INTELLIGENT TRAFFIC LIGHT CONTROL SYSTEM BASED ON IMAGE PROCESSING

Mr. Kapalavayi Ramesh Babu[1], Bathula Dhanunjay[2], Chittemsetty Sai Yeswanth[3], Donkada Shanmuka siddhu[4], Byrapuneni Yaswanth[5]

[1] *Assistant Professor ,Dept. of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Andhra Pradesh, India*

[2]*UG Student, Dept. of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Andhra Pradesh, India*

[3]*UG Student, Dept. of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Andhra Pradesh, India*

[4]*UG Student, Dept. of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Andhra Pradesh, India*

[5]*UG Student, Dept. of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Nambur, Andhra Pradesh, India*

ABSTRACT

Real-time traffic control entails calculating the amount of time each lane requires to reduce traffic congestion, as well as the timing of each red, green, and yellow light. This is accomplished by sensing the density of vehicles across four lanes. The current traffic control system encourages smart movement and efficient use of time while reducing traffic. When considering a junction of four roads with predetermined traffic signals, time will be wasted because the time allotted to each lane cannot be changed based on vehicle density. Even if there are no vehicles in a given lane, the time allotted for that lane can still be used, and the number of vehicles at other junctions may increase. Predetermined traffic lights and ageing road infrastructure cause traffic congestion, making it difficult to clear traffic in a timely manner. The primary contribution of our work is to contrast the various approaches presented for actual traffic control and to develop a new methodology to reduce the difficulties associated with traffic clearing. The same amount of time on green lights wastes resources and stresses drivers, as well as for ambulance detection. The goal of this project is to regulate traffic lights using security cameras installed at intersections using image matching techniques, Python programming, Open CV, and image processing concepts.

KEYWORDS *Image Processing, Image Matching, Ambulance Detection, Open CV*

1. INTRODUCTION

In many regions of the globe today, road transportation is one of the most archaic forms of transportation. The number of automobiles on the road is exponentially expanding each day. Traffic lights are the signalling equipment used to manage traffic flow on the road and are located at junction sites. Traffic lights were first erected in London in 1868, and today they are found in the majority of international cities. The majority of traffic lights on the planet adhere to a predefined timing circuit. Even when there is little to no traffic, there are times when the cars on the red light side must wait for the green light. That causes a loss of priceless time. Concerns about traffic regulation at crossings exist in big cities.

There have been several attempts to dynamically change the sequence of traffic signals so that these traffic signals are controlled by the volume of traffic at any one time. These days, it's impossible to escape traffic congestion in metropolitan areas because of this. Ineffective traffic management results in the loss of priceless time, pollution, fuel waste, increased transportation costs, stress, and other negative effects, but more critically, emergency vehicles like ambulances become delayed in traffic. Pre-timed traffic lights are the most common type of traffic light in Malaysia, with signal timing cycles ranging between 45 and 120 seconds. They are unaffected by traffic on the roads and remain consistent throughout their operation because they are pre-programmed to wait for a predetermined amount of time after every change in signal. As a result, even if the traffic density in a specific lane is the lowest, users must wait for an extended period of time for their turn to receive the green light, and when it is their turn to leave, it causes other lanes to wait even longer.

Fig 1.1 Traffic control using image processing

It was suggested that the traffic light system be improved by employing a PIC microcontroller as an intelligent traffic signal system integrated with an infrared sensor to detect traffic density [4]. The disadvantage of this technology is that the infrared sensors only function over short distances, therefore it may provide false data when there is heavy traffic. Most governments throughout the world have a road maintenance preventative policy in place to provide quick repairs in case of road distress. The traditional human-based examination approach is very subjective and erroneous. As a result, the goal of this research is to present an adaptive traffic light control system based on image processing to determine road density. The technology identifies the density of the road and allocates time to each lane.

2. EXISTING SYSTEM

Nowadays, traffic departments in big cities use two classic approaches to reduce traffic congestion.

1) Controlling traffic lights automatically
2) Controlling manually

2. 1 Automated traffic light control:

In Automatic traffic light control, the timer on each lane's signal displays the current time. It is the default timing for red and green lights. If we need to modify the time, we must update the software and upload it to the microprocessor, which is a time-consuming procedure.

Fig 2.1.1 : Traffic light indicator with timing

2.2 Manual control:

In rare circumstances where traffic lights do not function properly, this approach is employed by displaying some sign boards and hand gestures. This procedure necessitates an excessive amount of man power. The biggest problem of using traditional traffic procedures is that it is a risky operation that necessitates a large amount of manpower.

Fig 2.2.1 : Traffic controlled by the police by using sign boards

2.3 Disadvantages:

1. **Human error**: Like all human activities, traffic police officers are subject to error, and mistakes in directing traffic can lead to accidents or other issues.
2. **Inefficiency**: While traffic police officers are effective in managing traffic flow in some situations, their methods may not always be the most efficient.
3. **Safety risks:** Traffic police officers are often required to work in busy and potentially hazardous environments
4. **Congestion:** Traffic lights can sometimes cause congestion, particularly during peak traffic hours or when there is an imbalance in traffic volume between different directions. This can lead to delays, frustration for drivers, and increased emissions from idling vehicles
5. **Lack of flexibility**: Traffic lights operate on fixed

3. PROPOSED SYSTEM

The methods employed for traffic control are the primary cause of the current traffic issue. Traffic timers only display the predetermined time. Similar to employing an open loop system, this. It is feasible to forecast the precise time on traffic signal timers if we use a closed loop system with cameras. We propose an image analysis-based solution for automating traffic signal control. Instead of using electrical sensors, the system detects cars using photographs. A camera will be installed near the traffic light. It will capture photo clips.

Image processing is a better way to manage traffic light status changes. It demonstrates the ability to reduce traffic congestion and save time due to a green signal on an empty route. The main idea behind this proposed system is to use camera and image processing techniques to detect an ambulance that has been hit in traffic.

Advantages :

1) This system is more reliable in calculating vehicle presence in the traffic.

2) The traffic control unit receives data from sensors and assists in determining traffic congestion.

3) Based on the detection, the system makes self-decisions and executes a traffic-reduction operation.

4) Able to detect Ambulance which was in the traffic.

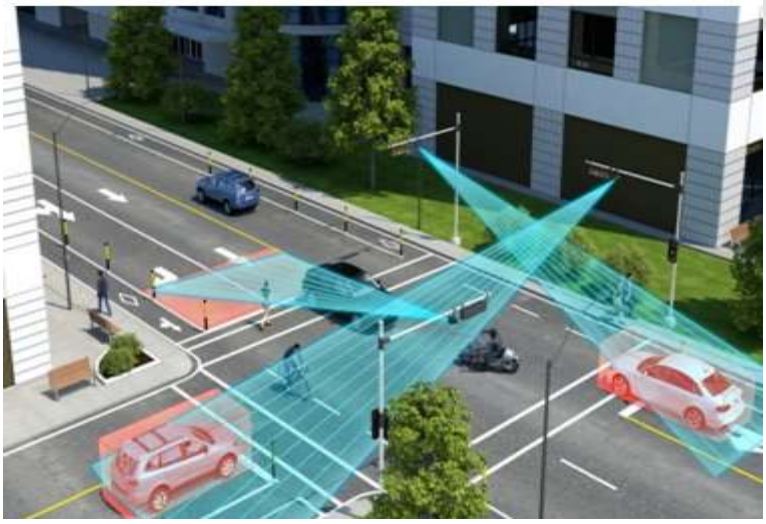


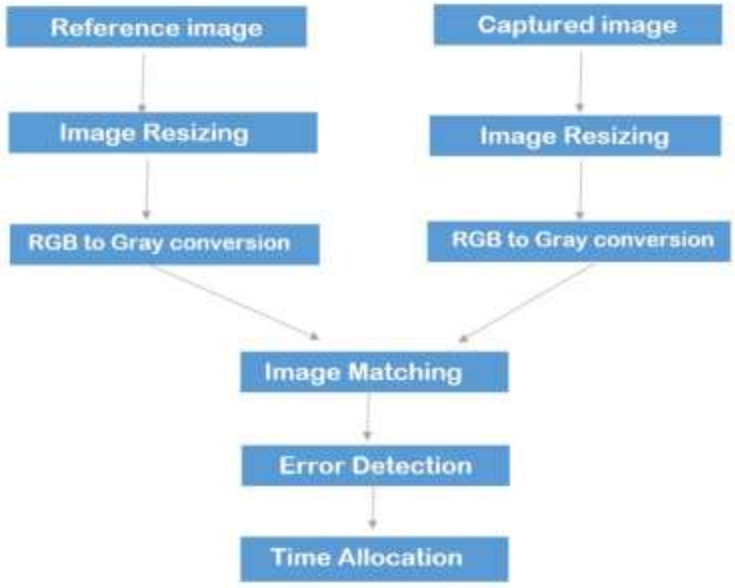
Fig 3.1 : Proposed system model

3.1 Requirements

To follow along the reader will need the following:

1. Python installed on your system.
2. OpenCV installed in Python on pc.
3. GPU: NVIDIA , CUDA 11.2 .
4. Libraries : OpenCV, NumPy, TensorFlow and Matplotlib.

4. DESIGN METHODOLOGY



4.1. Image resizing:

Image resizing is required when the total number of pixels has to be increased or decreased, whereas remapping might occur when adjusting for lens distortion or rotating a picture. Zooming refers to increasing the number of pixels in an image so that you can see more information as you zoom in.

4.2. GRAY conversion:

It is a digital photography picture conversion technology. It removes all colour information and simply leaves several shades of grey, with the brightest being white and the deepest being black. Its intermediate hues generally have the same brightness as the core colours (red, blue and green). Instead, it employs equal proportions of the main colours cyan, yellow, and magenta. Each pixel is a representation of the image's luminous intensity.

Original Image Converted Image

4.3 Image Comparision:

Image comparison by subtraction is a simple and effective method for detecting differences between two images, and OpenCV provides functions to perform this task. The two images are subtracted from each other to obtain a difference image. This can be done using the functions in OpenCV. After obtaining the difference image, a threshold value is set to determine the pixels that have changed significantly.

5. AMBULANCE DETECTION:

We develop this project to detect the ambulance in the traffic using image processing. Ambulance detection using image processing is a technology that aims to automatically detect the presence of ambulances in images using computer vision algorithms. The ability to detect ambulances in real-time can have significant implications for emergency response times and can help improve the overall efficiency of emergency services. Ambulance detection using image processing is a natural application of object detection algorithms. The approach involves training an algorithm on a diverse dataset of images containing ambulances and non-ambulances. Once trained, the algorithm can be used to detect ambulances in real-time and provide valuable information to emergency responders. Detecting an ambulance in an image using image processing can be done through various approaches. One common approach is object detection, where an algorithm is trained to recognize and localize objects of interest within an image

6. RESULTS

Fig 6.1 Reference Image

Fig 6.2 : Results after processing

Fig 6.3 : Ambulance detection in the traffic

7. CONCLUSION AND FUTURE SCOPE

This project entails the creation of an efficient traffic signal controller that detects the presence of vehicles on the road and estimates traffic density. With this method, we can better identify the ambulance in traffic. Overall, the intelligent traffic light control system based on image processing has a lot of future development potential and can play a critical role in the development of smart cities and sustainable transportation systems. More research and development in this field has the potential to result in more advanced and sophisticated systems that can improve emergency response capabilities.

8. REFERENCES

[1] "Traffic Light Control System Based on Image Processing," by R. Karthikeyan and A. Senthil Kumar, International Journal of Engineering Research & Technology, vol. 5 , no. 5, pp. 2691-2697, 2014. https://www.ijert.org/research/traffic-light-control-system-based-on-image-processing-IJERTV3IS050802.pdf.

[2] "Real-time Traffic Light Control System Using Image Processing," by D. D. Tran, M. C. Hoang, and N. T. Nguyen, International Journal of Control and Automation, vol no. 6, pp. 225-236, 2018. https://www.sersc.org/journals/IJCA/vol11_no6/20.pdf.

[3] "Traffic Light Control System Using Image Processing and Wireless Sensor Network," by K. Srinivasan and P. Akila, International Journal of Emerging Trends in Engineering Research no. 5, pp. 1-6, 2015. https://www.researchgate.net/publication/282717752_Traffic_Light_Control_System_Using_Image_Processing_and_Wireless_Sensor_Network.

[4] "Intelligent Traffic Light Control System Based on Image Processing and Adaptive Control Algorithm," by Z. Liu, J. Wang, and Y. Lu, Journal of Physics: Conference Series, vol. 1513, no. 1, 2020. https://iopscience.iop.org/article/10.1088/1742-6596/1513/1/012058.

[5] "Real-time Traffic Light Control System Using Image Processing and Deep Learning," by H. T. Kim and D. H. Kim, Proceedings of the 2019 8th International Conference on Software and Computer Applications, pp. 356-361, 2019. https://dl.acm.org/doi/10.1145/3368831.3368897.

[6] "Ambulance Detection and Traffic Light Control Using Computer Vision," by S. Yadav and S. Jain, International Journal of Computer Applications, vol. 177, no. 14, pp. 8-14, 2020. https://www.ijcaonline.org/archives/volume177/number14/32096-2020913416.

[7] "Real-Time Ambulance Detection and Traffic Light Control using YOLOv3 and Deep Learning," by J. N. Rajan and M. T. Ahmed, Proceedings of the 2019 10th International Conference on Computing, Communication and Networking Technologies, pp. 1-5, 2019. https://ieeexplore.ieee.org/document/8939009

[8] "Ambulance Detection and Tracking in Traffic Scenes Using CNN," by K. S. Elhoushi and A. H. Hassanien, Advances in Intelligent Systems and Computing, vol. 1127, pp. 231-238, 2020. https://link.springer.com/chapter/10.1007/978-3-030-39901-2_23

[9] "Ambulance Detection and Tracking using Faster R-CNN," by D. G. Girase and R. S. Prasad, Proceedings of the 2020 11th International Conference on Computing, Communication and Networking Technologies, pp. 1-5, 2020. https://ieeexplore.ieee.org/document/9193211

[10] "Ambulance Detection using OpenCV," by M. K. Salai and P. S. Sathya, International Journal of Engineering and Advanced Technology, vol. no. 1, pp. 201-207, 2019 https://www.ijeat.org/wp-content/uploads/papers/v9i1/A7684109119