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Vehicle Number Plate Identification and Speed Detection for Traffic Surveillance Prevention Using Machine Learning

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Abstract - **A traffic surveillance prevention system with vehicle number plate identification and speed detection using machine learning provides a complete traffic solution. By using only camera captures, a traffic observation system can measure major traffic boundaries from video layouts. This paper proposes to identify over-speeding vehicles' number plates and initiate an emergency message on detecting accidents. Utilizing the CCTV footage, vehicle detection takes place and the speed of the vehicle is derived using Open CV. The Number of the vehicle is recognized using contour under computer vision which is a field of machine learning that enables a computer system to derive meaningful information from digital images. The accident will be detected from the video input using the Convolutional Neural Network Algorithm and Computer Vision. On detecting an accident, an emergency message is initiated to the nearest control room with the corresponding location.**

Keywords- Number Plate Identification, Dense-net architecture, Machine Learning, Speed Detection, Accident Detection.

I. INTRODUCTION

The traffic Surveillance prevention system provides a comprehensive traffic solution, particularly in the areas of vehicle recognition, tracking, and accident identification surveillance cameras. Additionally, to detect any hazardous driving situations, ML-enabled systems should be able to identify each vehicle and track its characteristics. The number of people on the planet is growing, and as a result, so are the number of vehicles on the roads. The overuse of the roadways prevents smooth mobility of the vehicle traffic. An efficient traffic surveillance system that keeps an eye on the over-speeding of vehicles and detects accidents. Using an automated traffic monitoring system that can identify accidents in real time not only allows traffic managers to be informed of the accident's location but also has the potential to reduce the frequency of collisions by sending the number of over-speeding vehicles before the accident occurs, as well as generally contributes to improved traffic flow. In order to establish a reliable and flexible traffic monitoring system, anomalies such speed detection, number plate detection, accident detection, etc. need to be correctly detected.

II. RELATED WORK

Number plates and a traffic surveillance camera with GPS capability can be used to determine the location of an accident, and the traffic control kit is designed to detect over speeding vehicles. The vehicle is detected using the haar cascade classifier which specifically identifies the vehicles in the traffic [1]. ANPR, or automatic number plate recognition, is a form of image processing that uses number plates to identify the vehicle being by using the OCR (Optical Character Recognition). Then the accident is detected using the computer vision (Open CV) and dense Net algorithm an in-dept concept of convolutional neural network (CNN) using the reference [17]. The system creates complicated representations of data using denoising autoencoders that have been trained on regular traffic movies. By analysing the reconstruction error and the likelihood linked to these deep representations, accident detection is evaluated.[16].

III. PROPOSED METHOD

This traffic surveillance prevention system with accident detection using machine learning features a camera in its most basic form. (video input), and Open CV (Computer Vision) Technique that includes vehicle detection, and speed detection. The system is integrated with the Convolution Neural Network to enhance in order to do a number of surveillance tasks that will simplify usage, the existing video surveillance system can be enhanced significantly more than the conventional surveillance system by plugging into it. Hence, the computer integrated with this system will also be able to recognize the vehicle from digital videos. This Traffic Surveillance Prevention System is the most representative technology that can benefit people by providing a safer driving environment and information. Figure1 represents the project model. There will be a monitoring surveillance camera in this framework. Those surveillance cameras are utilized for detection of vehicle speed and number plate recognition then detection of the accident will also be done parallelly. If any of these cases the detection of over-speed or when an accident is found, a message is automatically transmitted to the closest control room.

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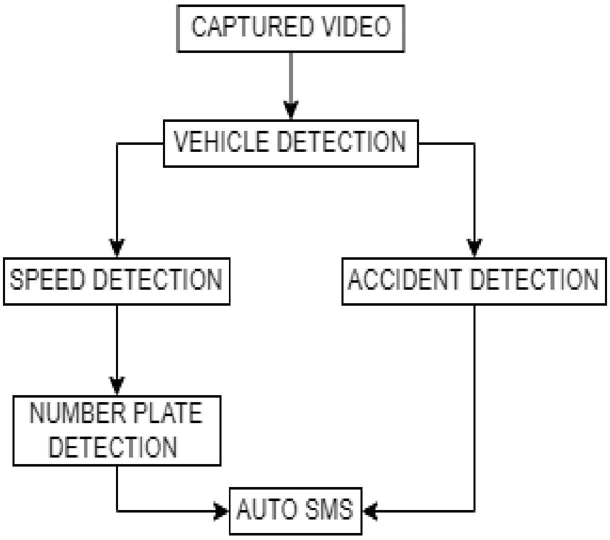

Fig.1. Flowchart of the Proposed System

A. Vehicle Detection

In order to identify automobiles inside an image, bounding boxes and labels for each item are often output. By utilizing categorization and localisation, it varies from the classification task of vehicles. For in-vehicle detection, for instance, all the vehicles must be identified. If we use the Sliding Window approach to categorize localized photos, we must apply an open cv to several picture cropping. Thus, the Haar cascade classifier algorithm which is a machine learning module that has the configuration used to detect vehicles.

B. Detection of Speed

This framework was implemented using the Open CV. To determine the velocity of the moving vehicle using a picture, the vehicle's speed is detected and then the video processing methods for open CV. Video is recorded, then examined to determine the vehicle's speed. Using the Moving cars are recognized using the masking techniques after frame subtraction. The time between frames and the corner detected object travelled in that frame are used to determine each vehicle's speed. For the various video sequences, a +/-2 km/h speed detection error on average was attained. The framework physically evaluated these values for the present street to determine pixels per meter (ppm), which was used for speed estimation. In order to be used on any other video, the value must be balanced because it will change from street to street. The system now determines the typical frame rate while processing videos.

d_meters= d_pixels/ppm (1)

Speed = d_meters * fps * 3.6 (2)

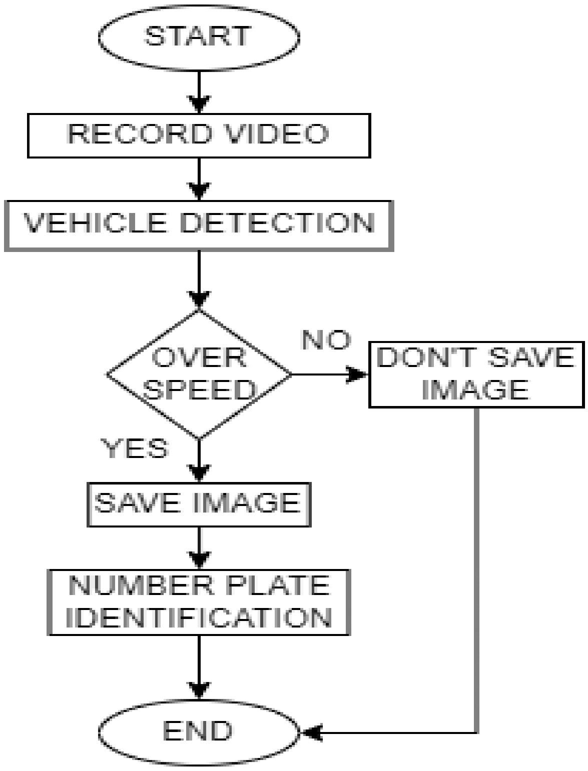

Fig.2. Proposed Speed Detection Flowchart

C. Identification of Number Plates

Detection of number plates is done by Contour under Computer vision which works over the picture. From the picture, extraction of the plate region is the first stage. It is initially transformed into a binary picture.

The approaches are then used to process the number plate's binarized image. First, a technique for extracting the text portions from a mixed image is utilized to locate this plate region. The image is processed alongside the scan lines, which are the vertical and horizontal runs. Some criterion tests are applied to the image by filtering procedures in order to locate the precise plate region and exclude the other parts . The next step is to cut the number plate characters after the number plate has been divided into its component components and the characters have been obtained separately.

Finding the beginning and ending locations of characters in a horizontal direction is how it is done. Before character recognition, each character is fitted to be the same size and has been standardized. Since the input image must be the same size as the database characters, a fitting strategy is required to match the characters with the database. The character image is compared to those in the database, and the number plate that results from that comparison is supplied as text with the highest degree of similarity.

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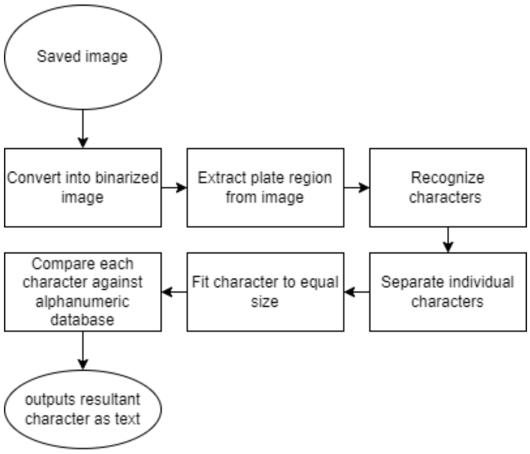

Fig.3. Proposed Number Plate Identification

D. Automation Detection

This section's main goal is to spot accidents on video using deep learning and computer vision. For implementing this framework, we are using Dense-Net from Convolutional Networks, which interface a feed-forward design connects every layer to every other layer. Dense-Net architecture is used within this framework to achieve the second goal, which entails frame-by-frame analysis to identify accidental and non-accidental frames. In the unlikely event that a risk occurs, a collision involving damaged automobiles should be considered. However, if any risk or collision didn't occur at that time, there is considered to be no accident.

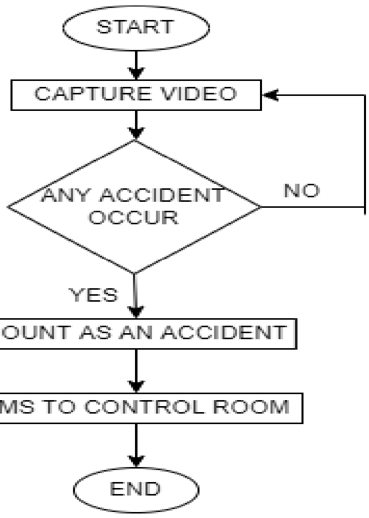

Fig.4. Proposed Accident Detection Flowchart

E. Alert Message

In this structure, when an accident is discovered, the closest control room receives an emergency notification. with the corresponding location. An emergency message will be initiated in two instances for speed detection and accident detection.

IV. EXPERIMENTAL RESULT ANALYSIS

A. Vehicle Detection

In this process, we give input by capturing video from a surveillance camera. A recorded video can be split into frame-by-frame images. That frame is captured using the stop motion effect. A unique method known as "stop motion" creates brief pauses between each frame. Actually, an action is produced by a series of images (video). This stop motion effect is applied to video recorded through surveillance cameras to save each frame. The Haar cascade classifier machine learning module is specifically used to detect the vehicles in openCV2. This method processes information more quickly and at a lower cost computationally. The testing conducted on the road demonstrate that it is a reliable real-time algorithm that is quite competitive with the current architecture.

B. Speed Detection

In this module, the Open CV2 (Open-Source Computer vision library) and Dlib machine learning toolkit are used to detect the speed of a vehicle. We need pixels per meter to calculate the distance travelled in meters with the distance travelled per second in meters since the speed of a vehicle is determined by the distance moved by the monitored vehicle in a second in terms of pixels. We shall learn a vehicle's speed.

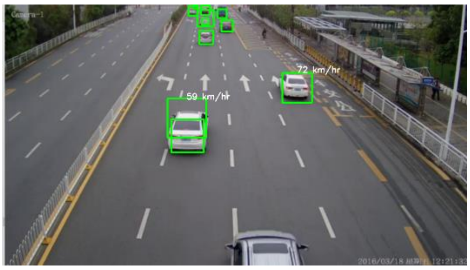

Fig. 5. Speed Monitoring

C. Detection of Number Plates

The first step is to extract the plate region from the stored image. The camera's image is first transformed into a binary image, which consists entirely of 1s and 0s (pure black and white). By thresholding all of the input image's pixels with pixel values of 0 (black), luminance less than the threshold value and 1 (white) for all other pixels.

The binarized image is subsequently subjected to various processing techniques. to locate the plate zone, which is a technique for removing text from mixed images. Once the location of the plate has been determined, filtering processes are used to apply some criterion checks to the image. The area involving just the plate is cut after finding the plate's placement.

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The characters are separated from the license plate into their component pieces. The plate characters must then be cut. Finding the beginning and ending locations of characters in a horizontal direction is how it is done. The characters are then adjusted for size. Since input photos must have the same size as database characters, a fitting strategy is required to match the characters with the database. The character image is compared to those in the database, and the number plate that results from that comparison is supplied as text with the highest degree of similarity.

Fig.6. Identified Number Plate

D. Automation Detection

In this framework, the accident on the camera is identified using computer vision and an extended deep learning algorithm (Dense Net). Our network has L(L+1)/2 direct connections as opposed to the Dense Convolutional Network (Dense Net), which connects each layer to every other layer in a feed-forward fashion. Convolutional networks with L layers have L connections, one between each layer and its succeeding layer. There are various variations of the Dense-Net, including DenseNet-121, DenseNet-160, and DenseNet-201. The neural network's layer count is indicated by the numbers above. All of the previous layers' feature maps are utilized as inputs for each layer, and then those layers' own feature maps are used as inputs for all of the following layers. The vanishing gradient problem is mitigated, feature propagation is strengthened, feature reuse is encouraged, and the number of parameters is significantly reduced thanks to the dense net.

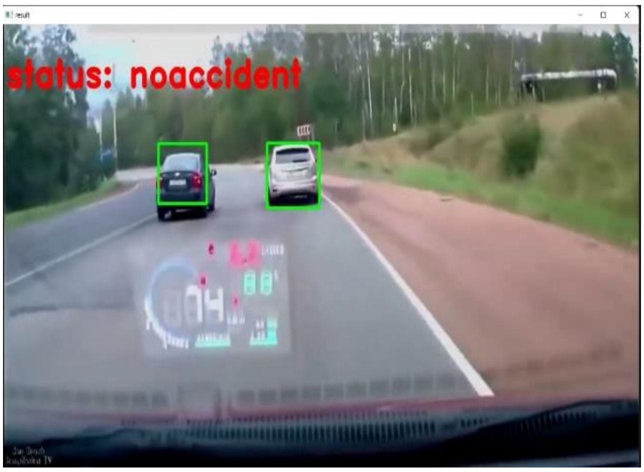

Fig.7. No Accident Detection

Fig. 8. Accident Detection

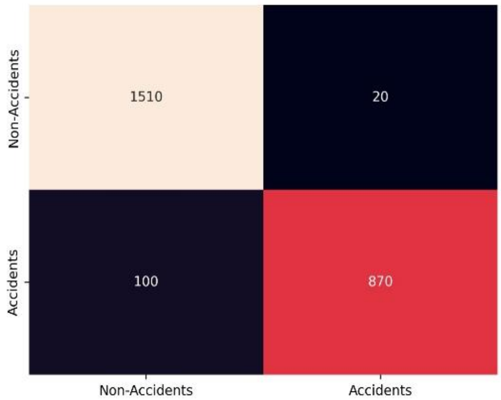

Fig. 9. Matrix representation

The above Figure 9. shows the confusion matrix of the accident and non-accident detection. In this accident and non-accident detection analysis part 85 % percentage of the data set are used for training and 15% dataset are used for testing. The overall mixed frames in accident and non-accident detection are totally 2500 frames are used. In that 970-accident frame, the overall correct predicted frames are 870 and then detected this accident frames as non-accident frames nearly 100. Then for non-accidental frame totally 1530 frames are used in that 1510 frames are predicted as correct frames whereas 20 frames are detected as accidental frame. So, the overall predicted total precision is 98.6% with an effective and reliable in real time scenario. Then for recall the total predicted value has around 94% ability to provide a positive output. From the result it shows that the Dense-net is very effective in running the detection of predicting the accident and no accident frame.

E. Alert Message

This framework is reliant on accident scene. When a car is traveling too fast, an emergency message will be initiated to the control room with the location of the vehicle with PywhatKit. When an accidental frame is detected, an emergency message will be initiated through pywhatkitto

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the nearest control room with the corresponding accident location.

V. CONCLUSION

This paper deals with the traffic surveillance prevention system with vehicle number plate identification and speed detection using machine learning. Automatic traffic monitoring systems now have a far wider range of applications thanks to the quick development of machine learning and high-performance computers. Automated traffic surveillance prevention systems employ methods like speed detection, accident detection, and number plate recognition. Watch the vehicle's speed, recognize the license plate, and look out for accidents. The system also sends notifications about the accident to the nearest control room. By using this system, we can actually manage to make a low-cost, flexible automated traffic surveillance prevention system.

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