

Intelligent Traffic Control System using Image Processing

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Abstract: *Traffic congestion is becoming more and more serious day by day. Main reasons for augmented traffic jam are increasing number of vehicles, the poor infrastructure and no proper distribution. The main reason for traffic is increased number of vehicles and increased number of population and development of country as whole. Management of traffic in India is a tough job and only manual efforts cannot solve this serious issue. We need a system to handle this situation more effectively. We need a dynamic system that is capable of controlling traffic as well as avoid congestion of roads, known as Intelligent Traffic Control System. In this project, we are dealing with traffic via image processing. Using different types of image processing algorithms, the vehicles can be detected on basis of which traffic lights can switch.*

Keywords: Intelligent traffic control, traffic lights, image processing, traffic control, traffic congestion

1. Introduction

Detection and classification of vehicle is essential for effective traffic control, for which, traffic related information needs to be collected and analyzed.. Some other techniques are Magnetic Wireless Sensor detectors[1], Radio Frequency[2], Regression Analysis[3], Motion Vector Technique[4], etc. Standard traffic control system is Manual Controlling, in which more man-power is required. Manually it is not possible to control traffic effectively.. Another system is Automatic Controlling, which uses timer for each phase. Electronic sensors are used to detect vehicles and produce signals. Time may get wasted by a green light on empty road. All these limitations are supposed to be eliminated via Image Processing, in which detection of vehicles is done through pictures in place of installed sensors. Firstly, traffic density is measured at signals and accordingly change time delays for traffic lights the side at which the traffic is more. In today's era, Transportation is very important, because of which traffic is increased, and to reduce this we need better traffic control system, which is able to cope up with traffic situation and change controlling as per the situation. Such an intelligent system will reduce traffic without affecting transportation. Dynamic system will give a new look which can take dynamic decision like change the time of red, green and amber lights.

2. Existing Systems

Various existing systems for traffic control are:

Microcontroller[5] that controls the traffic lights at the zebra crossing or we can say traffic junction, which is not a flexible method, rather, there is fixed on and off timings for yellow, green and red lights.

Vehicle Actuated Control [5], continuously attempt to adjust green light times. One of the major drawback is that it does not take into account the vehicles waiting at the red. A detector is located at a distance ahead of stop line and it

sends the controller sensitive to signals. The system will work only if the assumed flow matches the actual traffic flow.

Manual Controlling [5] requires extra man power. Moreover, only skilled operators can make judgements, hence, there is very high work load on skilled operators.

Automatic Traffic Light [5] performs its functioning through sensors and timers. Depending on timer values, lights are automatically getting ON and OFF. Another technique is using sensors where wastage of time by constant on green light on a bare road.. Hence, by using Automatic Traffic Light traffic congestion is still an issue.

3. Literature Review

Traffic congestion at signals and roads is a serious issue. Ample of traffic light signals are there in India to control traffic but still it is not efficient. Some traffic control system are designed and implemented using a suitable Microcontroller [6], while some are implemented using Embedded System.

3.1 Embedded systems

In this system, IR (infrared)[7] sensors, and built in 8 channels ADC are used. Emergency vehicles are detected using programmable IR sensors. Drawback : IR sensors need to be secured in safe place. Hence this system is expensive to implement.

3.2 Wireless Sensor Networks

Fuzzy [7] logic is used to define direction of emergency vehicle. Collection of information and response in an effective way is done by central monitoring system. Drawback: Communication in Wireless Sensor Network is still a research field. In order to survive in India's weather, Sensors need to become robust.

3.3 Active RFID and GSM Technology

System includes active RFID[7] tag, Wireless Coordinator, Wireless Router, GSM modems and a monitoring station software. Data is collected by wireless devices, that are mounted along the roadside, from Active RFID tags. Monitoring station collects data through GSM and respond accordingly. Drawback: Costly implementation of the system.

3.4 Image Processing

Traffic scene is overlooked by cameras [7] at high posts of traffic lights. Extracted images from video are analyzed for detection and vehicles counting. After surveying we can reach to conclusion that Image processing is most efficient technique among all the existing methods in terms of efficiency, reliability, functionality, etc.

Here we propose a system called Intelligent Traffic Control [8] using Image Processing, in which, vehicles are detected using cameras, which is placed along traffic light. An image is a rectangular graphical object. Smallest element of an image is a pixel; picture element, involves various issues regarding to image compression, enhancement techniques and various other operations which are complex. Such operations are for enhancement of images such as sharpening, blurring, brightening, etc. It is kind signal processing, in which, our image is the input signal. Output is an image or parameters of an image. Mostly, image is treated as two-dimensional signal. Signal processing techniques are applied to get the desired output. Image processing was mainly digital, but now analog Image Processing also came into existence. Cameras are used to capture images of roads which reflect traffic flow. Image Processing is beneficial and economical as cameras are affordable than electronic devices, sensors. We use a technique where captured image is compared to the referenced image, and various image processing operations are applied to get the result. For image morphology, finding optimal threshold value is very important. Operations in the mathematical morphology are Erosion[9] and Dilation. They basically work for binary images and some of them also work for grayscale images.

An image is 2-D function as $f(x,y)$, x, y are polar coordinates. Amplitude is known as the intensity of the image. Conversion of these y, x coordinates to digital values is required for getting it processed through digital computer. At some stage, image scaling occurs in all digital images. Image resizing is necessary for increasing or decreasing the density of pixels. Algorithm differs and hence, output of resizing image also differs. Every camera is resolution dependent, so system designed for one camera specification will not work for system designed for another camera specification. So, it is necessary to keep resolution constant, hence image resizing is performed. Perception of colours by human is through cones which are sensitive to wavelength. One is green sensitive, other is red sensitive, and the other is blue sensitive. We can obtain any colour from their combinations as we know these are the three standard colours used. To convert R-G-B value to gray, we know that each pixel has different R-G-B parameter, consider each and obtain reflected single colour. Image enhancement is required for more appropriate results. Edge detection is a set of mathematical methods which aim at

identifying points at which the image brightness changes sharply, has discontinuities or noise. Value of brightness varies for different colours. Most bright colour is green. Image is blurred in blue, and image is noisy in red. Various techniques are Sober Edge Detection, Prewitt Edge Detection, Roberts Zerocross Edge Detection and canny Edge Detection. Comparing a reference image with the real time image pixel by pixel is termed as Image Matching. Edge demarcates between two different regions. Pixels are located in image which corresponds to boundaries of cars detected in the image, which results to binary image of edge pixels detected. Sobert, Prewitt and Laplacian[5] operators are commonly used algorithms. In Gradient based Edge Detection[8], edges are detected when we look in the first derivative for minimum and maximum values, where presence of edge is determined by first derivative and second derivative determines where the pixel lies, either light or dark side.

3.5 Conclusion

Traffic management using image processing eliminates all the shortcomings of earlier standard systems used for controlling traffic. Excessive manpower is required in manual controlling, while timer is used in automatic controlling had a drawback of time being wasted by green light on a empty road. Image processing eliminates all these pitfalls. This technique is far more effective in traffic control. It diminishes the use of extra hardware devices like sensors, wireless routers, GSM modems, setup for a monitoring station etc. Presence of vehicles detection is consistent as we are using actual images of traffic here. Reality is visualized and hence, functionality is more effective and efficient than all techniques. It achieves near perfect accuracy and performance of system is remarkable.

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