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Identification of Traffic Rules Violators Using Image Classification and Segmentation

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ABSTRACT: A crucial instrument for enhancing road safety is the Traffic Rules Violation Detection System, which automatically detects and reports traffic rule breaches. This abstract offers a condensed description of the system, stressing its essential elements and Python's involvement in its execution. To identify and categorize many forms of traffic offenses, including speeding, running red lights, and unlawful lane changes, the system combines computer vision techniques and machine learning algorithms. Python, a well-liked programming language, was used as the basis for creating this system because of its adaptability, sizeable library, and user-friendliness. The system primarily uses video footage recorded by security cameras placed in key areas. The system is equipped with the ability to process.

KEYWORDS: Traffic Rules, Violation Detection, Automated Enforcement, Speeding Detection, Artificial Intelligence.

I. INTRODUCTION

Real-time identification systems are crucial for safety, adherence to security regulations, socialism, and personal safety issues. Traffic regulations are crucial for safety because they prevent motorists from colliding with people or causing accidents. AI-developed systems might serve as an alternate approach. Our technology can identify a variety of rules that have been broken, such as driving without a helmet or using a vehicle crossing signal at a red light. The basic concept is to find these infractions using cameras that are already there. We can achieve that using a machine learning (ML) method that uses image processing to identify offenders, calculate their number, classify their violations, and then punish them. This will improve the effectiveness of enforcing traffic laws.

Systems for detecting traffic rule violations are essential for preserving road safety and enforcing traffic laws. In order to monitor and identify instances of traffic rule infractions, these systems use cutting-edge technologies. This ensures compliance and lowers the danger of accidents on the roads. These technologies are becoming crucial tools for traffic management authorities and law enforcement organizations because of the rising number of cars and complex traffic scenarios. To cover a large area and capture various views, these cameras may include pan, tilt, and zoom capabilities. They give authorities a visual record of traffic activity so they may check the film for infractions of the rules.

II. RELATED WORK

The use of picture classification and segmentation algorithms to identify traffic law offenders has been investigated in a number of research papers and initiatives. The 2018 study "Traffic Light Violation Detection and Recognition". This study utilizes machine learning and image processing to identify and track down traffic light violators. It entails categorizing the traffic light's status (red, yellow, or green) and locating cars that disobey traffic light signals. The 2019 publication "Real-time Traffic Light Detection and Recognition": In order to identify and recognize traffic signals in real-time, this research employs deep learning algorithms. Segmentation is used to locate the areas of interest (traffic lights) within the picture, and classification is used to establish the light's status. The next year's "Vehicle Detection and Traffic Light Violation Detection": In this study, traffic light violations and vehicle detection. Convolutional neural networks (CNNs) are the main topic of the paper "Traffic Rule Violation Detection Using Convolutional Neural Networks" (2022). The study uses image segmentation to pinpoint the offending vehicle inside the image and image classification to categorize infractions. In the study "Efficient Traffic Rule Violation Detection Using Semantic Segmentation" (2023), semantic segmentation is investigated as a tool for effective traffic rule violation detection. The system can precisely identify violations and their context by segmenting the picture into relevant sections. In the study "Multi-Task Learning for Traffic Violation Detection" (2023), many tasks are carried out at once, including the detection of vehicles, the identification of traffic

lights, and the categorization of violations. For more accurate violation detection, image segmentation aids in localizing the regions of interest.

III. LITERATURE REVIEW

Dynamic Traffic Rule Violation Monitoring System Using Automatic Number Plate Recognition with SMS Feedback
AUTHORS: Padmaja B, Sunil M P
DESCRIPTION
In order to give vehicle position information, a method known as automated number-plate recognition (ANPR; see also other names below) scans vehicle license plates using optical character recognition on pictures. It may utilize cameras for policing traffic regulations, already-installed closed-circuit television, or specialized cameras. ANPR is used by police agencies all around the world to uphold the law, including figuring out if a vehicle is registered or licensed. Additionally, transportation authorities and electronic toll collection on pay-per-use highways utilize it to keep track of traffic movements. Both the text from the license plate and the photos captured by the cameras may be saved using automatic number-plate recognition, and some systems may be configured to store a photo of the plate as well.

IV. PROPOSED SYSTEM

A suggested system for detecting infractions of traffic laws would be a thorough and clever solution that makes use of cutting-edge technologies to precisely detect and record transgressions. With the use of this system, we are able to identify the vehicles that break the law and issue fines. With the help of this technique, we may identify several cars breaking the law simultaneously put information about these issues in a local database. Assemble a varied collection of photos or movies that were taken by surveillance or traffic cameras. Label various traffic code breaches, such running red lights, speeding, using the incorrect lane, and more, to annotate the dataset. Additionally, add pixel-level annotations to the dataset to aid with segmentation tasks.

Advantages
➢   High Accuracy
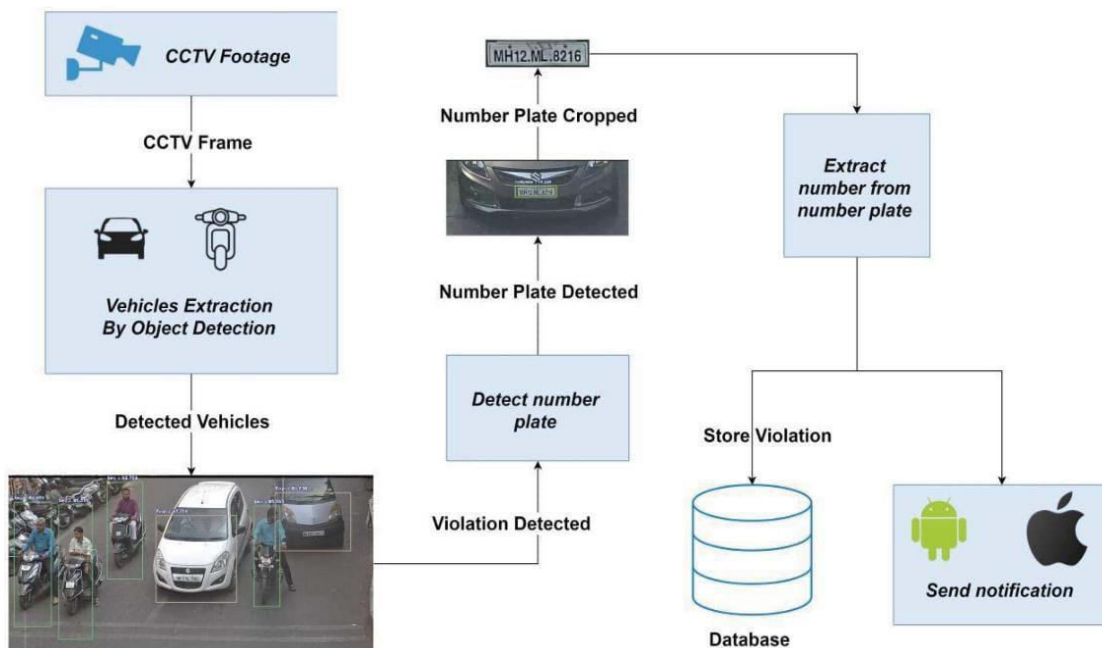➢   High Efficiency

V.SYSTEM ARCHITECTURE

Figure1: System Architecture

VI. MODULES

➢ User
➢ System

User Module:
In a traffic rules violation detection system, the user module plays a crucial role in facilitating interactions between the system and the users, such as drivers, traffic authorities, or other stakeholders involved in the traffic management process.

System Module:
The system module in a traffic rules violation detection system is the core component responsible for detecting, monitoring, and managing traffic violations. It is the backbone of the entire system and performs various tasks to ensure accurate and efficient violation detection and enforcement.

VII. ALGORITHM

CNN ALGORITHM
Convolutional Neural Networks (CNNs) are a powerful class of deep learning algorithms that have shown remarkable performance in image recognition and computer vision tasks. CNNs can be effectively utilized in a traffic rules violation detection system to automatically identify and classify various traffic violations from images or videos captured by surveillance cameras. A family of deep learning algorithms known as convolutional neural networks (CNNs) was created expressly for processing and evaluating visual input, such as photographs. CNNs are essential for both tasks: identifying traffic law violations using picture classification and segmentation.
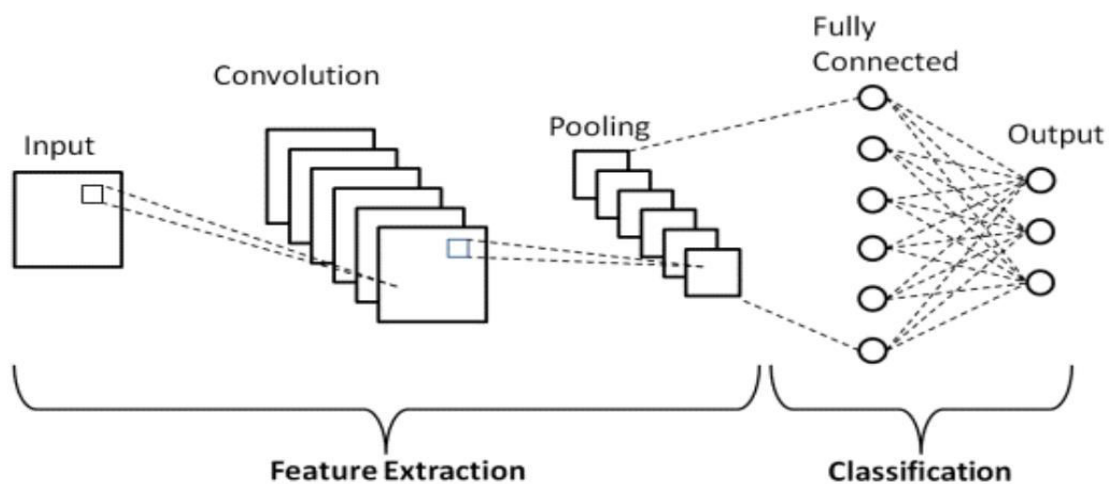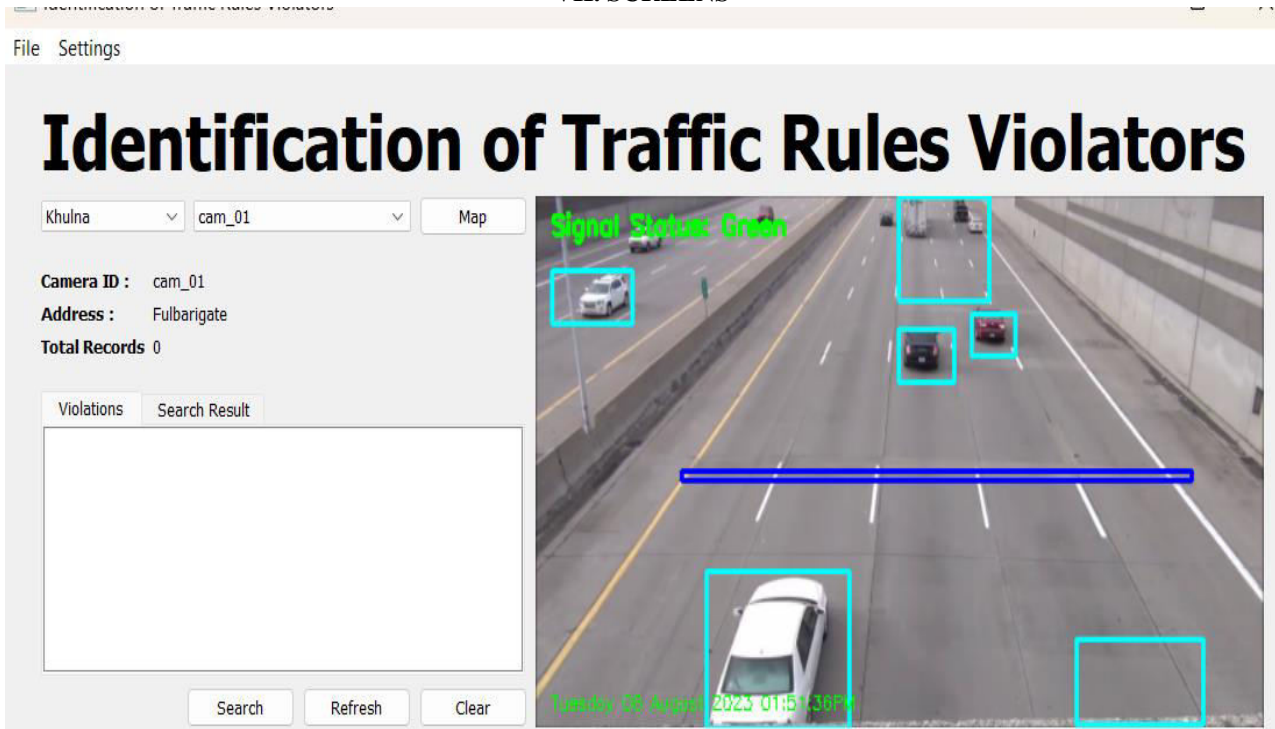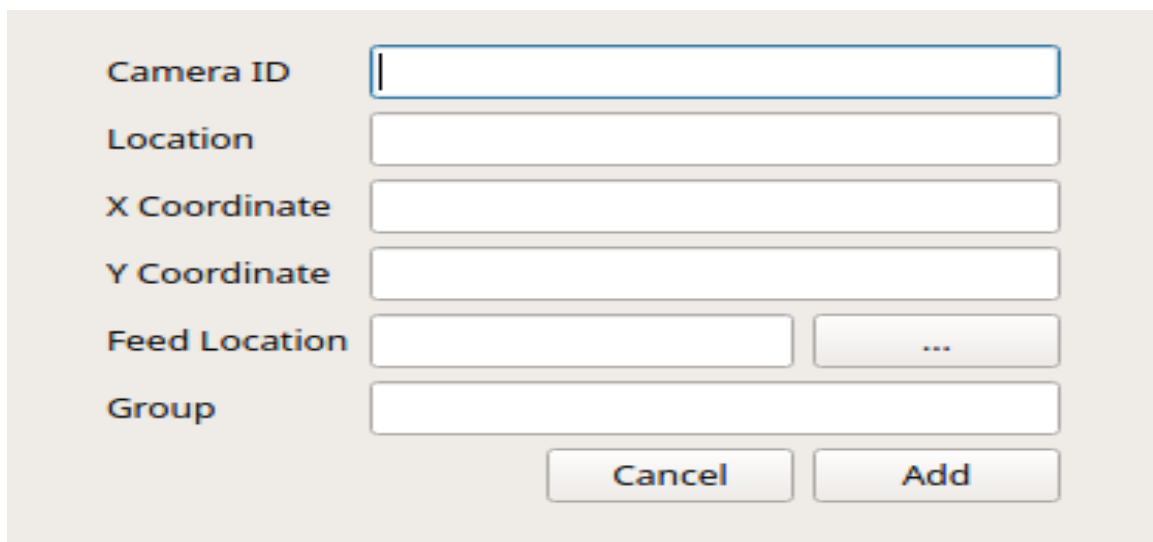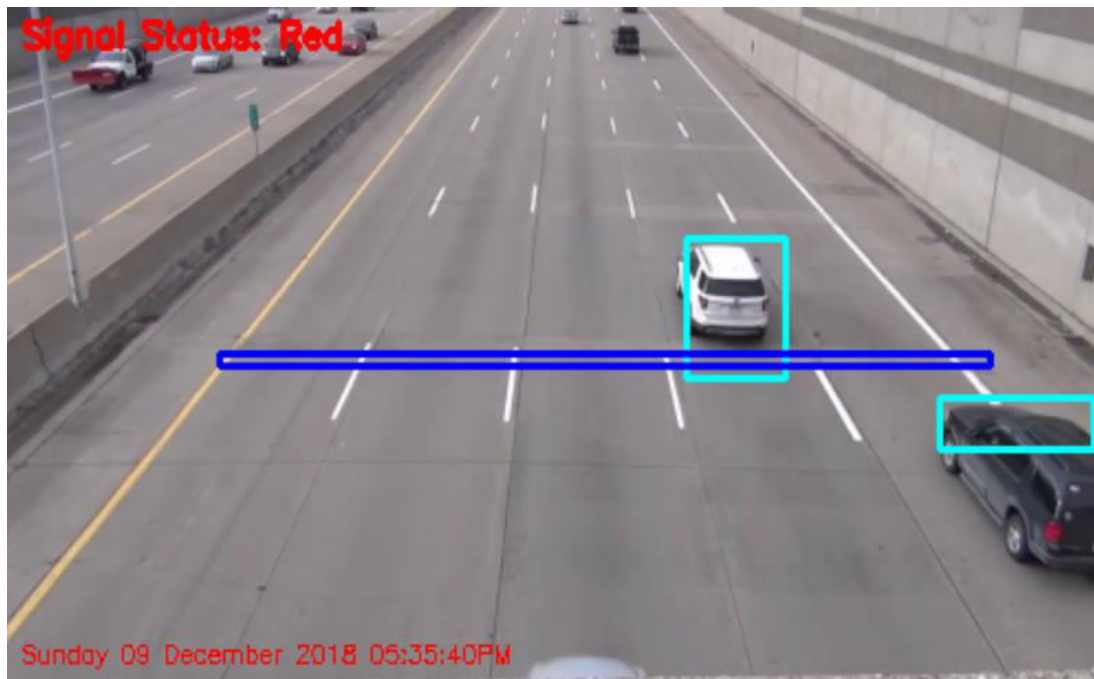

Figure2: CNN Architecture
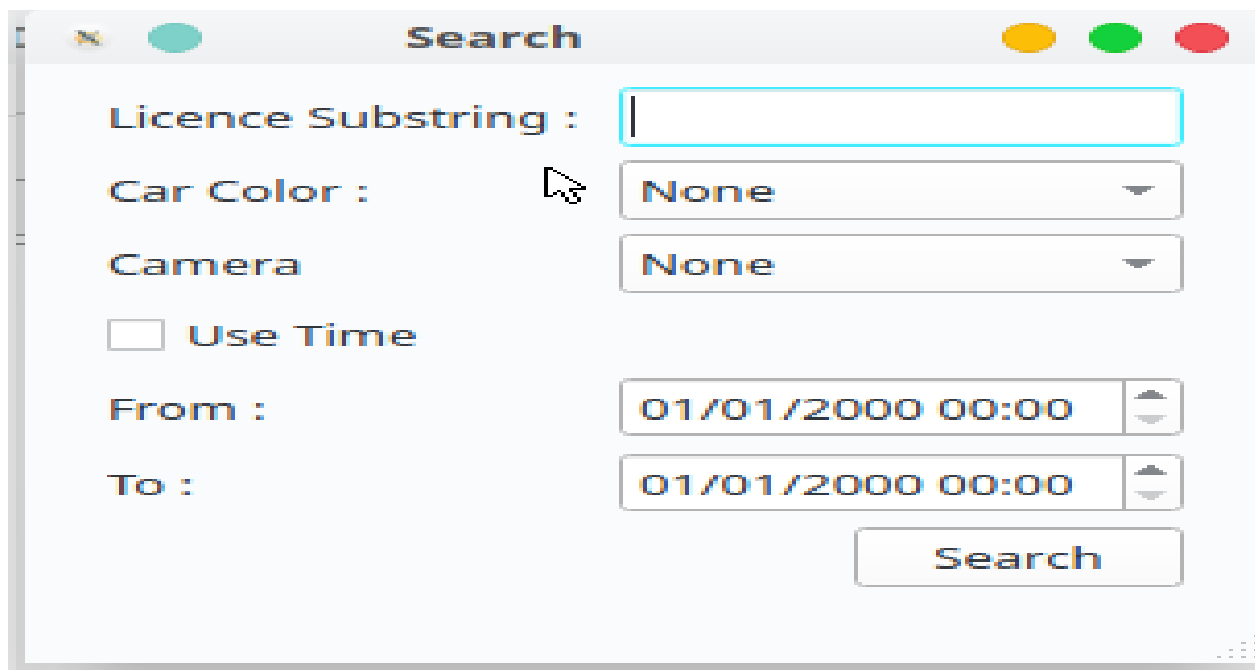
VII. SCREENS

SCREEN 1: Displays the moving vehicles
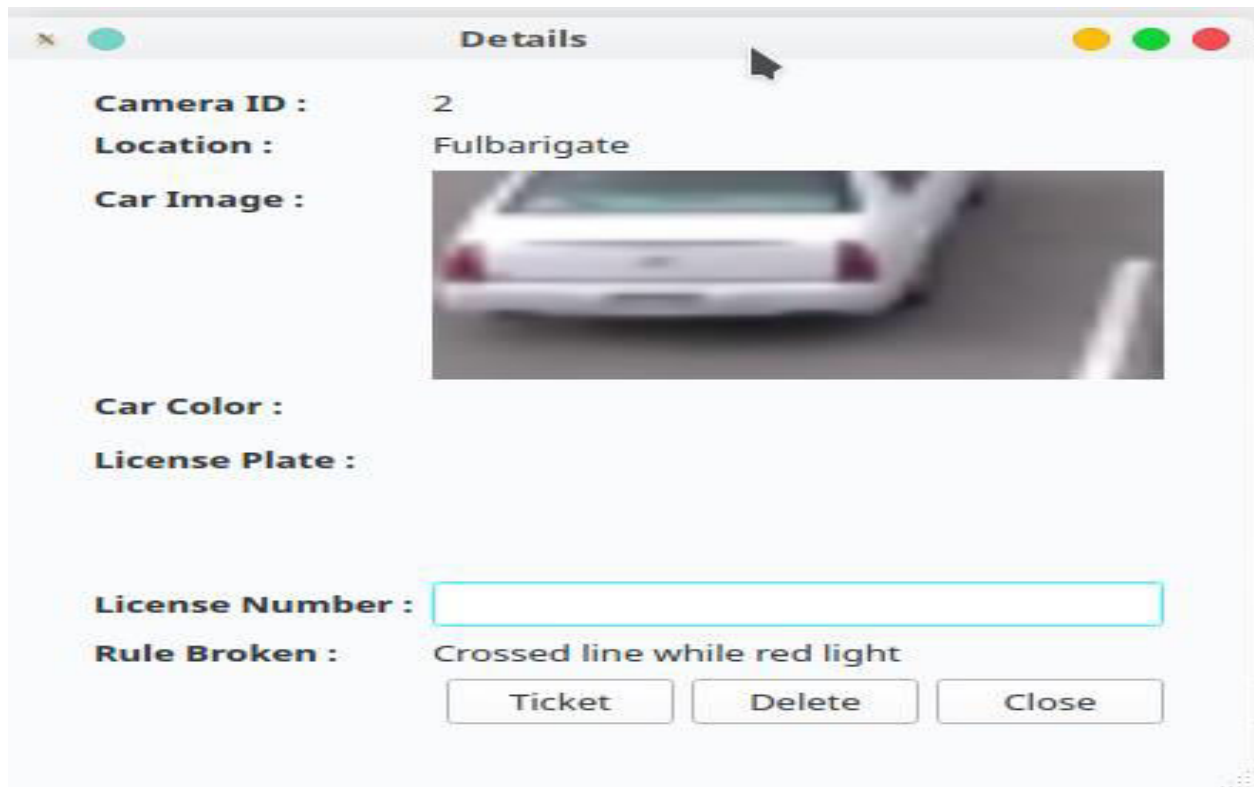

SCREEN 2: Interface for adding camera entity

SCREEN 3: Signal violation camera representation

SCREEN 4: Searching a rule or violation

SCREEN 5: Displays the details of rule violation

VIII. CONCLUSION

The traffic rules violation detection system is a sophisticated and valuable tool for enhancing road safety, enforcing traffic regulations, and managing traffic-related issues more effectively. This system combines various technologies, such as object detection, video analytics, and rule-based algorithms, to monitor and identify violations in real-time. The system's ability to generate real-time alerts enables swift responses to detected violations. While implementing the system may require an initial investment, its long-term benefits in terms of reduced accidents, traffic congestion, and associated expenses result in cost savings for communities and governments.

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