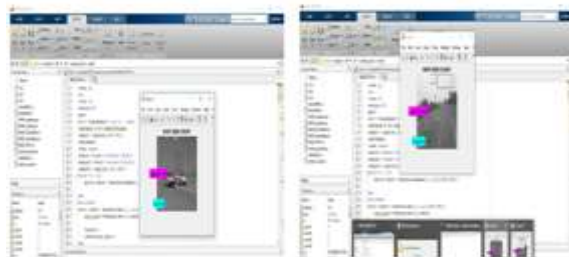
### III.RESULTS



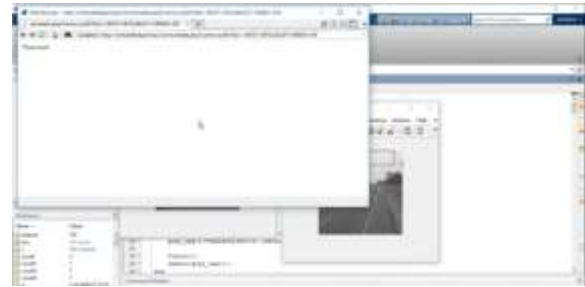
**Fig 2. Hardware Implementation**



**Fig 3. IOT Result**



**Fig 4. MATLAB result of count**



**Fig 5. MATLAB result posted in cloud**



**Fig 6. MATLAB result**

### IV.CONCLUSION

In this project, a method for estimating the traffic using Image Processing is presented. This is done by utilizing the camera images captured from the highway and videos taken are converted to the image sequences. Each image is processed separately and the number of cars has been counted. If the number of cars exceeds a specific threshold, warning of heavy traffic will be shown automatically. The benefits of this new method include utilization of image processing over sensors, low cost, easy setup and relatively good accuracy and speed. Because the proposed method has been implemented by utilizing Image Processing and Matlab software, production costs are low while achieving high speed and accuracy.

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