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Reduction of Ambulance Response Time and Accident Detection using IP and CPM

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Abstract: ***The usage of vehicles is rapidly increasing due to recent technological and economic development, and at the same time, the lack of infrastructure against the demand is leading to an increasing number of accidents and fatality of life. The trivial issues in our life system motivated us to come up with an application to automate this process and save lives. With a review of literature and brainstorming, I proposed the project on a smart traffic management system using image processing. The objective of this project is to develop a detect ambulance using image processing and machine learning techniques. In the first phase, we determined traffic density to minimize the delay caused by traffic congestion and to provide the smooth flow of vehicles. The density of vehicles on each side can be identified by using datasets. If the density is low on a particular side, the period for that side is normal and if the density is high the period will automatically increase compared to normal density. In the second phase, we simulated a crash or accident detection and for the prototype consideration, we have used static accidental image and trained model. In the third phase, analyzed ambulance detection using the dataset, for the prototype consideration for this, used static ambulance image and trained dataset. On detection of an ambulance, the traffic light is automatically changed to green. In each phase, the data updating and monitoring are provided. This scheme is fully automated and identifies the emergency vehicle and controls the traffic lights dynamically. Hence, the traffic management module is done using image processing techniques.***

Keywords: Image processing, OPEN CV, CNN, GUI, Traffic density Analysis.

I. INTRODUCTION

Image processing is a method to convert an image into digital form and perform the necessary operations on it, to get an enhanced image and information. It is a type of signal dispensation in which input is an image, like a video frame or photograph or characteristics associated with that image. The image processing system includes considering images as two-dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technology, with its applications in different aspects of a business. Image Processing forms the core research area within engineering and computer science. Image processing includes Importing the image with an optical scanner or by photography, Analyzing and manipulating the image which incorporates data compression, image enhancement and spotting patterns that are not visible to human eyes like satellite photographs, and the output is obtained in the last stage in which the result can either be an altered image or a report that is based on image analysis.

II. EXISTING SYSTEM

The Association for Safe International Road Travel (ASIRT) reports, annually approx.1.3 million people fatality on the road, 20-50 million of road users are incapacitated. Road crashes cost 1-2% of their annual GDP in different countries. Currently, Road traffic crashes rank as the ninth leading cause of death and account for 2.2% of all fatality globally. If it is not mitigated, road traffic hurts are predicted to become the fifth by 2030. The challenges imposed on local public servicing outsourcing in saving human lives resulting from vehicle accidents have become a critical concern. An automated and intelligent mobile solution is required for a zero-mortality rate since there is a lack of automated on-site medical assistance, late accident reporting, inaccurate geographic location, and lack of injured medical information. The current existing solutions that assist passengers in case of a vehicle accident are concerned with user interaction after the incident. Those mobile solutions require that the injured must launch the app and request help manually and that would not be possible if he/she is under the critical or serious non-vital situation. The situation becomes even worse if passengers go under an unconscious state. Traffic lights which are of current technology use a manual operating system for the time allocation and also require high maintenance during the operation. This causes, time lapsing, and an increase in vehicular traffic. In the existing system, the traffic congestion is predicted manually which is hectic and involves manual efforts. Similarly, accident detection is predicted manually and doesn't ensure quick first-aid.

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On the whole, in the existing system, the traffic management system is manual and not automated, right from traffic lights, accident detection, emergency vehicle detection, and regulating the traffic which isn't as efficient as the automated system. This proposed system i.e. Smart Traffic Management System dynamically can change the signal lights based on the traffic density, detect a crash and detect emergency vehicles and regulate the traffic accordingly.

III. OBJECTIVE OF SYSTEM

1) To calculate traffic density.
2) To detection of ambulance in traffic.
3) To detection of accident.

IV. LITERATURE SURVEY

"Traffic surveillance by using image processing", a paper of Susmita A. Meshram. A paper state that Road traffic and traffic congestion are major problems worldwide. To avoid such problems surveillance is the most economical technique for monitoring road traffic. Traffic monitoring has become vital to make sure quick detection of an incident's location, to avoid traffic and obstacles due to traffic. There are several methods to monitor the road traffic. One of the methods is Image processing. Digital image processing uses algorithms to process digital images. This paper includes Image processing for traffic surveillance.

"Smart Control of Traffic Light System using Image Processing" a paper of Khushi. A paper presents the congestion of the urban traffic is becoming one of critical issues with increasing population and automobiles in cities. Traffic jams not only cause extra delay and stress for the drivers, but also increase fuel consumption, add transportation cost, and increase carbon dioxide air pollution. The traffic controller is one of critical factors affecting the traffic flow. The conventional traffic patterns are nonlinear and complex and time dependent rather than traffic dependent. This paper proposes a traffic control system based on image processing using MATLAB code which changes the time of green, amber and red light with respect to the traffic density and traffic count. Two Arduino UNO is used, one for controlling green and amber lights and other for controlling red light. This is a continuous process.

"Real-time area-based traffic density estimation by image processing for traffic signal control system: Bangladesh perspective" is a paper of Mohammad Shahab Uddin. It states that, Traffic congestion is a daily occurrence in most urban areas of Bangladesh now a day. In the last 10 years the scenario has worsen due to rapid increase of vehicles and insufficient roads to accommodate them. This paper describes a method of real time area-based traffic density estimation using image processing for intelligent traffic control system. Area occupied by the edges of vehicles will be considered to estimate vehicles density. Calculating the areas of different live roads, the system will automatically estimate the traffic density of each road which will help to determine the duration of each traffic light. An intelligent traffic signal control system with the proposed traffic density estimation technique will be far better than the conventional timer-based system of Bangladesh. The main contribution of this research lies in the development of a new technique that detects traffic density according to the area of the edges of vehicles for controlling traffic congestion. Specialized algorithm, morphology and images captured with cameras will be used for the detection of traffic density for the intelligent traffic control system.

"An Image Processing and Artificial Intelligence based Traffic Signal Control System of Dhaka" is paper of author Abu Salman Shaikat. This paper presents, Traffic jam is one of the greatest problems of Bangladesh. It affects mostly on its capital city, Dhaka, where density of population is second highest among the world. One of the major reasons for occurring traffic jam is inaccuracy of the use of traffic signal. This paper introduces an intelligent traffic control system for four nodes traffic system. This system is entirely controlled by the use of image processing and artificial intelligence techniques. Image processing leads for detecting the density of vehicles by using Haar Cascade method, whereas artificial intelligence helps to modify the timing of traffic signal accurately time by time. This process held automatically and police can monitor from police box all over the time by computer. Moreover, in case of emergency, a manual system is introduced, which can support traffic police to turn the system to manual and operate the timing manually. Finally, traffic data is collected from road and prove the effectiveness of proposed system. This system will support as an extremely effective, self-coordinated and self-organized traffic control appliance.

V. PROPOSED SYSTEM

The objective of the proposed project is to develop a simulator to determine the traffic density, ambulance, and accident incidents using image processing and machine learning techniques. In the first phase, we determined traffic density to minimize the delay caused by traffic congestion and to provide the smooth flow of vehicles.

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The density of vehicles on each side can be identified by using datasets. If the density is low on a particular side, the time for that side is normal and if the density is high the time will automatically increase compared to normal density. The second phase work simulates a crash or accident detection and for the prototype consideration, used static accidental image and trained model. During the third phase, analyzed the ambulance detection using a dataset, for the prototype consideration used static ambulance image and trained dataset. On detection of an ambulance, the traffic light is automatically changed to green.

VI. SYSTEM ARCHITECTURE

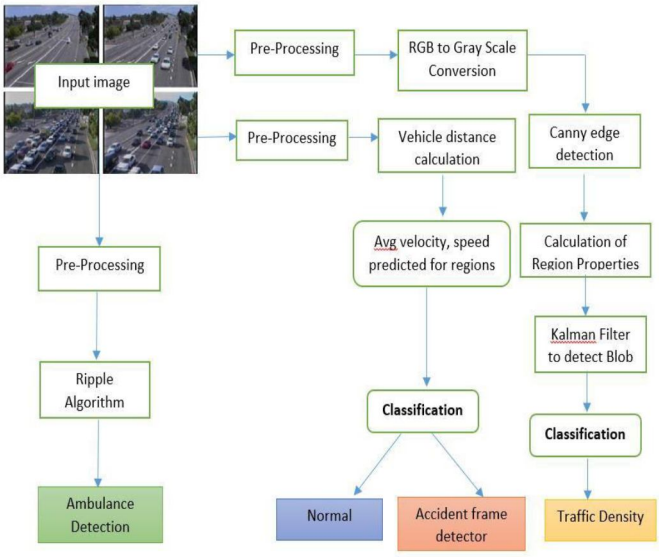


Fig -1: System Architecture Diagram

VII. IMPLEMENTATION DETAILS (MODULES)

The project involved analyzing the design of few applications so as to make the application more users friendly. To do so, it was really important to keep the navigations from one screen to the other well-ordered and at the same time reducing the amount of typing the user needs to do. In order to make the application more accessible, the browser version had to be chosen so that it is compatible with most of the Browsers.

A. Upload images

Uploading the image is done by user. Authorized person is uploading the new arrivals to system that are listed to users. Once the file is uploaded, then it is Image Pre-processing the Image to OpenCV in Serval operation to automated Traffic Scenes identification detection.

B. Analysis image

Object detection in computer vision. Object detection is the process of finding instances of real-world objects such as Car, bicycles, and Traffic sign in images or videos. Object detection algorithms typically use extracted features and learning algorithms to recognize instances of an object category.

C. Object Detection Images

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, cars, bicycles, Traffic sign) in digital images and videos.

D. OPENCV

Open CV is a library of programming functions mainly aimed at real-time computer vision. Open CV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, So OpenCV-Python is an appropriate tool for fast prototyping of computer vision problems.

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E. Ambulance Detection

The ripple algorithm is proposed and aims to detect the Ambulance from images obtained by a clear image. It can extract features of the target which are almost invariant when image rotations or target translation and scaling, such that it can detect targets. Moreover, by the templates representing targets, it also can detect the target using machine learning models which we have used to train the system. Template Matching is a high-level machine vision technique that identifies the parts on a picture that match a predefined template. The Advanced template matching algorithms, Convolutional Neural Network allow us to find occurrences of the template regardless of their orientation and local brightness.

F. Notification

Our System able to notify the particular user about the particular live traffic condition according to their types. The higher density of vehicle and traffic jams are notify to Traffic Police Login, Accidents are notify to the Nearest Hospital, etc.

VIII. ALGORITHM/TECHNOLOGY

A. Convolutional Neural Networks (CNN)

Convolutional Neural Networks (CNN) is one of the variants of neural networks used heavily in the field of Computer Vision. It derives its name from the type of hidden layers it consists of. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers, and normalization layers. Here it simply means that instead of using the normal activation functions defined above, convolution and pooling functions are used as activation functions. To understand it in detail one needs to understand what convolution and pooling are. Both of these concepts are borrowed from the field of Computer Vision

B. Region-based Convolutional Neural Networks(R-CNN)

R-CNN is a state-of-the-art visual object detection system that combines bottom-up region proposals with rich features computed by a convolutional neural network. At the time of its release, R-CNN improved the previous best detection performance on PASCAL VOC 2012 by 30% relative, going from 40.9% to 53.3% mean average precision. Unlike the previous best results, R-CNN achieves this performance without using contextual rescoring or an ensemble of feature types. To bypass the problem of selecting a huge number of regions, Ross_Girshick et al.proposed a method where we use selective search to extract just 2000 regions from the image and he called them region proposals. Therefore, now, instead of trying to classify a huge number of regions, you can just work with 2000 regions.

R-CNN algorithms have truly been a game-changer for object detection tasks. There has suddenly been a spike in recent years in the amount of computer vision applications being created, and R-CNN is at the heart of most of them.

C. YOLO Algorithm Steps

1) *Step-1:* YOLO first takes an input image
2) *Step-2:* The framework then divides the input image into grids (say a 3 X 3 grid) Image classification and localization are applied on each grid. YOLO then predicts the bounding boxes and their corresponding class probabilities for objects (if any are found). Suppose we have divided the image into a grid of size 3 X 3 and there are a total of 3 classes which we want the objects to be classified into. Let's say the classes are Pedestrian, Car, and Motorcycle respectively. So, for each grid cell, the label y will be an eight dimensional vector.
3) *Step-3:* Define a function to calculate the IoU between two boxes

a) pc defines whether an object is present in the grid or not (it is the probability)
b) bx, by, bh, bw specify the bounding box if there is an object
c) c1, c2, c3 represent the classes. So, if the object is a car, c2 will be 1 and c1 c3 will be 0, and so on.

4) *Step-4:* Define a function for Non-Max Suppression.
5) *Step-5:* Create a random volume of shape (19,19,5,85) and then predict the bounding boxes.
6) *Step-6:* Finally, we will define a function which will take the outputs of a CNN as input and return the suppressed boxes.
7) *Step-7:* Use the yolo-eval function to make predictions for a random volume.
8) *Step-8:* Use a pre-trained YOLO algorithm on new images.
9) *Step-9:* Define a function to predict the bounding boxes and save the images with these bounding boxes included.
10) *Step-10:* Read an image and make predictions using the predict function. Step-11: Plot the predictions.

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IX. SYSTEM REQUIREMENTS

A. Software Used

1) Python 4.4 or above
2) Anaconda 2
3) Windows 8 or above
4) VS Studio Code

B. Hardware Used

1) Processor: Pentium IV or higher
2) Minimum RAM: 4GB Required
3) 20 GB available hard disk space and Only(64-bit) Version

X. APPLICATION

1) Traffic management system.
2) Accident prediction system.
3) Accident control.

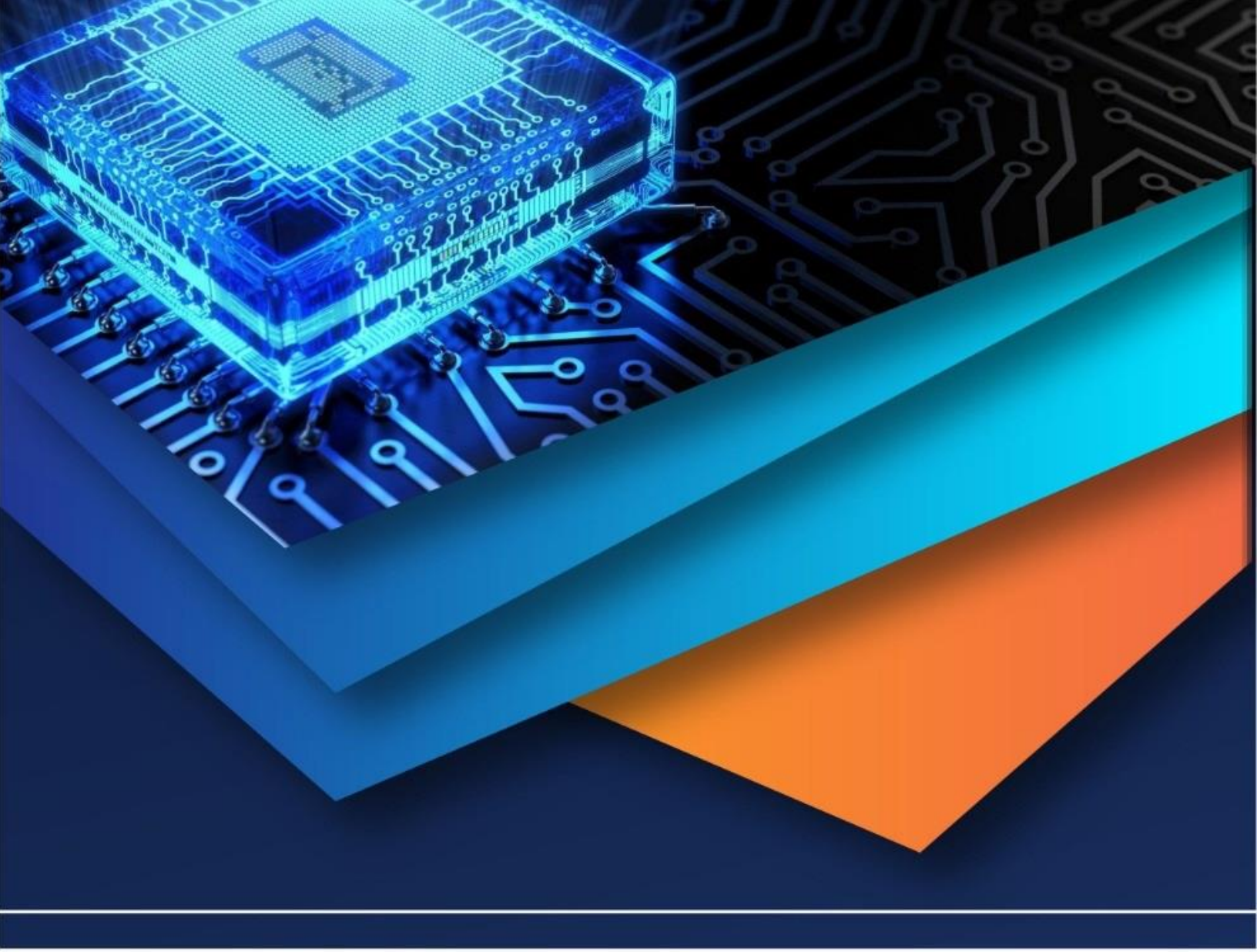
XI. CONCLUSION

Traffic Density Analysis, Ambulance, and Accident detection System Using Image Processing has been discussed in this proposed system. This project provides a framework that analyses the dataset input images. Periodic frames would help to increase the processing speed of the framework. BLOBS increases the efficiency and improves the detection as well as analysis of vehicles. The framework to automatically classify traffic, ambulance vehicle, and accidents in the roads using image processing and machine learning techniques is one of the most successful topic models.

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