Automatic Traffic E-challan Generation

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Abstract

Traffic law violations are now a serious problem, and society's moral fabric is being weakened by people's casual and irresponsible attitudes. Although our country's traffic laws have greatly improved over the past few years, the human factor in our current system remains a liability and produces poor results that could have been far better. The precision of traffic management will improve with automated plate recognition, and automated detection and restrain of license plates is a crucial component. Our technology automatically detects automobiles that violate traffic laws at the appropriate signals, and every vehicle's registration number is identified using CNN and deep learning. The database is checked for the type of car and the owner's information using the detected vehicle number. This data is utilized to promptly and directly create a challan in the vehicle owner's name and send the owner the necessary fine notification.

Keywords- Python, Raspberry pi, Convolutional Neural Network

1. Introduction

The foundation of efficient traffic management is automatic license plate identification, which is a key component of contemporary intelligent traffic management systems. In monitoring road traffic, it is frequently employed. There is a direct correlation between the number of traffic rule breaches and the huge increase in the number of vehicles on the roads. Every year, on average, around 1 lakh people are killed on Indian roads, and a significant number of these fatalities are caused by traffic rule infractions [1][2].

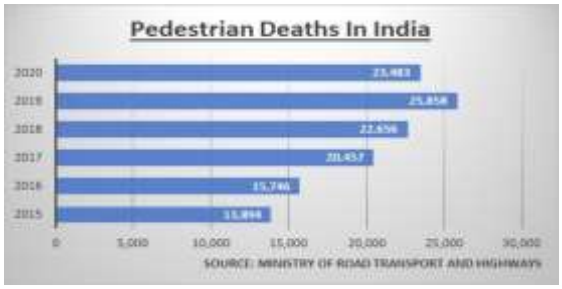


Figure 1. Pedestrian Deaths in India (MINISTRY OF ROAD TRANSPORT AND HIGHWAYS, 2020)

The automated spotting and restraint of license plates is a crucial component of license plate identification. The process is based on identifying offending cars, such as those that halt at the forefront of zebra lines, Analysis of the suspect vehicle's license plate, and systematic challan creation. Delivering the E-challan on the same day that the offense is committed is one of the main points of emphasis. Decreasing the amount of manual labor required by traffic police by abolishing the requirement to manually choose to violate vehicles and then getting in touch with the RTO to obtain the vehicle's data. The system should be intelligent enough to recognize the offender and retrieve the data automatically, therefore this intermediary phase should be removed [3][4].

2. Related Work

Since every nation has its regulations and formats for license plates and characters, there has been a great deal of research done in this area. Therefore, just one strategy

Figure 2.Raspberry pi 3 Model B

cannot be used to achieve the goal in every country [5][6].

In India, the current operating mechanism involves two individuals (Traffic Police Officers) in the creation of an E-challan. When the signal is red, one person watches the video while another takes pictures. Following that, he looks for the offending vehicle. That person takes a large number of automobiles that are on the zebra crossing. The second individual receivesthe number from him. Another person from the traffic police takes the number from the license plate and enters it into the description for the violation of traffic law by that vehicle. After that, the system produces the challan [7][8].

3. Hardware and Software

I. Raspberry Pi 3

The Raspberry Pi, a United Kingdom-based development that has the objective of advocating computer literacy, Hence producing a seamless experience for computer science education, is a small computer that can fit in the palm of one's hand. The Raspberry Pi is also a moderately priced Linux-running computer that consists of a collection of GPIO (general purpose input/output) pins enabling you to explore Intelligent Systems [9][10]

The Raspberry Pi 3 is around 50% more significant than the Pi 2 because of its quad-core 64-bit CPU, which works at 1.2 GHz. As a result, the Raspberry Pi 3 can run business software and browse the internet. Adding a WiFi chip and Bluetooth is the most remarkable upgrade in this latest iteration. Removing the need to plug in WiFi and Bluetooth dongles, also conserves more space and also frees up many USB ports as well [11][12].

II. Raspberry Pi Camera Module V2.1

The Raspberry Pi Camera has a specially created add-on component for Raspberry Pi hardware. Especially in comparison to the 5-megapixel Omni Vision OV5647 sensor in the original camera, the v2 Camera Module of it features an 8-megapixel Sony IMX219 sensor. Module 2 can record high-quality videos and live photos. Beginners will find it easy to use, but advanced users will find it has a lot to offer if they want to learn more. All Raspberry Pi 1, 2, 3, and 4 versions are compatible with the camera. The MMAL and V4L APIs can be used to access it [13][14][15].

Figure 2. Raspberry pi Camera v2.1

III. Python IDLE

One of the most frequently adopted solutions for existing software development is Python,

an interpreted, general-purpose programming language. It is especially enticing for use in Rapid Application Development and is used as a scripting language or a glue to connect existing components because of its efficient integrated data structures, dynamic typing, and dynamic binding. Python code readability is given prime concern, which reduces the cost of program maintenance.

For all major systems, the standard library and the Python interpreter are openly accessible in source code or as binary format. It is easy to use and enables us to use a Raspberry Pi to transform an idea into real-time. Python uses Standard English vocabulary and has a very simple syntax that prioritizes readability. Launch IDLE first. The simplest approach to learning Python is to use its IDLE or integrated development environment [16][17][18].

IV. System Specification and Design

The following limitations are used to construct the device:

a) The 15–30 cm scanning distance range

b) The Scanning material's maximum size is flexible.

c) The text line can be tilted up to 5 degrees from vertical.

d) Character types can be Roman, Egyptian, or Sans Serif.

The module is made to be positioned using two L-clamps over the board's encasing, eliminating the need for any physical equipment or stand-like structures to support the pi cam module. To sharply capture the script, the pi camera lens is adjusted.

V. System Implementation

The systemcreated possesses two primary characteristics:

1) Locating the automobiles that broke the law.

2) Producing e-challans for contravening cars.

3.1. Pre-processing

When the signal turns red, the camera positioned above the signal takes a picture. Noise and unwanted data exist in the image that was taken. The image from the forefront of the zebra crossing has been trimmed for license plate recognition and the noise has been eliminated.

3.2. License Plate Recognition

After pre-processing, the image contains not just one, but several license plates. The technology will identify each vehicle license plate that has disregarded the laws.

3.3. Feature Extraction

The precise number of each car must be recognized and extracted when all license plates are detected. The letters and numerals that are on the license plate are taken off and then identified.

3.4. Database Verification

Until a match is discovered, the received license plate number is lookedat throughout the entire database. Once a match is made, all of the user's information is retrieved.

3.5. E-challan Generation

The data collected from the users will be used to issue an e-challan in the owner's name, and the owner of the vehicle who doesn't follow the rule will be notified via SMS or mail.

5. Methodology

5.1. Pre-processing

Input image

Image in Gray Scale

Image translation from RGB to grayscale:

Grayscale conversion of the image is required. The cvtColor() method involves adjusting the color space of the snapshot., must be used in order to achieve this.
As soon as the color space conversion code is received. We utilize the function COLOR BGR2GRAY to transform the BGR color space of our source picture to grayscale.

5.2. Noise Reduction and Edge Detection

Bilateral Filter

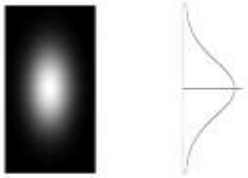
Edges are preserved while images are flattened and noise is reduced using a filter i.ebilateral filter.
The bilateral filter can be drafted as :

$$BF[I]_p = \frac{1}{W_p} \sum_{q \in S} G_{\sigma_s}(\|p-q\|) G_{\sigma_r}(|I_p - I_q|) I_q$$

Normalization Factor

Space Weight

Range Weight



cv2.bilateralFilter(gray, 11, 17, 17)
The bilateral filter() method in OpenCV takes the following arguments:
d: Each pixel neighborhood's diameter.
sigmaColor: Sigma value in a color space.
SigmaSpace: Sigma's value in the coordinate system.

Canny edge filter

In order to spot the edges in an image, one applies the OpenCV Canny() Function.
cv2.Canny(bfilter, 20, 200)
Canny edge detection is an Algorithm consisting of 4 steps:
(I) Utilize Gaussian Smoothing to decrease noise.
(II) Image gradient computation using the Sobel filter.
(III) Just jeep the local maxima by using Non-Max Suppression, or NMS.
(IV) Apply the hysteresis thresholding using the T upper and T lower threshold values from the Canny() function.

5.3. Recognizing License Plate

Contours

Simply stated, a contour is a curve that unites all continuous points (along the boundary) that have the same hue or intensity. The contours are a great tool for identifying and recognizing objects as well as form analysis.
OpenCV has a findContour() function that helps in extracting the contours from the image.
In the CV, there are three arguments. The source picture, the contour retrieval mode, and the contour approximation method are the first three parameters of the findContours() function.

The contours are then identifiedand sorted from large to tiny, and the first 10 results are solely taken into consideration. The license plate number will appear among all the results because it is likewise a closed surface, but the counter in our illustration may be anything with a closed surface.

```
for contour in image_contours:
approximately = cv2.approxPolyDP(contour, 10, True)
  if len(approximately) == 4:
    location = approximately
    break
```

We will scan through all of the results to see which ones have a rectangular shape contour with four corners and a closed figure before generating the numberplate image from the collected data. A four-sided rectangle would absolutely be the shape of a license plate.

Masking

Now that we identify where the number plate is positioned, the halting information is virtually irrelevant to us.So, excluding the area where the number plate sits, we can now apply masking to the entire image.

```
Mask_of_image=np.zeros(gray.shape, np.uint8)
Image=cv2.drawContours(Mask_of_image, [location], 0, 255, -1)
Image = cv2.bitwise_and(img, img, mask =Mask_of_image)
```

5.4. Character Segmentation

The image is segmented to conceal the license plate number before being saved as a different image as the next development is number plate recognition. The character in the picture can then be found using this image.

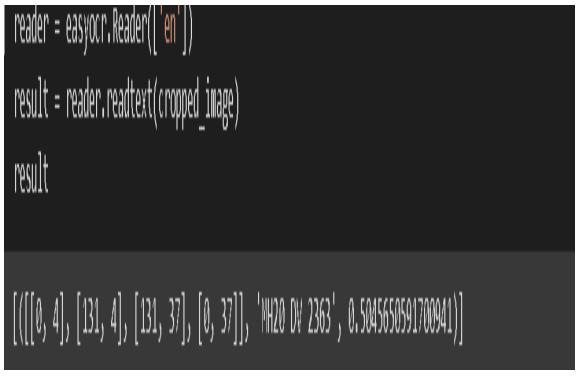
```
(a, b) = np.where(mask == 255)
(a1, b1) = (np.min(x), np.min(y))
(a2, b2) = (np.max(x), np.max(y))
Image_cropped = gray[a1 : a2 + 1, b1:b2+1]
```

The resulting image is shown below.

5.5. Character Recognition

This strategy's concluding component is reading the number plate specification from the segmented snapshot. To read characters from a photograph, the Easy OCR program will be utilized.

```
easyocr.Reader(['en'])
reader.readtext(cropped_image)
```



OUTPUT : MH20 DV 2363

5.6. Database Verification

Law requires that each item of personal property have a unique identification number that links it to the owner.

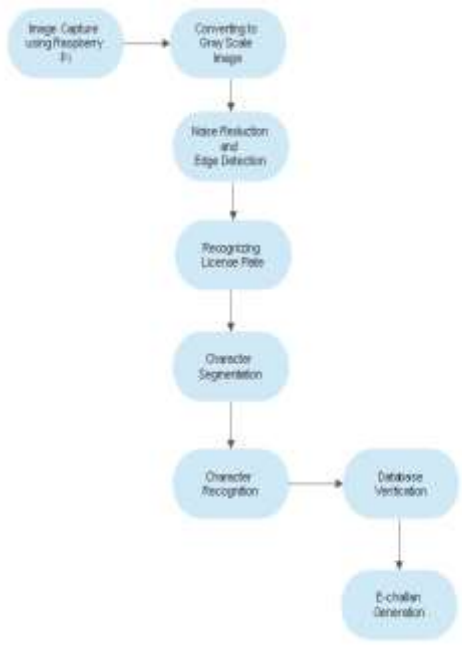
The API provided below can be used to acquire information regarding user details :

parivahan.gov.in/rcldstatus/

5.7. E-challan Generation

The system generates a Challan leveraging user data that has been captured, and SMS is sent using the API provided below. The API for sending SMS: Way2sms

6. Activity Diagram



7. Results and Discussion

7.1.GUI Screenshots

6. Conclusion

E-challan is an auto-generated challan system that uses a CCTV camera toreduce the incidence of accidents on Indian roads.

This research focuses on python-based automated e-challan generation.The government can use the automatic e-challan generating tool to execute all tasks that are presently completed manually in an effective, intelligent, and fully automated manner. The method will greatly increase pedestrian safety and increase rule compliance among drivers.

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