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 also 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'll also 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. But 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.

Fig 1: Traffic jams on Roads

If there's 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 road block 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. This 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. So, the timing for Green Light is set supported the density. The road which has more vehicles, longer is allocated for that roads. It's 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 gets 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.

CONVENTIONAL TRAFFIC CONTROL SYSTEM

A.   Manual Controlling

In this form of traffic management Manpower is included. A policeman/men is standing at each cross section and controls the traffic by using different signs.

B.   Drawbacks Of Conventional System

This system requires a large number of Manpower. It also uses a timer for each phase, which is fixed and does not adopt according to the real-time traffic on that road. Because of that, the traffic control signals may result in a re-entrant collision of vehicles and it may cause delay in quick movement of traffic.

C.   Automatic Controlling

This is most suited method nowadays as it reduces Manpower. In this type of method, the time is allocated as per the number of vehicles present in the lane. Less number of vehicles is having less number of time. This system can also identify emergency vehicles, fire brigade vehicles as well as VIP cars, etc. and according to that the signal will change.

III.   ACTUAL 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 consider road junction containing 4 lanes as shown in fig 3.
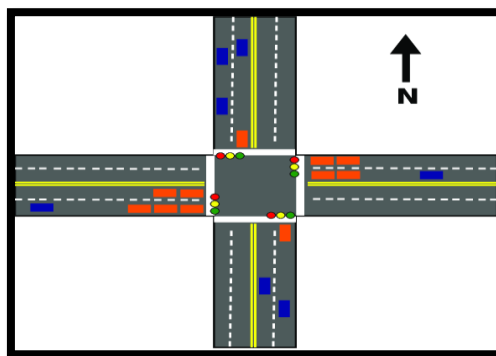

Fig 3: A perfect traffic junction having 4 roads, fitted by camera.

As considering above fig 3. Allow us to consider 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 going to 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 in this lane.
Components required for connecting Traffic Lights with Arduino UNO:
Dotted Veroboard, Arduino Uno, stoplight Module x 4, Male Header and feminine Header, on/off Switch, Battery Clip, and battery 9v.

2.   Ambulance   approaching an   indication
when an ambulance approaches a proof, it must have a green signal, so there's minimal waiting at the junction. The

standard practice is that, if an ambulance approaches an indication, the lights are turned green only after the policeman at the junction hears the siren. The vehicles before of the ambulance must clear, only then the ambulance can cross the junction. An answer to the present problem is installing RF link and microcontroller within the ambulance. The motive force is given a far off to regulate the traffic light. When the ambulance approaches the road junction, the motive force selects the lane number and makes the signal green in his lane and immediately all the opposite 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 results in delay to succeed in the situation. Together with this many peoples breaks the traffic rules. So to avoid this situations we've got proposed a particular case as "Barrier at zebra crossing". In this, the lanes which has Red Signal the Barrier will get opened for that lanes. And also the lane which has green signal the Barrier are going to be closed for that lane. This Barrier are going to be created above the crossover lines. It'll use Arduino UNO and a few sensors to make Barrier.

IV. BACKGROUND

The problem with the timer based traffic system is that it will allocate a fixed time to all the lanes. So, if the particular lane has no traffic or dense traffic will also have the common time (as 120/60 sec). This could make people waiting at other roads intolerant and they tend to move even they are having red signal. This may lead to 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 resulting in confusion and accidents. A possible solution to this is density based Smart Traffic Light Control.
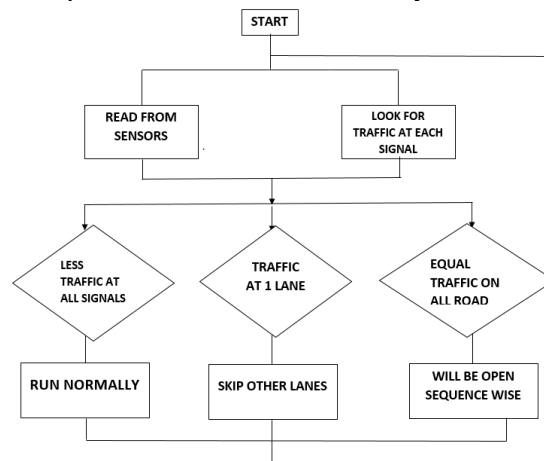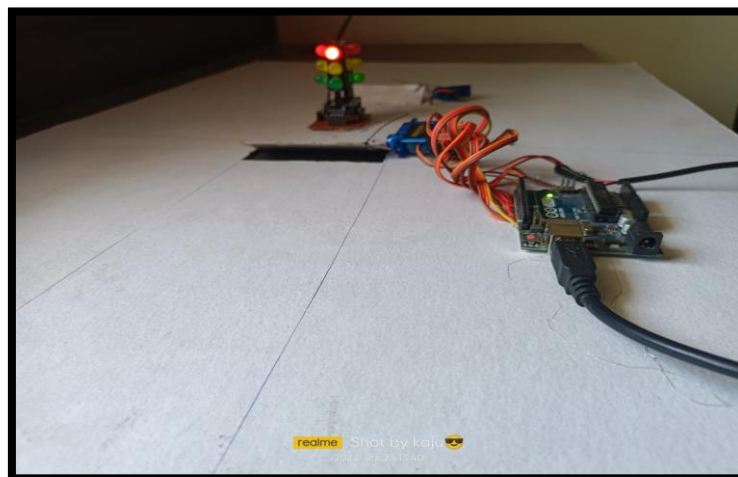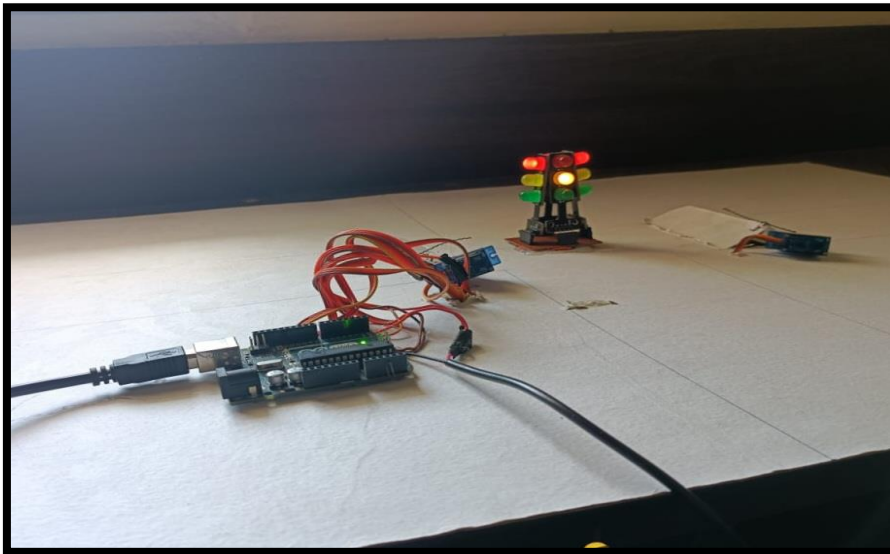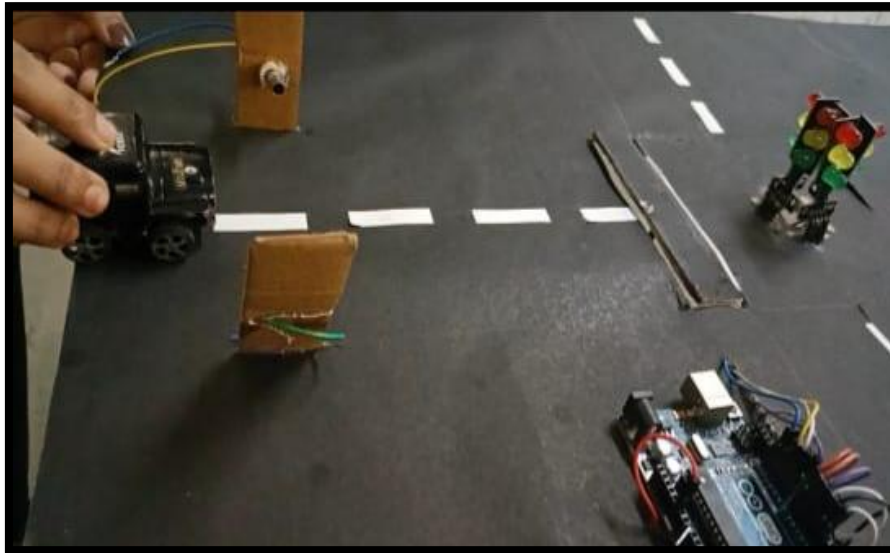

Fig 2: Flowchart of Traffic Signaling

V. RESULTS

VI. 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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