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# Traffic Signal Pattern Algorithm

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***Abstract: Every day we are witnessing a rapid increase in traffic volume on roads. Traffic signals are made to manage the traffic to get less disturbance during the journey and to avoid collisions. Sometimes these traffic signals might become a reason for a delay due to poor time management at signal timings. The old traffic signal patterns are the main cause of this issue and hence this project of new signalling patterns will help in using traffic signals more efficiently. In the traditional pattern at a crossover only one signal can be opened but using our pattern algorithm more than one signal can be opened and traffic could clear more easily. Even concepts of image processing are used to make the system more automated and intelligent.***
***Keywords: Image processing, OpenCV, Arduino, Signalling,***

## I. INTRODUCTION

In this modern-day era of high-speed lifestyle, we need to be fast in competition. The same thing goes with the traffic. We want to reach our destinations as fast as possible and the most hated thing by people is a traffic signal. People just hate a signal because of its long waiting period. Our project primarily aims at the solution to reduce this waiting time and make the process efficient and automated.

Traditionally signal has a pattern of opening one signal at a time, but we propose to open more than one lane partially and clearing traffic of more than one lane at a time. For instance if we open a lane for just straight and left side, open the lane on right side for left and right side, and rest two on left. This will open all four lane partially and make more traffic movement in less time.

The basic idea is to implement this algorithm just for high traffic intensity times, not every time. Hence to determine this time we are using image processing to monitor streets.

If the system detects vehicles more than a given threshold on two lanes it will automatically implement two lane algorithms according to the positions of the lane (opposite or sidewise). The algorithm will work at crossovers and where roads are perfectly squared three-lane roads.

Previously on this concept, there are several models which we studied. There was research on traffic signal light controllers using image processing. This model was an intensive improvement and we are using it in our project for smart detection of traffic density and using our signal pattern algorithm to enhance effectivity. One model was based on using API to get traffic conditions and adjust signals accordingly.

This is applied to single-lane signals in series. Also, the problem of improper timing for other lanes was a major issue for the project. The model was based on an “Adaptive signal control system were implemented using deep learning and reinforcement learning algorithm (RL). Instead of a real traffic operation, the present study utilized Vissim, a commercial traffic simulator, as an environment” (rof . Sunayana Jadhav#1, 2020).

The image processing models had a major drawback that they would turn whole signal to green if they saw traffic density got more than threshold. It was forming a paradox in which if a lane got more traffic it would release and would have red signal for very long time as in that time other lanes would accumulate more no of vehicles.

Even some models used basic technologies like Ultrasonic sensor and Infrared sensors to detect crowd density. These systems had their own disadvantages majorly of false detection. The systems failed as they will even detect objects other than cars. For instance IR sensor can detect other metal pieces as every metal can reflect IR rays. In case of ultrasonic sensor it would detect every object that would fall under its range even walking human may give errors.

The advantage of our project is we do not completely shut down any signal as red or green but we manipulate timing of signal to either increase green and decrease red duration or vice versa. Even for some heavy traffic areas and times we change the algorithm to a whole new algorithm. The new algorithm can allow green signal in more than one lane.

Our project will help reduce traffic signal timing and increase efficient traffic flow.

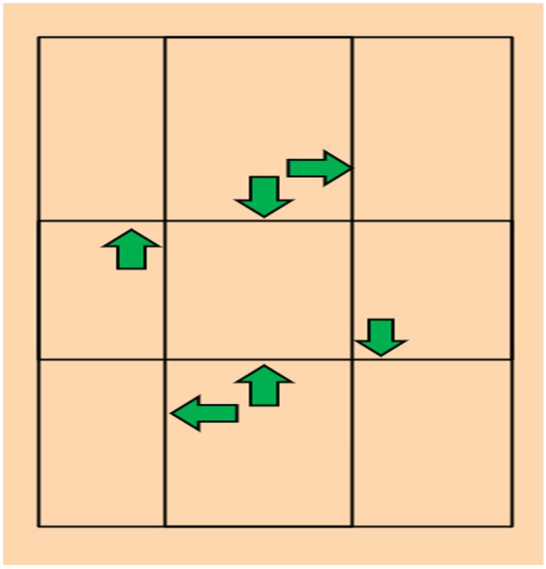
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## II. METHODOLOGY/EXPERIMENTAL

### *A. Algorithm*

Our first algorithm works on multiple lanes opening concepts. The algorithm's main purpose is to substitute image processing model in rush hours so that the paradox we talked earlier would not happen. In this algorithm we open partial signal of more than one lane and clear traffic of two or more lanes at a time. A full signal of a lane means you turn green forward, right and left for a lane at once. By partial signal we mean we would only turn either of forward green, left green, right green in a single lane or any of their combination. For first image we turn forward green of any two lane in opposite direction and turn green left of all directions.



The second image has another pattern of algorithm one. Here we keep left of all sides on for permanent. Along with that we will keep front green on of a lane and green right on, on lane anticlockwise (from top view) to it.

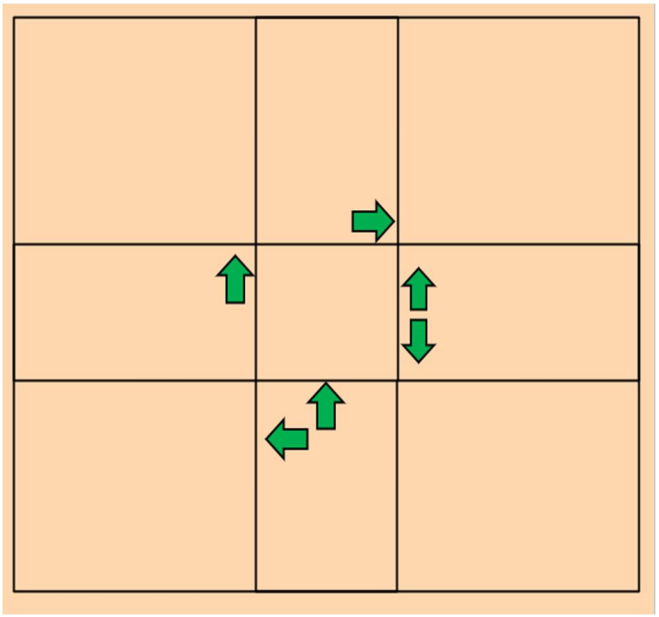


Image processing will be used in other situations when there is not heavy rush traffic. As the signal timing will be based on traffic density, we will be leaving no road empty and green light on. It will be capturing the data from signals fixed on signals. The image will be stored in a computer in which the algorithmic code is stored and control will occur.

When the image is stored, it will be analyzed by the code which we have written. The code will perform multiple operations in order to obtain a image which is readable for the system.

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First it will convert the image into a greyscale image. Our normal image is in RGB format with colors which me interfere with the borders of objects. A greyscale image only has black and white tints which varied as objects are present. The greyscale image will be very efficient for the system to detect and mark with the marker.

The next step is image enhancement and edge detection. This phase is to make image clearer and more edgy so that blurriness of image could be reduced. the degradations in image are removed such as noise, blur and distortions. This increases quality of image. It is very important step in regard with the analysis made by system. The last step involves edge detection and data analysis in which the markers are placed on desired object and no of vehicles is counted.

For markers we will be using a standard cars.xml file which has all prerequisite code of marker placing, image sourcing and analysis derivation. The source image will be provided prior to system and the machine will be trained to seek that image in any image captured by cameras.

## III. RESULTS AND DISCUSSIONS

The system detected and tracked vehicles as they moved around the area of interest. The system was able to alert the hardware when the number of vehicles in the area of interest exceeded a certain threshold. The system can help improve passengers' overall experience by preventing long waiting times and congestion. The system may help to solve some challenges in terms of security, which should be addressed through proper regulations and protocols.

## IV. CONCLUSION

People will get less stress at signals. Time of people will be saved. Emergency services will get first. Traffic handling improves. Efficient use of services will occur. Environment will have a good impact. Waiting time will reduce causing less pollution. Heavy crowd lanes will be moved first. Empty lanes would have a red signal. The project has huge future scope and it may be implemented in daily use to reduce traffic at crossovers.

## V. ACKNOWLEDGMENT

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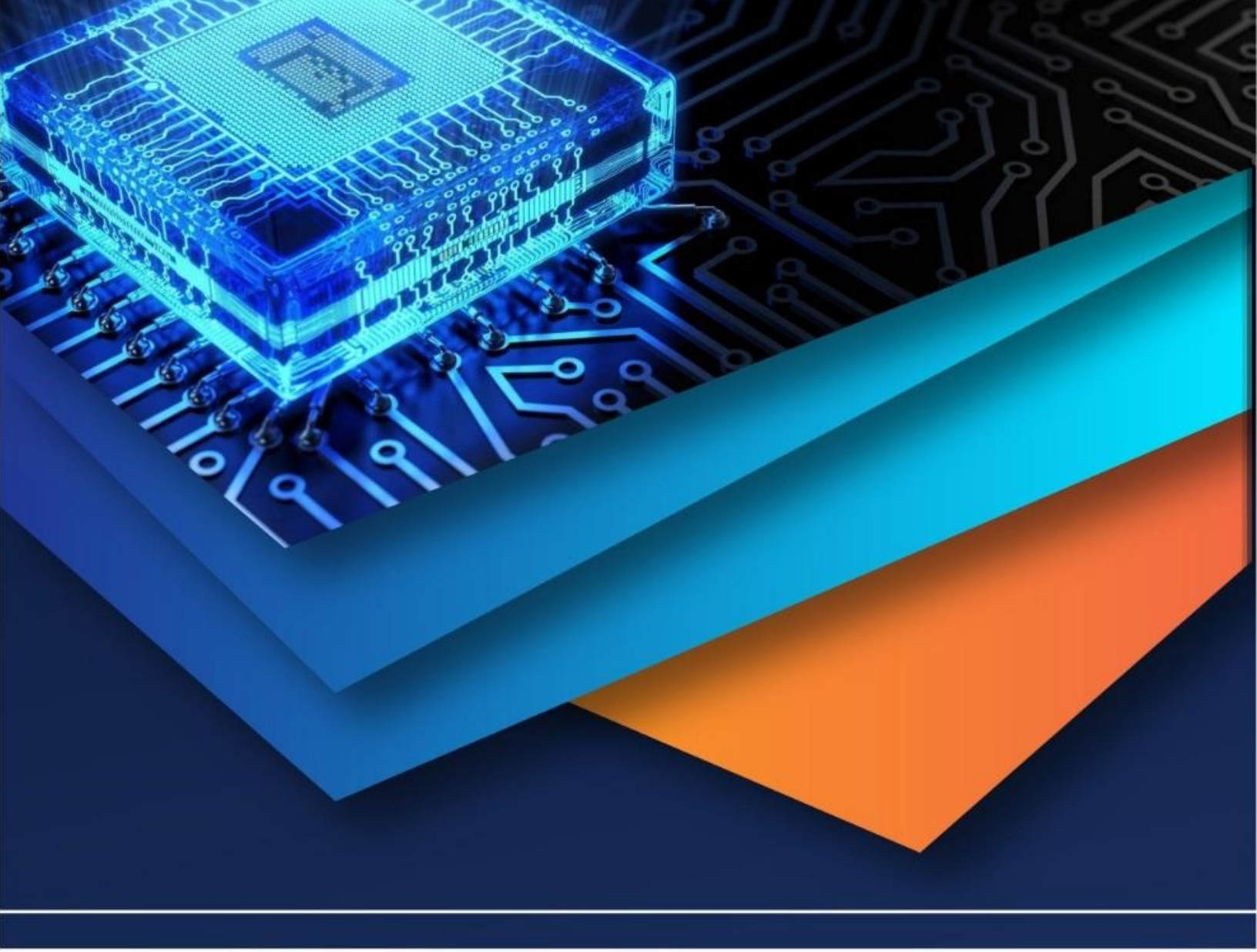
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