TWO-WHEELER CONTAINMENT AND CHARGING APPARATUS

Bhagirathi Bai V[1],Amith HN[2], Tanush BD[3], Mohit R Karthik[4], Sowmya S[5],

Article History: Received: 07.04.2023 **Revised:** : 20.05.2023 **Accepted:** 03.06.2023

Abstract

A locking and AC charging facilities for two-wheeler is disclosed. The system is meant for locking the two-wheeler and providing the AC power supply to charge their EV's by plugging the charger. It has two different mechanisms to lock two-wheeler. It locks the front wheel of the bike and the body of the two-wheeler. It consists of a cabin that has space and AC power supply to fit entire charger to charge the EV. The system can include one or more vertical supports, one or more curved cantilevered crossbars pivotally connected to one or more vertical supports, one or more wheel locking mechanisms, and a control system. Each curved cantilevered crossbar can include two substantially relatively extending arms and a frame locking mechanism. The system also consists of boot space that store the charger for charging of EV vehicle. The body frame locking mechanism can be made up of one or more frame locking bars and one or more frame locking actuators. Each wheel locking mechanism can include a wheel locking bar and a wheel locking actuator. The charging connector boot space can include the socket, boot space and locking actuator. The locking mechanism control system can be configured to actuate the boot space lock, the body frame locking actuators and the wheel locking actuators. A user-friendly application to interact to the apparatus is developed.

Keywords: Two-wheeler containment, Charging apparatus, Wheel locking mechanism, Body locking mechanism

[1*]Assistant Professor, Department of Mechatronics Engineering, Acharya Institute of Technology, Karnataka, Bengaluru, India, Pincode:560107
[2345]Research Scholar, Department of Mechatronics Engineering, Acharya Institute of Technology, Karnataka, Bengaluru, India, Pincode:560107

DOI:

I. INTRODUCTION

The present invention is charging and parking station for two-wheeler. It disclosed as it provides security to the two-wheeler while parking. It also provides the charging facility. The invention is used by the people who search for parking space to park their two-wheeler. The vehicle is parked in our system that as the one or more locking mechanism that include body frame locking mechanism, wheel locking mechanism and charging facility. As soon as the vehicle is parked in the system the system locks its body, by body frame locking mechanism for two-wheeler like moped and lock the vehicle by wheel locking mechanism for bike. The body frame locking mechanism is achieved by rotating the curved cantilever bar towards body of a vehicle which is pivoted to vertical support. The wheel locking mechanism is achieved by making the wheel get locked when the vehicle is parked in the system. The boot space contains the power supply socket which can be used to get the power output and provide the space for storage. The system also provides the boot space that provide power output and space for storage.

Problem definition and solution:
There are issues pertaining to parking and there will be a lot of requirements of charging station as there will be increase of EV's users. Thus, we are stressing to solve two problems one is recharging and along with parking facility. As we observe thousands of two wheelers are parked by road side without any safety. Thus, we are solving this problem by providing the parking and recharging facility locally. Because of constantly increasing in the fuel rate there is lot of demand for EV vehicle which cause increase demand for charging station. There are basically 1,57,712 EV users in India according to 2021 which is continuously growing. There is increase of theft rate of 11% in India over previous year. Both of these are growing in tremendous rate which make our service ideal choice. According to a study by National Renewable Energy Laboratory (NREL), Indian cities will need 4,900 Direct Current Fast Charging (DCFC) stations while interstate corridors will only need 400 DCFC stations. Cities must build a seamless network of charging stations for encouraging EV adoption.
Solution is to provide the electric socket so that all the Ev holders just plug their charger to the socket and avail the facility. It can be ensured the safety of the vehicle during the time of the recharge process and even after charging until the vehicle leave the system's station. The parking facility is for 24hrs along with charging facility so that people can have assurance of vehicle using application software and get the facility of recharging and parking.

II. LITERATURE SURVEY

a) Wheel locking mechanism: An examination of the various kinds of wheel locks offered for sale, including clamp locks, boot locks and tyre locks. A review of the benefits and drawbacks of each kind of wheel lock, taking into account elements like use, toughness, and security. A review of the laws and guidelines that apply to the usage of wheel locks, especially when it comes to parking enforcement and vehicle immobilization. A summary of recent advancements in wheel lock technology, like smart locks that can be managed remotely with a smartphone app. The least secure and most portable locks are tyre locks, which are also the easiest to remove by deflating the tyre. For instance, in the US, parking enforcement organizations must abide by the standards established by the National Institute of Standards and Technology (NIST) for the correct operation and calibration of immobilization devices. Advanced security features in some smart locks, such tamper warnings and geofencing, can help deter theft and unauthorized usage. The Traffic Management Act 2004 and other pertinent laws control the usage of wheel clamps in the United Kingdom.

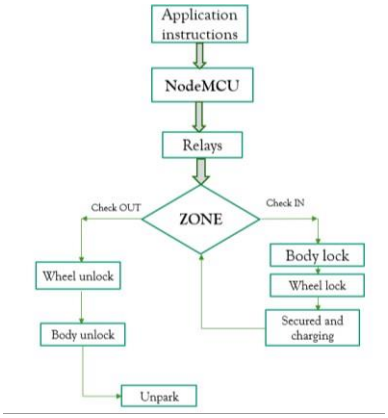
b) App development for wheel locking system: It may be more secure and convenient for owners and parking enforcement agencies if an app for wheel locking mechanisms is developed. This overview of the literature intends to highlight best practices for user interface and user experience (UI/UX) design, explore the many phases of app development, and examine the prominent programming languages and frameworks used in mobile app development. In a study titled "Design and Implementation of a Smart Car Lock System Based on Internet of Things," for instance, the authors discuss the creation of a mobile app that can remotely manage a smart lock for vehicle security. The application makes use of Bluetooth and the Internet of Things (IoT) to communicate with the lock and provides real-time feedback on the lock status and location. An additional article titled "Smart Parking App Development Using Bluetooth Low Energy (BLE) Technology" describes the creation of a mobile app that may assist drivers in finding and reserving parking spaces as well as paying for parking using a Bluetooth Low Energy (BLE) beacon and mobile wallet integration. In summary, developing an app for a wheel locking mechanism has the potential to increase security and convenience for both vehicle owners and parking enforcement organizations.

III. IDEOLOGY AND EXPERIMENTATION

Design:

The vehicle is parked in our system that as the one or more locking mechanism that include body frame locking mechanism, wheel locking mechanism and charging socket. As soon as the vehicle is parked in the system the system locks its body, by body frame locking mechanism for two-wheeler like moped and lock the vehicle by wheel locking mechanism for bike.

Flowchart:



Experimentation:

1.Modeling:
For modeling ONSHAPE has been utilized. A software as a service (SAAS) paradigm is used to offer the computer-aided design (CAD) software system Onshape over the Internet. Users can interact with the system through a web browser or an Android app. 3D model of any complex model is easily visualized by the Onshape. Therefore, the two-wheeler containment and charging apparatus is modeled using OnShape software.

2. Meshing:
Meshing is very important step pertaining to analysis process. Meshing divides the product or model in number of parts for further analysis. If meshing is accurate then results are also feasible. Thus, fine meshing is carried out for better results.

3.Analysis:
The upper part of the two-wheeler containment and charging apparatus is iron which is to be found having a stress more than limited which leads to the damage of the apparatus. Thus, the structure is designed in such a way that is strong enough to withstand with excess of stress and pressure. So, the static analysis is carried out to find Von mises stress and to find the which material is best suitable for the two-wheeler containment and charging apparatus.

$$\sigma = \frac{F}{A} \quad \mathrm{N/m^2}$$

Where, σ is the normal stress
F is the axial force applied to the object
A is the cross-sectional area of the object

4.Structural Design:
These are the sketch that related to the present invention two -wheeler containment and charging apparatus, the dovetails is as follows:
1. The boot space flip door: boot space is secured through the rotate-able extending flip door.
2. The boot space: boot space provides the power output and space for storage.
3. Liner and rotate-able actuators: The curved cantilever bar is actuated to lock the body of the vehicle by the actuator controlled by control system.
4. Curved cantilever bar: curved cantilever beam which is pivoted to the vertical support which is subjected to rotate in specific angle and direction by the actuator that is attached in the vertical support.

Figure 1 Model of Two-wheeler containment and charging apparatus

5. Wheel lock mechanism the wheel is placed in the system so that the linear actuator is actuated to lock the wheel of the two-wheeler.
6. Two-wheeler: this the subject which the two-wheeler containment and charging apparatus is designed for this may be bike or a moped or a bicycle.

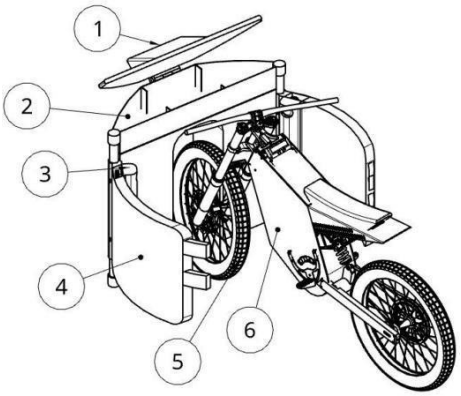


Figure 2(a) Sketch of the Apparatus

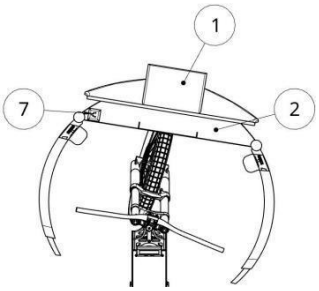


Figure 2(b) Top Sketch of apparatus

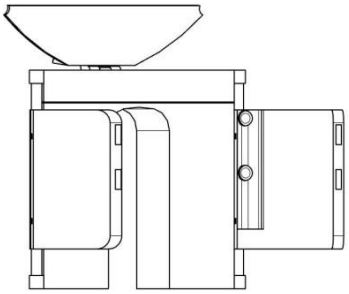


Figure 2(c) Front Sketch of apparatus

5.Conclusion:

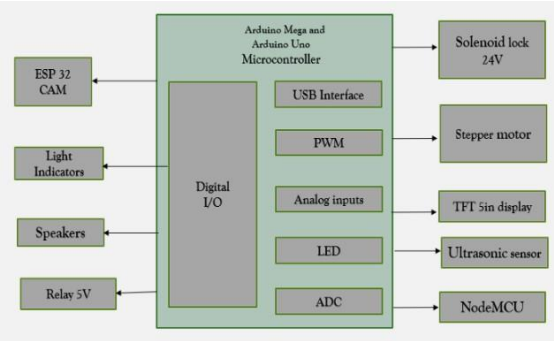
In the presented work the static analysis of two-wheeler containment and charging apparatus's mechanical structure is carried out for different forces, stresses and pressure. Stress concentration on the curvy filaments was more which could cause damage to the apparatus structure. Our invention in two-wheeler locking system the construction material is metal. Outer look of the invention can be varied according to our needs. The inner circuit are closed circuits are metal made. It optimized safety purpose to the two-wheeler with safe way locking by using gear system technology. Entirely, our invention gives the possible security and protection to the vehicle monitoring system. We also provide Electric Vehicle charging station with parking space, the customer vehicle is secured in the apparatus. It is additionally providing digital monitored parking system through interlocking system with high security.

IV. Materials

• **Arduino Uno:** The microcontroller board known as Arduino Uno is based on the ATmega328P chip. It is made to make learning electronics and programming simple for novices. It contains a variety of input/output pins for connecting to additional parts including sensors, motors, and displays.
• **Relays**: A microcontroller can be used to control this electronic switch. It is frequently used to turn on and off high voltage or high current devices. A contact is pulled down by the relay's electromagnetic coil when it is energized, allowing current to flow across the circuit.
• **NodeMCU:** The ESP8266 microcontroller serves as the foundation for the open-source development board known as NodeMCU. It is made to make it simple to develop Internet of Things (IoT) projects that need Wi-Fi connectivity. The Arduino IDE or the Lua programming language can be used to programme the NodeMCU.
• **TFT Display:** This kind of color display can be utilized to give the user visual feedback. TFT displays are widely utilized in a and produce high-quality images using thin-film transistor technology. Test was performed. The number of subcarriers and OFDM symbols are the independent variables, while Bit Error Rate and Signal to Noise Ratio in dB are dependent variables.
• **Arduino Mega:** Microcontroller board called the Arduino Mega is based on the ATmega2560 chip. It is comparable to the Arduino Uno but has additional memory and input/output pins, making it appropriate for bigger applications.
• **Solenoid Lock:** This electronic lock operates by employing an electric current to open and close. A solenoid, an electromechanical device that transforms electrical energy into mechanical energy, and a latch that secures the lock together make up the lock. The solenoid pulls the latch to release the lock when current is applied to it.
• **Actuators (Motors):** A device known as an actuator transforms electrical energy into mechanical energy. To regulate movement or carry out a specified function, such as opening and closing a valve or lifting an object, actuators are utilized in a range of applications.
• Gear motors of 10rpm are used for the 3D printed gear body locking mechanism. Ball bearings to provide rotary motion, spur gear (involute 4 degree) for rotation. Bluetooth for the speaker communication is employed.

V. Methodology

Block Diagram:



User needs to interact with the station through application TriSpiderr. In the application developed, location of the stations will be shown in the geographic map which is been integrated in it. User needs to select the nearest station in the map further it enroots the user to the selected station after reaching the station. User should connect to the apparatus Wi-Fi for the communication.
Steps need to be followed to park the two-wheeler:
• Initially, the user needs to park the vehicle at a proper distance which will be displayed on the TFT display attached on top. When the distance between the wheel locker and the wheel is 60 cm, the TFT displays "You can park the vehicle."
• The user needs to select the hours of charging provided with the price. After that, the user must enter their phone number to get an OTP, which will be verified during check out.
• In the application, the user needs to complete the payment for charging for a specific number of hours. As of now, the cost for an hour is kept at 100 rupees.
• After successful completion of payment, the user needs to tap the "check-in" button displayed on the screen. Firstly, the body lock will be actuated, and then the wheel lock will be actuated. The vehicle should then be plugged in with the two-wheeler charger provided at the station. The vehicle will start charging with the supply of 230 volts.
• The user can move around as their vehicle will be secured and safe. Even after charging for the user-selected duration, the vehicle will remain locked until the user unparks.
• When the user wants to unpark the vehicle, they must verify the OTP received through the "check-out" button.
• After clicking the check-out button, the wheel will unlock, and then the body will unlock, allowing the user to retrieve their vehicle.

VI. Prototype Working

Figure 3 Working two-wheeler containment and parking apparatus prototype (unlock position)

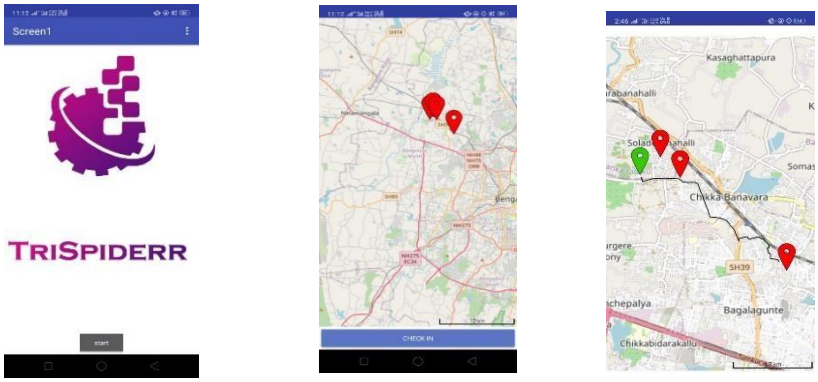


Figure 4(a)(b)(c) Application Interface showing station's location after clicking start

The application TriSpiderr will fetch the location of the nearest apparatus through Google Maps API integration. Once the station is selected, the direction to reach the station will be displayed.

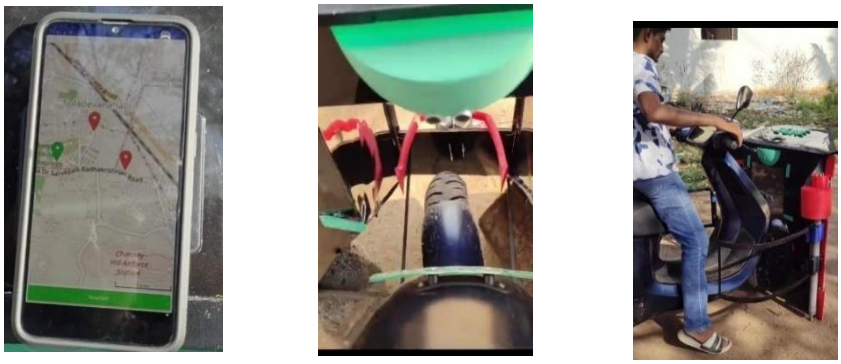


Figure 5(a)(b)(c) Application Interface shows message when reached and User needs to park the vehicle in the boot space as shown

After reaching the station, the user needs to make sure that the vehicle's wheels are parked at a distance of 60cm, which will be assisted by a TFT display on top of the station. The display will guide the user by showing the message "You can park now." The user can then tap on the check-in button, which will direct them to the pricing interface. User needs to select price for required hours.

Figure 6 Parking assistance on TFT display

In the pricing interface, the user needs to enter their phone number in the text space provided. After submitting the phone number, a random OTP will be generated and sent to the respective phone number entered. The OTP will be used for verification when the user unparks the two-wheeler. The user needs to complete the payment before parking the vehicle, as it is prepaid. After the payment is completed, the body lock actuates to lock the body, followed by the wheel locker actuators.

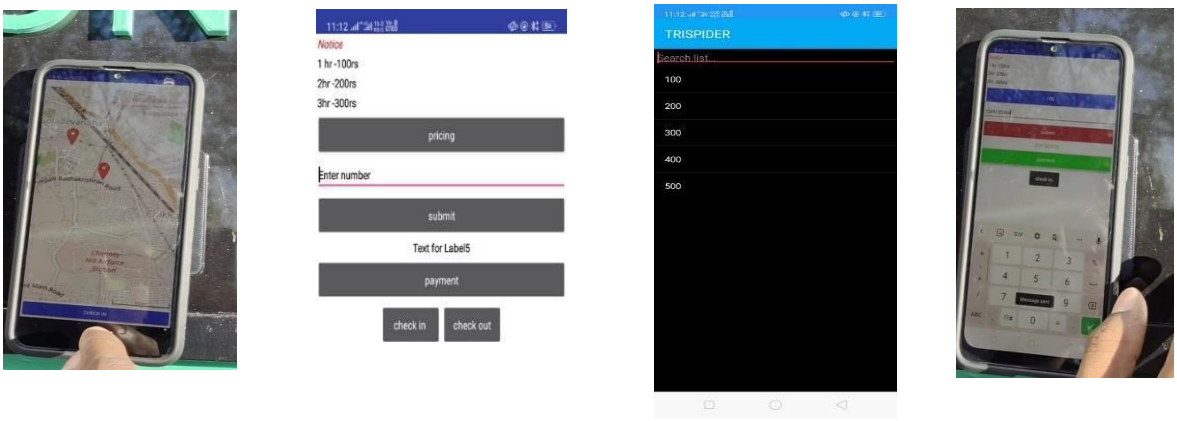


Figure 7(a)(b)(c)(d) Interface of application of before and after clicking “Check In” and selection of price then entering phone number to which OTP is sent via message

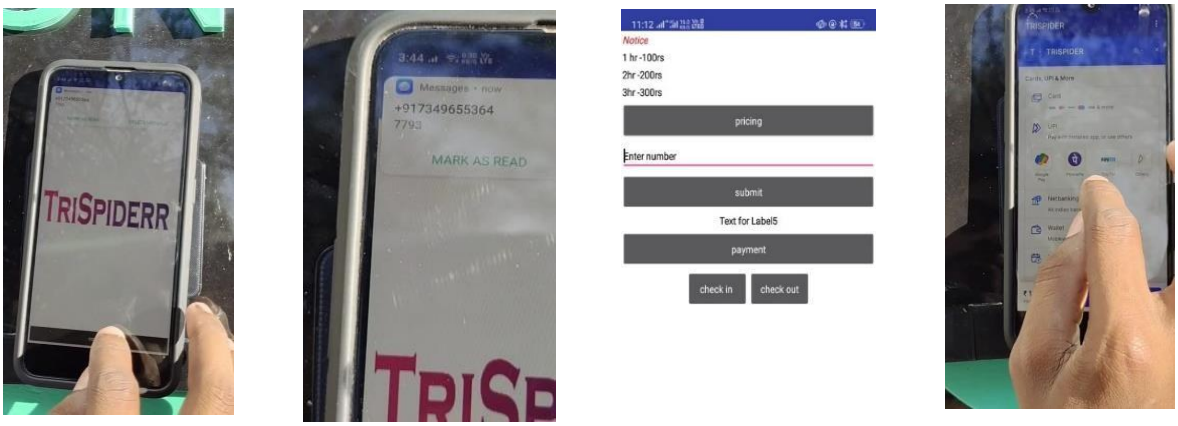


Figure 8(a)(b)(c)(d) OTP received via message and payment process

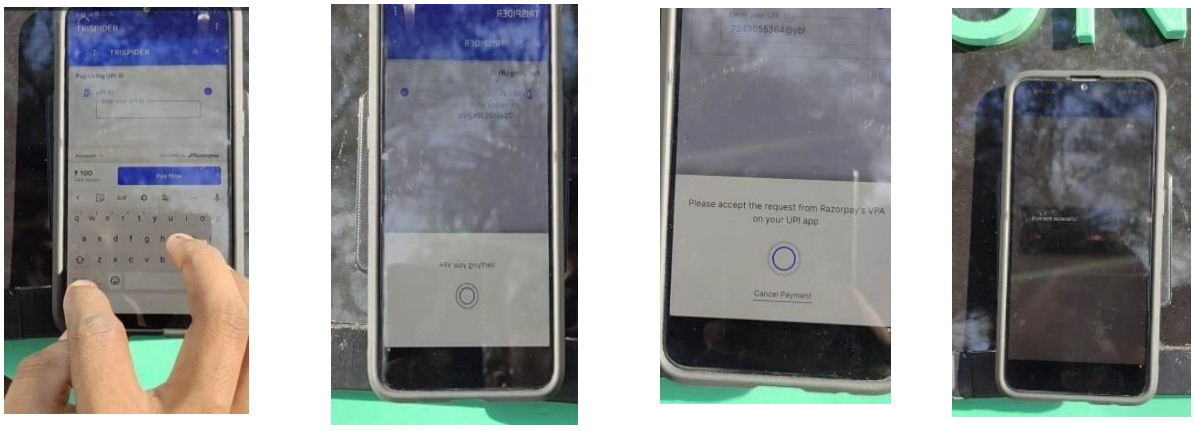


Figure 9(a)(b)(c)(d) Entering UPI ID and payment successful message received

Figure 10(a)(b)(c) Check in successfully -message received and body and wheel lock actuated

The user can now leave the vehicle locked in the station and roam around. When the user comes back to retrieve the vehicle, they need to tap on the "Check out" button, which will direct them to the OTP verification interface. In the text space provided, the user needs to enter the OTP received while parking. The OTP will be verified, and the message "Checked out successfully" will be displayed in the application. As soon as the OTP verifies, the wheel unlocks followed by the body lock. The user can retrieve the vehicle after unlocking it.

Figure 11(a)(b)(c) After clicking check out, OTP is to be entered and check out state of system

When an EV is plugged into the charging station, it will charge after plug-in for a pre-defined period of time. Once the charging period is complete, the EV will stop charging automatically to prevent overcharging and damage to the battery.
It is important to note that stopping the charger will not affect the body lock and wheel lock mechanisms in the station. These mechanisms are designed to keep the EV securely in place during the charging process and while parked at the station. This ensures that the EV remains safe and secure at all times, even after the charging process has finished.
After the user completes the payment on the payment on the Trispiderr application. We check the payment status by querying the Razorpay API. This allows the application to verify if the payment has been successfully processed and confirmed.

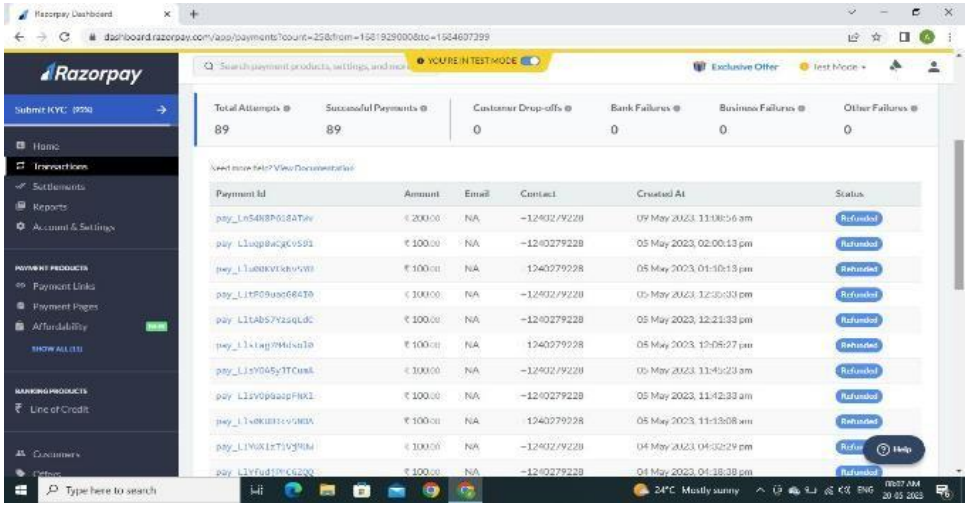


Figure 12 Razorpay payment status check

Using Firebase to store the OTPs (One-Time Passwords) generated for the Trispiderr application. Generating and Sending OTP: When a user enters their phone number in the Trispiderr application, a random OTP is generated. This OTP is then sent to the user's phone number for verification purposes. This process can be implemented using Firebase Cloud Messaging (FCM) or a similar service to send the OTP via SMS.

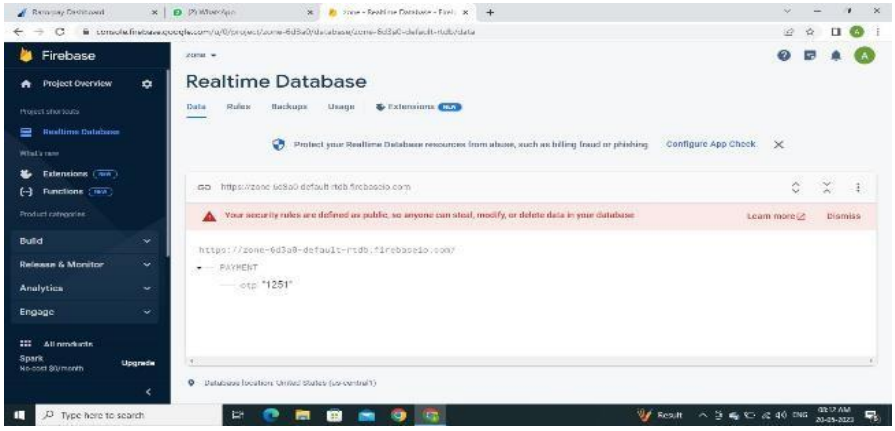


Figure 13 Firebase data (OTP) stored

VII. CONCLUSION

The parking facility is available 24 hours a day and includes charging facilities, which means that users can recharge their EVs and park them for extended periods of time. This is especially convenient for users who need to leave their vehicles at the station while they are at work or running errands.
The prototype has been developed for all of the mechanisms, including the body lock and wheel lock mechanisms. The design structure can be changed according to specific requirements at a later stage, which provides flexibility in terms of adapting the charging station to meet the evolving needs of EV users.
Overall, highlight is the importance of safety and convenience in EV charging infrastructure. By providing a secure parking facility and charging system, the charging station helps to ensure the safety and reliability of the charging process, while also providing a convenient solution for EV users who need to recharge and park their vehicles.

VIII. REFERENCE

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