

Vehicle Entry Control by using Automatic Number Plate Recognition

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Abstract— For a very long time, security has been a primary concern of every organization. In this paper, we are implementing a system which helps us to ensure automated entry of vehicles and proper administrative control over the entry gates. A proper database is also maintained using the MySQL and records can be accessed anytime when necessary. The system is accurate in detecting the license plates, by the use of OpenALPR Cloud API and also fetch vehicle details from Indian MoRTH website. The image is captured by the IP camera, when triggered by an ultrasonic sensor. The system utilizes the API for the telegram application to provide easy notifications and bot connectivity. The system is implemented on Raspberry Pi 3 Model B and has been tested for large No. of images.

Keywords— Automatic Number Plate Recognition (ANPR), OpenALPR, IP Camera, Raspberry Pi, Telegram, MySQL.

1. INTRODUCTION

The regulation of entry of the vehicles in the premises is often a tedious task to maintain, since the manual security errors are a very major issue. Nowadays, advancement in technology has led to automation of various areas. The vehicle monitoring, and record maintenance is the duty of the security in-charge and is done manually. This process often does not follow a standard, is difficult to maintain and guarantees certain amount of error. If the process is automated, there are various advantages as compared to the manual approach. The manual approach of keeping the vehicle entry records might be a simple, in cases where the amount of the vehicles is limited.

But, in places like parking area, the number of entering/exiting vehicles can be in few hundreds to thousands. In that case, manual record maintenance turns out to be a cumbersome task to accomplish. The proposed system works on automatic recognition of the registration number plate of the vehicle, and permitting the entry, if the vehicle is registered.

Our proposed system utilizes an open source license plate recognition service, OpenALPR Cloud API. This is a cloud-based service that is used to analyze the vehicle image and extract the Registration Number of the vehicle. The record for the vehicle details is taken from the database available at the ‘Ministry of Road Transport and Highways’ website. By automating the process of entering the vehicle’s record in the database, the database can be accessed from anywhere by the administrator by using telegram bot. The database contains proper record of each and every vehicle, including information like vehicle make/model, chassis no. of the vehicle etc., which is allowed to enter the premises or not, in a tabular form.

Earlier, the procedure of the license plate recognition described, uses the MATLAB Neural Network toolbox for image processing and comparison as described in [1, 2].

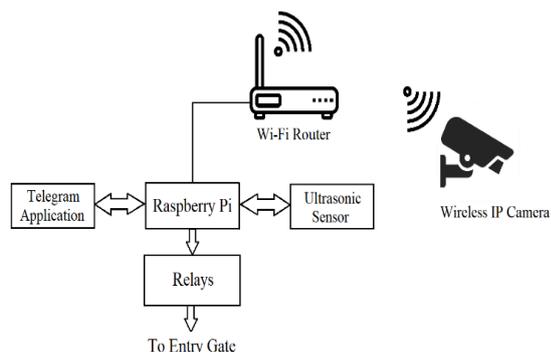


Fig. 1: Block diagram of proposed system

There are various algorithms available for detection and recognition of license plate of the vehicles, each of which have certain pros and cons as described in [3]. There are three most suitable methods for determining license plate of vehicles. These three Algorithms are most efficient in detecting the registration no. of localized number plates. The algorithms are: License Plate Recognition with k-NN, OpenALPR – India, Convolutional Neural Network (CNN) according to [4]. Best results, keeping in mind the time taken to process the image and Localized detection accuracy, are obtained by the OpenALPR Library.

The Telegram Application used is an open source messaging application, which is incorporated in the Raspberry Pi. We are sending the messages by using the Telegram Command Line Interface (CLI). The Telegram Bot which is provided for the administrative control purposes is accessed by using python script and appropriate functions.

2. PROPOSED WORK

The proposed system works on the Raspberry Pi 3 Model B, which is a cost efficient, portable and low – energy single board computer. The administrative access to the system is provided using the bot facility of an open source messaging application, Telegram, whose API is incorporated in the system.

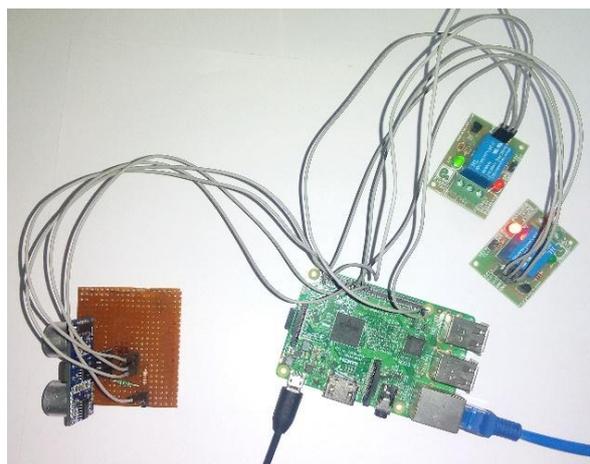


Fig. 2: Hardware of the proposed system

The main modules of the proposed system are:

- Image acquisition
- Image processing and retrieval of vehicle information
- Verification
- Database population
- Telegram notification
- Telegram bot for administrative control

2.1 Image Acquisition

The functionality of this part of the system is based on the two components: A wireless IP camera and an ultrasonic sensor module.

- 1) *IP Camera:* An IP camera, or Internet Protocol based camera, is a Digital Video Camera commonly used in surveillance purposes. This type of cameras is capable of sending video streams over the internet, either via Wi-Fi or LAN. The IP camera has an IP address which can be used to access the image captured by the IP camera.
- 2) *Ultrasonic Sensor:* The Ultrasonic Sensor Module is used to determine the distance to an object, with the help of echo location technique. If a vehicle is present at the gates, the ultrasonic sensor will detect it and trigger the IP

camera to capture the image and send to the Raspberry Pi for further processing.

2.2 Image Processing and Retrieval of Vehicle Information

This is a 2 – step process. The image is acquired from the IP camera and processed using the Raspberry Pi, which gives the vehicle information and all the required details.

1) *OpenALPR Cloud API:* The OpenALPR Cloud API is a web-based service, which takes image as the input and gives the vehicle registration no. as the response, according to the vehicle region present in the request, which in our system is India.

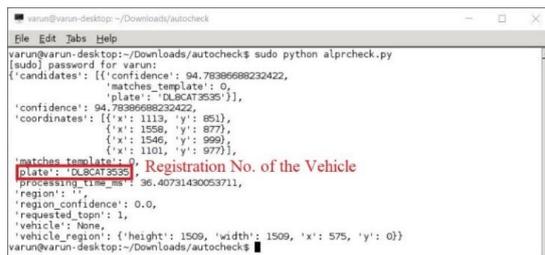


Fig. 3: Response from OpenALPR Cloud API

2) *Vehicle Details from Ministry of Transport Database:* The registration no. detected is passed to the website of

‘Ministry of Road Transport and Highways’ via a python script. The generated data from the website is retrieved and stored along with the registration number of the vehicle for verification process.

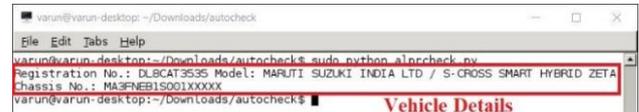


Fig. 4: Vehicle Details with information from MoRTH

2.3 Verification

The vehicle details are compared with a text file present in the system, to verify whether the vehicle is registered or not. If the vehicle is found to be registered, then the associated entry details are stored in the database. The Gates are then opened by using a relay driven motor mechanism. If the vehicle is found to be unregistered, then also the vehicle details are stored in the database, but the gates remain closed in this case.

2.4 Database Population

The vehicle details are stored in the MySQL based vehicle database in the system. The date and time of the entry of the vehicle along with the vehicle details

```
mysql> use Vehicle
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> select * from Log;
```

ID	Time	Vehicle	Entry Permitted
1	2018-04-08 00:00:00	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	Yes
2	2018-04-08 00:40:17	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	Yes
3	2018-04-08 00:46:21	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	No
4	2018-04-08 00:48:50	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	No
5	2018-04-08 15:10:31	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	No
6	2018-04-08 15:15:56	Registration No.: DL3CBF3907 Unable to get Details from RTO	No
7	2018-04-08 15:16:54	Registration No.: DL3CBF3907 Unable to get Details from RTO	No
8	2018-04-08 15:17:57	Registration No.: DL49AK49 Unable to get Details from RTO	No
9	2018-04-08 16:19:05	Registration No.: DL49AK49 Unable to get Details from RTO	No
10	2018-04-08 16:22:09	Registration No.: MH12DE1433 Unable to get Details from RTO	No
11	2018-04-08 16:23:23	Registration No.: KA03MG2784 Model: TATA MOTORS LTD / SAFARI DICOR 4X2 Chassis No.: 403063KTZNXXXX	No
12	2018-04-08 16:26:38	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	No
13	2018-04-08 16:28:55	Registration No.: KA03MG2784 Model: TATA MOTORS LTD / SAFARI DICOR 4X2 Chassis No.: 403063KTZNXXXX	No
14	2018-04-08 16:29:55	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	Yes
15	2018-04-08 16:34:31	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	Yes
16	2018-04-08 17:22:48	Registration No.: MH12DE1433 Model: FORD INDIA PVT LTD / FIESTA 1.6 SXI ABS Chassis No.: MAJBOXMRTB6YXXXX	Yes
17	2018-04-08 17:43:23	Registration No.: KA03MG2784 Model: TATA MOTORS LTD / SAFARI DICOR 4X2 Chassis No.: 403063KTZNXXXX	No
18	2018-04-08 18:20:28	Registration No.: KA03MG2784 Model: TATA MOTORS LTD / SAFARI DICOR 4X2 Chassis No.: 403063KTZNXXXX	No
19	2018-04-08 18:21:51	Registration No.: KA03MG2784 Model: TATA MOTORS LTD / SAFARI DICOR 4X2 Chassis No.: 403063KTZNXXXX	No
20	2018-04-08 18:25:55	Registration No.: KA03MG2784 Model: TATA MOTORS LTD / SAFARI DICOR 4X2 Chassis No.: 403063KTZNXXXX	No
21	2018-04-12 21:51:23	Registration No.: DLBCAT3535 Model: MARUTI SUZUKI INDIA LTD / S-CROSS SMART HYBRID ZETA Chassis No.: MA3FNEB1S001XXXXX	Yes
22	2018-04-12 22:37:57	Registration No.: DLBCAT3535 Model: MARUTI SUZUKI INDIA LTD / S-CROSS SMART HYBRID ZETA Chassis No.: MA3FNEB1S001XXXXX	Yes
23	2018-04-12 22:40:21	Registration No.: DLBCAT3535 Model: MARUTI SUZUKI INDIA LTD / S-CROSS SMART HYBRID ZETA Chassis No.: MA3FNEB1S001XXXXX	Yes
24	2018-04-12 22:47:44	Registration No.: DLBCAT3535 Model: MARUTI SUZUKI INDIA LTD / S-CROSS SMART HYBRID ZETA Chassis No.: MA3FNEB1S001XXXXX	Yes

24 rows in set (0.01 sec)

Fig. 5: MySQL database records details

and whether the vehicle entry is permitted, are stored in the database. Details of about all the vehicles entering the premises in a single month can be stored and maintained by the proposed system, even with large amount of traffic.

2.5 Telegram Notification

Each time a vehicle is present at the gate, whether registered or not, then the user of the system is notified via messages on the Telegram application. The messages will involve all the vehicle details along with a picture of the vehicle. Then the user can take the appropriate actions if the vehicle is not permitted to enter the gate.

2.6 Telegram Bot for Administrative Control

Telegram Bots are a special feature of the Telegram application, each of which have unique identifier which is known as Bot Token and hence making it an administrative control method in our system. The Bots can be designed to do specific tasks as designated according to the programming defined. In our system, an inline keyboard is used to provide administrator access to following services:

- 1) *Gate Control*: The gates can be controlled by the security administrator and the present status at the gates can also be monitored by using the bot buttons 'Gate Open', 'Gate Close' and 'Photo'.
- 2) *Registering a Vehicle*: An unregistered vehicle whose image is captured by the IP camera, can be added to the text file present in the system by the administrator by the 'Add Car' button of the Telegram bot.
- 3) *Database Records Access*: The records which are present in the vehicle database can be accessed by the administrator as a date wise

record by 'Access Records' button in the Telegram bot. The records are retrieved from the database and shown to the user in CSV file format.



Fig. 6: Notification on Telegram application

3. PROPOSED ALGORITHM

The proposed system provides a very efficient manner to control the entry and exit of vehicles on the basis of license plate recognition. The algorithm of the proposed system is given as follows:

- i) Ultrasonic sensor continuously monitors the gate for any vehicle presence.
- ii) When a vehicle is detected by the ultrasonic sensor, then it triggers the system to capture a photo of the vehicle by the wireless IP camera.
- iii) The IP camera captures the photo. The captured photo is downloaded and stored in the system.

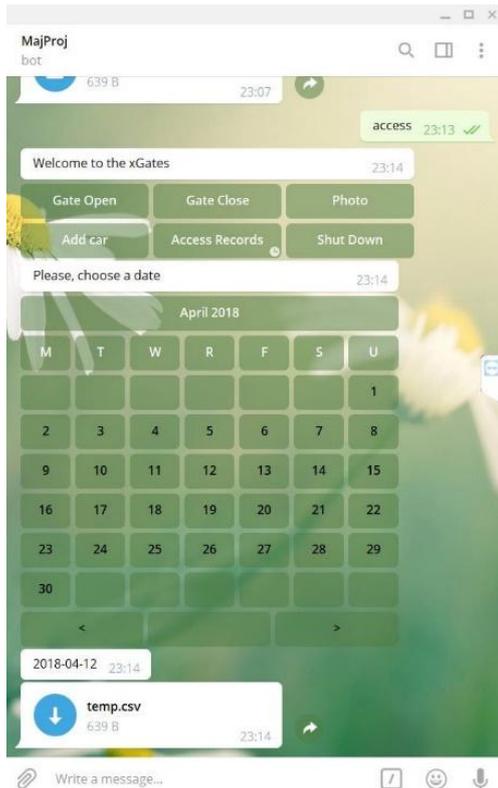


Fig. 7: Telegram Bot with Database Access

- iv) The acquired image is processed by use of the OpenALPR Cloud API which gives the vehicle registration no. by recognizing the license plate.
- v) This license plate no. is then fed into the MoRTH website for getting the vehicle details. The details along with the license plate no. are stored together.
- vi) If the vehicle details are already present in the text file in the system, then an appropriate record is inserted in the database consisting of entry date and time of the vehicle, vehicle details and entry is permitted. After this, the user is notified through a message on the Telegram app and the gates are opened.
- vii) If the vehicle details are not present in the text file, then the record is also inserted in the database, but

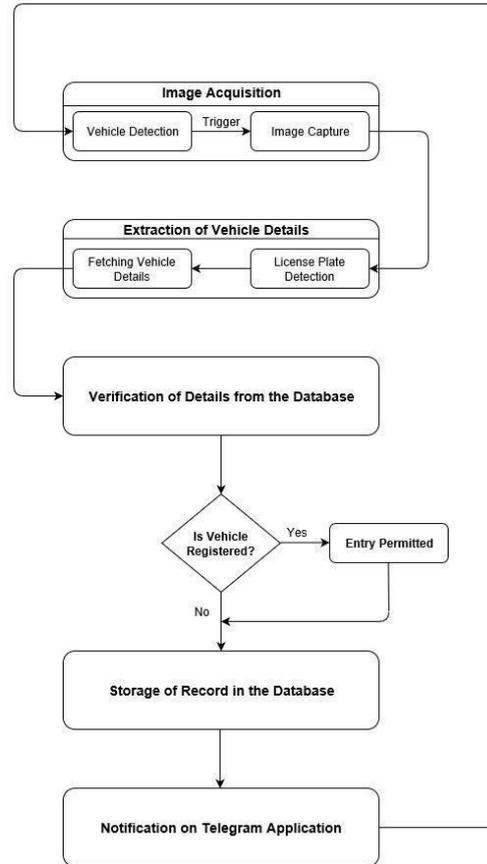


Fig. 8: A Flowchart depicting work flow of the system

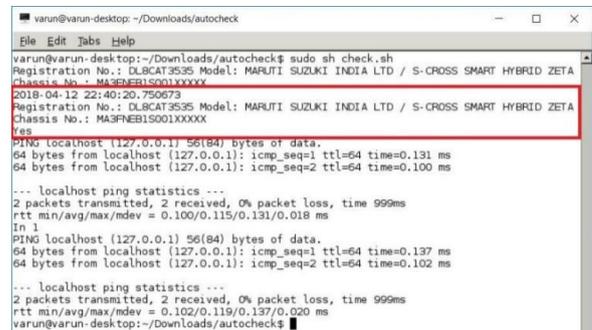


Fig. 9: Output for a Registered Car with Entry Permitted

the gates will remain closed in this case.

- viii) After the process is completed, then the ultrasonic sensor starts its monitoring again.
- ix) If the vehicle details are not present in the database or the system is unable to process the acquired image correctly; then the user has the authority to control the opening

of gates remotely, with the help of Telegram BOT.

- x) Also, the database records can be accessed remotely from the Telegram bot by the administrator, for a particular date and a CSV File of the same with be sent on the bot.

4. RESULTS

The system takes maximum 10 seconds (depending on the internet speed) to recognize license plate and fetch details from MoRTH website. Then the process of comparison with the text file and entry in the database takes another 5 seconds. So, gates start opening for the registered car within 20 seconds of the vehicle detection. The notification for any unregistered car is sent to the user within 50 seconds to the Telegram application, thus allowing security personnel to take further appropriate action.

5. CONCLUSION AND FUTURE SCOPE

The proposed system fetches the image and opens the entry gates within 20 seconds, if the car or vehicle is registered. Otherwise, the status at the entrance is sent to the security in-charge, which can take action thereafter. The proposed system has many advantages, like low power, low cost and high accuracy in Image Recognition, thus, making the system very useful and reliable for security purposes. The current system can also be utilized in many current Scenarios with some Modifications. The

system can work with even greater speed and accuracy with proper internet connectivity and high-quality cameras. This system requires internet access all the time, this can be one of its drawbacks.

The system has a great amount of future scope, it can help to automate the traffic rules management system, can also help to detect and track stolen vehicle locations on the fly.

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