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Automatic Traffic E-challan Generation

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Abstract

Utilizing state-of-the-art technology, Automated Traffic E-challan Generation systems are employed to promptly detect and document traffic violations as they occur. By seamlessly integrating cameras, sensors, and sophisticated algorithms, these systems independently identify transgressions including but not limited to speeding and unauthorized parking. After detection, electronic citations (e-challans) are swiftly produced and delivered to vehicle proprietors, thereby optimizing enforcement procedures and bolstering overall road safety. However, notwithstanding their efficacy, the deployment of such systems mandates the meticulous consideration of privacy and equity issues, necessitating the enactment of suitable regulatory protocols. The Automatic recognition of license plate is the basis of effective management in traffic, the automatic detection and localization of license plate is an important part.

Keywords- Python, Raspberry Pi, Convolutional Neural Network

1. Introduction

Automated Traffic E-challan Generation systems represent a transformative shift in traffic regulation strategies, leveraging cutting-edge technology to rationalize the issuance of traffic violation citations. This section provides an overview of the significance of these systems in contemporary traffic governance, accentuating the requisite for efficacious regulatory approaches to mitigate road safety hazards and enhance traffic flux. The Foundation of efficient traffic management is automatic license plate identification, which is a key component of contemporary intelligent traffic management systems [1][2].

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

2. Evolution and Progression

Tracing the historical trajectory of Automated Traffic Fine Generation, this section scrutinizes the metamorphosis of technology from manual enforcement paradigms to automated frameworks. It investigates seminal milestones, technological strides, and legislative advancements that have

steered the evolution of these systems over time [3][4].

3. Technological Components and Operational Framework

This section delves into the elemental technological components and operational modalities of Automated Traffic Fine Generation systems. It expounds upon the functions of cameras, sensors, license plate recognition systems, and algorithms in

real-time detection and documentation of traffic violations [5].

4. Related Work

Currently in India, two operating mechanisms take place. One is a Traffic police officer who clicks the picture while the other type is the operator who watches the video of vehicles running onto the road. With the help of each other , they search for the offending vehicle. Upon locating

Figure 2.Raspberry pi 3 Model B

the vehicle, they note the license plate number and input it into their devices. After that e-challan is generated by the system [6].

5. Hardware and Software

5.1.Raspberry Pi3

Raspberry was developed in the United Kingdom. It provides a seamless experience for computer education. It is a very tiny computer and its size is approximately equal to the size of the palm of one hand. Raspberry Pi3 is more effective than the Raspberry Pi2. It uses quad-core 64-bit CPU which operates at 1.2Ghz. Now Wi-Fi chips and Bluetooth are also added to the latest version [7].

Figure 3. Raspberry pi Camera v2.1

5.2. Python IDLE

Python IDLE is the most adopted method for existing software development in Python. This is particularly utilized in quick application development and serves as a scripting language to integrate existing components.
Python IDLE is user-friendly, and it enables the use of Raspberry Pi to turn concepts into tangible outcomes. The most straightforward method to learn Python is through utilizing IDLE [8].

5.3. System Implementation

The implementation of the system features two main aspects:
1) Identifying the vehicle involved in a violation.
2) Producing electronic fines for vehicles that have infringed the law.

6.1. Pre-processing

One photo is clicked every time the signal turns to be red. Then noise and unwanted data are removed from that photo.

6.2. License Plate Recognition

Following the initial preprocessing, the captured photograph includes numerous license plates. Subsequently, the technology singles out the license plate associated with a violation [9].

6.3. Feature Extraction

It's essential to accurately identify the vehicle count when a license plate is recognized. Then the letters and the numbers on the license plate are identified.

6.4. Database Verification

Following the extraction process, the obtained license plate number is cross- referenced across the entire database. Upon finding a matching entry, comprehensive information about the vehicle's owner is retrieved [10].

6.5. E-Challan Issuance

The information gathered about the owner is utilized to create an electric challan. Owners who have violated the law are then informed via text message [11].

7. Methodology

7.1. Pre-processing

Input picture (RGB)

Figure 4.Picture(Gray Scale)

Figure 5.Transforming an image from RGB to grayscale

Converting an image to grayscale plays a crucial role. The cvtColor() function alters the image's color space, which is essential for accomplishing the task.
Upon receiving the code space conversion, we employ the COLOR_BGR2GRAY function to transform the BGR color space of our original image into grayscale.

7.2. Bilateral Filter

We use a bilateral filter to convert our input image into a smoothed version of that image. It is also used to remove noise and details but it maintains the sharp edges without blurring.
The bilateral filter :

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

Normalization Factor

Space Weight

Range Weight

7.3.Canny edge filter

To detect edges within an image, the OpenCV Canny() function is utilized, as demonstrated by the command .cv2.Canny(bfilter ,20, 200).

This technique is used to extract useful information from images and reduces the amount of data to be processed.

Figure 6.Recognizing License Plate

8. Contours

Put simply, a contour represents a curve linking all the continuous points that share the same color or intensity of an object. Contours help recognize objects and analyze their shapes.

OpenCV, a software library for computer vision tasks, provides a function called findContour() that extracts these lines from an image. This function requires three inputs: the original image, the method for finding contours, and the method for approximating contours.

Once the contours are found, they are sorted from largest to smallest, and only the first 10 are considered. Among these contours, the license plate number will typically be included because it forms a closed shape, just like many other objects. In the provided example, the object being tallied could be any item with a closed contour.
Within the loop for image contours:

```
Approx.=cv2.approxPolyDP(contour,10,True)
        if len(approx)==4:
         location =approx.
         break
```

We examine each result to identify those with a rectangular-shaped contour, featuring four corners and a closed structure, before creating the image of the number plate from the gathered data. The image that has four sides will be guaranteed a license plate shape.

9. Masking

Now we know the location of the license plate, so we don't care about the rest of the details. Therefore we'll bypass the area containing the license plate and proceed to apply a mask to the entire image.

```
ImageMask=np.zeros(grayshape , np.unit8)
ProcessedImg=cv2.bitwise_and(img,img ,
mask=ImageMask,[location],0,255,-1)
ProcessedImg=cv2.bitwise_and(img,img,mask=Im
ageMask)
```

10. Character Segmentation

The visual data undergoes segmentation to obscure the license plate identifier before its storage as a distinct image, aligning with the forthcoming advancement in number plate identification. Subsequently, the subject within the visual content can be identified utilizing this processed picture.

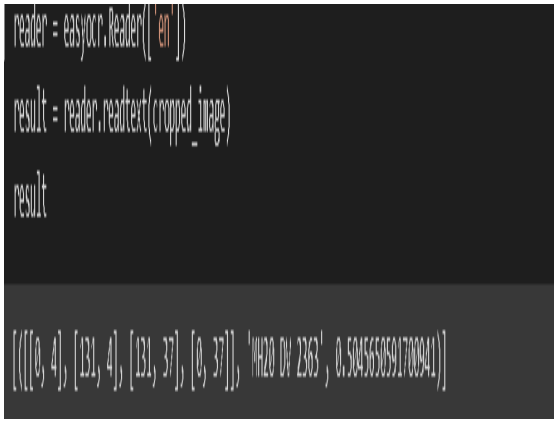
(x_co,y_co)=np.where(mask==255)
(top_x,top_y)=(np.max(x_co),np.max(y_co))
(bottom_x,bottom_y)=grayptop_x:bottom_x+1,top_y:bottom_y+1]

CroppedImage=gra[top_x:bottom_x+1,top_y:bottom_y+1]

The resulting image is as follows::

11. Character Recognition

This technique facilitates the extraction of number plate information from a segmented image. Characters within the image can be identified using the Easy OCR library.
easyocr.Reader([‘en’])
reader.readtext(segmented_image)



RESULT : MH20 DV 2363

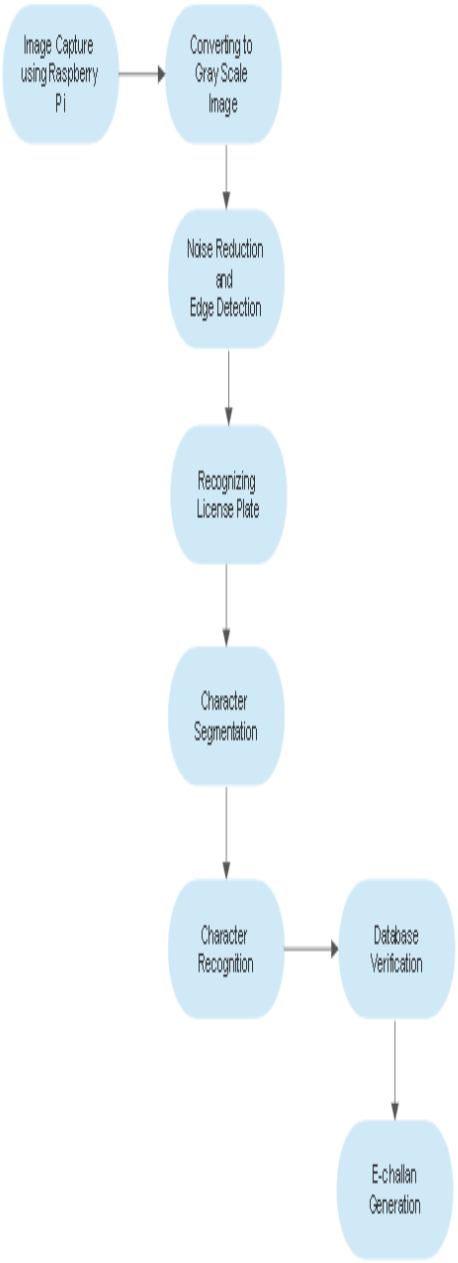
12. Database Verification

Authorities mandate that every piece of personal property, possessing a distinct identification number, be linked to its owner.
parivahan.gov.in/rcldstatus/---This listed API is used to gather information regarding the owner.

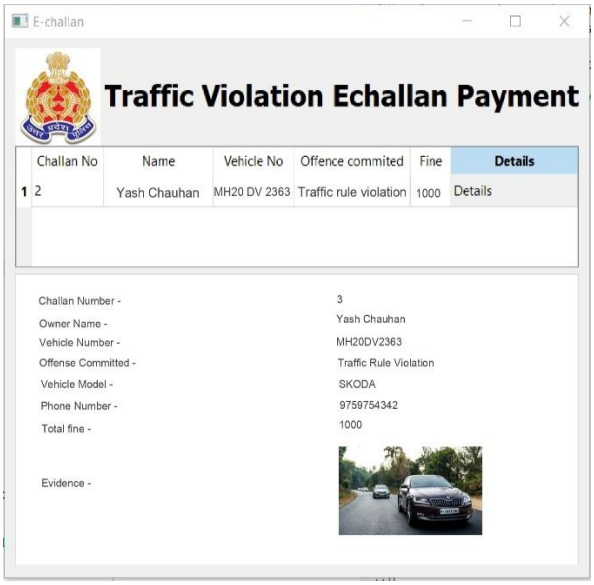
13. E-challan Generation

The system generates a challan based on the analyzed owner information and dispatches an SMS to the owner through the following API(Way2sms)- this API is utilized for sending SMS messages.

13. Diagrammatic representation of activities



14. Results and Discussion



15. Conclusion

The e-challan system, utilizing CCTV surveillance, aims to decrease road accidents in India.
This study delves into the automation of e-challan issuance. The government can deploy the e-challan mechanism to automate tasks currently done by hand, enhancing efficiency and intelligence in the process. This approach is expected to install a sense of caution among drivers regarding traffic rule violations.

16. Reference

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