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TRAFFIC RULES VIOLATION DETECTION SYSTEM

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ABSTRACT

Traffic Rules Violation Detection withComputer Vision is a project aimed at automating the process of detecting traffic violations using computer vision techniques. The system utilizes CCTV camera footage to detect and track vehicles, and then identifies various types of traffic violations such as signal violation, parking violation, and wrong direction violation. The project also includes a user-friendly graphical user interface (GUI) that allows users to monitor the traffic footage,receive alerts about violations, and take necessary actions.

The system's methodology involves several steps. First, the input frames from the CCTV footage are preprocessed using techniques like grayscaling, blurring, background subtraction, and binary thresholding. These processes help in extracting the moving objects, i.e., vehicles, from the frames. Next, a vehicle classification model based on the MobileNet V1 architecture is used to classify the detected vehicles into car, motorcycle, or non-vehicle categories.Once the vehicles are classified, the system proceeds to detect traffic violations.

Signal violation is detected when a vehicle crosses a predefined line on the road during a red signal.Wrong direction violation is detected by tracking the movement of vehicles and determining if they are traveling in the wrong direction based on their positions.To manage the data and facilitate system operation, an SQLite database is employed. The database consists of tables such as Cars (containing information about recorded cars), Rules (storing traffic rules and fines), Cameras(holding details about camera locations and feeds), Violations (recording instances of rule violations), and Groups (for organizingcameras into groups).

The implementation of the project involves using OpenCV for image processing and computer vision tasks, while TensorFlow is utilized for training the vehicle classification model. The GUI is built using the PyQt5 library, providing users with options to managecameras, view violation records,

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add cars and rules, search for vehicles, and more. The GUI also offers visual representations of cameras and violations, making it easier to monitor and analyze the detected violations. Overall, Traffic Rules Violation Detection with Computer Vision aims to automate the process of traffic violation detection, enhance the efficiency traffic monitoring, and provide a user-friendly interface for

1. INTRODUCTION

The increasing number of cars in cities can cause high volume of traffic, and implies that traffic violations become more critical nowadays in Bangladesh and also around the world. This causes severe destruction of property and more accidents that may endanger the lives of the people. To solve the alarming problem and prevent such unfathomable consequences, traffic violation detection systems are needed. For which the system enforces proper traffic regulations at all times, and apprehend those who does not comply. A traffic violation detection system must be realized in real-time as the authorities track the roads all the time.Hence, traffic enforcers will not only be at ease in implementing safe roads accurately, but also efficiently; as the traffic detection system detects violations faster than humans. This system can detect most common three types of traffic violation in real-time which are signal violation, parking violation and wrong direction violation. A user friendly graphical interface is associated with the system to make it simple for the user to operate the system, monitor traffic and take action against the violations of traffic rules.

The increasing number of vehicles on the roads has led to a rise in traffic congestion and a higher incidence of traffic rule violations. These violations not only disrupt the flow of authorities to manage and take actions againstviolators.

traffic but also pose a significant risk to public safety. To address this issue, there is a need for automated systems that can effectively detect and monitor traffic rule violations in real-time.

2. PROBLEM STATEMENT

The existing system for traffic rule violations detection typically involves a combination of technologies such as CCTV cameras, sensors embedded in roads, and software algorithms. These systems can detect violations such as speeding, running red lights, illegal turns, and improper lane usage. Once a violation is detected, the system can automatically generate a ticket or alert law enforcement for further action. Additionally, some systems may use machine learning algorithms to

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improve accuracy and efficiency over time. hese systems leverage a mix of technologies to detect various traffic violations, offering automated enforcement and aiding law enforcement in maintaining road safety. Machine learning integration enhances their effectiveness and adaptability over time.

2.1 LIMTATION OF SYSTEM

High Initial Setup Cost: Implementing a machine learning-based system requires significant initial investment in infrastructure, technology, and expertise for data collection, preprocessing, model development, and integration.

Data Privacy Concerns: The collection and processing of large amounts of data, including images and videos from surveillance cameras, raise concerns about privacy and data security. Proper safeguards and privacy measures must be implemented to protect sensitive information.

3. PROPOSED SYSTEM

The main idea is to develop a system that can automatically identify and flag violations like speeding, running red lights, illegal parking, or improper lane changes. This system would use machine learning algorithms to analyze data from traffic cameras or sensors, detect rule violations, and alert authorities in real-time. By implementing such a system, it can help improve road safety, reduce accidents, and enhance traffic management efficiency. It's a promising technology that can make a significant impact on traffic regulation enforcement.

Recognize specific patterns associated with various violations. The model learns to identify these violations by extracting features from the data and making predictions based on those features. Once the model is trained, it can be deployed to analyze real-time traffic camera feeds. When the model detects a potential violation, it can trigger alerts or notifications for further action by authorities. Continuous feedback and retraining of the model with new data can help improve its accuracy over time. Overall, using machine learning for traffic rule violations detection can enhance traffic management, promote road safety, and streamline enforcement processes. It's an exciting application of technology that can have a positive impact on society.

3.1 ADVANTAGES

Accuracy: Machine learning algorithms can analyze vast amounts of data and detect violations with high accuracy, reducing false positives and negatives compared to traditional methods.

Efficiency: Automation provided by machine learning allows for real-time detection and

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processing of violations,enabling quicker response times and moreefficient enforcement of traffic rules.

Adaptability: Machine learning models canadapt to changing traffic patterns and environments, improving their effectivenessover time without the need for constantmanual adjustment.

4. METHODOLOGY

4.1 IMAGE PROCESSING

Grayscaling and blurring: As the part ofpreprocessing the input frame got from the CCTV footage, the image is grayscaled andblurred with Gaussian Blur method.

Background Subtraction: Background subtraction method is used to subtract the current frame from the reference frame to get the desired object's area. equation (1) shows the method. dst(I) = saturate(|scr1(I) − scr2(I)|)

Binary Threshold Binarization: method is used to remove all the holes and noises from the frame and get the desired object area accurately. equation (2) shows how the binary threshold works. dst(x, y) = maxVal if scr(x, y) > thresh else 0

Dilation and find the contour: After getting the thresholded image, it is dilated to fill the holes and the contour is found from the image. drawing rectangle box over the contours desired moving objects are taken.

4.2 VECHILE CLASSIFICATION

From the preprocessed image moving objects are extracted. A vehicle classification model isused to classify those moving objects into three class - Car, Motobike and Non-vehicle. The classifier model is built with mobilenet v1neural network architecture.

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Type / Stride	Filter Shape	Input Size
Conv / s2	3 x 3 x 3 x 32	224 x 224 x 3
Conv dw / s1	3 x 3 x 32 dw	112 x 112 x 32
Conv / s1	1 x 1 x 32 x 64	112 x 112 x 32
Conv dw / s2	3 x 3 x 64 dw	112 x 112 x 64
Conv / s1	1 x 1 x 64 x 128	56 x 56 x 64
Conv dw / s1	3 x 3 x 128 dw	56 x 56 x 128
Conv / s1	1 x 1 x 128 x 128	56 x 56 x 128
Conv dw / s2	3 x 3 x 128 dw	56 x 56 x 128
Conv / s1	1 x 1 x 128 x 256	28 x 28 x 128
Conv dw / s1	3 x 3 x 256 dw	28 x 28 x 256
Conv / s1	1 x 1 x 256 x 256	28 x 28 x 256
Conv dw / s2	3 x 3 x 256 dw	28 x 28 x 256
Conv / s1	1 x 1 x 256 x 512	14 x 14 x 256
Conv dw / s1	3 x 3 x 512 dw	14 x 14 x 512
Conv / s1	1 x 1 x 512 x 512	14 x 14 x 512
Conv dw / s2	3 x 3 x 512 dw	14 x 14 x 512
Conv / s1	1 x 1 x 512 x 1024	7 x 7 x 512
Conv dw / s2	3 x 3 x 1024 dw	7 x 7 x 1024
Conv / s1	1 x 1 x 1024 x 1024	7 x 7 x 1024
Avg Pool / s1	Pool 7 x 7	7 x 7 x 1024
FC / s1	1024 x 1000	1 x 1 x 1024
Softmax / s1	Classifier	1 x 1 x 1000

Table:Mobile net body architecture

Parameter name	Value
learning rate	0.01
training steps	100

Table: Training hyper parameters

IOLATION DETECTION

After detecting the vehicles three violation cases arises **Signal violation**: if a vehicle crosses a predefined line on the road while there is red signal, it is detected as a signal violation.

Parking violation: if a vehicle stands still in no parking zone for a predefined time, it is detected as a parking violation.

Direction violation: when a vehicle comes from a wrong direction, it is detected by tracking the vehicle. The direction of the vehicle is determined using its current position and previous few positions.

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5 IMPLEMENTATION

GRAFICAL USERFACE INTERFACE(GUI)

The user interface has all the options needed for the administration and other debugging purpose so that, we do not need to edit code for any management. For example, if we need to add some sample cars or camera in thedatabase, we can do it with the menu item.

Primarily, for the start of the project usage, the administrator needs to add a camera with the menu item. In the way, the administrator can add the location of the camera, the feed file for the camera. Here the feed file is installed by the camera module over the internet. We have used Linux file sharing pattern for getting the video from the camera, where the camera will feed the givenfile to the server, and the server will take the feed file to process and detect violation. Also the X and Y coordinate of the camera location can be saved by the admin. This is done for future use, when we will try to use a map for locating the cameras with ease. Alsothe admin need to specify some rules with a JSON file for the camera. For example, the camera is used for cross road on red lineviolation, or is used for wrong place parking detection etc.

6. SYSTEM ARCHITECTURE

The purpose of the design phase is to arrange an answer of the matter such as by the necessity document. This part is that the opening moves in moving the matter domain to the answer domain. The design phase satisfies the requirements of the system. The design of a system is probably the foremost crucial issue warm heartedness the standard of the software package. It's a serious impact on the later part, notably testing and maintenance. The output of this part is that the style of the document. This document is analogous to a blueprint of answer and is employed later throughout implement tation, testing and maintenance. The design activity is commonly divided intoseparate phases System Design and Detailed Design.

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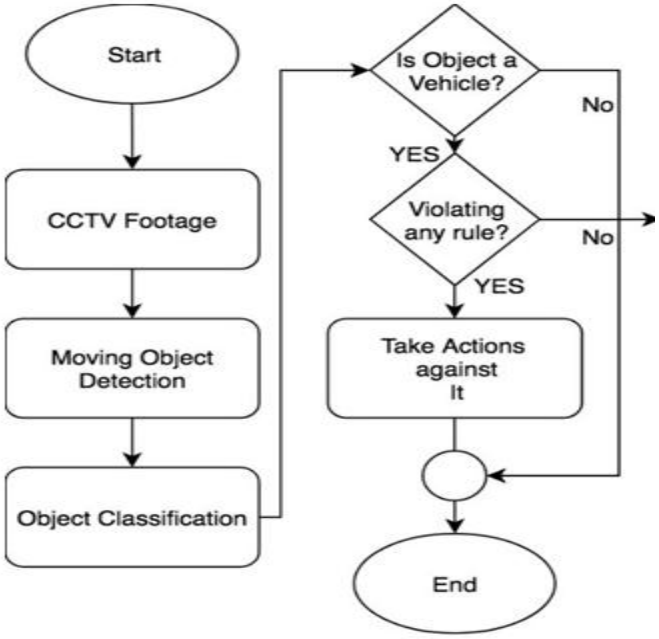

7 RESULTS

vechile classification

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violation detection

8. CONCLUSION

The Traffic Rules Violation Detection with Computer Vision project presents a comprehensive solution for automating the detection of traffic rule violations using computer vision techniques. By leveraging image processing algorithms, vehicle classification models, and violation detection algorithms, the system can accurately identify violations such as signal violations, parking violations, and wrong direction violations in real-time. The user-friendly graphical user interface enhances the usability and accessibility of the system, allowing traffic police officers or administrators to monitor traffic, view violation alerts, and manage therecorded data effectively.

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