



## PLAZA PLUS – AN IMPROVEMENT IN TOLL TAX COLLECTION

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**Abstract:** Taxes are paid to everything around us. The government collects toll taxes at toll plazas, where the vehicle needs to stop and pay the tax to travel any further. In the fiscal year 2021, approximately 15000 crores were collected as toll tax. Even though the existing toll collection has reduced the waiting time near the toll plaza, there are problems associated with it. As the number of vehicles passing through the toll plaza increases, so does the traffic near the plaza. Access to the emergency lane is limited to ambulances and VIPs, but there is no option for the common person who is in a hurry or has an emergency to use the emergency lane near the toll plaza. Our focus is to provide an option for the common people to use the emergency lane or to skip the traffic near the toll plaza. To provide this option, we use an automatic number plate recognition system with the additional feature of pre-booking toll tickets. This system addresses the issue of the vehicle owner who is in an emergency and does not have the option to skip the queue near the toll plaza.

**Index Terms - Automatic Number Plate Recognition System, Pre-booking, Toll Booth, Toll Tax**

### I. INTRODUCTION

The Indian Road network plays a vital role in connecting districts, states, and other nations. It comprises national highways, expressways, state highways, major district roads, other district roads, and village roads.

Table 1 : Measurement of roads in highways

National Highways	1,40,995 km
State Highways	1,71,039 km
Other Roads	60,59,813 km
Total	63,71,847 km

As mentioned in Table 1, India has a total road network of 63.72 lakh km, making India the world's second-largest road network [1] after the United States of America. For the development of these road networks, the Indian Government collects road tax and toll tax.

Tolls are an indirect tax that must be paid while using national or state highways. These taxes are collected by the NHAI (National Highways Authority of India) and utilized for the construction, maintenance, and covering of newly built national and state highways [2].

The government has placed toll plazas on national and state highways to collect these toll taxes. As per the fee rules declared in 2008, the spacing between the adjacent toll plazas is 60 km. In the manual method of toll collection, a vehicle needs to stop near the toll plaza, make a cash payment, and collect the payment receipt before advancing any further. In 2018–19, the average waiting time for vehicles near toll plazas was around 8–10 minutes. With the introduction of Fast Tag in toll tax collection, the waiting time for vehicles near toll plazas has now been reduced to 47–48 seconds. If the maximum wait time per vehicle is 50 seconds, the average wait time in a month near the toll plaza is  $50 \times 30 = 1500$  seconds.

$$\text{Yearly total time taken} = 1500 \times 12 = 18000 \text{ secs} = 5 \text{ hours} \quad (1)$$

Although that is a considerable improvement in waiting times, at certain locations, especially near cities and densely populated areas, there are still some delays at toll plazas during peak hours. Suppose the time taken by each vehicle during peak hours to cross a toll plaza is approximately 120 seconds; the average wait time in a month is  $120 \times 30 = 3600$  seconds.

$$\text{Yearly total time taken} = 3600 \times 12 = 43200 \text{ secs} = 12 \text{ hours} \quad (2)$$

On average, a vehicle must wait around 12 hours near a toll plaza with its engines on, which leads to intense fuel loss, more pollution, and a waste of money and time [3].

## II. RELATED WORK

### • Raspberry Pi Based Smart Toll Collection System [3]:

Prof. Chhaya Athavale et al. proposes a Raspberry-based toll collection system for toll tax collection. They have implemented a project on a toll collection system using a Raspberry Pi and Passive RFID tags. The toll is automatically collected from the user's account with respect to the RFID tag placed on the windshield of the vehicle. An LCD screen is placed on-site to display details such as toll deducted and remaining account balance. This proposed system addresses problems like time wastage, fuel consumption, and collection errors at one go. The proposed system focuses on bringing transparency in toll collection and preventing corruption and tax evasion problems.

### • An Efficient Cashless Toll Collection System using RFID tag[4]:

Pritesh A. Patil et al. Have discussed the Automatic toll series device and the use of RFID tags in cashless mode. Their recognition is to reduce the amount of time spent close to the toll plaza, to provide passengers with amusement of plaza prices and illegal entry, and to detect stolen automobiles. To make the assignment extra reachable, an Arduino is used, and an RFID reader is designed for the usage of 8051 microcontrollers on the Arduino kit. RFID tags are of sorts specifically lively tags and passive tags. In this challenge, they have used passive RFID tags. SystemEM-18 reader module is used to routinely pick out, and song tags attached to gadgets. The essential cause of the system gives a base for enforcing RFID-based total toll collection systems to automate the toll collection method by using monitoring automobiles at toll series.

### • Smart Toll Tax Automation and Monitoring System Using Android Application [5]:

Mr. Christopher et al. have developed smart toll tax automation using RFID technology with a microcontroller sign processing gadget and cellular software which allows people to pay toll tax automatically. They have additionally provided an SMS facility to inform the information of tax deductions to the consumer. The proposed framework includes a person, tag, cell software for monitoring, and antenna. The person wishes to connect the RFID tag to the windshield or dashboard of the automobile. Whenever the person attempts to cross the toll gate it produces passive radio waves which in turn cause magnetic waves which transfer the person's information to the reader and the information is stored in a configured database. If the automobile is registered the alarm buzzers and LED mild begins blinking concurrently for 30 secs and opens the gate with the help of an inbuilt DC motor. They have proposed an efficient machine to automate the method of toll tax series with the android software and RFID clever playing cards. Their cognizance is on providing a person-pleasant, secured toll tax series device.

## III. PROBLEM DESCRIPTION

Even though there is considerable improvement in the queue near the toll does exist due to the following reasons –

- No fast tags – the government has mandated fast-tag for every toll plaza some vehicle owners still use the manual mode of toll collection.

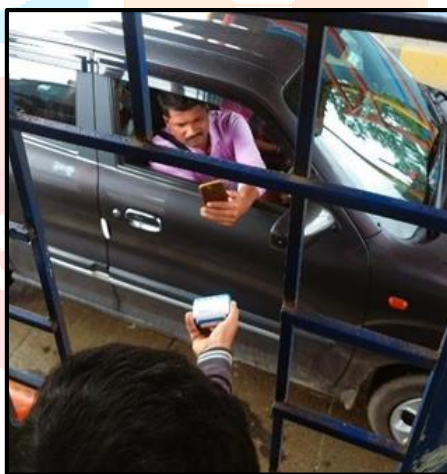


Figure 1 [a] [b]: Toll tax paid through manual mode

- Misplacement of fast tag on the windshield leads to delay in this situation the person sitting near the toll should come down and use the other smart reader device.



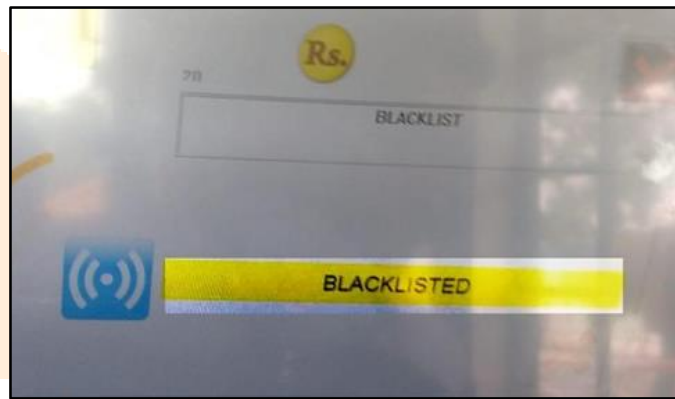
Figure 2 [a] [b]: Toll person scanning using the manual reader.

- Some vehicle owners do not attach the fast tags to their windshields which leads to delays.



**Figure 3:** Tag not attached to the windshield.

- Some vehicle owners show the government IDs like Police IDs, Army officers IDs, and even BBMP corporate IDs.
- Blacklisted vehicles – a vehicle with 2nd owner will face issues and vehicle owners with low balances with their fast tag account.



**Figure 4:** Blacklisted vehicle displayed on the computer screen.

Vehicle owners or common people who are in a hurry or in an emergency have no choice but to use emergency lanes near the toll plaza, but emergency lanes are only limited to VIPs and ambulances. The main objective of the project is to provide access to the emergency lane for the common people who are in a hurry or have an emergency.

#### IV. PROPOSED SYSTEM

To provide access to the emergency lane to the common people, a system can be proposed that includes the pre-booking of the toll ticket through the website. And to overcome the issues related to the fast tag, we make use of a number plate recognition system technology.

The objective of our proposed system is to build a user-friendly website through which-

- The vehicle owner can-
  - Create an account to access the website.
  - Pre-book their toll tickets and can therefore utilize the emergency lane.
- The admin can-
  - Verify the information provided by the user.
  - Based on the information provided, the admin can accept/reject the account creation process of the user.
  - Can manage the information related to the tollbooths.
- The toll booth manager can-
  - Alter the vehicle number, if the recognized number is wrong and allow the user to pass through the gate.

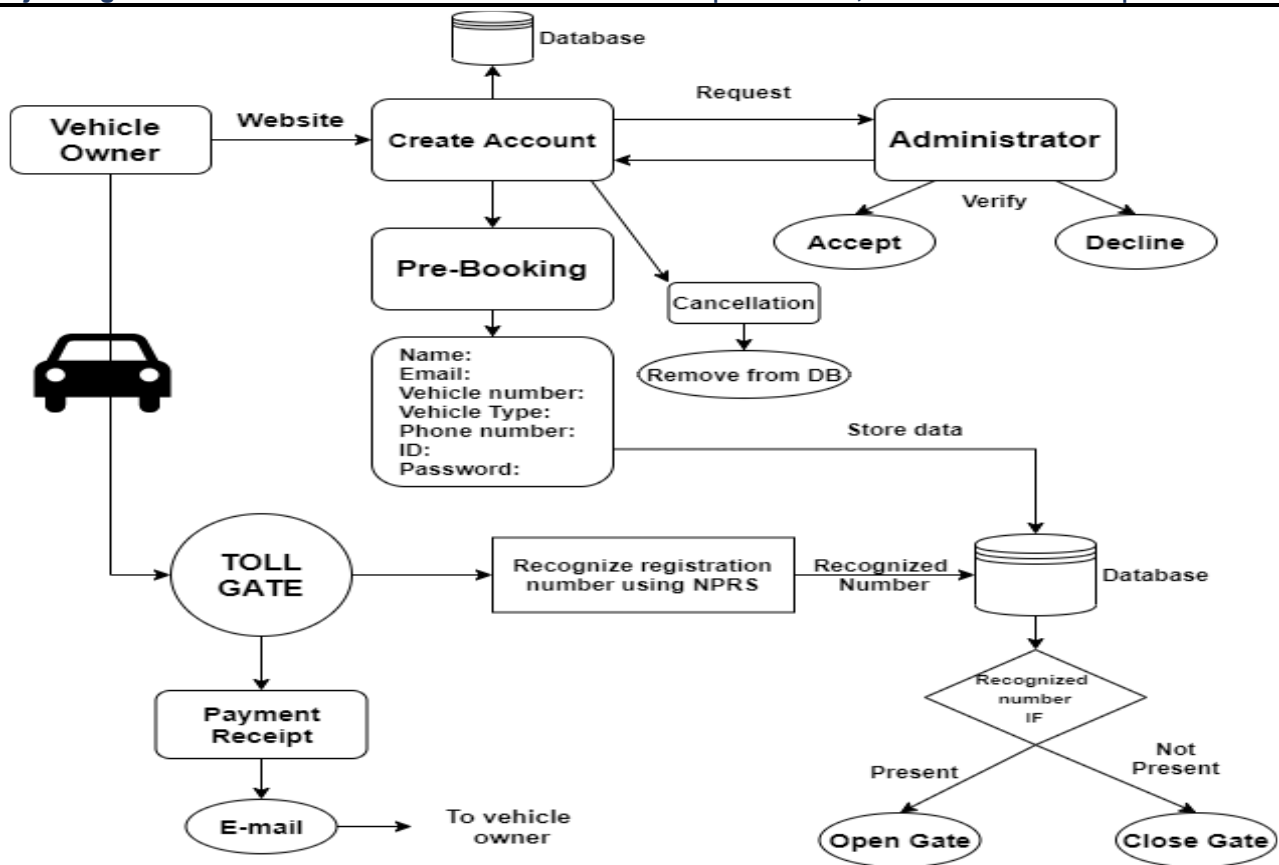


Figure 5 : System Architecture

Figure 5 represents the System Architecture of our project.

Referring to Figure 5-

- To utilize the emergency lane, the vehicle owner needs to create an account with their vehicle number.
- After submitting the request to create an account, the admin receives the request and verifies the details provided by the vehicle. The admin has the right to accept or reject the request for creating the account and the admin has also access to add toll plazas.
- Whenever the vehicle owner wants to use the emergency lane, they can log in and pre-book the toll ticket.
- A number plate recognition system is placed near the emergency lane of the toll plaza. Whenever a user who has pre-booked the toll comes near the emergency lane, the number plate recognition system detects the number-
  - If the number is present in the database, the toll gate opens automatically.
  - If not, the gate remains closed.
- And the transaction details will be sent to the user’s email id.

V. RESULTS

5.1 Snapshots of the website

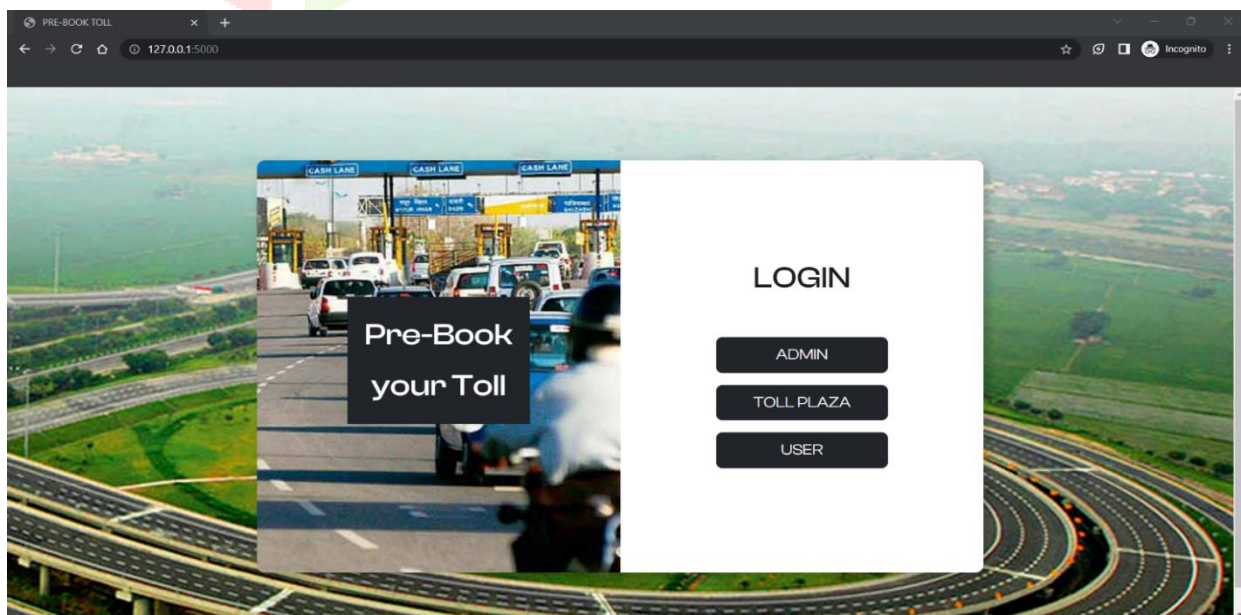


Figure 6: The log-in page

Figure 6 shows the login page of the website through which the user can access their respective accounts.

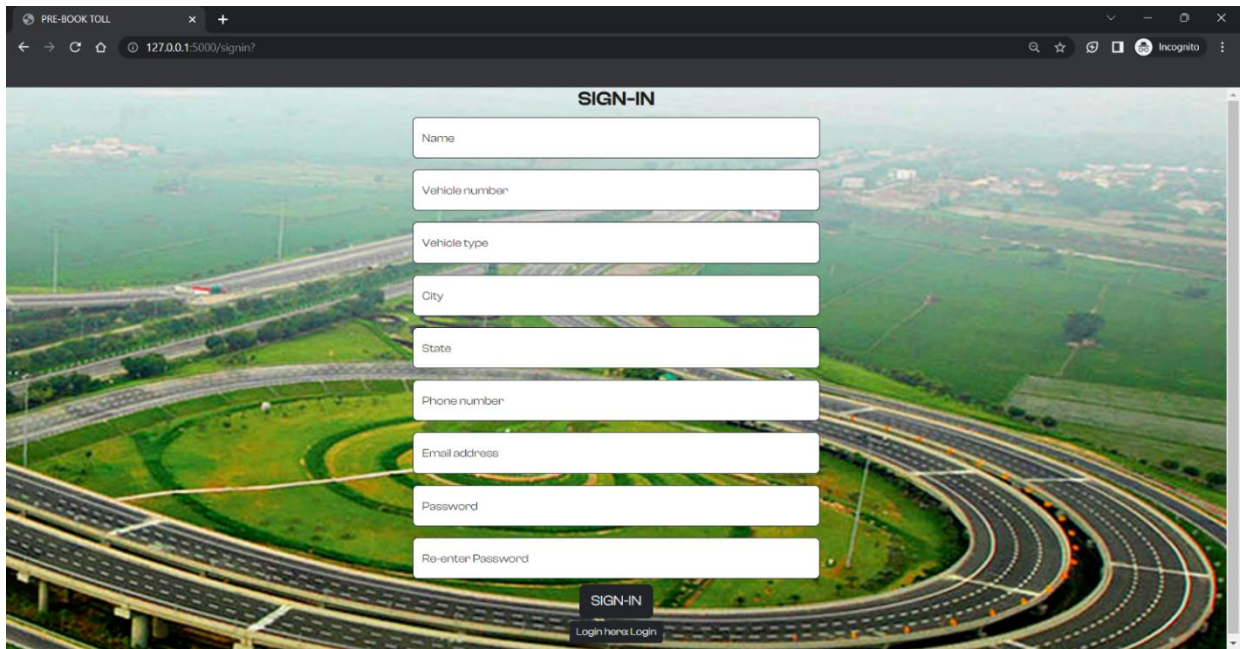


Figure 7: The user sign-in page

Figure 7 shows the user sign-in page through which the user can send an account creation request by providing the information asked.

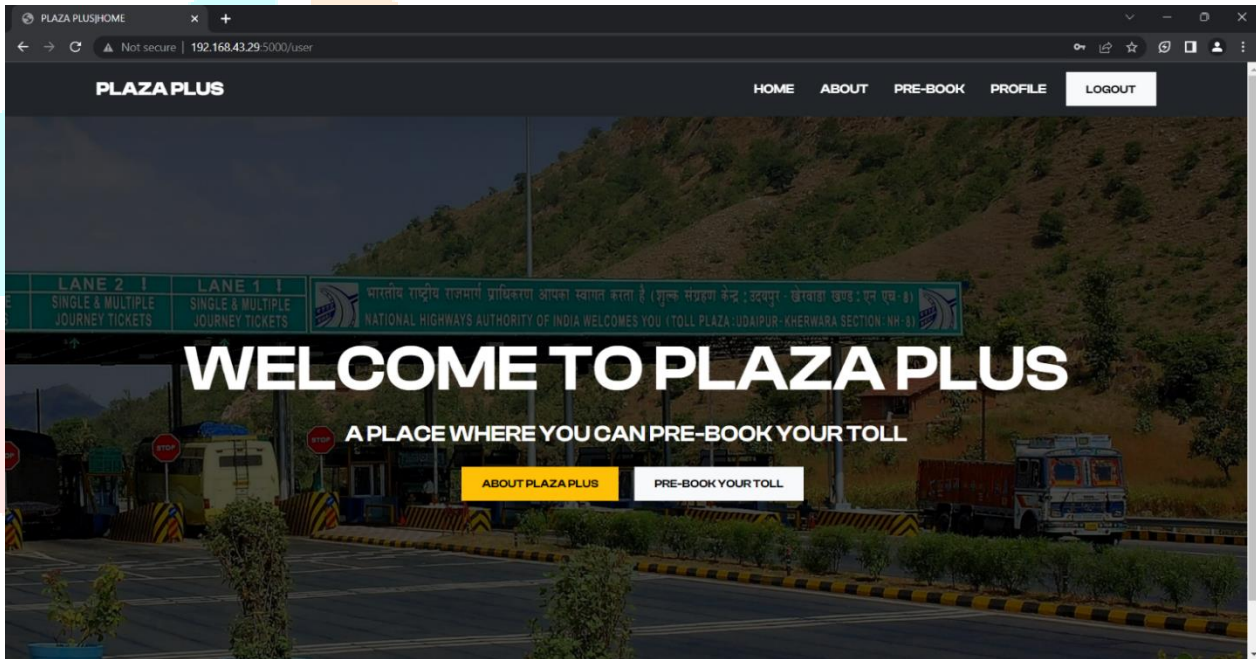
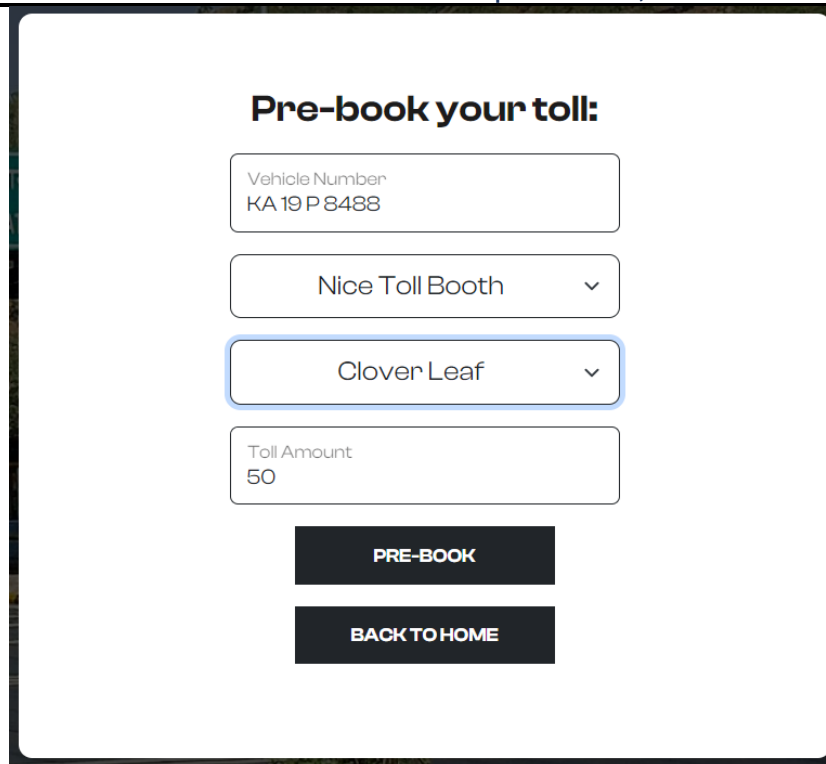


Figure 8: User home page

Figure 8 shows the home page, which can be accessed when the user logs in.



**Pre-book your toll:**

Vehicle Number  
KA 19 P 8488

Nice Toll Booth

Clover Leaf

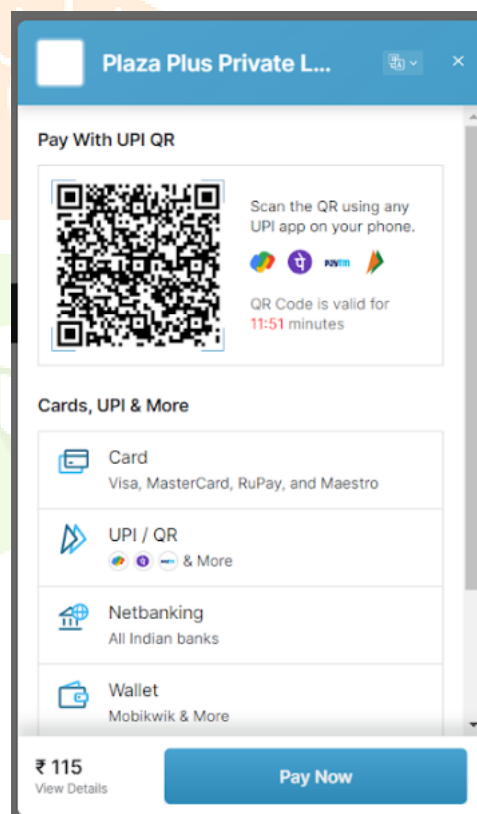
Toll Amount  
50

**PRE-BOOK**

**BACK TO HOME**

**Figure 9:** Pre-book toll page

Figure 9 shows the pre-booking page where the user can pre-book their toll by selecting the toll and the route through which the user wants to pass through.



**Figure 10:** The payment process.

Figure 10 shows the payment process, once the user pre-books the toll, the user is required to pay for the pre-booked toll, and the payment will be carried out through Razor pay.

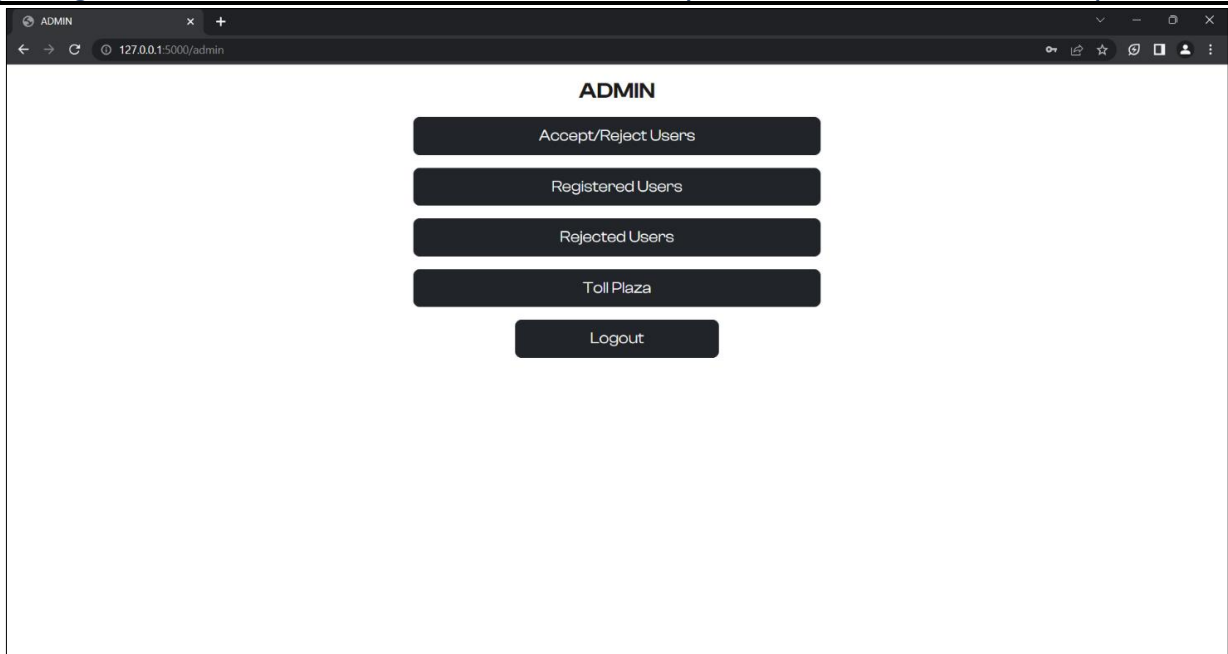


Figure 11: Admin dashboard

Figure 11 shows the admin dashboard where the admin can access the tollbooth and user details.

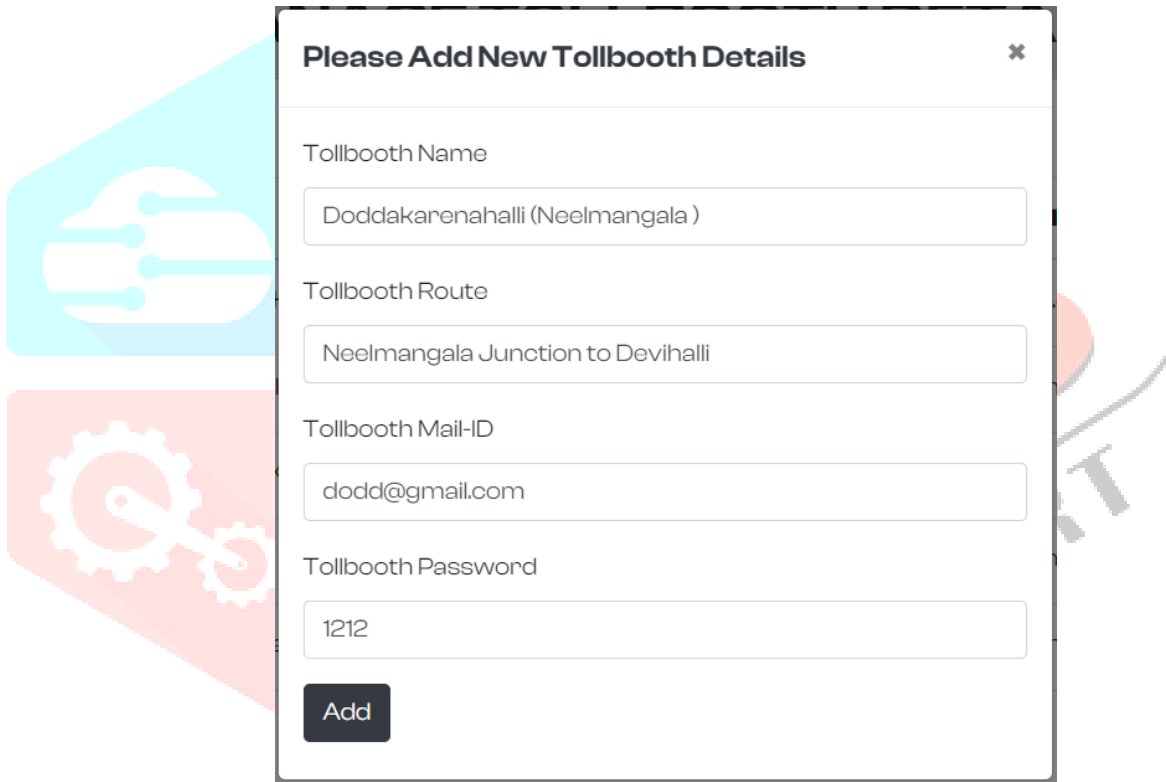


Figure 12: Add new toll booth details page.

Figure 12 shows the page where the admin can add new tollbooth details, which will be reflected throughout the users and admin website.

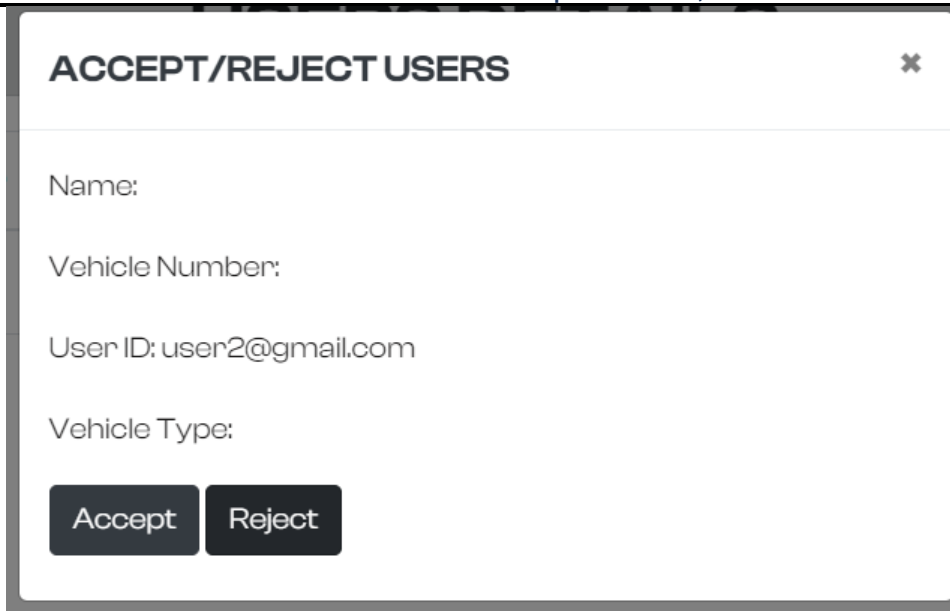


Figure 13: Accept/Reject users page.

Figure 13 shows the page through which the admin can view the information provided by the user and based on the information provided the admin can accept or reject the user account creation process.

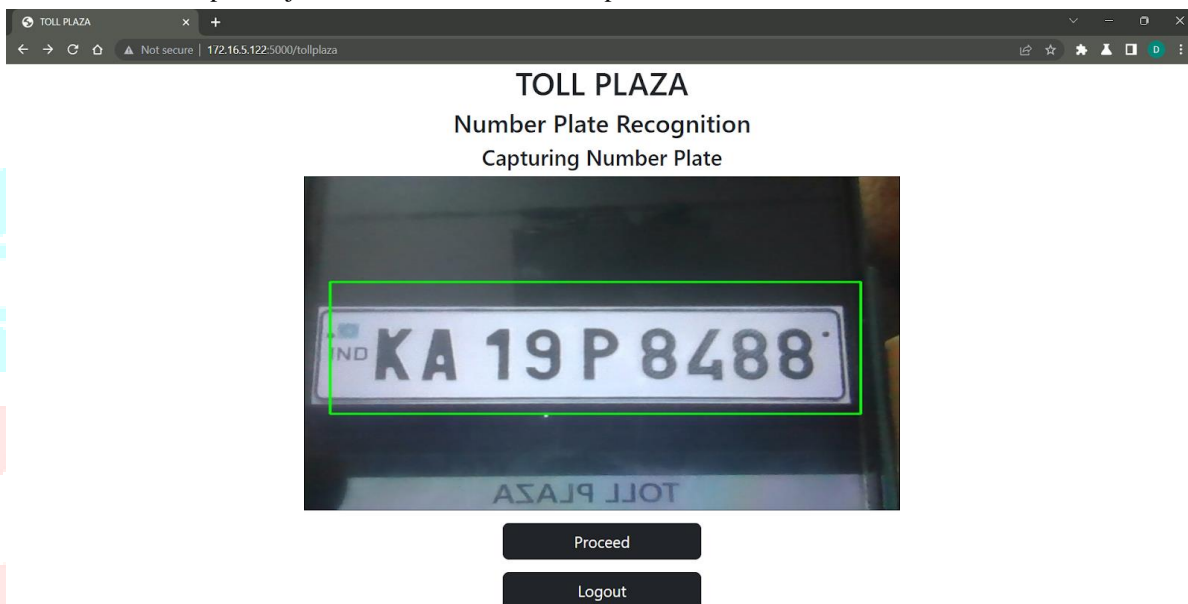
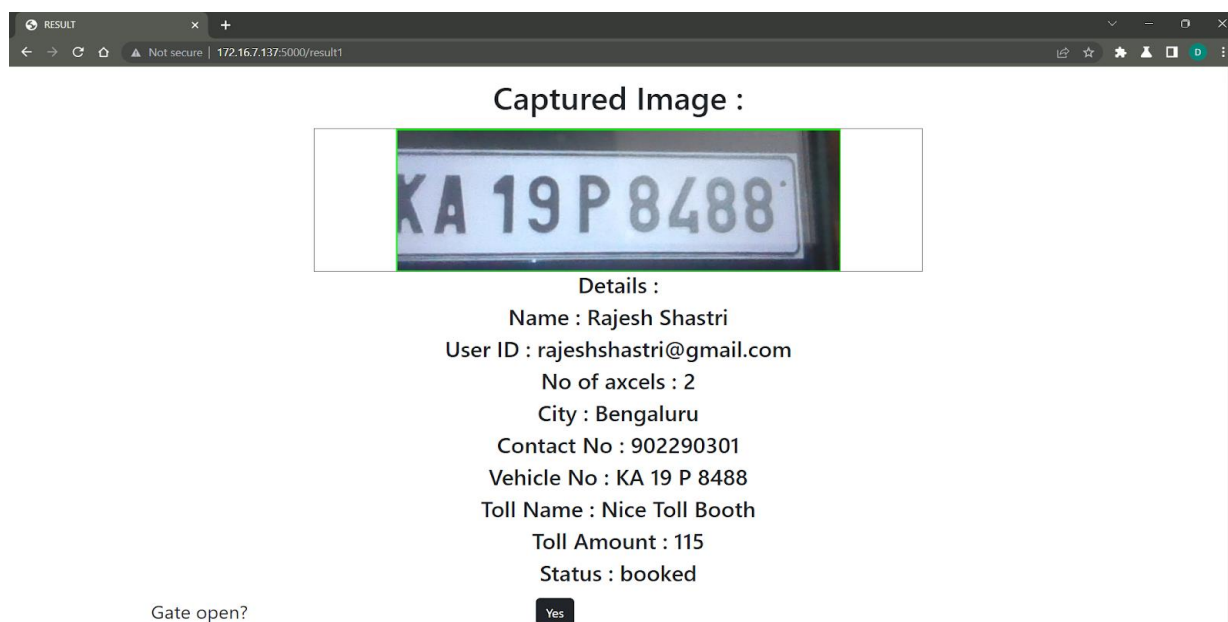


Figure 14: The Tollbooth page

Figure 14 shows the video captured by the camera which is placed near emergency lane of the toll plaza.





**Figure 15:** The final page

Figure 15 shows the page where it displays the number plate recognized, with the details related to that number plate.

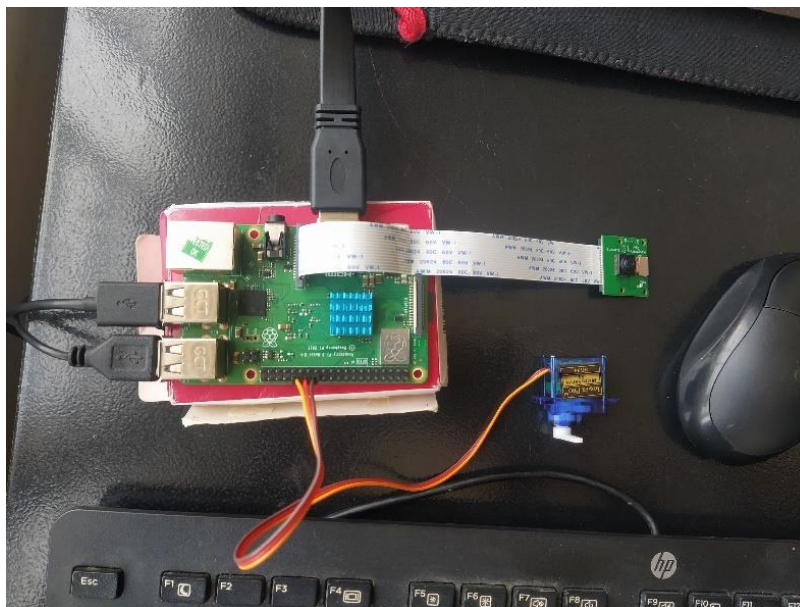
**Figure 16:** Raspberry Pi Prototype

Figure 16 shows the hardware components used for the demonstration of the model built. Demonstration was shown using raspberry pi connected with the pi camera and servo motor which acts as the toll gate.

## 5.2 CONCLUSION

Implementation of this system helps the common people who are in hurry or emergency skip the queue near the toll plaza which further leads saving time. The system enables better utilization of the emergency lane, which was previously limited to VIPs and ambulances. As a result, valuable time for the public during emergencies can be saved.

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