ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 9, Issue 9, September 2022

Licence Plate Recognition System Using Open-CV and Tesseract OCR Engine

[1] Rithik B, [2] Raghav G, [3] Harshith M, [4] Rahul Patwadi, [5] Aravind H S

[1] [2] [3] [4] [5] Electronics and Communication Engineering Department JSSATEB Bangalore, Karnataka, India.
Corresponding Author Email: [1] rithikbalaram77@gmail.com, [2] ragavgsm21@gmail.com, [3] harshith2907@gmail.com, [4] rpatwadi@gmail.com, [5] aravindhs1@gmail.com

***Abstract*— As the technology has taken a leap to make sure human lives get easier, it has also come with certain consequences. One of them being traffic control and vehicle owner identification has really become a serious issue in the 21st century. Due to the advancements in automobile technology, it is very easy for a person to violate traffic rules and it is practically not possible for humans to stop or have a track record of the vehicles' number plate travelling at higher speeds. This is a major problem which is being faced by developing countries and our paper will discuss an implementable solution for this problem.**

Licence plate recognition (LPR) is an information processing system which performs an optical character recognition (OCR) on a digital image of the licence plate which consists of alpha-numeric characters. In this paper we put forward three staged licence plate recognition system based on open-cv and tesseract OCR engine which consists of licence plate detection, character segmentation and character recognition. The system generally uses infrared (IR) illumination to allow the camera to capture images at any point of the day. It also performs various functions such as capturing the image of the vehicle, storing the captured image along with the transcript of the licence plate. Open cv plays an important role in preparing images and videos to identify objects and tesseract OCR is used for text recognition in our prototype. The main purpose of this system is to design and develop an accurate image processing method along with successful recognition of the alphanumeric characters.

Keywords - Licence plate recognition (LPR), Open-cv, tesseract OCR engine, character segmentation, character recognition, infrared illumination, image processing, text recognition.

I. INTRODUCTION

Every day, the world advances to a better future and the dependency on technology by the people is increasing rapidly, especially the transportation technology. Transportation plays a major role in today's world. As time passes, people are looking for faster means of transportation to save time. As we live in 21st century, it is pretty evident on how transportation technology has advanced and is made available to every single [1] person on this planet. As it made available to the common people, it is very necessary to ensure their safety by implementing strict road rules which has to be followed by everyone. Licence plate recognition (LPR) system is one of the applications by which a post disaster calamity can be prevented, basically any person breaking the rule cannot get away with it easily.

To help us recognize the licence plate in vehicles, computer vision plays a pivotal role. OpenCV which is a sub division of computer vision library helps us achieve our final result. Every vehicle in [2] this world has a unique number through which the identification of the vehicle takes place. The unique number is the only identity given to vehicle and it also is the main identification feature of the vehicle. The unique number given to the vehicle is called as the licence plate which will be registered in the nearest transportation department. our system on the other hand has various applications such as detection of highway speed, detection of stolen vehicles, system for collecting human and non-human loss, and many more.The system consists of two main parts

- locating licence plates
- identifying licence numbers

In the first step, the localisation of the licence plate takes place based on the features of the licence plate. Shape, symmetry, height to width [3] ratio, colour, texture greyness, and many other characteristics are among the characteristics. There are two main activities happening in the second stage.

- character separation
- character recognition

Here, the characters are separated so that the individual alpha-numeric value [4] can be identified and in the second step the character is run through an optical character recognition (OCR) engine for the successful recognition of character or the number.

II. OPENCV

Computer Vision is a division of artificial intelligence in which humans can understand how the images and videos are stored. It is also used to manipulate and retrieve data from these images.

The widely used open-source library for image processing, machine learning, and computer vision is called OpenCV. Today's systems heavily rely on it for real-time operation.

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 9, Issue 9, September 2022

This open-source framework can be used to process photos and videos to recognise objects, faces, and even human handwriting. Python is able to process the OpenCV array structure for analysis when this library is combined with a number of other libraries, such as NumPy.

The very first OpenCV library released was the OpenCV version 1.0. Since it is distributed under a BSD licence, both academic and commercial [5] uses are free. It supports all of the popular interfaces, including Python, C, C++, and Java. It is compatible with a number of os, including Windows, Linux, MAC OS, iOS, and Android. In order to achieve computational efficiency for real-time applications, OpenCV was created. Applications of OpenCV are

- Automated inspection and surveillance.
- Facial Recognition.
- Vehicle Street detection, tracking and counting view image stitching.
- Medical image analysis.
- Object detection and tracking.
- Robot detection and tracking and autonomous car navigation and control.

Open CV Interface

- I/O, processing, and display of images and videos (core, Image processing, highs) • Feature extraction and object detection (object detect, features 2d, non-free)
- Monocular stereo computer vision based on geometry (calib3d, stitching video stable)
- Superresolution photography (picture, video)
- Clustering and machine learning (ml, flann)
- Acceleration using CUDA (gpu)

III. TESSERACT-OCR

Tesseract - OCR is an optical character recognition engine used for recognizing alphanumeric characters in images. It was originally developed by Hewlett-Packard (HP) in the 1980s. It is an open-source software 2005 and the development of this engine funded by google since then.

It supports a number of operating systems, including Windows, Linux, and Mac OS.[6] The first version of Tesseract could only recognize English with the development of version 2. Tesseract was able to identify six additional western language along with English. The version 3 added language support significantly including ideographic and right-to-left languages. The ideographic languages are Japanese and Chinese whereas the right to left Arabic, Hebrew. A version released in 2015 [7] which was the v3.04 added 39 languages, which totals up to 100 languages. Version 4 can recognize up to 116 languages. Version 4 is based on LSTM (Long short-term memory). LSTM, a type of artificial neural network used in classifying, processing data. Its application is also used in deep learning problems.

The output of Tesseract depends on the images. If the images are not pre-processed correctly, it may result in poor quality. Images must be magnified so that text has an xheight of at least 20 pixels, any rotation or [8] skew must be fixed, and low-frequency brightness fluctuations must be high-pass filtered.

IV. METHODOLOGY

The histogram, texture, edge detection, morphological processing, and transformation are the foundations of the licence plate identification approach. We have covered a brief introduction to these strategies in the steps that follow.

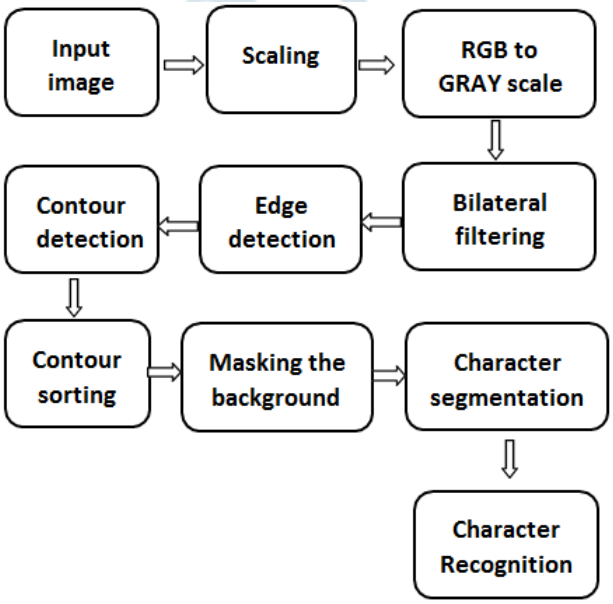

Fig A: Block diagram for licence plate identification

- CAPTURING THE INPUT IMAGE

The input images are captured by our high-resolution camera (Logitech 720p,30fps). [15] The quality and the resolution of the picture depends upon the camera as well as the vehicle being in its appropriate position. The image that was obtained will undoubtedly be in RGB format, so it needs to be converted to a grey image.

Fig. 1: captured input image

- SCALING

Reseizing the captured image is a very important step because it helps us avoid unnecessary problems which might

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 9, Issue 9, September 2022

arise due to bigger resolution picture. Here the captured image is reduced the desired frame by our code, it also makes sure that the licence plate remains the frame. This process is also called as the scaling of the digital image.

- GRAY SCALE CONVERSION

The image which is in RGB format is converted to Gray scale format. This conversion is very important because the RGB image will have a lot of data which is not required while processing the image. [9] One more reason for the conversion RGB image to Gray scale is that, RGB image holds different intensity labels and is represented by three channels. Therefore, a colour image will have lot of intensities which in directly a lot of data will be stored or will be getting manipulated in the background.

Fig. 2: RGB to Gray scale conversion

- BILATERAL FILTERING

Once the required resizing of the image another important step called bilateral filtering takes place. In this step the un wanted details from the image will be removed which again will help us or the system to store only required information.

Fig. 3: Bilateral filtering

The unwanted details in the picture are called noise and bilateral filtering helps reduce noise in the image along with helping us preserve the edges in the image, basically smoothing the image as a final result.

- EDGE DETECTION

Edge detection is a very important step in image processing technique which helps us identifying the boundaries of the object [13] (licence plate) in the image. Edge detection specifically works by detecting the discontinuities in brightness. It specifically is used for image segmentation and data extraction. Here in our code, we will be using canny edge method from open cv for edge detection.

- CONTOUR DETECTION

Contour detection is method of joining all the continuous points in the image or the picture which has same colour or intensity. Here in our program, we will be using contour detection to to identify the continuous rectangular shaped objects in the image. The main goal is to identify the borders of the objects in the image and localise them without any difficulty.

Fig. 4: Finding all contours in the image

- CONTOUR SORTING

After the completion of contour detection, the sorting of the of rectangular objects [11] should takes place which is necessary because the rectangular seize of car is much bigger than the rectangular seize of the licence plate, and our concern here is only licence plate, hence contour sorting is a very important step in our algorithm.

- MASKING THE BACKGROUND

As we now have the required object in the image, the other information in the background is pretty much useless.

Fig. 5: Masking the background

So, we mask the background except the required part in the image which is the licence plate. once the contour sorting identifies the required object in the image the other information in the image is useless. Hence the useless information in image is completely masked.

- CHARACTER SEGMENTATION

The next step in our algorithm is segmentation of the number plate which is a very important process for character recognition. Here the [14] required image if cropped and saved separately by our code. After the cropping of the required image, the segmentation of the characters takes place to decompose the image of a sequence of characters into sub images of individual symbols. In the next step we

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 9, Issue 9, September 2022

will explaining on how tesseract OCR will be used for character recognition

Fig. 6: Character segmentation

- CHARACTER RECOGNITION

The final step where the most important process take place is character recognition of the [12] number plate. Here we use tesseract OCR engine for recognition of characters. OCR uses artificial intelligence for recognition of characters in the image and tesseract is used to find templates in pixels, letters and sentence.

Fig 7: Character recognition

PROCEDURE FOLLOWED IN ALGORITHM

1. BEGIN

This is the first step of the algorithm.

2. Input the captured image
3. Output contains the characters in the image
4. Method: OpenCV and tesseract OCR engine.
5. LP: - licence plate

A license plate is basically defined as a vehicle which is displaying its registration details.

6. RGB to grayscale conversion

In this step, we convert the RGB image to shades of grey. It varies between complete black and complete black and complete white.

7. Morphological transformations

Morphological transformations are simple transformations based on the shape of an image which is usually performed on a binary image.

8. Gray scale image to binary image

By replacing every pixel in the input image with one with a brightness greater than the original image, this technique turns the grayscale image into a binary image (black and white).

9. Bilateral filtering

Bilateral filtering is used to smoothen images and reduce noise while preserving the edges.

10. Gaussian filtering for blur image

Gaussian filtering is basically mean filtering which performs a common function which is used to reduce image noise and reduce detail.

11. Finding contours in the image Essentially, contours are points that connect all of the continuous points in an image.
12. Recognition of all possible characters in the rectangular plate 13. Crop LP from the image
14. Apply steps from 6-12 on cropped image
15. Print the characters in LP
16. END

V. RESULTS

A total of 20 images were used to test the LPR system prototype which included images taken from varying distances, different illumination conditions and different camera angles. We faced problems with images which was taken from a long distance and our system was not able to detect the licence plate while the vehicle was in motion.

Fig. 8: Capturing the input image and scaling process

Fig. 9: Conversion of RGB format to grey scale format

Fig. 10: Conversion of Gray scale format to binary format and contour sorting

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 9, Issue 9, September 2022

Fig. 11: Character Recognition

VI. CONCLUSION

The main purpose of our paper is to design an efficient licence plate recognition system with minimal errors while recognising the number plate. We used 20 images for testing. We could identify the license plates effectively. The efficiency of our system can further be increased by combining image processing tech with neural network. Another main moto is to make sure that our system works accurately in various environmental condition and lighting conditions.

VII. FUTURE WORK

As the automobile sector advances, the technology which used to monitor and solve traffic and transportation management problems should also advance. LPR system is known for mass surveillance and if it is introduced in developing countries, problems like traffic clearance, transportation management and monitoring and tracking of vehicle and many more problems will come to an end.

REFRENCES

[1] Tella pavani and DVR Mohan "Number Plate Recognition by using open CV- Python", International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 03 | Mar 2019.

[2] Jameson, H. S. Abdullah, S. Norul, A. N. Ghazali, N. Nur, and N. A.Zamani, "Multiple Frames Combination Versus Single Frame Super Resolution Methods for CCTV Forensic Interpretation," Journal of Information Assurance & Security, vol. 8, 2013.

[3] N.Vishwanath,S.Somasundaram, M.R. Rupesh Ravi, N. Krishnan Nallaperumal," Connected Component Analysis for Indian License Plate Infra-Red and Color Image Character Segmentation", IEEE International Conference on Computational Intelligence and Computing Research, 2012.

[4] Ragini Bhat, Bijender Mehandia," Recognition of vehicle number plate using matlab", International journal of innovative research in electrical, electronics, instrumentation and control engineering vol. 2, issue 8, august 2014.

[5] Cheng-Hung Lin , Yong-Sin Lin , and Wei-Chen Liu, An efficient license plate recognition system using convolution neural networks. 2018 IEEE International Conference on Applied System Invention.

[6] R. Girshick, F. Iandola, T. Darrell, J. Malik, Deformable Part Models are Convolutional Neural Networks. arXiv preprint arXiv:1409.5403, 2014. in CVPR, 2015.

[7] S. Du, M. Ibrahim, M. Shehata, and W. Badawy. Automatic license plate recognition (alpr): A state-of-the-art review. Circuits and Systems for Video Technology, IEEE Trans. on, 23(2):311- 325, 2013.

[8] W. Liu, D. Anguelov, D. Erhan, C. Szegedy, S. Reed, C.- Y. Fu, and A. C. Berg. Ssd: Single shot multibox detector. In European Conference on Computer Vision, pages 21–37. Springer, 2016.

[9] Davix, X.A., Christopher, C.S., Christine, S.S. (2017) License plate detection using channel scale space and colour-based detection method. IEEE International Conference on Circuits and Systems (ICCS). In: Thiruvananthapuram, India. 82-6.

[10] A. Abd., Sun, SL., Fu, M.X., Sun, H., I, Khan. (2019) License Plate Segmentation Method Using Deep Learning Techniques. In: Signal and Information Processing, Networking and Computers. 4th International Conference on Signal and Information Processing, Networking and Computers (ICSINC). Qingdao, China. pp. 58-65.

[11] Mei Yu and Yong Deak Kim, "An approach to Korean license plate recognition based on vertical edge matching," IEEE International Conference on System, Man and Cybernetics, 2000, vol.4, pp. 2975-2980.

[12] Gisu Heo, Minwoo Kim, Insook Jung, Duk Ryong Lee, Il Seok Oh, "Extraction of car license plate regions using line grouping and edge density methods," International Symposium on Information Technology Convergence, 2007, pp.37-42

[13] Sanap, P. R.; Narote, S. P.; Patel, R. B.; Singh, B. P. (2010). AIP Conference Proceedings [AIP INTERNATIONAL CONFERENCE ON METHODS AND MODELS IN SCIENCE AND TECHNOLOGY (ICM2ST-10) - Chandigarh, (India) (25–26 December 2010)] - License Plate Recognition System for Indian Vehicles.

[14] 2016 International Conference on Information and Communication Technology (ICICTM), 16th - 17th May 2016, Kuala Lumpur, Malaysia "A Review on License Plate Recognition System Algorithms" Muayad Ali Hamood Bakhtan, Dr. Munaisyah Abdullah, Dr. Aedah Abd Rahman

[15] A Review Paper on License Plate Recognition System Shally Gupta*, Rajesh Singh, H.L. Mandoria International Journal of Innovative Research in Computer and Communication Engineering 2020 Vol 5 No 1.4

[16] LPRNet: License Plate Recognition via Deep Neural Networks 27 Jun 2018 Sergey Zherzdev, Alexey Gruzdev.