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A Hybrid System for Object Recognition and Tracking

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Abstract: In the new evolving world, traffic rule violations have become a central issue for majority of the developing countries. The numbers of vehicles are increasing rapidly as well as the numbers of traffic rule violations are increasing exponentially. Managing traffic rule violations has always been a tedious and compromising task. Even though the process of traffic management has become automated, it's a very challenging problem, due to the diversity of plate formats, different scales, rotations and non-uniform illumination conditions during image acquisition. The principal objective of this project is to control the traffic rule violations accurately and cost effectively. The proposed model includes an automated system which uses web camera to capture video. The project presents Automatic Number Plate Recognition (ANPR) techniques and other image manipulation techniques for plate localization and character recognition which makes it faster and easier to identify the number plates. After recognizing the vehicle number from number plate the SMS based module is used to notify the vehicle owners about their traffic rule violation. An additional SMS is sent to Regional Transport Office (RTO) for tracking the report status.

Keywords: Helmet detection with number plate, Triple riding detection, Detection signal jumping.

1. Introduction

Automation in day to day life has gained importance in recent years. The number of accidents on the roads is due to the rule violations such as breaking traffic signals, over-speeding, driving on wrong sides etc. To avoid such traffic violations, traffic police has to be present on the road and has to continuously check if some vehicle is violating the rule. A certain automated solution was developed to eliminate the violations; however, each of them had certain limitations. For example, the video capturing cameras eliminated need of an authority to be present to check rule violation. However, whole stored video had to be checked manually for the rule violation scenario. In this proposed system, a solution for signal breaking violation is given. The system includes an automated system by using web camera and number plate recognition application. If any vehicle crosses the zebra line, the desktop application will be initiated and will capture number plate image. Number plate recognition application by using image processing algorithm will recognize number plate and SMS will be sent to the offender in case of rule violation scenario.

Solid in all the countries there are driving rules available for people to drive carefully by being honest and respecting. When these rules are broken it is defined as a road violation. There road violations that happens in day to day traffic. For an example most common violations such as red-light violation, over-speeding, overtaking other vehicles through double white lines and single white lines. These road protocols are applied thoroughly for the places where most of the accidents happen This system is implemented to ease the work to the police using a user interface. Image processing technology is used to detect the lanes, vehicles and will identify vehicles who break rules. It will be easier for the police to identify who break laws of the traffic and for the policemen who take bribes and dishonest people will also be reduced. An image of the violation with the location, time, date and an image of the vehicle to the nearest policemen devices by deriving devices around the current location that violation happened.

As an example "When a vehicle speeds and if it cuts the line on a traffic light when it is on red light proposed system will detect them and take photos of the vehicle as evidences according to the protocol that is broke and send an alert to the nearest policemen device" this research is mainly considered about identify who break the rules. This system covers few components such as to detect vehicles who will not wear the helmet, triple riding, overtake in wrong places, vehicles that speeds and traffic light protocol violations. This system will be more reliable and vehicle detection and protocol identification will be accurate.

2. Literature Survey

Authors: Amirgaliyev Beibut, Kairanbay Magzhan, Kenshimov Chingiz, Title: Effective Algorithms and Methods for Automatic Number Plate Recognition Published in: IEEE 2018.

An automatic number plate recognition (ANPR) system is a key aspect in traffic congestion. This will help to minimize the different kind of violations on the road. Advanced systems for

tracking and identifying stolen, unauthorized vehicles are based on automated number plate recognition technology. This paper's main objectives are to review other methods and propose our own algorithm. A short review is performed on the various methods of number plate recognition algorithms. Further explanations of the proposed algorithm are illustrated in graphical forms to show how the algorithm works. This paper concluded with tests and evaluation results.

Merits – The car number plate pictures were taken from different sides and in different climate conditions and the accuracy of proposed algorithm is 90%.

Demerits - The distance from camera to the vehicle and the weather conditions decreases the performance of the system. Segmentation part as well as optical character recognition can be improved using other popular algorithms like Artificial Neural Network.

Authors: Yuan Jing, Bahar Youssefi, Mitra Mirhassani, Roberto Muscedere, Title: An Efficient FPGA Implementation of Optical Character Recognition for License Plate Recognition, Published in: 2017 IEEE 30th Canadian Conference on Electrical and Computer Engineering (CCECE).

Optical Character Recognition system (OCR) can be used in intelligent transportation systems for license plate detection. However, most times the systems are unable to work with noisy and imperfect images. In this work, a robust FPGA based OCR system has been designed and tested with imperfect and noisy license plate images. The OCR system is based on a feedforward neural networks, which uses an efficient and precise neuron. The neuron transfer function is based on an approximation of the Hyperbolic Tangent Activation Function. The neuron is utilized in a 189 160 36 feed forward neural network configuration. The network parameters were optimized and then tested with noisy images of license plates numbers. The network was able to maintain a 98:2% accuracy in recognizing the characters despite the image imperfections.

Merits: A robust FPGA based OCR system has been designed and tested with imperfect and noisy license plate images. It was able to maintain a 98:2% accuracy in recognizing the characters despite the image imperfections.

Demerits: It requires a proper system with selection of network size, and the optimized and efficient setup of the neuron activation function.

Authors: Farid Bounini, Denis Gingras, Vincent Lapointe, Herve Pollart, Title: Autonomous Vehicle and Real Time Road Lanes Detection and Tracking Published in: 2015 IEEE.

Advanced Driving Assistant Systems, intelligent and autonomous vehicles are promising solutions to enhance road safety, traffic issues and passengers' comfort. Such applications require advanced computer vision algorithms that demand powerful computers with high-speed processing capabilities. Keeping intelligent vehicles on the road until its destination, in some cases, remains a great challenge, particularly when driving at high speeds. The first principle task is robust navigation, which is often based on system vision to acquire

RGB images of the road for more advanced processing. The second task is the vehicle's dynamic controller according to its position, speed and direction. This paper presents an accurate and efficient road boundaries and painted lines' detection algorithm for intelligent and autonomous vehicle. It combines Hough Transform to initialize the algorithm at each time needed, and Canny edges' detector, least square method and Kalman filter to minimize the adaptive region of interest, predict the future road boundaries' location and lines parameters. The scenarios are simulated on the Pro-SiVIC simulator provided by Cavite, which is a realistic simulator of vehicles' dynamics, road infrastructures, and sensors behaviours, and OPAL-RT product dedicated for real time processing and parallel computing.

Merits- Robust against exogenous perturbations and different constraints, but good enough to control the vehicle with a simple couple of fuzzy logic laws.

Demerits– The fuzzy controller handles the vehicle's steering, which has a limitation for a maximum speed of 70 km/h in sharp turns.

3. Proposed System

This segment introduces the proposed methodology for continuous recognition of bicycle riders without helmet which works in two stages. In the primary stage, we identify a bicycle rider in the video outline. In the subsequent stage, we find the leader of the bicycle rider and recognize the number plate and furthermore distinguish whether the rider is utilizing a head protector or not. So as to decrease bogus forecasts, we merge the outcomes from successive casings for conclusive expectation. The square graph shows the different strides of proposed system, for example, foundation subtraction, include extraction, object order utilizing test outlines.

As helmet is important just in the event of moving bicycle riders, so preparing full casing becomes computational overhead which doesn't increase the value of discovery rate. So as to continue further, we apply foundation subtraction on dim scale outlines, with an aim to recognize moving and static items. Next, we present advances associated with foundation displaying.

4. Tools Used

Hardware Requirements:
- Web camera
- Laptop

Software Requirements:
- Open CV
- Python 3.7.7

5. Implementation

Utilization is the affirmation of an application or execution of a course of action, thought, model, plan, specific, standard, estimation, or system. In that capacity, Use is a declaration of a

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computer, programming or other PC process through programming and programming action. There may be different executions for a given insurance or standard.

Modules:

- Data Collection
- Python OpenCV
- Object Detection
- TensorFlow
- OCR.

A. Modules description

1) Smart Camera

The sharp camera contains a twofold processor which enables the camera to work honourably with applications, for example, design coordinating, optical character affirmation and data organize code continuously. The whole plan conveys significant standards diminish scale pictures which are indispensable for the execution of the persistent eye following estimation. Exactly when the camera is related through FTP or Ethernet hard drive, the data would then have the option to be moved to various devices. In this venture we are utilizing web camera to illustrate.

2) Python OpenCV

OpenCV is a library of PC vision produced initially by Intel and now maintained by Willow Garage. It is safe to use under the license of the open source BSD. It's a cross platform library. For the most part, it centers around the preparation of the picture. If the library discovers the system's Integrated Performance Primitives, these business updated schedules will be used to speed it up. OpenCV isn't a piece of code that pictures are running and processing. You've got to write script.

The Visual Studio Express Edition of Microsoft can be downloaded (for nothing). It's an outstanding IDE. The Visual C++ 2010 Express must be downloaded.

Likewise, OpenCV is not an executable file that you replicate and it will start to work. It is code, library files, and DLL documents that are unadulterated. You "link" to these library records when you write your own code to get to the capabilities of OpenCV.
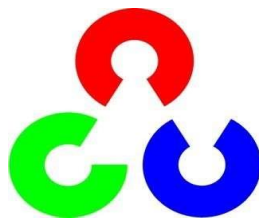

Fig. 1. OpenCV

3) Object Detection

Article Detection is the way toward discovering true item occasions like vehicle, bicycle, TV, blooms, and people is still pictures or Videos. It takes into account the acknowledgment, confinement, and recognition of numerous items inside a picture which gives us a greatly improved comprehension of a picture everything in all. It is widely used in appliances such as

image recovery, safety, observation, and propelled driver help frameworks (ADAS). Article Detection should be possible by means of various ways:

- Detection of objects based on their characteristics
- Detection of objects by viola Jones
- SVM HOG identification features
- Advanced object learning Identification

Fig. 2.

4) TensorFlow

TensorFlow is Google's Open Source Machine Learning Platform for programming data flow over a count of tasks. Hubs refer to numerical functions, while the edges of the diagram speak to the multi-dimensional points of information (tensors) within them.
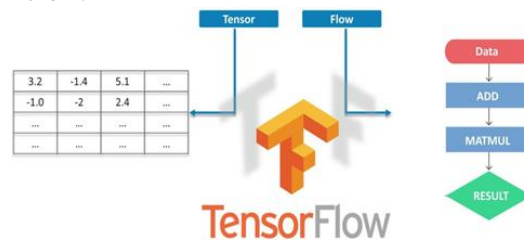

Fig. 3.

Tensors are simply multidimensional clusters, an enlarge to information with a higher measurement of 2-dimensional tables. TensorFlow's numerous highlights make it suitable for profound learning. By burning through whenever, along these lines, how do we interpret how we can perform object detection using TensorFlow.

5) OCR

OCR (optical character acknowledgment) is the utilization of innovation to recognize printed or transcribed content characters inside advanced pictures of physical archives, for example, a filtered paper record. The essential procedure of OCR includes analyzing the content of an archive and interpreting the characters into code that can be used to handle information. OCR is now and again additionally alluded to as content acknowledgment.

OCR frameworks are comprised of a blend of equipment and programming that is utilized to change over physical records into machine-discernible content. Equipment, for example, an optical scanner or particular circuit board is utilized to duplicate or understand content while programming commonly handles

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the propelled preparing. Programming can likewise exploit computerized reasoning (AI) to actualize further developed techniques for insightful character acknowledgment (ICR), like distinguishing dialects or styles of penmanship.

The procedure of OCR is most regularly used to transform printed version legitimate or noteworthy records into PDFs. When put in this delicate duplicate, clients can alter, configuration and search the record as though it was made with a word processor.

6. Methodology

A. Block Diagram

License plate recognition (LPR) is one form of ITS (Intelligent Transport System) technology that not only recognizes and counts the number of vehicles but also differentiates them. For some applications, such as electronic toll collection and red-light violation enforcement, LPR records license plates alphanumerically so the vehicle owner can be assessed the appropriate amount of fine.
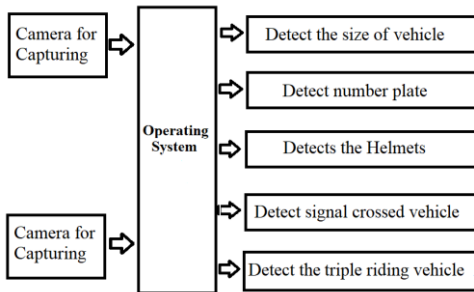

Fig. 4. Block diagram of system

In others cases, like commercial vehicle operations or secure-access control, a vehicle's license plate is compared against a database of acceptable ones to determine whether a truck can bypass a weigh station or a car can enter a gated community or parking lot. [20] A license plate is the unique identification of a vehicle. The basic issues in real time license plate recognition are the accuracy and the recognition speed. License Plate Recognition (LPR) has been applied in numerous applications such as automatically identifying vehicles in parking lots, access control in a restricted area and detecting and verifying stolen vehicles. Quality of algorithms used in a license plate detector determines the speed and accuracy of the license plate detection. In the past, a number of techniques have been proposed for locating the plate through visual image processing.

A video is taken from a camera, and then each frame of the video is processed as the image. In this stage the license plate region from the given image is located and isolated. Quality of the image plays an important part hence prior to this stage pre-processing of the image is necessary. So first each frame pre-processed by binarization, noise reduction and edge detection. Then, the license plate is located by different image processing technique.
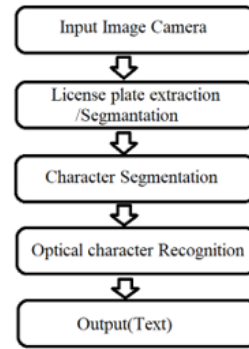

Fig. 5.

7. Results

A. Helmet detection with number plate

S1 #Test Case: -	UTC-1
Name of Test: -	Image Capture and Helmet Detection
Items being tested: -	Helmet Detection
Sample Input: -	Image
Expected output: -	Helmet should be detected
Actual output: -	Detection of helmet is done successfully
Remarks: -	Pass

Input Image | Output Image

Sent from your Twilio trial account – Dear Sir/Madam, this message is to inform you that your vehical KA 04 JM 8241 has been riding the vehicle without helmet which is an offence committed. Please pay Rs. 3000 to your nearest police station to avoid penalties.

Message Receive

B. Triple riding detection

S2 # Test Case :	UTC-
Name of Test:	Triple
Items being tested:	No of persons on
Sample Input: -	Image
Expected output:	System should detect no of
Actual output: -	No of persons detected
Remarks: -	Pass

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Input Image   Output Image

Message Receive

C. Signal jumping

SI #Test Case: -	UTC-3
Name of Test: -	Signal jumping
Items being tested: -	Red Signal Detection and Intimation
Sample Input: -	Image
Expected output: -	Signal Violation Detection
Actual output: -	Vehicle detection on signal jumping is achieved
Remarks: -	Pass

Input Image   Output Image

Message Receive

8. Advantages

- Detects and reads license plates automatically 24 x 7 in real time.
- High accuracy for heterogeneous number plates and Vehicle Speeds up to 120 km/hr.
- Capable of detecting and recognizing different dimensions, contrast, colors license plates with variety of character font & style.
- Transmits real-time stamp of entry/exit of the vehicle to the database. Alerts/Alarms for stolen or marked vehicles.
- Traffic rules following.

9. Disadvantages

- Non robust architecture
- The Capture Units controlled from the one only Process Unit will fall if the Process Unit does not work
- Complex installation and start-up.

10. Conclusion and Future Scope

Here in this project, the methods for traffic surveillance have been presented and the work on motion detection, license plate extraction and character recognition is carried out. In motion detection, a study on different background subtraction available in the literature has been studied and their performance tests on the different video test sequence are given. The fitness coefficient and error coefficient is also calculated for all the methods. It should be noted that robust motion detection is a critical task and its performance is affected by the presence of varying illumination, background motion, camouflage, shadow, and etc.

A program is being developed in this research to identify the motorcyclists who violate the laws of wearing the helmet. The program consists primarily of three parts–motorcycle identification, helmet identification, and license plate recognition of motorcyclists riding without a helmet. The key criterion is to determine whether or not the picture captured is of a motorcycle using HOG, and to test whether or not the motorcyclist is wearing a helmet using CNN. If the motorcyclist is marked without a helmet, then the motorcyclist's license plate is recognized using tesseract OCR. The accuracy of the motorcycle / non-motorcycle classification is 93%, the helmet / no-helmet classification is 85% and the license plate identification is 51%, resulting in an overall accuracy of about 76%. Increasing the training data collection and image quality will increase the accuracy.

The proposed system deals with the detection and tracking of vehicles which violate traffic rules. By increasing the technology, we can avoid traffic violations by detecting number plate, helmet vehicles which jump zebra crossing line with the help of OCR, Haar Cascade and CNN algorithm followed by tracking a violated vehicle with the help of captured image of number plate. With the help of this system an alert message with the fine amount details for violating traffic rules is sent to respective person. Thus, this helps to overcome the traffic violations.

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