Forewarn Traffic Signal with Ambulance Detection By GPS and Light Standard Signal Using Machine Learning

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Abstract

Imagine being stuck in a traffic jam, it’s pretty aggravating and all of a sudden you hear a siren of an ambulance and everyone around us start making space for the ambulance to pass and relived to reach its destination, but it is unfeasible in every circumstance. Ambulance services are one of the mainly affected services in traffic jams. Let’s talk about few statistics, according to a report published by Times of India about 146,133 people were killed in road accidents in India in the year 2016. Unfortunately, about 30% of deaths are caused due to delayed ambulance. Another Indian government data shows more than 50% of heart attack cases reach hospital late. Providing prompt and effective emergency health services by the ambulances is a challenge in country like India. So, the main core is to make sure that ambulances should be prime concerned during traffic jams and help them reach their destined hospitals instantaneously. The exercise behind this is whenever the ambulance finds a nearby traffic signal within the radius of 500 metres, it will immediately send the request to the control room for checking the current status of the signal in which the ambulance has to cross. What it takes is that mainly we need to train an SVM classifier which is a machine learning module on extracted features to differentiate between Vehicle and Non-Vehicle objects. For feature extraction to have a robust feature set and to increase accuracy level we will be using Histogram of Oriented Gradients (HOG). Using this we should be able to get further details of vehicles like their colour. Scikit-image python library provides us with the necessary API for calculating HOG feature. Once we have the prediction model, it’s time to use it on our test images. Prediction model will be applied in a special technique called Sliding Windows. By Eliminating false positives, we should be able to identify the Ambulance. Now we improve traffic clearance by also using street lights for detecting the approach of ambulance by placing lightweight detector CSL-YOLO on street lights and train Machine Learning module to identify the ambulance and share its location with control room to intimate its approach. Now when it is within 500 meters, we display ambulance symbol onto traffic lights and instruct the citizens to move towards the right allowing the free space on the left for the ambulance to reach the destination. By this we can conclude that this development will help in management of services and reduces risk of life.

I. INTRODUCTION

In the growing hi-tech era, the road rage in every city escalating profoundly and it is ungovernable. This stitch has definite consequences in the existence as well as future. When it is about the assurance or the safety the fire engines, Ambulances are at high risk. Allotting a special lane for an ambulance in India at present is impractical. To ease the moments of these vehicles we have come up with the solution of “forewarn traffic signal with ambulance detection by GPS and light standard signal using machine learning”. The reason behind this work is to provide smooth and fast flow for emergency vehicles to reach the destination in time. In this paper we consider ambulance as our emergency vehicle. A survey said that 90% of heart patient can be treated if they reach in time, without any traffic congestion. It is one of the major problems of current growing world where people always prefer a comfort way of transportation buying a car or bike thus increasing the congestion it may even get worse in the future. The situation today has led to many deaths and losses, the solutions made by this thesis should be understood and coordinated and help emergency vehicles pass through the congestion.
In this we use the Global Positioning System (GPS) where it is a navigation system using satellites, a receiver and algorithms to synchronize location, velocity and time data for air, sea and land travel. GPS is made up of three different components, called segments, that work together to provide location information: (a) Satellites, (b) Ground control, (c) User equipment. GPS works through a technique called trilateration. Used to calculate location, velocity and elevation, trilateration collects signals from satellites to output location.

CCTV footage of the road is taken and detects the emergency vehicle. Images are taken every second with the help of CCTV camera. In every image, each vehicle is detected on the road. After detecting every vehicle, they classified it into an emergency vehicle and regular vehicles. If an emergency vehicle is found, the computer can notify the module that operates the lights placed on the nearing street poles to turn their lights into blue color indicating the approach of an ambulance. For object detection we use Yolo-V3. Yolo-V3 architecture is very fast and can process 45 images per second in a computer with a good processor. It can be observed for input resolution of 832 pixels; the speed for each individual output layer exceeds real-time (30 FPS). Yolo-V3 reframes the image and divides it into predetermined grids. Then it predicts multiple bounding boxes and verifies the probability of an object to be an ambulance through those boxes.

Technically in India there isn’t any established system for Ambulance detection and traffic clearance but the most common system followed around the globe is through RFID [Radio Frequency Identification]. In this system the emergency vehicles like ambulance, fire brigade, police vehicles, VIP cars etc. will have special RFID tags when such vehicles come at the traffic junction the RFID reader reads these special tags and manipulate particular lane signal to green thus allowing the emergency vehicles pass easily through the junction and thus avoiding wastage of time.

**Disadvantage of the Existing System**

1. The ambulance has to be at very close distance for operation.
2. The number plates of the vehicles should have RFID tags.
3. Some researchers have warned that a virus placed on an RFID chip can infect other networked chips, and ultimately assault vulnerable databases.

When the ambulance is in close proximity of a traffic jam it’s GPS location is shared with the control room to alert the police for clearance. when the ambulance crosses the positioned CCTV camera placed on one of the street lights, it captures

Djahel et al designed an advanced traffic control system that minimized the emergency vehicle congestion level. Traffic management controller architecture was made with the help of fuzzy logic controller for emergency services. Their method had got the control of changing the traffic light, changing the speed limit, lane clearance etc. Fuzzy logic determinates most accurate evaluation of the low, medium, high congestion level.

Another idea was given by Parthasarathi et al. [14] that an intelligent traffic system that implements some embedded system for giving more priority of an emergency vehicle in a traffic control system. They measured the density of the vehicle by the infrared detector but could not work efficiently in real time scenarios. The toy car was used to make the prototype of a traffic model [4] Bauza et al presented a Cooperative Traffic Congestion detection (CoTEC) method for cooperative vehicular traffic system. The performance evaluation of this method is done using a unique open-source simulation platform called I TETRIS. The results show that the method provides better and accurate results for different traffic scenarios with congestion problems.

**II. METHODOLOGY**

- Multiple Images every second for checking the presence of an
- GPS sharing with the control room- Install a GPS

Ambulance using module Yolo. This trained machine learning module Yolo identifies each vehicle on the road. After detecting every vehicle, they categorize them into the emergency vehicle and regular vehicles. From the emergency vehicles ambulance is sorted out. Once the ambulance has been identified an indicator is initiated, which causes the next street lights to turn into blue color to warn the people.
Advantages of the proposed system

1. Traffic clearance starts before the ambulance can reach the junction which helps in avoiding major time delay.
2. No additional changes have to be made for the vehicle.
3. No threats of database outflow.
4. Additional backup is provided using GPS.

The rest of the paper is as follows: Section II provide an overview of the surveys. We provide an overview of each equipment and the process in Section III. Section IV preview the research methodology, sources of data, research approach and discuss the experimental results. Conclusion and future work are draw in Section V.

III. LITERATURE SURVEY AND COMPARATIVE ANALYSIS

[1] Nellore et al calculated the distance of an emergency vehicle using the camera and informing the Traffic Management Centre (TMC). They used visual sensing technique. A camera was used to record 1920 × 1080 pixels video with 30 frames per second. Tracking device into the ambulance. Signals are transmitted from the satellite to the receiver. The receiver calculates the distance between itself and the satellites in real time. A report is created showing ambulance’s travel distance or movement, coordinates and speed. The data is transmitted to the GPS server using a wireless or cellular network. GPS servers allow end-users to access reports in real-time from their computer, Smartphone or tablet. When the ambulance is within 1 km of a traffic light the ambulance driver activates the GPS system, by doing so the location of the ambulance is shared with the control room alerting the traffic police for traffic clearance. Using the driver’s Smartphone, the live location of the ambulance can share with the control room.

(2) Capturing the ambulance using camera - when the ambulance reaches 500m mark and crosses the CCTV camera placed on one of the street lights, Images are taken every second with the help of CCTV camera used as input to ML module Yolo for identification of ambulance. (3) Using Machine Learning module for ambulance identification- YoloV3 uses a deep convolution neural network called Darknet-53 architecture. It is a 53-layer neural network trained on ImageNet for classification combined with detection layer making the total network 106 layers deep. The variation of neural network that is very popular and accurate for image related task in called Convolution neural network (CNN). First task of this ml module is to segregate Vehicle and Non-Vehicle objects using “Slid Window” method. Later it has to classify the vehicles into types of vehicles like car, truck, motorbike. Now finally come to the category of trucks and when the yolo model comes across the predetermined features of an ambulance, it successfully recognizes it and builds an active response for further tasks.[4] Manipulate Lights based on response from ML module—Upon on identification of ambulance yolo module produces an active signal that instructs the lights to change colour into blue using an electric impulse and also display “MEDICAL EMERGENCY LOGO” on the traffic signal.[5] Instructions for public—Once the lights turns blue and logo is displayed, public are hereby informed about the arriving ambulance and are requested to clear the left side of the road and move to the right hence free up the space for ambulance to pass. If the traffic is too heavy then [6] Return to regular—Once the ambulance is out the control of the traffic signal is given back to the control system and the blue lights are returned to normal or turned off. The camera also starts capturing images and runs through module for further ambulance detection.

IV. RESULT AND DISCUSSION

So basically, the project works like a loop. Let's take the first case if an ambulance is being detected by the cameras it sends the signal, then a blue colour light is turned on with the help of street lights where, Incandescent lightings with deployed halogen bulbs are used which provide highly efficacious illumination which is brighter than the drivers ambient lights which is also visible in daylight. These lights help the people in road rage to understand that there is an ambulance coming and this also helps in alerting the people on the either side of the roads. Simultaneously the symbol shown in the Fig [1] is being displayed on the traffic head lights which alerts that an ambulance is on the way. The camera monitors constantly. But when an ambulance is not detected it continues the loop. This helps in reducing the chances of being stuck at traffic and allows the ambulance to reach its destination. Fig [2] basically explains about the working process. Fig [3], Fig [4], Fig [5] are the sample models of how the ML modules works.
Medical Emergency Logo
This is the symbol which displays on the traffic headlight.

Illustrating mode of functioning

Sample of Blue Street lights for alerting the public

Fig [1]

Fig [3]
These are the module images which help in detecting an Ambulance.
Fig [6] shows the most effective cause for an ambulance getting delayed is due to traffic congestion. This project helps us in overcoming the situation and reducing the risk rate of it.

V. CONCLUSION AND FUTURE SCOPE

This paper proposes a solution to put an end. The main reason in India is that a third lane cannot be developed for ambulances so, we have proposed this idea which can save people lives by clearing the traffic by turning on the GPS and triggering the lights into blue colour for alerting the people. The main scope of this paper is to reduce the death rate of people whose ambulance gets stuck in traffic, despite being able to survive yet fail too because of delayed treatment.

ACKNOWLEDGMENT

The team members of the research project want to sincerely thank our guide Associate Professor Dr. N.Vinaya Kumari and the Department of Computing Science and Engineering, Malla Reddy Institute of Technology and Science, India for their encouragement and support for completion of this work.

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