IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 12, Issue 5, May 2023

DOI: 10.17148/IJARCCE.2023.12594

TRAFFIC LIGHT MANAGEMENT SYSTEM USING OPENCV

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ABSTRACT: Traffic jams have become one of the biggest problems any metropolitan city faces in today's time. This paper suggests implementing a smart traffic detector using OpenCV. The density of vehicles on the road keeps increasing to a higher amount these days. In traffic signal, people waste much time particularly during the peak hours of the day. In order to solve this problem of high traffic pressure, it is indispensable to solve traffic congestion. The frustration that is faced by people during traffic jams could also lead to mishaps such as accidents. Thus an idea of monitoring the traffic congestion using real-time image processing techniques, through this software has been proposed. The theme is to determine the traffic density on each side of the road by calculating the number of vehicles at the traffic signal zone. In this, an input image of traffic surveillance is shown to our trained machine which declares whether there is traffic or not by judging via the number of vehicles seen. After the image acquisition, the image undergoes various image pre-processing, image enhancement, and edge detection techniques. This project has been customized to be used in the future to control the traffic signals as well as monitor violators and avoid inconvenience and accidents as much as possible.

Keywords: Traffic Sign, Arduino UNO, Node MCU, Camera

I. INTRODUCTION

Traffic light management is one of the essential systems that help to ensure safe and smooth traffic flow in urban areas. The traditional traffic light management system relies on pre-programmed signals that are not adaptive to traffic conditions. In recent years, computer vision technologies such as Open CV have been developing intelligent traffic light management systems that can respond to traffic conditions in real-time. This literature reviewaims to provide an overview of previous research on traffic light management systems using Open CV.Traffic light management systems have been widely studied in the past. The traditional trafficlight management system relies on pre-programmed timers that control the duration of each traffic light phase. However, this approach is not adaptive to traffic conditions, leading to inefficiencies in traffic flow. With the advancement of computer vision Technology, researchers have proposed the use of Open CV to develop intelligent traffic light managementsystems that can adapt to real-time traffic conditions.

This system works like clockwork with the lights changing at regular intervals, but soon people realized that the system had a flaw. In many occasions vehicles had unnecessary waiting periods because the light would be red even when the opposite road was empty. The main purpose of this paper is to introduce a system which will allot time to each road based on the amount of traffic. The amount of traffic on a single lane is classified under three levels: low, medium and high. These levels are determined by the Arduino UNO based on inputs received from the ultrasonic sensors and camera. Based on the level of traffic the Arduino UNO then allots timings for a lane, and makes changes to the red, green and yellow indicators. This traffic management system fulfills its duty by enabling the smooth movement of vehicles andit also has a fail- safe system which will prove useful in unexpected circumstances.

II. LITERATURE SURVEY

The density of vehicles on the road keeps on increasing day by day. The need to control traffic congestion has become more advantageous these days. Increase in the traffic congestion generally results in high transportation cost and also wastage of time particularly during the peak hours of the day, excessive fuel consumption, etc. so the effort has to be made to put an end to such problems that keep on increasing on a day to day basis in our country. Even though several techniques are already available for detecting the density of vehicles on the road like a fuzzy-based controller, Radio Frequency Identification (RFID) concepts which include an RFID reader and tag for detecting the traffic, they are all much costlier and are difficult to implement in real time. Efficient and cost-effective methods have to be incorporated for controlling traffic congestion. Several algorithms are available to calculate the traffic density. Some are as follows: model-based, feature-based, region-based, probabilistic based, active contour-based. But these algorithms failed to

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concentrate on computational complexities and time factors. Thus these algorithms are not implemented in real-time. Immediate response should be considered as an important factor while working with traffic related problems.

III. PROBLEM STATEMENT

The current road surveillance cameras and their viewing software can simply capture images when traffic rules are violated and for obtaining number plates and identification of drivers. Through this project, we will be able to successfully detect as well as further monitor the traffic according to the number of vehicles as well as keep in track the rest of the attributes present such as road signs, footpath, lanes and pedestrians. This will give the necessary boost required in the existing software of the surveillance cameras and is also useful for AI self-driving cars and robotic machinery.

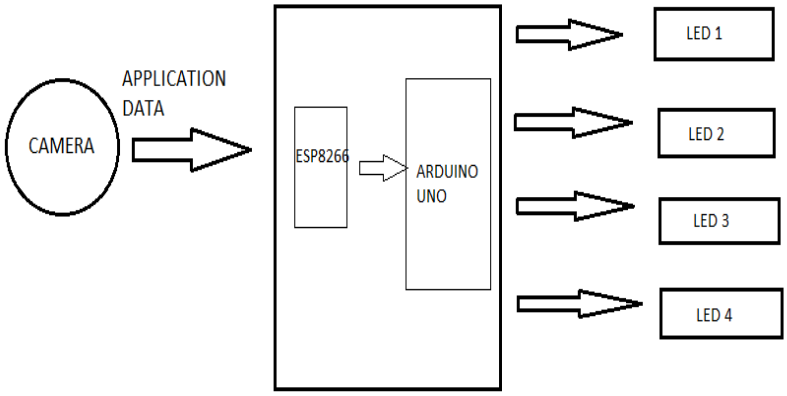
IV. PROPOSED SYSTEM

The Traffic Detection performs the main functionality of determining the amount of traffic. OpenCV firstly converts the input image from BGR to grayscale, after which the picture undergoes masking i.e. useless and redundant data is removed using suitable coordinates. Then canny edge detection helps in outlining and defining each distinct object seen in the image. The next step is to calculate the HOG (Histogram of Gradient) transform by determining x-sobel (x derivative) and y-sobel (y derivative) of the image. The dataset then undergoes a grid search where most efficient gamma values are retrieved as the output. This is the basis on which the dataset is trained using an SVM model. This model is used to detect vehicles as well as classify them using an RBF kernel. The RBF kernel uses the most efficient gamma values and this is why it has a very high rate of accuracy. Linear kernel can also be used which uses C values but RBF kernel is preferred for its better accuracy. Image processing involves issues related to image representation, compression techniques and various complex operations, which can be carried out on the image data. The operations that come under image processing are image enhancement operations such as sharpening, blurring, and brightening and edge enhancement. Traffic density of lanes is calculated using image processing which is done of images of lanes that are captured using digital camera. Initially, the input image file is given for preprocess using file explorer This file is processed by OpenCV which is used to preprocess the image and detect details (process mentioned above). The statistical data is fed to the trained model which computes and delivers the result.

V. METHODOLOGY

The traffic light control and red-light camera were both parts of the intelligent traffic light control system. A computer received video of all 4 lanes of the junction after being alerted to it. The computer system analyses each frame of the brief video clip that was collected using PYTHON and OPENCV algorithms in order to determine the density for the intersection's four lanes. The computer system keeps track of all sides' and lanes' detected vehicle counts. Based on the relative traffic density and these data, the algorithm allocates the time for the green light. There are several algorithms or strategies to adhere to and put into practice for video image processing procedures. When processing an image or a video, we are often interested in recognizing the items that are shown in it so that we may carry out further analysis on them, such as counting them or determining their sizes. The idea of edges, or the lines that indicate a change from one group of related pixels in the picture to another group that is dissimilar, is crucial for identifying objects in images.

BLOCK DIAGRAM



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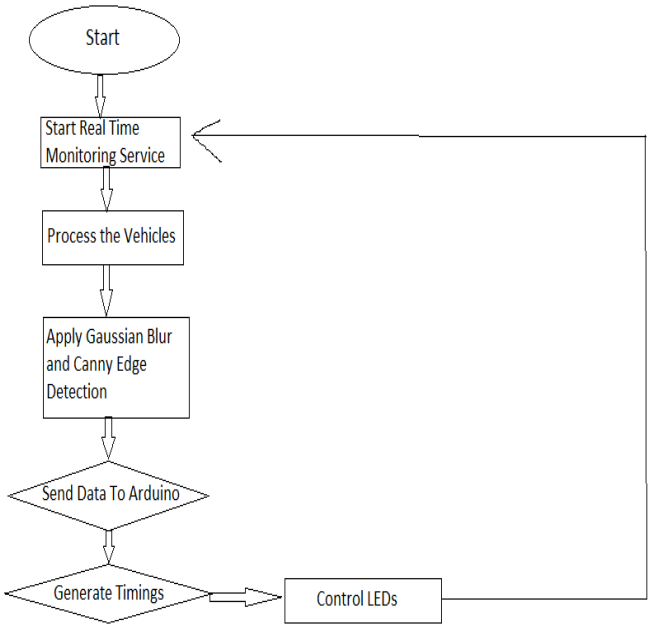

VI. RESULTS AND DISCUSSION

The cameras read the color video frames, which are then regarded as a lane's input.

Fig. Vehicle count as captured from the testing environment.

After the color image, the RGB is now converted into the gray color image. This process is called Pre-processing.

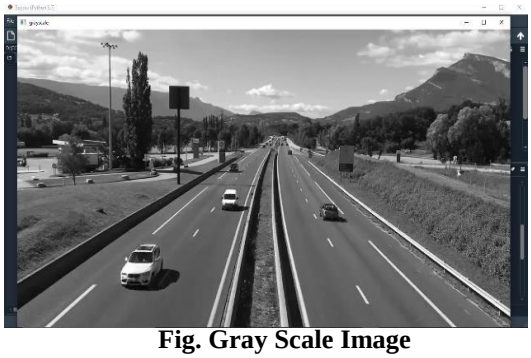

Fig. Gray Scale Image

The grey color picture now has a salt and pepper noise added to it.

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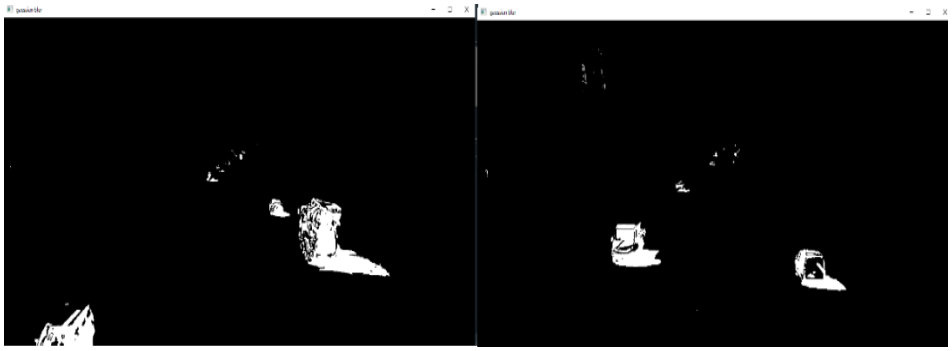

Fig. Filtered application on the traffic scene

These steps are repeated for the full movie and then for the following upcoming lanes, providing the desired outcomes. Finally, utilizing contours and edge detection, the count may be calculated. Tracking and detection are also carried out. This counts and shows the number of cars seen during the video.

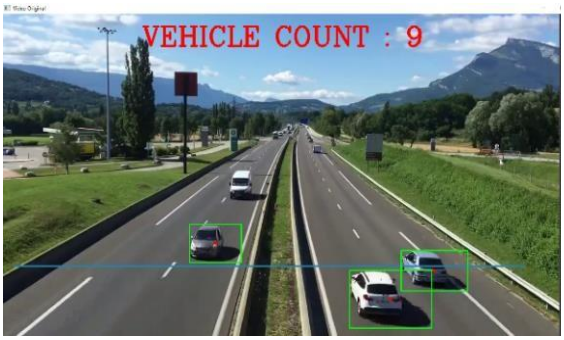

Fig. Vehicle Count, Detection and Tracking

VII. CONCLUSIONS AND FUTURE SCOPE

Vehicle utilisation has expanded dramatically in our contemporary period as the population has grown fast. It is caused by hightraffic. To overcome this issue, we need use new communication techniques, such as image processing-based intelligent traffic regulating and monitoring systems. Thus, based on the above theory, we can deduce that by adopting density-based traffic signal regulation, we can save a significant amount of time, fuel, unneeded pollution, and also avoid excessive traffic jams, resulting in smooth traffic flow. Many add-ons, such as information on cars at certain intersections through internet access, violation of rules detection, and many more, may be developed on this project. This is better for the people, the city, and the environment.

In actuality, we now use time-based traffic light regulation in India, and we are suffering widespread traffic congestion, which wastes time and fuel. We hope that these approaches will be implemented as soon as feasible so that the constraints of the current method may be addressed. Advanced study and implementation of different machine learning and image processing approaches willimprove its realism and dependability.

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