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Smart Video Analytics System

Vishal SIngh[1], Swati Kumari[2], Vidur Sharma[3], Dr. Manjula Shanbhog[4]

[1]*Student, Dept. of Computer Science & Engineering, IILM CET, Greater Noida, Uttar Pradesh, India*
[2]*Student, Dept. of Computer Science & Engineering, IILM CET, Greater Noida, Uttar Pradesh, India*
[3]*Student, Dept. of Computer Science & Engineering, IILM CET, Greater Noida, Uttar Pradesh, India*
[4]*Professor, Dept. of Computer Science & Engineering, IILM CET, Greater Noida, Uttar Pradesh, India*

Abstract - *In the world where annually more than one million people die on the road, Lack of road traffic safety emerged as one of the major problems across the globe, results in increasing road accidents chances. Road traffic deaths and injuries have a terrible impact on individuals, communities, and countries. They involve a huge cost to overburden health care systems, occupy scarce hospital beds, consume resources, and end in significant losses of productivity and prosperity, with deep social and economic repercussions. The presented system would involve multiple CCTV cameras which will be mounted at a certain height, where nice footage can be recorded at various Red Lights across the cities. The designed system mainly focuses on the 'seat belt wearing' parameter of four-wheelers, i.e whether a driver is wearing a seat belt or not. The system will extract relevant images from footage for the image analysis and with the help of the computer vision; the system will determine whether a driver is wearing a seat belt. Similarly, our aim is to use technology to make the traffic environment more friendly and safe for everyone and every second. Now to make sure that people follow all the rules, we need to tell them their faults and see to it that they pay the fine. This will ensure that the person pays for his/her mistake and does not make them again in the future. Doing so will also increase the knowledge of traffic rules in the community.*

***Key Words*: Computer Vision, E-Challan Generation, Optical Characters recognition, Automated Number Plate Recognition, Computer Vision, Seat Belt, Image processing.**

1. INTRODUCTION

The aim of this research paper is to ameliorate the current problems being faced on a daily basis. For a better traffic environment for the cities and towns, the situation needs to be dealt with. To do this, technology will play an important role. The ability of technology to change our lives has been observed and is also being observed currently on a daily basis. Today we have the entire world connected with each other through a mobile device that we take for granted. We can access any file stored anywhere in the world in a split second, the technology of the cell phone is a simple example of what great wonders we can achieve. Similarly, our aim is to use technology to make the traffic environment more friendly and safe for everyone and every second. Now to make sure that people follow all the rules, we need to tell them their faults and see to it that they pay the fine. This will ensure that the person pays for his/her mistake and does not make them again in the future. Doing so will also increase the knowledge of traffic rules in the community.

In this research paper, it is explained, how an environment can be created where traffic violators are captured with the help of a camera and computer vision application during the violation of rules, and the fine is sent to the violator right that moment.

The smart analytics system will use the Automated Number Plate Recognition (ANPR) system, Red Light Violation Detection (RLVD) system. The system will provide assistance in detecting, Violators using a Cell phone while Driving, Absence of helmet, Triple Riding Detection, Data Visualization to name a few.

2. SURVEY OF LITERATURE

2.1 Road Safety Importance

Road traffic safety has emerged as one of the major problems across the world, as we all know it results in increasing road accidents and injuries. In recent times the government has imposed heavy fines for traffic rules violation so that people can take traffic rules more seriously. But we have also seen many people are still not abiding the traffic rules, risking their lives and others as well by not following the traffic rules properly.

Every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. Road traffic injuries cause considerable economic losses to individuals, their families, and to nations as a whole. These losses arise from the cost of treatment as well as lost productivity for those killed or disabled by their injuries, and for family members who need to take time off work or school to care for the injured. Road traffic crashes cost most countries 3% of their gross domestic product.

- Correct helmet use can lead to a 42% reduction in the risk of fatal injuries and a 69% reduction in the risk of head injuries.
- Wearing a seat-belt reduces the risk of death among drivers and front seat occupants by 45 -

50%, and the risk of death and serious injuries among rear seat occupants by 25%.
- The use of child restraints can lead to a 60% reduction in deaths. [4]

2.2 Automated Challan Generation System

An automatic E-challan generation for a traffic rule violation is an IoT based project module that will automatically detect violating vehicles and punish them accordingly. This module is designed to reduce the work of traffic police officers so that they can focus on other violations like illegal parking, driving on the wrong side, and drunk & driving. This module will work in order to reduce the violations and make the city a better and safe place for pedestrians and vehicles. The need for automation is increasing due to the growing number of vehicles on the road every day. It has become an impossible task for traffic police officers to watch and control every road and every vehicle. It is up to human beings to maintain discipline but in a densely populated country like India patience runs thin and forces the people to break the law. [5]

3. Research Methodology

The presented system uses the captured images of the 4 wheelers for analyses. The developed software checks the seat belt parameter from the images. If violation found then the system moves for Automated Number Recognition process, where the captured images of the car are scanned and the number plate is identified. The vehicle number is used as a key pointer and searches for all the data related to the vehicle's information such as the registration number, owner's name, type, etc.

This database will then be used for Automated Challan Generation System and the violator is fined right at the moment.

Seat Belt Detection:

For detecting the seat belt we have used The Canny Edge detection algorithm to identify the edges of the seat belt and a feature extraction algorithm called Hough Line Transformation is used to draw and identify the straight line for seat beat area.

Pre-processing

Pre-processing is the set of algorithms applied to the image to enhance the quality and details. It is a precisely important and common phase in any computer vision system.

Localization

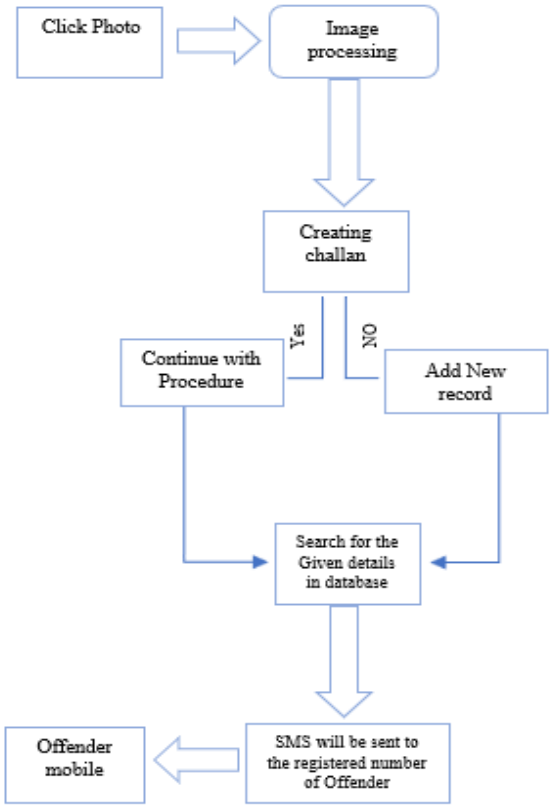
In this study, we have used the localization method to make use of the interested and required area from the whole image.

4. System Control Flow

4.1 Seat Belt Detection

There have been ongoing efforts regarding computer- vision based seat belt detection. The process of detecting whether a person is wearing a seat belt or not, is one of the most difficult tasks implementation wise. This is due to many reasons.

System Architecture



- The belt is small in width making it difficult to detect.
- There may be a time when the color of the belt will match the color of the clothes worn by the person which would make it even more difficult to detect, and will also give out false results.

To ensure that accurate results, an algorithm is needed to be designed that can further use the power of artificial

intelligence and neural networks to increase accuracy, whether the person has buckled up or not.

4.2 Number Plate Recognition

Number plate recognition is deterrent for serial traffic offenders. The software helps with reactive security as well, which includes inspections, forensics, investigations, and legal proceedings. No matter from the perspective you look at it, automatic license plate recognition seems like a necessity for ensuring our safety on the road. In fact, it could also be particularly useful when it comes to detecting stolen vehicles. The use of ANPR in this way has proved to be important in the detection of many offences, tackling uninsured vehicle use and uncovering cases of major crime. It also allows officers' attention to be drawn to offending vehicles whilst allowing law-abiding drivers to go about their business unhindered attention to be drawn to offending vehicles.

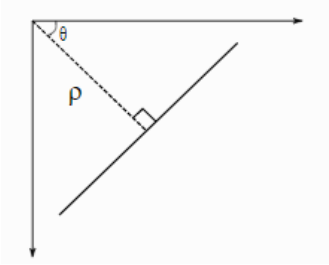
The role of ANPR is the key to ensuring that the violators pay fine and do not continue without doing so. Its use will give an easy way for the police to find the people who might abscond from the law. ANPR is an invaluable tool in the campaign to make our traffic environment smoother and safer. As ANPR has become established, equipment costs have dropped and technology improved which has allowed ANPR to be adopted by the Police. Automatic Number Plate Recognition (ANPR) is important for modern traffic enforcement and safeguarding public road safety in an ever-increasing road traffic volume. Automatic Number Plate Recognition systems identify unique vehicle number plates and generate vital traffic statistics to help government agencies to better monitor, maintain, and manage traffic situations, also as road system design and development.

5. RESULT AND DISCUSSION

When images are to be utilized in different areas of image analysis like visual perception, it's important to scale back the quantity of knowledge within the image while preserving the important, characteristic, structural information. For achieving better results, Hough Line Probabilistic Transformation is applied one the digital images. A line is often represented as y = mx + c or in parametric form, as

$$\rho = x\cos\theta + y\sin\theta$$

Where ρ is the perpendicular distance from origin to the line, and θ is the angle formed by this perpendicular line and horizontal axis measured in counter-clockwise.



So if the line is passing below the origin, it will have a positive rho and angle less than 180. If it is going above the origin, instead of taking an angle greater than 180, an angle is taken lesser than 180, and rho is taken negatively. Any vertical line will have 0 degrees angle and horizontal lines will have 90 degrees. [2]

Fig - 1 Seat belt detection result, the prediction result is of good quality as it correctly marks the seat belt area.

Fig. 1 is showing the seat belt detection result, we are achieving these results after doing some pre-processing at the given input image.

In the first step, the system transforms the given input image to Grayscale after this step image blur is applied for image smoothening.

In the second step, the Canny Edge Detection algorithm is applied to converts images into edges. After successful completion of the above-described steps, Hough Line Proabablistic Transformation starts drawing lines in the seat belt area, as shown in fig. 1.

After the successful seat belt detection. The system moves to analyze other images.

Fig - 2 No Seat Belt detection result

If the system failed to detect a seat belt from an image then it moves to the next step, where the automated number plate recognition process takes place.

Fig - 3 Car Front Cropped image

5.1 Pre-processing

For the present system pre-processing involves two processes: Resize – The image size from the given input image. It is to be resized to a feasible aspect ratio. Normally, these images will be in RGB mode, with three channels (red, green, and blue). The number of channels defines the amount of color information available on the image. The image has to be converted to grayscale.

5.2 Localization

For the present system pre-processing involves two processes: Resize – The image size from the given input image. It's to be resized to a feasible ratio. Normally, these images are going to be in RGB mode, with three channels (red, green, and blue). The number of channels defines the amount of color information available on the image. The image has to be converted to grayscale.

Localization is done by using an image processing technique called Thresholding. The pixels of the image is truncated to two values depending upon the value of the threshold. Thresholding requires pre-image analysis for identifying the suitable threshold value. The adaptive thresholding technique determines a local threshold value for every image pixel so on avoid the matter originating from non-uniform illumination. [7]

Fig - 4 Drwaing Cantours result, the images is showing a rectangular drawn at the number plate area

5.3 Character Recognition

Finally, the selected blobs are sent to an Optical Character Recognition (OCR) Engine, which returns the ASCII of the license number.

6. Conclusion and Future Research

In this research paper, our main focus was to make a safer traffic environment. But in the future, this video analytics system can be integrated into other places as well. For example, the system can be used to secure a particular residential society or secure an airport by identifying threats with the help of AI.

Using cameras, sensors and powerful algorithms coupled with Artificial Intelligence holds a lot of potential in the future. This combination is what the next generation will be leveraging in their everyday life. It is our time to develop technologies that would benefit future generations and see to it that simultaneously a safer environment is also achieved.

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