International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

Automatic Number Plate Recognition Using YOLO

1.Dr.M. NARESH,2.KUNTLA VISHWA SAI,3.SIDDHARTHA CAMALA,4.RENEVA SAHEEL CHOUDHARY,5.REHAN ABDUL NAYEEM

[1] Associate Professor, Department of AIML, SriIndu College Of Engineering & Technology, Hyderabad.
[2,3,4,5]U.G.Scholor, Department of AIML, SriIndu College Of Engineering &Technology, Hyderabad.

***Abstract*—** In the current scenario, toll collection often causes delays at checkpoints, as manual payment processes are both time-consuming and fuel-intensive. To address these challenges, this project proposes an automated toll collection system using an Android application integrated with Firebase. The system aims to reduce waiting time, minimize fuel consumption, and eliminate the need for manual intervention, thereby enabling faster and more efficient vehicle movement through toll gates. In the proposed approach, drivers are required to install a mobile application that is connected to digital payment gateways such as Paytm and other e-wallet services. The application maintains essential user details, including driver information, license number, and vehicle registration number, creating a unique identity for each user. Drivers can make toll payments in advance through the app, and the transaction details are stored in the centralized Firebase database in real time. When a vehicle approaches the toll gate, a camera system captures and recognizes the number plate, verifying it against the database. If the payment has already been completed, the gate opens automatically, allowing seamless passage. During the return journey, the system again verifies the vehicle details and checks the type of payment—such as one-time or return pass—and grants access accordingly. This automated system enhances efficiency, reduces congestion, and provides a smart solution for modern toll management.

Keywords—License Plate Recognition, YOLO, firebase, App, OCR, traffic.

I. INTRODUCTION

In India, nearly all freeway projects are developed by private sectors through Public Private Partnership (PPP). Private organisations hold on to construction capitals and reasonable profits from people. Once the road has been constructed tax is collected by these organisations for the betterment of roads, we call this tax as toll tax. Many toll collection systems are deployed by numerous organisations at various toll booths. However, such way of collecting taxes generally wastes time and increases traffic on freeways/ highways. Initially, in India toll was collected manually this was called as manual toll collection system. This traditional method is insufficient for collection of toll tax because each vehicle owner pays the tax by providing cash to the person present at the toll plaza this causes congestion in lanes. Although in December of 2019 Government of India introduced FASTAG system which works on RFID. Our system eliminates the drawbacks produced by FASTAG. Our proposed system is beneficial because with the help of this system traffic congestion is reducing significantly and also helps in reducing corruption at the toll booth. Our main system is basically divided into two parts: Vehicle Detection and License plate localisation and recognition. Toll Gate Automation detects vehicle using

Received: 02-02-2026 | Accepted: 09-03-2026 | Published: 17-03-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

YOLOv3 tiny which is the most recent developed algorithm for faster object detection. YOLO or You Only Look Once is an object detection model which works much differently from the region-based models such as R-CNN and Fast R-CNN. YOLO works by taking an input image and splitting it into an S*S grid, each grid takes m bounding boxes. YOLOv3 tiny is the most efficient real time object detection approach with higher recognition rate and processing speed. Now, after vehicle has been detected next step is to localize the license plate from the car image. Accurate localization of License Plate from vehicle images is elixir and onerous because each license plate differs from region to region. The traditional License Plate Localization algorithms are basically classified in three categories such as colour-based, edge-based and texture-based. This step results in only License Plates and other parts of the car are ignored and extracted. After License Plates have been localized in our system next step, we apply Python package tesseract which is an OCR engine which helps in segmenting and generating textual version of generated image. The generated textual version is then stored toll database. The converted text that is obtained of the license plate number is then checked on the database server by comparing the alphanumeric and then once the match is found a fee is deducted from the profile that is associated with the number and the respective signal is passed on to the hardware prototype to open the tollgate.

II. MAIN SYSTEM

Main system is basically divided into two parts:

A. Detection of Vehicle

In our system for detecting vehicles pictures are taken from camera which is placed 10-12 meters ahead of toll gate and 1 – 2 meters above ground level. In such way proper recognition takes place and it can avoid misleading images taken by a different angle. R-CNN model bypasses the problem of selection of large number of regions, selective search is applied in R-CNN for extracting 2000 regions from the image (called as region proposals). Fundamentally the input image captured by the camera is passed to R-CNN for extraction of region proposals (approx. 2000) also computation of CNN features is done in this part before classifying the regions. R-CNN takes a huge amount of time for training the network and also takes around 47 seconds for testing each image. Fast R-CNN is similar to R-CNN but

Received: 02-02-2026 | Accepted: 09-03-2026 | Published: 17-03-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

works faster because it requires feeding of input image to the CNN rather than feeding of region proposals to the CNN, it does this for generating a convolution feature map before identifying the region of proposals and finally swaddles the region of proposals into squares afterwards fixed size is decided by reshaping with the help of ROI pooling layer. In this paper, we espouse YOLOv3 tiny to identify vehicles. YOLO or You Only Look Once is an object detection algorithm which works much differently from the two algorithms mentioned before i.e. R-CNN and Fast-RCNN. YOLO as the name suggests You Only Look Once works by taking an input image before cleaving it into an S*S grid, bounding boxes are taken up by each grid. YOLOv2 and YOLOv3 are the most efficient, time saving and faster real time object detection models. In our system, using YOLOv3 we got an average of 97.14% for detecting vehicles. Fig. 1 shows the output after applying YOLOv3, we were successful in detecting the vehicle. The bounding box is then extracted and passed for localising the license plate.

B. License Plate localisation and recognition

This step is divided into two parts:

I. License plate localisation

Now, after vehicle has been detected next step is to localise the license plate from the car image. Accurate localisation of License Plate from vehicle images is elixir and onerous because each license plate differs from region to region. The traditional License Plate Localization algorithms are basically classified in three categories such as colour-based, edge-based and texture-based. Cheng-Hung Lin1, Yong-Sin Lin1, and Wei-Chen Liu2 in their paper adopted SVM to detect vehicle's license plates. In Phalgun Pandya and Mandeep Singh presented an approach to localise license plate based on morphological opening and closing operations, experiment resulted in 98% accuracy in localising License Plates. This and passed as an input image for localisation of license plate. For localising license plate, we used training and testing approach, we used SSD-mobile net model for training and testing the license plates. After applying we got the result as shown in the figure below.

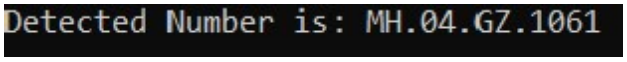
Similarly, the ROI of license plate is then extracted as an image as shown in the figure below. This extracted image is then passed for character recognition.

II. Character Recognition

In the last stage, for character recognition we used an inbuilt python package called as pytesseract for recognizing the characters. The cropped image generated in the step above was converted to grey scale image for better accuracy in recognition of alphabets and numerals.
step results in only License Plates and other parts of the car are ignored and extracted. In our system, once the vehicle has

Received: 02-02-2026 | Accepted: 09-03-2026 | Published: 17-03-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper



I. Firebase

been detected the region of interest (ROI) is then extracted

After getting the license plate number in the textual form the host server is checked for the same match. It sequentially checks the database for all the registered license plate

Received: 02-02-2026 | Accepted: 09-03-2026 | Published: 17-03-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

numbers. These license plate numbers have a profile associated with it where the information about the user is stored. It also has the available balance in the user's profile. So, after finding the match in the database and checking for the necessary balance the money is then deducted and a signal is passed on to the hardware system to open the toll gate. The toll gate would remain open if the same process is done with the next car after the one that has passed the toll gate otherwise the gate will be closed.

II. Comparison with RFID

RFID stands for Radio Frequency identification it uses radio waves to transmit information RFID tags to an RFID reader. RFID has some limitations as well some of them are listed below:

1. Materials like metal and liquid can impact the signal.
2. Sometimes may take longer time for detection.
3. RFID tags and RFID reader are very expensive.
4. Implementation can be difficult and time consuming as well.

Whereas our system can overcome some of the above listed limitations. Every toll booth uses CCTV camera for security purposes our system can use the camera for detection of vehicles. Since we are using the pre-installed cameras the cost of system is reduced significantly as compared to RFID. Implementation of the system is not very difficult. Although the performance can be increased by incorporating large computation power like a server.

III. CONCLUSION

In this paper, we have proposed an efficient method for detection of license plate and for recognition of the characters. With the implementation of YOLO model detection of vehicle such as car was highly accurate. For localisation of license plate, we used training and testing method which yield a great accuracy. And for recognition we used pytesseract an inbuilt python package.

REFERENCES

[1]. Cheng-Hung Lin1, Yong-Sin Lin1, Wei-Chen Liu2 "An Efficient License Plate Recognition System Using Convolution Neural Networks" International Conference on Applied System Innovation April 2018.
[2]. Etqad Khan, Dipesh Garg, Rajeev Tiwari and Shuchi Upadhyay "Automated Toll Tax Collection System using Cloud Database" 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU) February 2018.
[3]. Akshat Shukla, Dhananjay Hedaoo, Manoj Chandak, Veena Prakashe "A novel approach: Cloud based Real-time Electronic notice board" International Conference on Smart Technology for Smart Nation August 2017.
[4]. Miral M. Desai, Jignesh J. Patoliya "Smart Toll Collection System using Embedded Linux Environment" International Conference for Convergence in Technology April 2017.
[5]. Anumol Sasi, Swapnil Sharma "Automatic Car Number Plate Recognition" International Conference on Innovations in Information, Embedded and Communication Systems March 2017.
[6]. Amitava Choudhary, Alok Negi "A New Zone based algorithm for Detection of License plate From Indian Vehicle" International Conference on Parallel, Distributed and Grid Computing December 2016.
[7]. Reji P. I., Dharun V. S "An Efficient Algorithm for Real Time License Plate Localization" ARPN Journal of Engineering and Applied Sciences December 2016.
[8]. Joseph Redmon, Ali Farhadi "YOLO9000: Better, Faster, Stronger" December 2016.
[9]. Rahim Panahi, Iman Gholampour, "Accurate Detection and Recognition of Dirty Vehicle Plate Numbers for High-Speed Applications" IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS August 2016.
[10]. Joseph Redmon, Ali Farhadi "YOLO: Unified, Real-Time Object Detection" May 2016.
[11]. Ketan S. Shevale "Automatic number plate Recognition System for Toll Booth Application" Internation Journal of Engineering Research and Applications October 2014.
[12]. Reji P.I, Dr. Dharun V.S "License Plate Localization: A Review" International Journal of Engineering Trends and Technology April 2014.
[13]. Amr E. Rashid "A Fast Algorithm for License Plate Detection" International Conference on Signal Processing, Image Processing and Pattern Recognition February 2013.
[14]. Prathamesh Kulkarni, Ashish Khatri, Prateek Banga, Kushal Shah "Automatic number plate Recognition System for Indian Conditions" 19th International Conference Radioelektronika April 2009.
[15]. Prathamesh Kulkarni, Ashish Khatri, Prateek Banga,Kushal Shah "A Future Based Approach for Localization of Indian Number Plates" March 2009.
[16].Reddy, S. K. R. (2021). Strengthening the Security of Loyalty Reward Systems: An In-Depth Analysis of Emerging Cyber Threats and Protection Mechanisms. Journal of Computational Analysis and Applications, 29(6).
[17].Poojari, R. INTELLIGENT SYSTEMS+B108 AND APPLICATIONS IN ENGINEERING.

Received: 02-02-2026 | Accepted: 09-03-2026 | Published: 17-03-2026