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Smart Traffic Light Control Using Image Processing

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Abstract: ***Nowadays, holdup has become one in every of the foremost critical problem thanks to increasing population and automobiles in cities. Hold up causes delay and stress for drivers and increases pollution and carbonic acid gas emissions. The traffic controller is one in all the critical factors affecting the traffic flow. This paper proposes a control system supported image processing including video processing within which traffic signals change accordingly the density of traffic and it will make use of Arduino UNO board for Traffic Lights, Emergency Vehicles and Barrier. A video camera and traffic lights are interfaced with Arduino UNO. The video is processed and Arduino enables the traffic lights to vary when required. Along with this, barrier at zebra crossing and emergency vehicle passing are the best concept for today's smart city.***
Keywords: Image Processing, Time, Signals, Emergency Vehicles, Barrier.

I. INTRODUCTION

One of the most important problems in India is Traffic. Most countries have automobiles, buses, trucks, motor vehicles, motors, scooters and bicycles. However, in India, additionally to the current routine urban transportation, and contributing substantially to the congestion, are networks of auto-rickshaw, two wheelers still as heavy vehicles. This has led to the explosion of traffic, higher number of accidents, deaths and increase in commuting time over the years.



Figure 1 Traffic jams on Roads

If there is an accident in India, people block the roads as they need and begin fighting, taking law into their own hands. This ends up in a roadblock and makes it very difficult for ambulance to succeed in the spot, sometimes even for hours. Nowadays, the traffic in India is controlled by Traffic signals and secondly by Policeman. These two methods are most effectively but now as India is using smart technologies this two methods may be switch to Automatic light Controlling System. Our Project mostly works on reducing the waiting time for empty road. For doing this, Arduino is employed by capturing a video of every lane. Number of vehicles present on road and traffic density are calculated by applying appropriate Arduino functions. Therefore, the timing for Green Light is set supported the density. The road that has more vehicles, longer is allocated for those roads. It is not time dependent. Time is allocated as per the traffic of vehicles. Just in case if vehicle having Red Signal tries to interrupt the rule and passes the lane then the Barrier is opened and therefore the vehicle stops. This project also works for emergency vehicles.

II. PROBLEM STATEMENT

Conventional traffic controller uses pre-defined time to manage the duration of signal in one particular direction or in some places human physically must do the task. While their system is somehow convenient but isn't efficient and, in some cases, costly since large human forces is required to take care of traffic rules similarly as tie up control. We purpose system that is able to tackle above stated problems using Image Processing.

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III. LITERATURE SURVEY

1) *Khushi*: The congestion of the urban traffic is becoming one of critical issues with increasing population and automobiles in cities. Traffic jams also causes delay and stress to reach the destination. Because of traffic jams, fuel consumption is also increased along with transportation cost. Traffic controlling is serious problem affecting traffic flow. In this paper a traffic control based on image processing using MATLAB is developed. This is a continuous process. [1]
2) *Pallavi Choudekar, Sayanti Banerjee, and M.K. Muju*: This paper proposes a system for controlling the stoplight by image processing. A camera are installed alongside the traffic signal. It will use digital image processing for vehicle detection and the traffic conditions will be controlled. Within the present work, the designed system aims to realize the subsequent Distinguish the presence and absence of the vehicle in road images Signal the traffic signal to travel red if the road is empty. Signal the stoplight to travel red if the utmost time for the green light has elapsed whether or not there are still vehicles present on the road [2]
3) *Mohammad Shahab Uddin, Ayon Kumar Das (2014)*: Traffic congestion may be a daily occurrence in most urban areas of Bangladesh now every day. Within the last 10 years the scenario has worsen because of rapid increase of vehicles and insufficient roads to accommodate them. This paper describes a technique of real time area based traffic density estimation using image processing for intelligent control system. Area occupied by the sides of vehicles are considered to estimate vehicles density. Calculating the areas of various live roads, the system will automatically estimate the traffic density of every road, which can help to work out the duration of every light. An intelligent traffic light system with the proposed traffic density estimation technique are much better than the traditional timer based system of Bangladesh. The most contribution of this research lies within the development of a replacement technique that detects traffic density consistent with the world of the sides of vehicles for controlling holdup. Specialized algorithm, morphology and pictures captured with cameras are going to be used for the detection of traffic density for the intelligent control system [3]
4) *Real Time Traffic Signal Control using Fuzzy LogicController. Sweta Pandey:* .et.al. Proposed a paper in which, controlling the traffic signal system is the main objective making the road traffic decent, safe, less waiting time and fuel consumption. This paper provides overview of fuzzy logic control system usedfor better control of flow of traffic at every roadintersection. [4]
5) *Urban traffic controlling is based on Fuzzy Control. Haibo Mu:* .et.al. Proposed a distributed control system, which comprises some local fuzzy controller controls the traffic flow at its designated intersection according to traffic flows of related intersections in addition to its own. The algorithm will be activated when their dense traffic. By adopting the designated simulated annealing algorithm, the special case controller optimizes the green time extension of all the intersections in the road network [5]
6) *Density Based light system Using Image Processing. D. Prakash:* proposed a system that measures a density of traffic by processing an image that contains camera and microcontroller. It uses Matlab and ARM processor to control traffic a microcontroller, LPC2148 ARM processor is employed to manage the traffic light. [6]

IV. CONVENTIONAL TRAFFIC CONTROL SYSTEM

A. Manual Controlling

During this type of traffic management Manpower is included. Policeman/men is standing at each cross section and controls the traffic by using different signs.

B. Drawbacks of Conventional System

This method requires an outsized number of Manpower. It also uses a timer for every phase, which is fixed and does not adopt in keeping with the real-time traffic on it road. Due to that, the control signals may end in a re-entrant collision of vehicles and it should cause delay in quick movement of traffic.

C. Automatic Controlling

This can be most suited method nowadays because it reduces Manpower. During this variety of method, the time is allocated as per the amount of vehicles present within the lane. Less number of vehicles has less number of your time. This method can even identify emergency vehicles, fire brigade vehicles also as VIP cars, etc. and in keeping with that, the signal will change.

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V. ADVANTAGES

A. Real time traffic switching in line with the emergency vehicle.
B. Decreases Manpower.
C. Reduces Accident.
D. Number of violators will be reduced.

VI. BACKGROUND

The problem with the timer based traffic system is that it will allocate a hard and fast time to any or all the lanes. Therefore, if the actual lane has no traffic or dense traffic will have the quadruple time (as 120/60 sec). This might make people waiting at other roads intolerant and that they tend to maneuver even they are having red signal. This might cause accident. Similarly, a road with high amount of traffic would require more green-signal time for the vehicles to clear, which is not available. This is often leading to confusion and accidents. A possible solution to the current is density based Smart light Control.

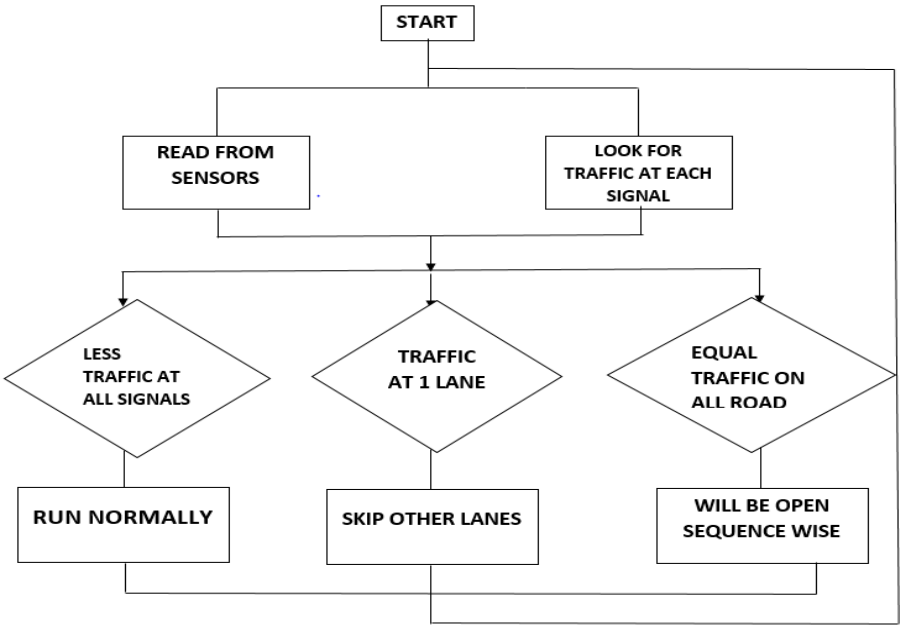


Figure 2 Flowchart of Traffic Signaling

VII. METHODOLOGY

This technology works supported the density of traffic near the stoplight. A webcam has been accustomed capture the live video of the road. The camera is connected to the Arduino board. Allow us to think about road junction containing 4 lanes as shown in fig 3.

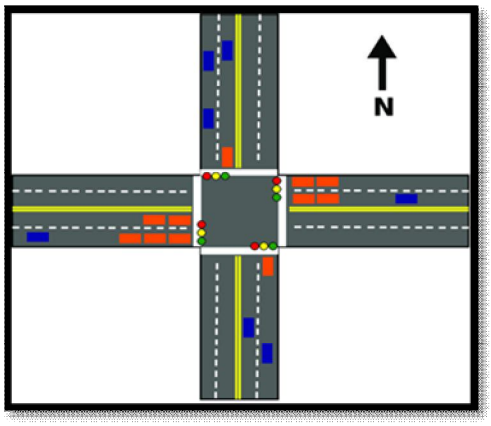


Figure 3 A perfect traffic junction having 4 roads, fitted by camera.

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As considering above fig 3. Allow us to contemplate the lane 2 (L2) has dense traffic as compared to other three lanes. So, the image are captured for lane 2 by the camera and in line with the vehicles captured within the image using Fast R-CNN Technique of image processing the time (40 sec) are visiting be allocated to lane 2. After passing vehicles from lane 2 the signal will switch to Red Signal and Barrier are get opened for lane 2, lane 3 and lane 1.
More Density of Traffic for Lane = longer allocated for Green Signal.

There are certain special cases that arises during this proposed system, they are:

1) *Automatic Timer Based Traffic Signals:* As discussed in above topic, we are creating a stoplight-supported density. During this method, the stoplight time will change per the density of vehicles during this lane. Components required for connecting Traffic Lights with Arduino UNO; Dotted Veroboard, Arduino Uno, stoplight Module x 4, Male Header and female Header, on/off Switch, Battery Clip, and battery 9v.
2) *Ambulance Approaching a Signal:* When an ambulance approaches a symbol, it must have a green signal, so there is minimal waiting at the junction. He quality practice is that, if an ambulance approaches a sign, the lights are turned green only after the police officer at the junction hears the siren. The vehicles before of the ambulance must clear, only then the ambulance can cross the junction. A solution to this problem is installing RF link and microcontroller within the ambulance. The driving force is given a far flung to control the stoplight. When the ambulance approaches the road junction, the driver selects the lane number and makes the signal green in his lane and immediately all the other signals within the junction will turn red. After the ambulance passes by, the signal at the junction again regains its original flow of sequence of signalling.
3) *Barrier at Zebra Cross:* Nowadays we see many accidents near traffic signals and it causes heavy traffic, which ends in delay to reach things. Along with this many peoples breaks the traffic rules. Therefore, to avoid these situations we have been proposed a specific case as “Barrier at zebra crossing”. In this, the lanes that has Red Signal the Barrier will be opened for those lanes. In addition, close the lane that has green signal the Barrier are visiting for that lane. This Barrier are visiting be created above the crossover lines. It will use Arduino UNO and some sensors to create Barrier.

VIII. CONCLUSION

The study showed that image processing is a better technique to control the state change of the traffic light. It shows that it can reduce the traffic congestion and avoids the time being wasted by a green light on an empty road. It is also more consistent in detecting vehicle presence because it uses actual traffic images. It visualizes the reality so it functions much better than those systems that rely on the detection of the vehicles’ metal content. Overall, the system is good but it still needs improvement to achieve a hundred percent accuracy.

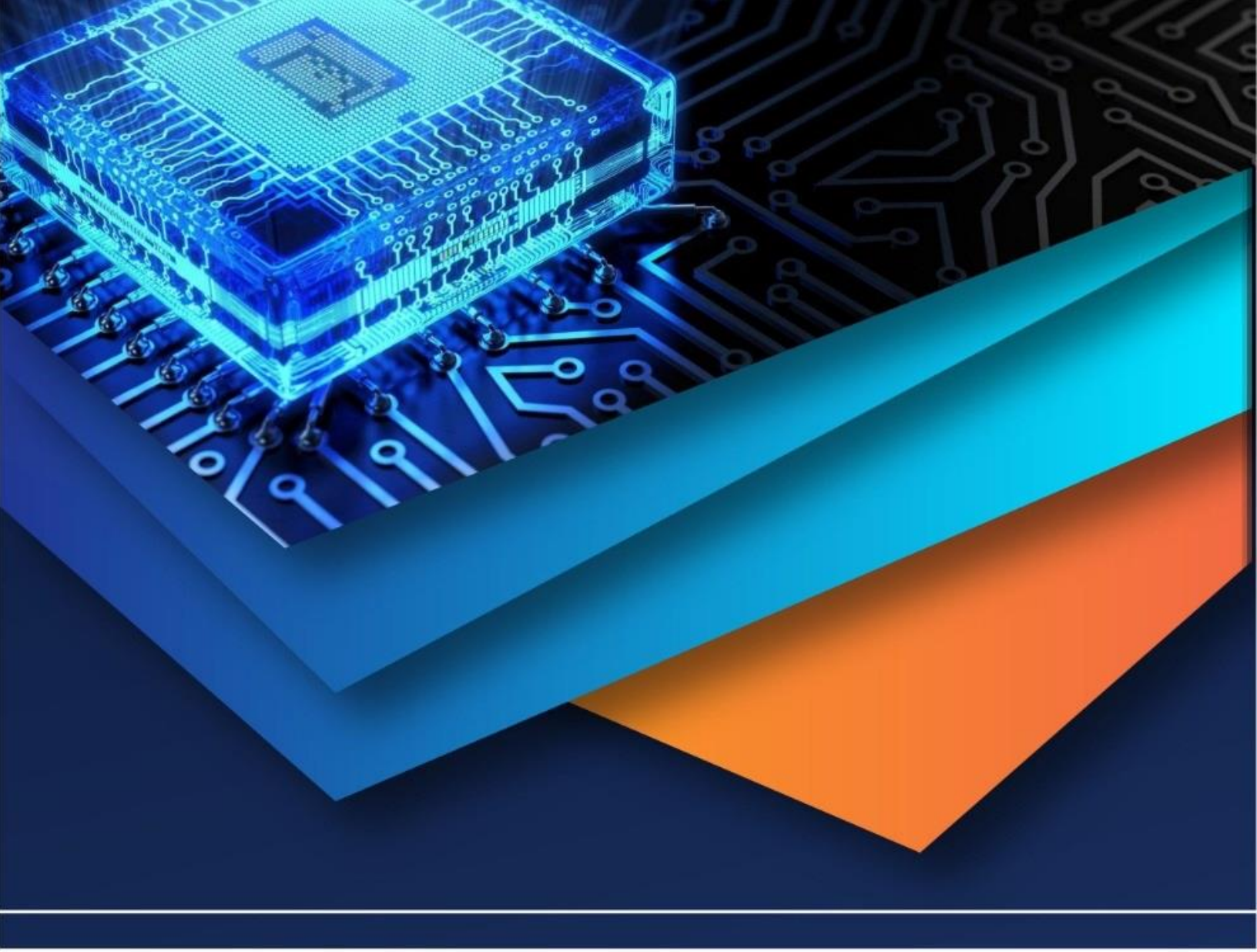
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