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Traffic Clearance for Ambulance using Deep Learning

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***Abstract*—The basic mode of transportation for limited distances is mostly through road ways. As the problem of urban traffic overcrowding spreads, there is a pressing need for the introduction of advanced technology and equipment to improve the state-of-the-art traffic control. Nowadays traffic problem is increasing because of the increasing number of vehicles and the limited resources provided by the current infrastructures. Due to this, the waiting times at signals accumulate, and lead to wastage of time. In concern with this problem, we have proposed a system that will help emergency vehicles like ambulance, fire brigade, police cars, etc. to pass through the junctions without being stopped. The article presents an application of computer visualization method along with deep learningfor traffic flow monitoring and road traffic analysis. The application is utilizing image processing and pattern recognition methods planned and personalized to the needs and constrains of road traffic analysis.**

***Index Terms*— Deep Learning, Convolution Neural Networks, Image Processing, Image Classification, Image Segmentation, Traffic.**

I. INTRODUCTION

Vehicular traffic is endlessly increasing everywhere in the world, and can cause terrible traffic congestion at intersections. Most of the traffic lights today feature a fixed green light sequence;therefore, the green light sequence is determined without taking the presence of emergency vehicles into account. Emergency vehicles such as ambulance, fire engines, police cars, etc. In most of the heavily populated cities, traffic congestion has become a major problem and it has almost become impossible for the emergency vehicles like Ambulance to reach the destinations on time. Stuck in the traffic jam and delayed in reaching their destination can lead to loss of property and valuable lives. Traffic flow monitoring and traffic analysis based on computer visualization techniques, and specially traffic analysis and monitoring in a real-time mode raise valuable and complicated demands to computer algorithms and technological solutions. Most realistic applications are in vehicle tracking, and the critical issue is initiating a track automatically. Traffic analysis then leads to reports of speed violations, traffic congestions, accidents, or against the law actions of road users. Many scientists and researchers suggested a variety of approaches to these tasks. The approach in this article focuses on methods of image processing, pattern recognition and computer vision algorithms to be useful to road traffic examination and monitoring. One of the most important aspects was to modify these algorithms to fit to real-time road monitoring processes, and therefore the model of system for traffic analysis was developed.

II. RELATED WORK

A. Traffic Control System for Emergency Vehicle Clearance:

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Author: Kapileswar Nellore(2016):
Objective: Proposed a mechanism using integrated sensors.
Methodology: Sensors detects the object in real time video using camera by considering intersection, velocity, traffic density etc.
Output: Traffic signal turns green until the emergency vehicle is passed and reverts to its original state.
Drawback: Sensors may fail due to malfunctioning

B. GPS based Traffic Signal Control System for Ambulance using Machine Learning:

Author: M. Abhirami (2021):
Objective:Ambulance driver will have a mobile app, which has emergency toggle.
Methodology:Through the toggle, signal is sent to nearest Traffic intersection to change its status.
Output:With the use of machine learning the request is sent to freeze the green light until the vehicle is passed.
Drawback: The signal will remain green until the vehicle is passed, it may cause traffic congestion.

C. Intelligent traffic signal control system for ambulance using RFID and CLOUD:

Author: B. Janani Saradha, G. Vijaya Sri(2017):
Objective: An android app to connect both the ambulance and the traffic signal station using cloud networking.
Methodology: When the ambulance halts in the traffic signal, RFID installed at the traffic signal tracks the RFID tagged ambulance and sends the data to the cloud.
Output: The particular signal is made green until the ambulance passes-by; it regains its original flow after it.

III. PROBLEM DEFINITION

In 2017, around 24,012 people died due to delay of ambulance to reach the destination due to traffic. Unfortunately, every year 30% of deaths are caused due to delay of ambulance or other emergency vehicles.As compared to other countries, which are equipped withsophisticated emergency system, India has very few systems that could play major role in managing health emergency. The country has emergency telephone numbers that can be dialled to seek help in accidents or disaster, such as 108 for ambulance, 100 for police and 101 for fire and rescue. A typical problem faced is reaching the location of the patient or victim to provide the help due to terrible traffic management.

IV. SYSTEM ARCHITECTURE

Figure 1 shows the system architecture of the proposed system. Traffic management isdone by continuously capturing the video of vehicle on road and processing it using Convolution Neural Network (CNN). CNN is a class of artificial neural network, most commonly applied to analysevisual images.It automatically extracts the important features of the vehicle and detects the type of vehicle without any human supervisions. The proposed solution uses a dataset for this project retrieved from Kaggle and Google, and using this dataset the features of the Ambulance i.e., siren, colour scheme and stickers.
There are 5 layers in CNN, namely: Input, 2 hidden layers, Pooling and Output.
Input layer- The data is given as input in this layer which is in form of images.
1st hidden layer- The given images are divided into pixels.
2nd hidden layer- The divided pixels will be assigned with color values that ranges from 0-255 used to write the values of the pixels
Pooling layer- The combination of all the pixels is known as pooling. This layer decreases the required number of weights or computations which helps to retrieve the output.
Output layer-The output is retrieved.
Ambulance naming on the front is compared with the other vehicles found in the video. If any of the vehicle has the features of the Ambulance, then that vehicle is cropped and the image processing takes place. When the vehicle detected is confirmed to be the emergency vehicle, the signal will be turned green in the path where the ambulance is moving and thus provides a clear path to reach its destination.

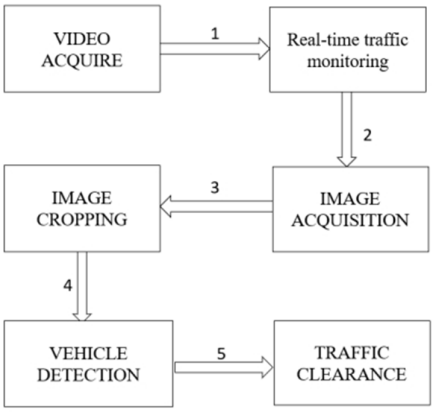

Figure 1: System Architecture

1. Camera is used to record and monitor the real time traffic.
2. If an ambulance is identified the image is captured to check the specifications of the vehicle.
3. CNN is used extract the specified vehicle from the image by considering each frame.
4. The image is cropped for the specific ambulance and divided into pixels and vehicle is identified.
5. Then the traffic signal is turned green until the ambulance is passed and again retains to the original state.

V. PROPOSED SYSTEM

Figure below showsdata flow diagram of the proposed system. The user provides a data, which is in form of a video. Using the datasets provided, the frames of the ambulance in all possible angles are extracted and further leads to object detection in the video data provided.
The weights classification or featuresis done comparing the features of the ambulance with all the vehicles in the video data. If the features match with any of the vehicles in the video, the vehicle identification is done. The vehicle identified will be classified away from all other vehicles in the video data and finally the signal in which the Ambulance is moving towards is turned green and provides a free flow for the traffic.

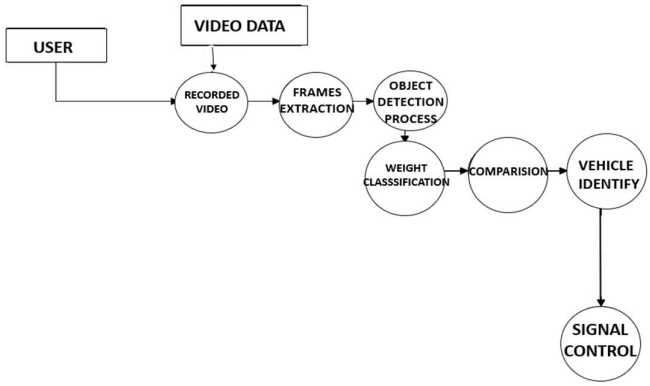

Figure 2: Design diagram

VI. FUNCTIONAL REQUIREMENTS

User: who will use the application.
Reg: In this module, the user will enter the details like Name, Username, Password, Email, Phone etc to store the data into the server, which will be used by the user to enter into application.
Login: In this module, the user will specify his credentials like Username and Password to enter into the application for using the application.
Video Upload: In this fragment, user can upload Videos.
Frames Extraction: In this fragment, after uploading video frame extraction will be done frames are extracted based on low- or high-level features

Vehicle Identification: After detecting the object in each frame it will detect the vehicle on that object.
Signal Control: Based on vehicle it will count the number of vehicle and calculate the vehicle density after that it will control the signal based on vehicle count.

VII. Working of the Project

The input is given in the form of recorded videos. The main objective of this phase is the pre-processing of the object. As we are using CNN algorithm pre-processing required is much lower.
Pre-processing is noise cancellation and correction of the video i.e., cleaning of the unwanted contents in the video. Identifying certain frequency that have the higher level of background noise and subtracting those bands from the original video is done through noise cancellation using filters.

VIII. Results

Ambulance Detection (Snapshots):

The above snapshots are a clear picture of how our project is detecting only the emergency vehicle i.e., the ambulance based on the datasets we have provided. As mentioned before, the ambulance is detected based on the features we have provided. The vehicle is identified as emergency and is detected in 0.59 secs in the first picture and 0.60 secs in the second picture.

IX. Conclusion

Traffic congestion is one of the most commonly faced problem in today's world and this project helps in providing a clear path for the Ambulance. The proposed solution helps clear traffic congestion in case of emergency and saves many lives. The system works more effectively in the traffic signal junctions where the congestion is more and provides a green zone in the path where the Ambulance is moving

X. FUTURE WORK

Instead of assigning our project only for the Ambulance, we can add more datasets of other emergency vehicles like Fire Engines, Police Cars, etc and thus our project can help in Traffic Clearance not only for the Ambulance, but also for the other emergency vehicles as mentioned above.

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