



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 4, April 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



9940 572 462



6381 907 438



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Automatic License/Number Plate Detection & Recognition

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ABSTRACT: In today's world, the number of vehicles on road are increasing exponentially. As the number of vehicles increases on the road, many problems related to these vehicles are increasing day by day. Vehicle Theft and breaking of traffic laws are becoming more prevalent. Moreover, as the world is moving towards autonomous vehicles and self-driving cars, police standing on the sides of road to check drivers and vehicles and penalise them on their wrong doing seems old school. Also, police are limited to certain places and time, therefore people could easily break traffic rules by knowing the time and location of police. This creates a limitation which technology can overcome because technology can reach everywhere at all time. This Automatic License/Number Plate Detection and Recognition system is a beginning step for adapting technology in these sectors. With the help of this system, many places where vehicle detection and regulation are required, could easily become automated. This system also helps to store the data which is being generated, so one can easily go through the data and perform the necessary functions that could be associated with it. The data stored could also helped in automation of these systems. Therefore, this system could be a stepping stone to an automated future.

I. INTRODUCTION

Automatic License/Number Plate Detection & Recognition is a system developed to detect the License/Number Plate of vehicles around the world. This system is developed using python and its machine learning components. The main work of this system is to detect the number plate on a vehicle and then extract the number written on that number plate. In addition to this, this system will also store at what time and date the number plate is detected by the system. Other parameters like geo location, speed, vehicle type etc. could also be added in the database. Thus, making this system versatile. This system could be used in different sectors like car parking and police.

In car parking it can be used to store the data when a car is arriving and leaving the car parking. Also, with the data collected from the cars which are arriving in the parking, the system could be evolved and could tell the drivers at what slot in parking they should park the car. Like if someone who generally parks his car for longer period of time, could park his car at the end and other people who parks the car for less time could park behind it. That increases the efficiency and could help in accommodating more cars in the parking. Also, by the system, they could estimate the possible fare that the drivers might have to pay. Thus, increasing the productivity of the parking spaces and helps in increasing their revenue.

It is especially useful for Police. Police can use this system in various ways. Like they can install this system in different places, which can detect the vehicle passing there at what time, place and speed. This would help them to automate the system to searching vehicles and sending chalans to people who breaks the traffic rules. Also, as the data for each car is being stored in the data base, they could see the frequency of the traffic rules breaking done by the driver. So, this could help them in making a more effective fine for the driver.

One more sector this system could help in is traffic light time. Usually, traffic lights have a fixed time for each side of road, which stays the same, no matter what the time is, how much traffic is congested in the back and how many cars are on the other side of road. The system could analyse the number of vehicles passing through a traffic light. By studying this data, an efficient time could be found for each side of road at a particular time of day. Thus, helping is better management of traffic.

This system can also be used in Fastag, which is widely spreading across India. Instead of vehicles getting a special sensor for Fastag, which takes extra time and resources, their vehicle number plate could be used to detect the vehicle and then cut the toll tax from that vehicle. Also, as autonomous and self-driving cars comes in future, they can use this system to get the characteristics of other vehicle around them and their driving characteristics. This will help them in better decision making on roads. Thus, this system has a wide scope in future.

II. BACKGROUND

Many technologies related to image data faces some common problems, which are storage and accessing of image data. Also, when it comes to image, many times the image quality is not up to the mark that could be stored and could be used for data analysis in future. Also, using image data directly into systems is a huge problem because working with image takes a huge amount of processing and time, and if a system has to use these images again and again, this could slow down the system and thus decreasing the efficiency of the system. Therefore, a solution has to be made for these problems and that's where Optical Character Recognition or OCR comes into play. OCR is a technology which is used to extract the data from an image.

In the research paper, A Detailed Analysis of Optical Character Recognition Technology [1], written by Kareem Abdulwahhab Hamad and Mehmet Kaya, they said that storing images takes up a lot of storage space and effort. One first has to scan or capture the image, then have to upload it on the database. The images also need to be in good quality for feature extraction to work properly. Then utilising these images for different process is quite a difficult task. Therefore, if one extract all the information in the image using OCR, they get all the information from it in text form or character form, which is easier to store, takes less storage and are easy to process. Therefore, systems like Automatic License/Number Plate Detection & Recognition uses this technology.

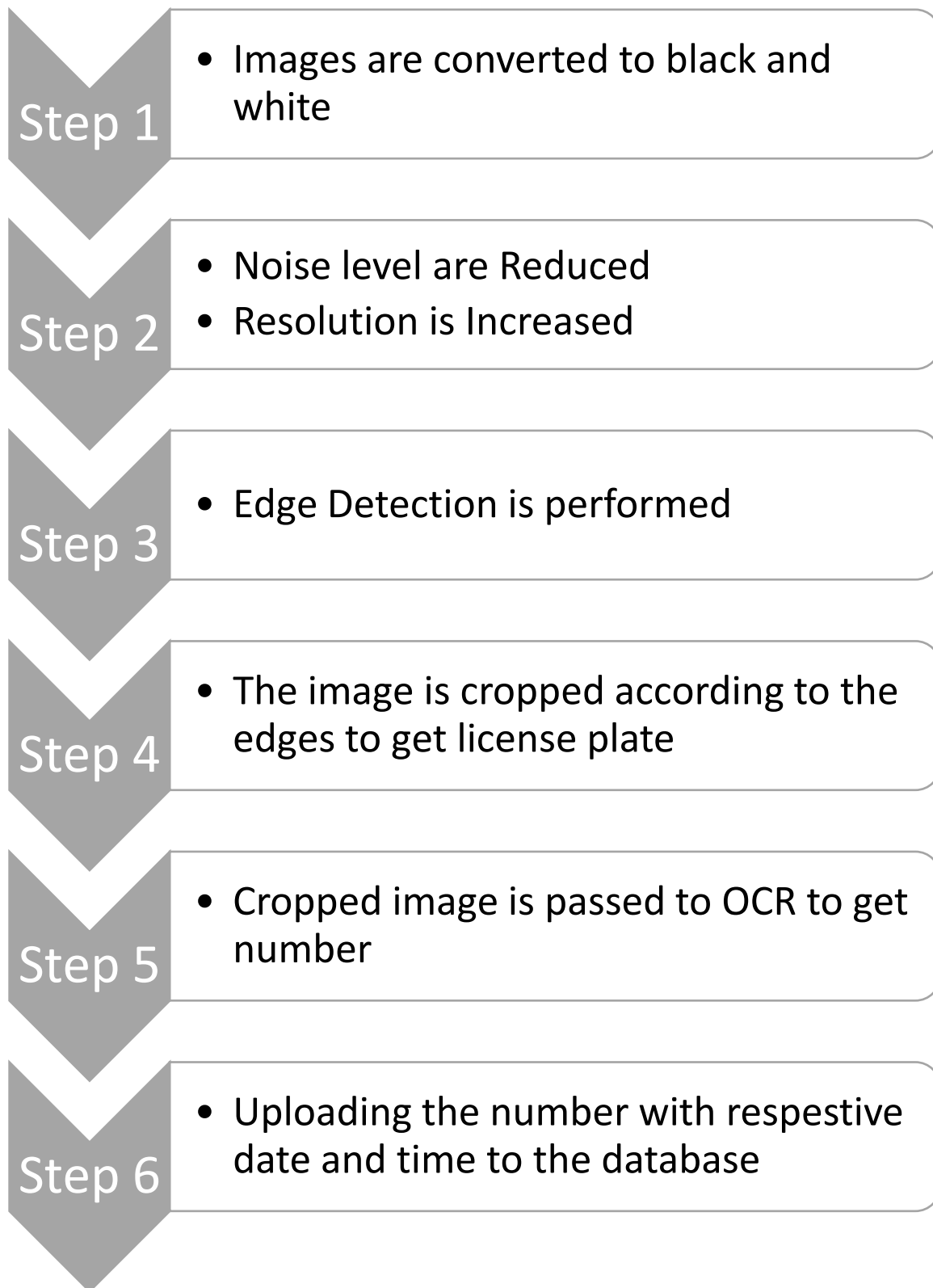
Sometimes, one character is written in different styles. In the modern world of style and fashion, every character has more than a thousand way to be written. This creates a problem while feature extraction of the image. Also, not everyone would be familiar with every style of a character that are present around the world. This is very evident for License Plates, as License plate styles varies from place to place, countries to countries. In the research paper, Handwritten Optical Character Recognition (OCR): A Comprehensive Systematic Literature Review (SLR) [2], written by Jamshed Memon, Maira Sami, Rizwan Ahmed Khan, And Mueen Uddin, they have mentioned how OCR could help in solving this problem. As OCR would extract the text from the image, it would store it in a uniform style. Thus, making it easier for everyone to understand and then processing it.

Another problem is that of picture quality. In order to OCR to work properly, the system needs to have good quality of images. This creates a problem because in the projects like this one (Automatic License/Number Plate Detection & Recognition System) because many sector that it is going to be used does not have a good quality of cameras. In the research paper, A new approach for upscaling document images for improving their quality [3], by Ram Krishna Pandey, Shishira R. Maiya and A.G. Ramakrishnan, they have mentioned how they are using deep neural network-based model that utilizes the traditional interpolation methods, takes the best features from them and reconstructs a high-resolution image from these features. This is achieved using Convolutional Neural Network (CNN). By this technique, we could provide good quality images to the OCR model for better results.

III. PROPOSED APPROACH

To get the License Plate Number of a vehicle, we first need to get some images of the vehicles with their number plate visible. After getting these, we can start with our process. The process is broken down in following steps:

1. Converting images to black and white
2. Doing noise reduction and increasing resolution
3. Edge detection
4. Cropping the edge to get license plate image
5. Passing the cropped image to OCR to get the number
6. Uploading the number to database with their respective time and date



(a) Flow Chart for The model

First of all, all images are converted to black and white. This is done because coloured images are larger in size as compared to their black and white counterpart. Coloured images are comprised of 3 main components: Red, Green and Blue. Providing different values to these 3 provides different intensity to these colours and then those adds up to give us our colour. In computer language, we can say that there is a matrix containing information for each pixel of screen. Now, if there are 3 colours (red, green, yellow), it will create a 3x3 matrix, which is complex, hard to compute and also takes a lot of space to store. Therefore, if there is just one colour to adjust, that is black, it will take just one matrix, and will be easier to compute for our process. This step is also crucial for edge detection.

Doing Noise reduction and increasing resolution is very important, because many of the images that will be provided to us for dataset will not be in best quality and will have lot of noise and distortions. Converting the image in black and white could also contribute in losing some details in the image. Therefore, to retain all those loss information and making image clearer is important to reduce the noise and increasing the resolution to get a good quality and sharp image. This image will also help in proper edge detection in further steps.

Edge detection is done to get all the edges that are present in the image. This is specially done in this project so that we can extract the edges which are formed over the license plate. This is done by using a fact that the license plates are always rectangle in shape and also the length of that rectangle is always more than the width of that rectangle. This helps in proper detection of our license plate. Also, by converting the image into black and white and increasing the resolution of image, the images generate a great contrast in the edges which makes it easier for model to detect the edges and provide the coordinate for the same.

After getting the coordinates for the license plate, the image is extracted using those coordinates. This gives a clear picture of license plate, removing most of the extra useless data which was previously present in the image. This further reduces the image size and thus helping in faster computing of result. Once the image of license plate is generated, it is passed in OCR model to get the text present in the image. As the image is most likely to contain only characters, it would help in increasing the efficiency of our OCR model, thus giving us more accurate results.

After getting the results from the OCR model, the results are uploaded with the time and date. For reference images of the vehicles which were used for this purpose is also uploaded with the results. More attribute like location, speed etc. can also be easily added in the database, making in more versatile and adaptable for the future iteration of the model.

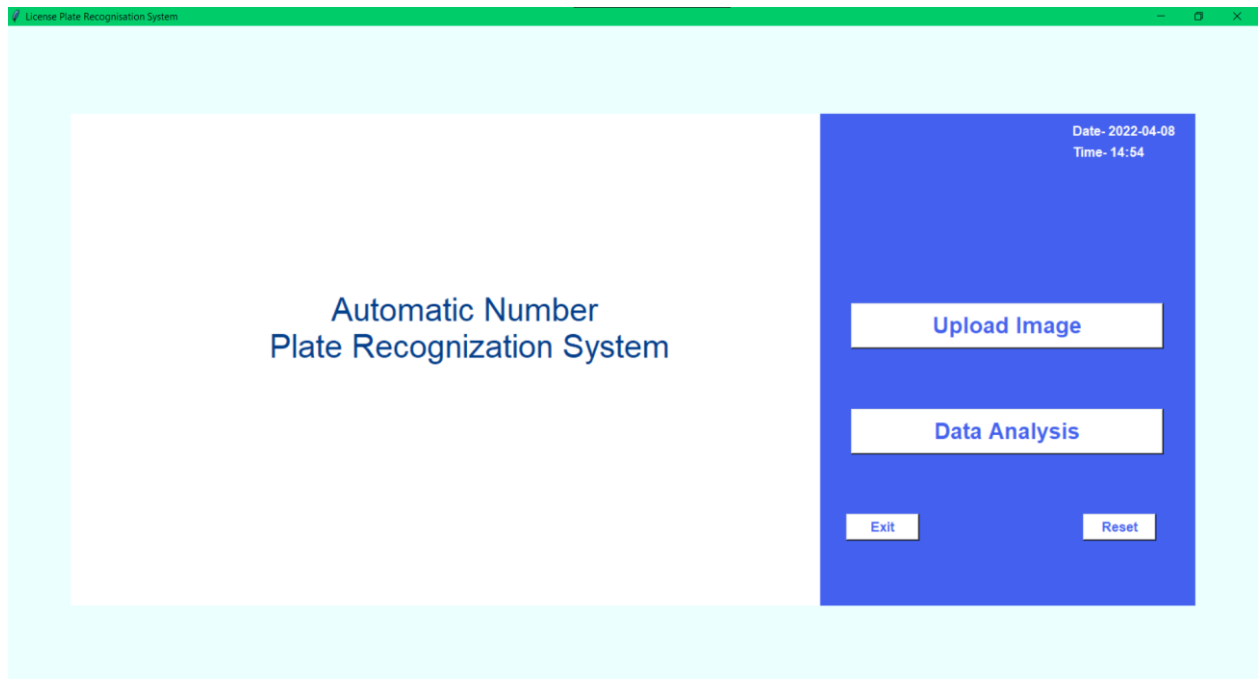
IV. RESULT

IV.I.ENVIRONMENT

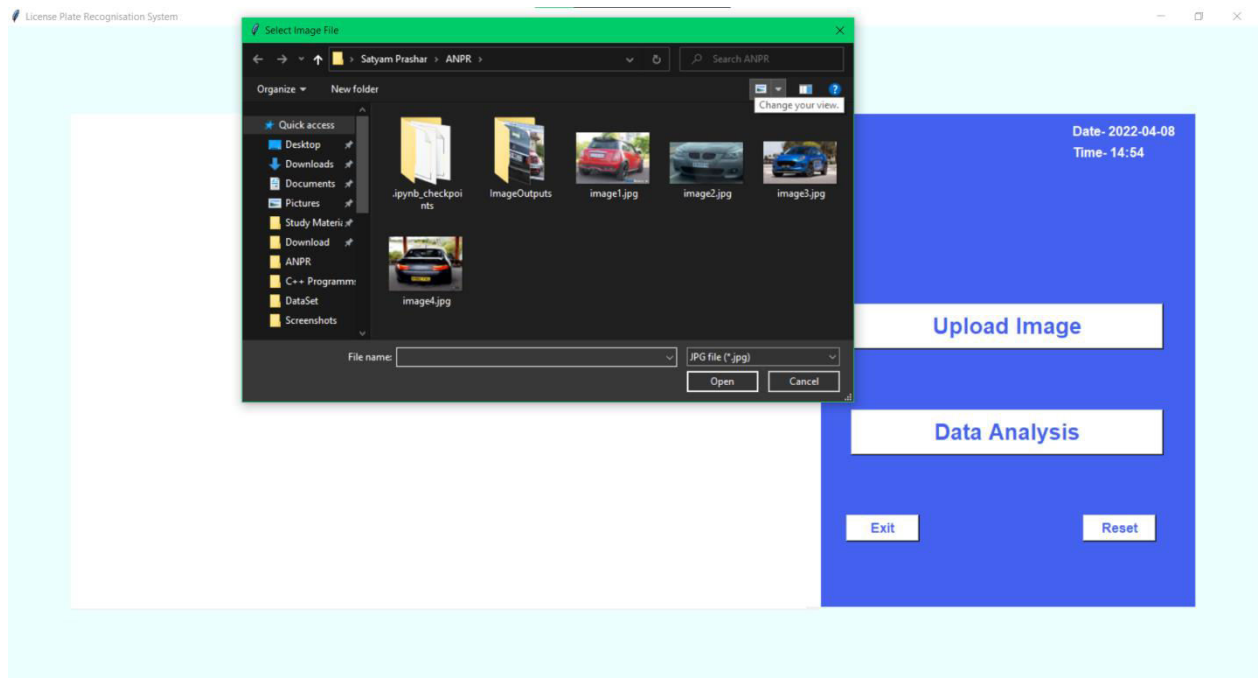
The system used for the results is equipped with AMD Ryzen 5 2500U with Radeon Vega Mobile Gfx 2.00 GHz CPU and Nvidia GTX 1050 4gb GPU. The RAM of the System is 8 GB. The version of python used is 3.8.5. OpenCV version 4.5.5.64. OCR version 1.4.1. Tkinter is used for the GUI. MySql is used for storing data.

IV.II.RESULTS

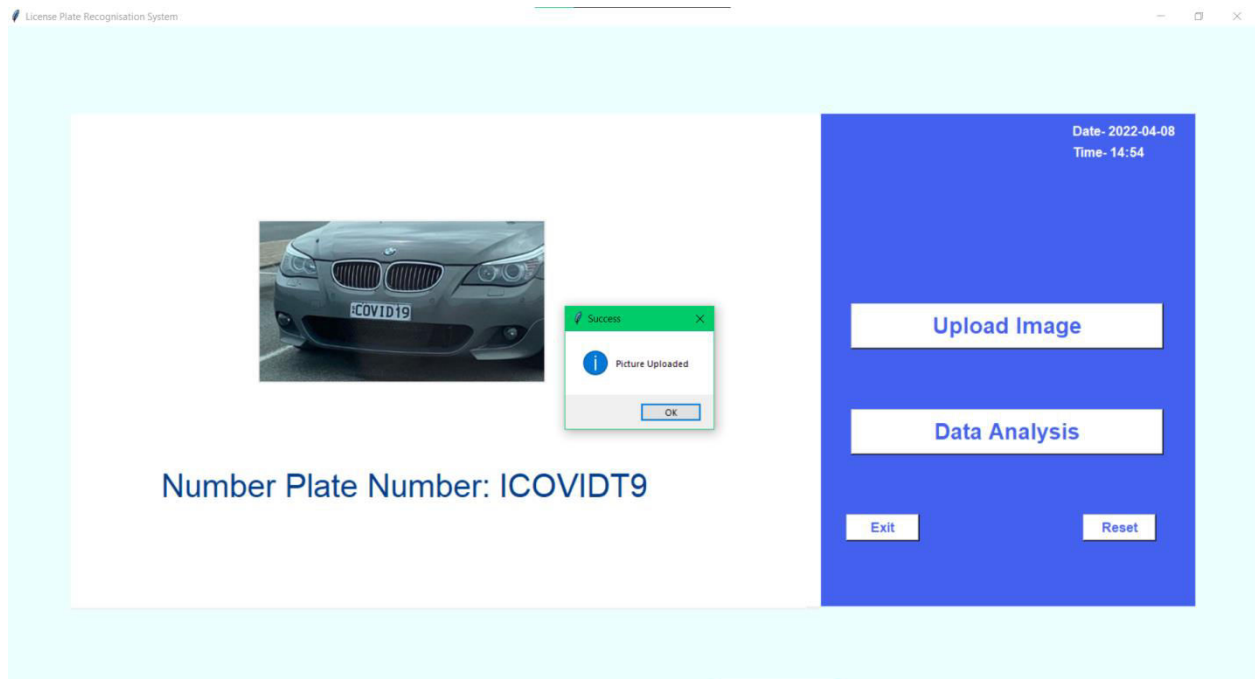
So, by implementing and working on the above-mentioned steps, a System is generated which can take an image and can extract the license/number plate out of it.



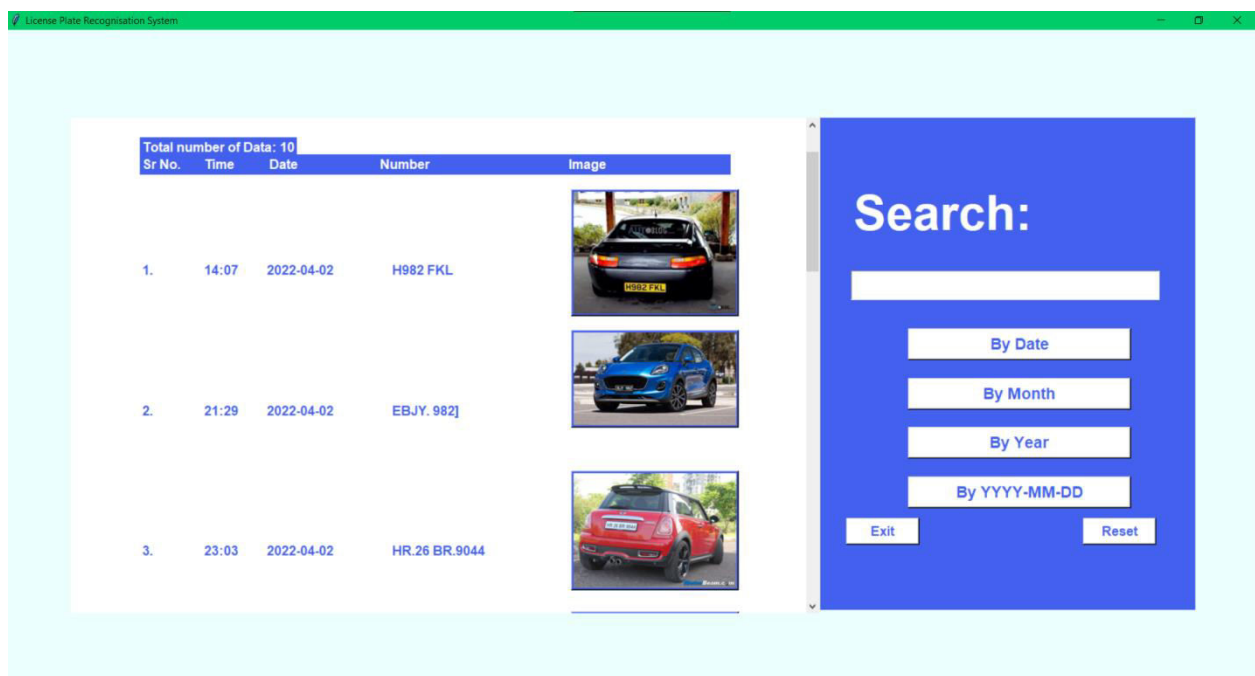
(b) Home page



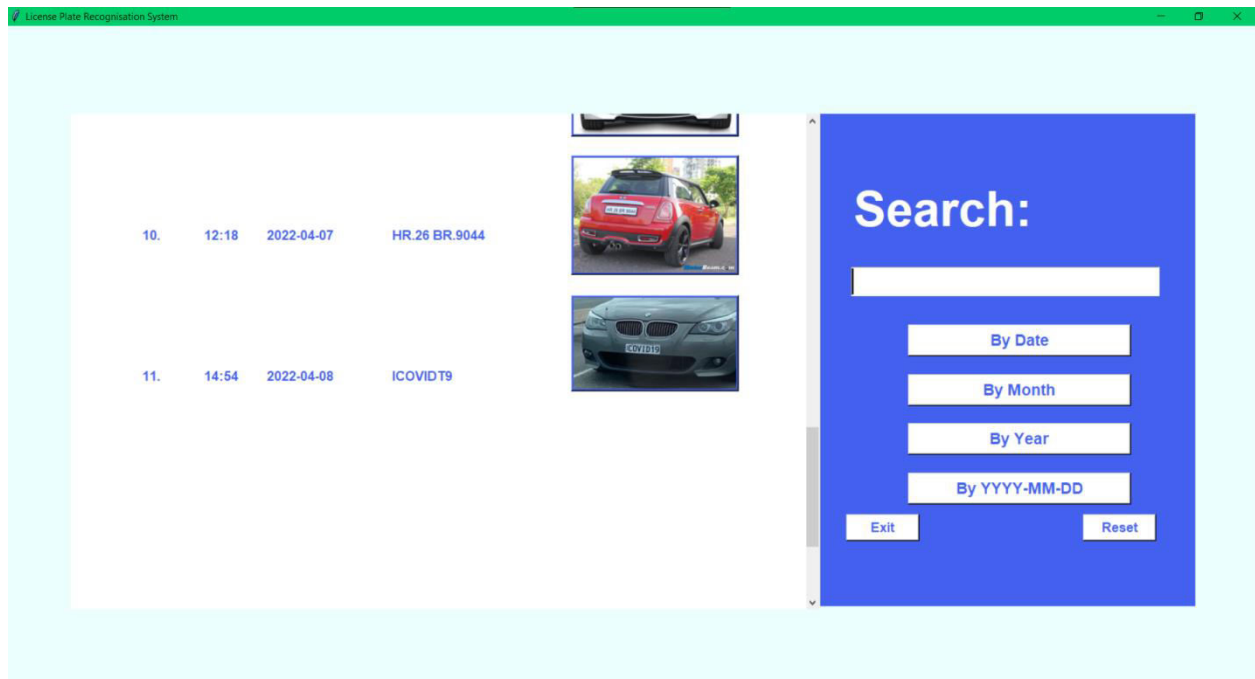
(c) Uploading Image



(d) Picture Uploaded



(e) Data Analysis Section



(f) Picture That we Uploaded is present here with Vehicle Number

This is my version of how this system could work. In future, some other functionalities could be added in the system to make this system usable for other purposes. As mentioned before, location could be added so that if the spotted car is stolen, the system could detect it and tell the location of car so that it could recovered. Also, if we add speed factor in it, if a car passed the spot above the speed limit, then the car could be recognized and a chalan could be send to the owner of the car. Thus, making the process of chalan automated. Also, the fastag system could be attached with License plate Number, so that resources could be saved that were going to be used on making special sensors. Also, the data generated could be used to manage the traffic light time and assign more accurate and precise time for each traffic light for more free flowing traffic. Also, in parking lot, the system could check where there is spot in the parking and what will be the most appropriate spot for the owner to park for the effective use of parking lot and many more.

V. CONCLUSION

In conclusion, technology is the future of the world. Everything is going to be related to technology somehow. This Automatic License/Number Plate Detection & Recognition is also a stepping stone towards the technology driven future. It not only releases burden from man force, which was previously used to do this work, but also increase the productivity and reliability of that work. This system can help in better management of vehicle, lowering down the number of road accidents and traffic rules breaking. It could help in increasing the effectiveness of parking lot and help in increasing their revenue. Also, this system could play a part in the autonomous and self-driving cars in the future. The possibilities of where this technology could be used is endless. It is on us how we could use this technology for our benefit.

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