

# Digital Image Processing based Intelligent Traffic Light Controller

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**Abstract** - As the problem of urban traffic congestion spreads, there is an urgent need for the introduction of advanced technology and equipment to improve the state of the automotive control environment. Traffic problems these days are increasing due to the growing number of vehicles and limited resources provided by the current infrastructure. The simplest way to control traffic light is to use a timer for each stage. Another way is by using electronic sensors to detect the presence of cars, and to produce signals. We suggest a traffic light control system for image processing. The system will detect cars through images instead of using electronic line sensors. A camera will be installed next to traffic light. It will take a sequence of photos. The sequence of images will then be analyzed using digital image processing to determine vehicle availability, and depending on traffic conditions in traffic light can be controlled.

**Key Words:** Intelligent Transportation System (ITS), Traffic light, Image Processing, edge detection.

## 1. INTRODUCTION

Automatic traffic monitoring are essential for road use and management. Traffic parameter measurement has become an active research area for the development of intelligent mobility systems (ITS). Because Information for ITS application traffic - information needs to be collected and distributed. Various sensors have been used for measuring traffic restrictions to update traffic data. For this vision based camera system is more easy for traffic parameter estimation. It provides qualitative information of road congestion as well as quantitative information of vehicles count. Quantitative traffic parameters can give us complete traffic flow information. Image tracking of real time traffic helps us in catching the faulty peoples as the number plate of their vehicle is also detected using Image Processing.

## 2. Application and future work

The following are the application of this Intelligent Traffic Light Controller:

- Provide driver confidence by providing traffic control signals that are generally considered to be the solution to all road traffic problems.
- Provide traffic sequences.
- Ongoing travel is scheduled.
- Helps in detecting the number plate of vehicles. So that faulty peoples can easily be caught.

The following is the future work of this Intelligent Traffic Light Controller:

The focus will be on achieving controller using DSP as it can protect high investment in industrial control computer while gaining improved computer power and improved system design. The use of hardware will enable the project to be used in real work situations. In addition, we propose a vehicle identification system as they pass by, providing emergency vehicle selection and assisting in high-level monitoring.

## 3. Hardware used and its description

### 3.1 Arduino Uno

**Arduino Uno** is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index boards.



Fig.1 Arduino Uno

### 3.2 Digital Camera

In this project, we have used a wireless camera for providing continuous photo capturing of real time traffic which then digitally processed and on the basis of that the software gives the vehicles count. However for the cost reduction of the project very simple camera was used but in future a high resolution camera can be used with the ability of night vision. Digital camera is for capturing the images of Real-Time Traffic which provide info. of traffic.

### 3.3 LED

When the diode diode is forwarded, junction diode power is released, and power is released from the assembly due to the repetition of electrons and holes. In the case of silicon and germanium diodes, the energy released is in the infrared region. In a connecting diode made of gallium arsenate or indium phosphate, energy is released from the visible region. Such a connecting diode is called a diode illumination diode or LED.

## 4. Software Used

### 4.1 MATLAB Software:

MATLAB is the most widely used computer language technology. It includes calculations, views, and settings in an easy-to-use area where there are problems and solutions to standard mathematical text. Common uses include:

- Statistics
- Algorithm development
- Modeling, simulation, and the like
- Data analysis, testing, and visualization
- Scientific and engineering graphics
- System development, including Graphical User Interface structure

## 5. Methodology

The following are the steps involved

- Photo detection
- RGB on gray conversion
- Image enhancement
- Image matching using edge recognition process

### Category 1:

- The first photo acquisition is done with the help of a webcam

- The first photo of the road is taken, where there is no traffic

- This blank street image is saved as a reference image at a specific location specified in system

- The conversion of RGB to gray is done in the reference image

- Now gamma correction is done in the gray image to achieve image enhancement

- The edge acquisition of this reference image was subsequently made with the help of Canny on the edge adoption provider

### Category 2:

- Street photos are captured.

- The conversion of RGB to gray is done in the sequence of captured images

- Gamma correction is now performed on each gray image purchased to achieve image enhancement

- Metal detection of these real-time street images has now been made with the help of finding canny engineers

### Category 3:

- After the curve is detected, the number of vehicles is calculated on the entire lane. And in this case the cars are counted.

- On the basis of quantity the time of green light to be turned on is given. Let's take for example if there are 4 cars in the first lane, 3 cars on the curb, 10 cars in the third lane and no car in the fourth lane. Then 5 seconds is given to the car to pass due to this green light on the first line for 20 seconds, on the second road for 15 seconds, the third lane for 50 seconds and the fourth red light.

## 6. Image Enhancement

The acquired image in RGB is first converted into gray. Now we want to bring our image in contrast to background so that a proper threshold level may be selected while binary conversion is carried out. This calls for image enhancement techniques. The objective of enhancement is to process an image so that result is more suitable than the original image for the specific application. There are many techniques that may be used to play with the features in an image but may not be used in every case.

- Linear (negative and identity transformations)
- Logarithmic (log and inverse log transformations)
- Power law transformations (gamma correction)
- Piecewise linear transformation functions

The third method i.e., power law transformation has been used in this work. The power law transformations have the basic form

$$s = cr^\gamma$$

Where S is output gray level, r is input gray level, c and  $\gamma$  are positive constants.

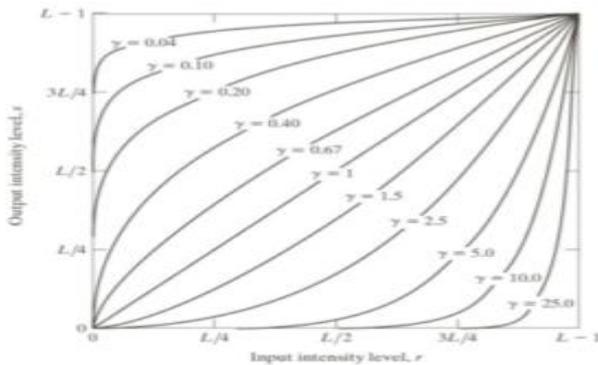


Fig.2 Image Enhancement

## 6. Edge Detection

Edge Discovery is the name of a set of mathematical modes that aim to identify points in a digital image where the image brightness changes significantly, or more, technically, than subtraction or sound. The points at which the light of the image changes firmly are arranged into a set of limited parts of a line called edges.

The same problem of finding discontinuities in the 1D signal is known as step detection and the problem of finding signal disconnection over time is known as seeing change. Edge detection is a basic tool for image processing, machine vision and computer guessing, especially in the areas of feature display and feature extraction.



Fig.3 Canny Edge Detection

## 7. Conclusion

"Traffic control is used for image processing" is a process that proposes to overcome all the limitations of the previous (used) methods used to control traffic. Previously the use of automatic traffic control was used for the time being wasted by a blank green light. This method prevents this problem. When comparing the various edge-algorithm detection

algorithms, it was understood that the Canny Edge Detector process was the most efficient. The project demonstrates that image processing is a more effective way of controlling traffic compared to traditional methods. The use of our technology eliminates the need for additional Hardware such as sound sensors. Extra response time for these vehicles is important in preventing loss of life. The main advantage is the variability of the time signal that controls the installation of a suitable vehicle the accuracy of the calculation of time due to a single moving camera depends on the state of registration while facing the road regularly. The issuance of the source code clearly indicates the number of vehicles expected and basically that time of lighting illumination i.e. green, red, yellow.

## REFERENCES

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