RSET
RAJAGIRI SCHOOL OF
ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

Project Report On

Blockchain Based Vehicle Management System

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

Computer Science and Engineering

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CERTIFICATE

This is to certify that the project report entitled ***"Blockchain Based Vehicle Management System"*** *is a bonafide record of the work done by* ***Abhishek P S (U2103009), Akshay M S (U2103019), Albin John Johny (U2103022), Amith Krishnan P M (U2103033)****, submitted to the Rajagiri School of Engineering & Technology (RSET) (Autonomous) in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in Computer Science and Engineering during the academic year 2024-2025.*

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Last but not the least, we would like to express our sincere gratitude towards all other teachers and friends for their continuous support and constructive ideas

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Abstract

In response to the growing demand for a secure, transparent, and efficient system for vehicle registration, this project proposes a blockchain-based platform designed to streamline the complex processes involved in buying, selling, and registering vehicles in India. Our platform will provide a centralized system for vehicle registration, creating a reliable, tamper-proof ledger for all vehicle ownership and financing records. This system will allow for seamless transactions between buyers, sellers, and financial institutions, reducing fraud and ensuring all transaction details are securely recorded and verifiable. A key feature of this platform is the integration of smart contracts, which will automate processes such as insurance transfer and new insurance applications. When a user purchases a vehicle through the platform, they can select insurance options and complete the transfer of ownership without navigating complex bureaucratic processes. The automation of these steps through smart contracts minimizes human error, lowers administrative overhead, and ensures regulatory compliance by storing a digital, immutable record of each transaction on the blockchain. By offering a user-friendly interface that enables vehicle selection through a network of registered dealers, this platform allows users to purchase vehicles online with ease, avoiding the intricate details of registrations. As a secure and efficient alternative to traditional systems, this solution aims to modernize India's automotive industry, promoting transparency, reducing fraudulent activities, and enhancing the consumer experience in buying and selling vehicles.

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Chapter 1

Introduction

1.1 Background

Presently, the inefficiencies in the existing vehicle management system are quite like cumbersome paperwork, longer processing time, and highly dependent on manual verification process. After all these, vehicle buyers and sellers incur the challenge of repeated visits to registration offices, dealing with multi-intermediaries, and not knowing the past ownership history or liabilities such as loans or insurance claims pending on a particular vehicle. There would be document forgery or stealing/ selling of ve- hicles, which poses high-risk fraud threats. This would result in delays, increased costs, and an overall frustrating experience for all the stakeholders.

The vehicle management system based on blockchain will solve all the issues mentioned previously by utilizing the benefits of the unique features of blockchain technology. Under this system, every transaction, starting from registration proceeding through financing, passing to ownership transfers, and ending with updating insurance information on the decentralized and immutable ledger, would be recorded. It provides transparency because the understanding and stakeholder-involvement-of-the-vessel-owner registration agency-dealer-bank-insurance agency-can access one point of fact-all the above stated. Smart contracts would automate any task such as ownership verification, transfer, and so on, which reduces effort and time.

This system ensures greater access and better security. The cryptographic methods of blockchain make fraud less active because the records of vehicles will be de-synergic. By removing unnecessary intermediaries and automating workflow, the project not only brings about efficiency but also enables participants to have a smooth and reliable transaction experience.

1.2 Problem Definition

The current vehicle management system is outdated, prone to fraud, and bogged down by manual processes that lead to unnecessary delays and confusion. This project aims to change that by creating a blockchain-based solution designed to make the system efficient, transparent, and hassle-free. By automating car registration and ownership transfers, we're making the entire process faster, more secure, and much easier for everyone involved.

1.3 Scope and Motivation

The system seeks to make the proclaimed vehicle registration, transfer of ownership, financing, and insurance management easier and safer. This will connect and integrate the different stakeholders-such as vehicle owners, registration and other government agencies, dealers, banks, and insurance providers, among others-into one common platform. It intends to apply modern automated workflows and reduction in processing time, while ensuring data transparency and data security, through blockchain technology and smart contracts. The project is service to handle a myriad stages across an entire vehicle lifecycle-from initial registration and financing to resale and ownership transfer-thus making the life of all users seamless and fuss-free.

The inspiration of this project is the existing vehicle management system which has proved to be inefficient and risky. Some of the challenges include very lengthy procedures, high administrative costs, frequent errors, and lack of transparency which gives room for fraud such as document tampering or selling vehicles with liabilities undisclosed. The solution offered to this is the adoption of blockchain technology which provides decentralized and secure tamper-proof platform for vehicle transactions. This system thus benefits twofold-automating processes and reducing reliance on intermediaries. Finally, the project envisions an ecosystem of a comprehensive end-to-end transparent as well as reliable and user-friendly vehicle management for all parties concerned.

1.4 Objectives

1. **Streamline Vehicle Registration-** Make and automate vehicle registration as simple as possible with reduced time and paerwork.

2. **Facilitate Hassle-Free Ownership Transfer-** To ensure transferring ownership of vehicles through smart contracts and automated processes facilitated by smooth and efficient operations.

3. **Enhance Data Security and Integrity-** Leverage blockchain's cryptographic capabilities to maintain a tamper-proof and immutable record of all vehicle transactions.

4. **Improve Operational Efficiency-** Automate manual processes using smart contracts to reduce processing times, administrative overhead, and human errors.

5. **Promote Scalability and Future Integration-** Design the system to accommodate future expansions, such as integrating with IoT devices for real-time vehicle monitoring or extending functionalities to other regions.

1.5 Challenges

Integrating the blockchain-based system with legacy systems used by vehicle registration agencies, banks, and insurance providers can be complex and time-consuming. Implementing blockchain infrastructure, developing smart contracts, and integrating them into existing processes require significant investment and specialized technical skills. Also, educating users about blockchain technology and gaining their trust in the system's security and reliability is crucial for widespread adoption.

1.6 Assumptions

1. All key stakeholders, including vehicle owners, registration agencies, dealers, banks, and insurance providers, will be willing to adopt and actively participate in the blockchain-based system.

2. Initial data entered into the system will be accurate and verified to ensure the integrity of the blockchain records.

3. Smart contracts deployed on the blockchain will execute as intended without errors, automating processes like ownership transfers, loan clearances, and insurance updates.

1.7 Societal / Industrial Relevance

The proposed system enhances transparency and trust by providing a tamper-proof ledger where stakeholders can verify vehicle ownership, history, and liabilities, reducing fraud and protecting consumers. By streamlining public services like vehicle registration and ownership transfer, it improves service delivery and reduces administrative costs, benefiting both citizens and government agencies. The system promotes economic efficiency by lowering transaction costs and accelerating market activities, while also fostering accountability and reducing corruption through transparent record-keeping. Its automation and digital nature minimize paperwork and physical visits, contributing to environmental sustainability.

1.8 Organization of the Report

The report is structured as follows:
Chapter 1 provides an introduction to the project, highlighting the need for the project, the motivation behind it, and its relevance to society.
Chapter 2 follows with a review of the referenced papers, elaborating on the methodologies employed in the base and related works. Chapter 3 contains the overall conclusion of the design of the project.

Chapter 2

Literature Survey

2.1 Blockchain for Vehicle Registration, Transferring and Management Process in Sri Lanka

The paper explores the application of blockchain technology to streamline and secure vehicle registration and management[1]. It highlights challenges in Sri Lanka's existing centralized system, such as fraud, data manipulation, and inefficiencies. To address these, the authors propose a blockchain-based system implemented on the Ethereum platform, leveraging smart contracts to automate key processes like registration, ownership transfer, and vehicle modification. The study emphasizes data security, transparency, and efficiency, validated through a prototype comprising a web portal for administrative use and a mobile app for public data access. Testing was conducted on private and public networks, showcasing reduced transaction times and enhanced data integrity. This research offers a compelling framework for secure vehicle lifecycle management, with potential for broader integration of stakeholders such as insurers and manufacturers.

Important functions of the Vehicle Registration System are vehicle registration, ownership transfer, modification, certificate generation, and access to information on vehicles. Ethereum blockchain forms the basis for the smart contracts created in Solidity and use of a factory contract to generate specific contracts, thereby providing storage of vehicle-related information. Smart contracts are made to restrict misuse of data through access control. The technical implementation consists of usage of Remix IDE and Ganache for the testing and development on Rinkeby. The implementation of the web portal is done in React.js with a Flutter application to address mobile interactions. By now, tests have been done on private and public blockchains, having average transaction times of 15-17 seconds, indicating efficient performance. Moreover, expert evaluations gave some qualitative assessment feedback on usability, security, and scalability, thus confirming that this

system is able to integrate data integrity improvement and possible mobility management budding in Sri Lanka.[1]

2.2 BCVehis: A Blockchain-Based Service Prototype of Vehicle History Tracking for Used-Car Trades in China

BCVehis system which is introduced in this paper, is the answer to all issues where a student wants to go about making the used-car transactions transparent or worthy in true sense. It is important to note that the buyers are left thinking in the dark regarding one of the biggest problem faced in the market which includes lack of credible information about the history of a car. BCVehis solves this problem through an open decentralized system that can avail itself to major participants, including but not limited to car owners, insured companies, mechanics, and even regulators uploading and verifying the vehicle data.

Validation, retrieval, and nursing of data are efficient and transparent in a vehicle's lifetime by employing smart contracts. The entire operation is built on the Xuper blockchain. Additionally, BCVehis integrates auxiliary storage systems in the discharging and handling of large files such as images, repair records, and so on.

Enabling uploading vehicle data through mobile applications, web portals, or APIs, the solution then stores the complete history of the vehicle on a shared ledger, accessible only to authorized users. Thus, BCVehis applies cross-checking mechanisms to ensure the accuracy of data by verifying information from multiple sources.

The study has shown that there is a vast gain in used-car transaction transparency through BCVehis, instilling confidence in buyers about going ahead with many transactions in future; it would help pave the way for a much more reliable and secure car market. In particular, work within BCVehis addresses user authentication, privacy of data, and scalability, thus having the potential of transforming vehicle data sharing and management across the automotive industry[2].

2.3 A Decentralized Vehicle Anti-Theft System Using Blockchain and Smart Contracts

The paper presents Blockchain-structured Vehicle Anti-Theft System (BVATS) for vehicle theft mitigation. The main characteristic of the paper is to develop a decentralized framework based on smart contract technology instead of traditional, centralized, anti-theft mechanisms that have failed to secure data due to the probability of data breaches as well as inefficiencies. bvats offers a means to efficiently authenticate vehicles and authorize drivers through smart contracts that allow multiple drivers, other than the owner, to access the vehicle while still ensuring data integrity. It comprises unauthorized access detection and biometric verification to authenticate the driver. A comprehensive implementation methodology, testing results on the ethereum platform, and design evidence of the system's effectiveness in preventing and enhancing unauthorized vehicle access were provided by the authors.

Architecture consists of six nodes: Owner, Vehicle Seller Agency (VSA), Vehicle Certification Agency (VCA), Blockchain Server, Vehicle Transportation Agency (VTA), and the Vehicle. Each vehicle in the system is assigned a unique Universal Vehicle Key (UVK), which is created by the Vehicle Certification Authority (VCA) using the owner's license number and the vehicle's engine number. This key is securely stored on the blockchain and plays a vital role in verifying the vehicle's owner and authorized drivers. Smart contracts are one of the major hosts automating and simplifying the important processes such as ownership verification, driver authorization, and vehicle data management. The system also incorporates an additional layer of safety in the form of a biometric system, where only an authorized person may start the vehicle. In case of unauthorized access attempts made, an alert is immediately sent to the vehicle owner and the Vehicle Tracking Authority (VTA) that keeps a real-time watch on the vehicle status. All the smart contracts on this platform are developed using Solidity, ensuring very strong and reliable automation. There are various elements like blockchain, smart contracts, and biometric security that increase convenience and safety of vehicle management highly[3].

2.4 A Novel Blockchain-Based Framework for Vehicle Life Cycle Tracking: An End-to-End Solution

This paper proposes a novel framework of managing life cycle data of vehicles using blockchain technology. It points out the shortcomings of a centralized vehicle management system, such as lack of security, limited transparency, and a key single point of failure and introduces a blockchain-based way out. Altogether, lifecycle tracking for vehicles entails both the registration for new and used vehicles, ownership changes, servicing, insurance management, accident reporting, and even scrapping. The strength of blockchain's decentralized and tamper-proof nature permeates the operation of the system from where trust and transparency features are integrated to serve all stakeholders, including vehicle owners, buyers and sellers, insurance firms, and regulatory authorities. One such distinguishing attribute of this framework is integration with IoT devices, allowing real-time observation of vehicles and dynamic access control under certain conditions. A machine learning powered price-prediction module is also attached to this solution for unable using historical data such as mileage and condition to predict prices of used vehicles. Hyperledger Fabric on Amazon Cloud instructs case authors to develop this rather novel framework using careful permissioned access and smart contracts, alongside RAFT-based consensus mechanisms, for secure handling of transactions. A case study presents the use case of Saudi Arabia, and shows how this framework may play out in real life-how stakeholders may interact within a decentralized network in the safety of a transparent manner. This solution is going to ensure better security, accountability, and efficiency in operations and is scalable in becoming a globally deployable model in vehicle management[4].

2.5 Summary and Gaps Identified

Application of blockchain technology in vehicle management is reported in Chapter 2 as a summary of several research studies proving its potential and practical establishments. The chapter starts from an analysis discussing how blockchain can change vehicle registration, transferring, and management in Sri Lanka by targeting the primary issues that affect a centralized system, such as fraud, inefficiency, among others. The proposed solution relies on Ethereum smart contracts for automating processes, thus being more

transparent and secure.

While also, the chapter presents BCVehis, a prototype based on the decentralized blockchain for vehicle history tracking incorporated in used-car transactions in China. The system expects to minimize the problem of asymmetric information through the uploading and validation of data by multiple parties in a decentralized ledger. An example of how BCVehis works to ensure data integrity, privacy, and scale is provided by presenting the use of the Xuper blockchain platform and auxiliary storage.

Additionally, a major study highlighted is the Blockchain-based Vehicle Anti-Theft System (BVATS) that utilizes smart contracts and biometric verification to allow secure driver authorization and real-time alerts during unauthorized access attempts. The architecture of the system includes key entities and a unique Universal Vehicle Key (UVK) for authentication that is secured such that it has been tested on the Ethereum platform for improving vehicle security.

The chapter ends with an examination of an innovative end-to-end system for vehicle life cycle tracking that incorporates blockchain into IoT to manage processes from registration to scrapping. This solution, implemented on Hyperledger Fabric, demonstrates active monitoring, ownership transfers, and a machine-learning module for price prediction with a case study in Saudi Arabia.

Chapter 3

System Design

3.1 System Architecture

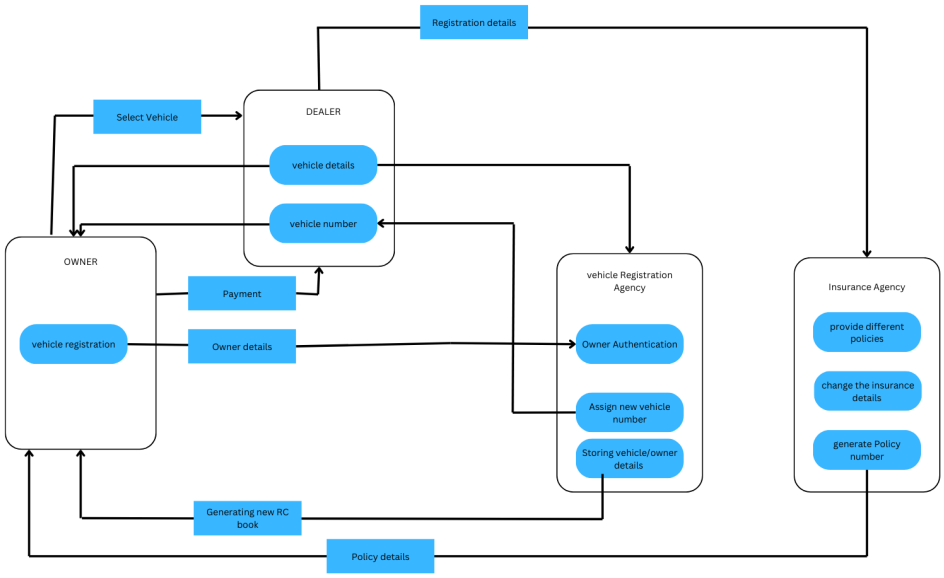

Figure 3.1: System Architecture

The architecture diagram shows the four major players in this blockchain vehicle management system which include the Owner, Dealer, Vehicle Registration Agency, and Insurance Agency. The whole processing of the car selection process is through a finance application dealing with all matters concerning insurance, vehicle registration, policy creation, and loan requests. Furthermore, smart contracts enable digital data storage and the automation of numerous procedures, such as loan approval and ownership confirmation. Complete real-time integration, including safe data sharing and ownership modification, as well as the issuance of vital papers like insurance policies, RC books, and NOCs, will improve the performance of all stakeholders.

3.2 Data Flow Diagrams

3.2.1 Use Case Diagrams

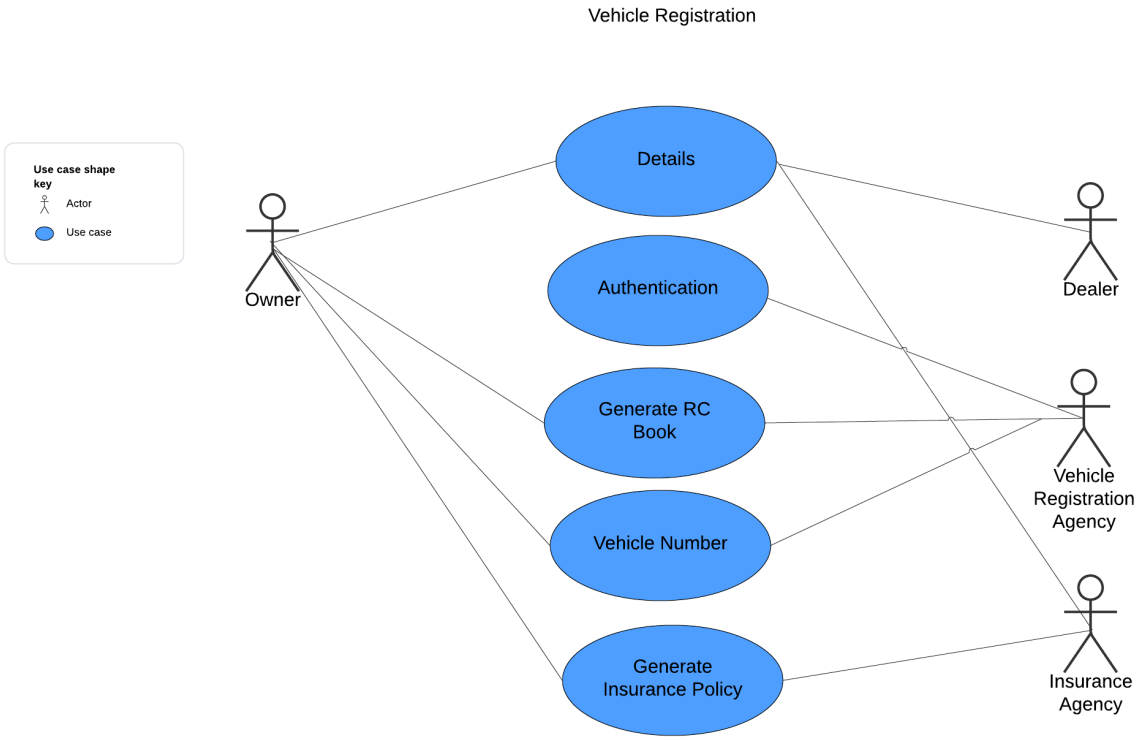

Figure 3.2: Use Case Diagram- Vehicle Registration

3.2.2 Sequence Diagrams

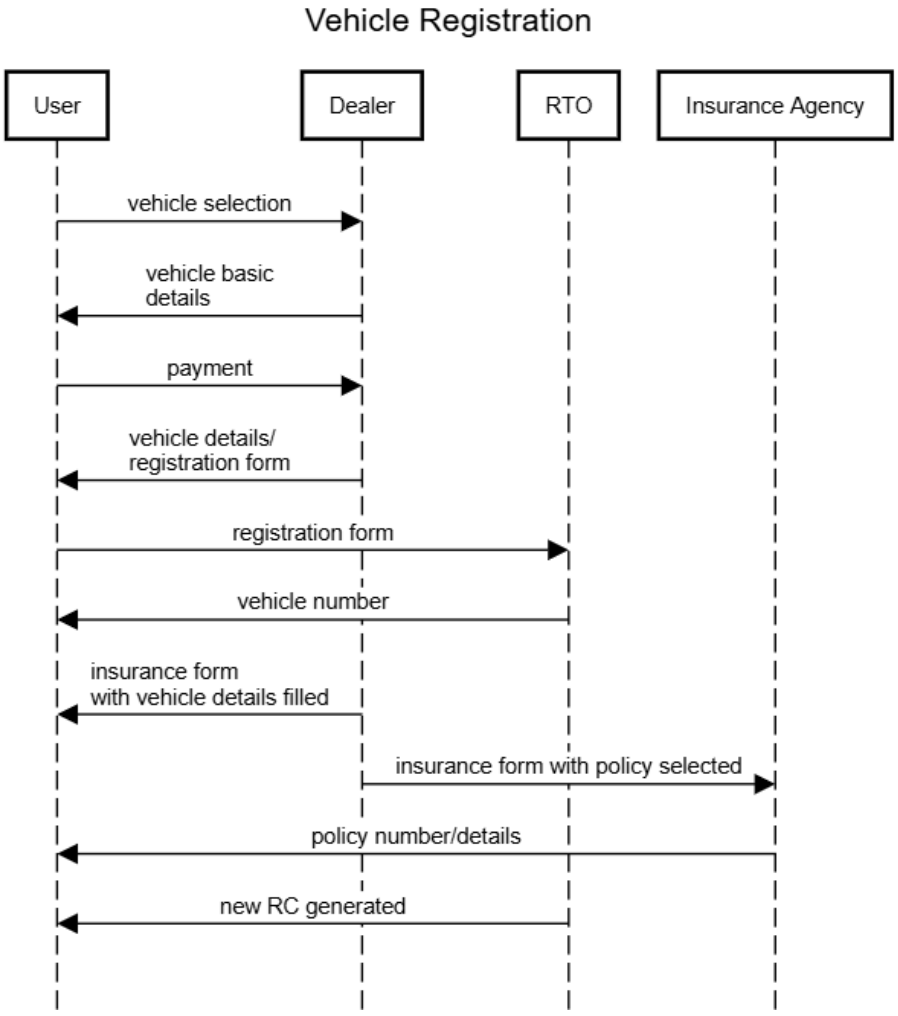

Figure 3.3: Sequence Diagram- Vehicle Registration

3.3 Tools and Technologies

3.3.1 Hardware Requirements

- Windows, macOS, Linux
- 8GB RAM
- 500GB of disk space

3.3.2 Software Requirements

- Ethereum- Blockchain-based computing platform to build and deploy decentralized applications
- Solidity- To create smart contracts for blockchain platforms.
- Truffle
- Python
- Flask
- Ganache
- HTML, CSS, JS
- MySQL

3.4 Module Division

Abhishek- Integration with Frontend, Environment Setup.
Akshay- Owner Module, Testing, Frontend.
Albin- Dealer Module, MySQL.
Amith- Frontend, Vehicle Registration Module, Testing.

3.5 Key Deliverables

The developed system will provide a user-friendly dashboard for vehicle owners and RTO officers to seamlessly manage vehicle registrations and updates. This intuitive interface

displays essential details such as vehicle information, registration status, and ownership records, making interactions straightforward and efficient. Vehicle registrations are digitized, with unique registration numbers and digital Registration Certificates (RC) securely stored on the blockchain. All vehicle details, including make, model, and VIN, are recorded immutably, linking them to the owner's information. This eliminates the need for manual processes, ensuring transparency and security. Additionally, users can access a comprehensive transaction log, allowing them to review the entire history of actions related to their vehicle, from registration to ownership changes, promoting trust and accountability.

3.6 Project Timeline

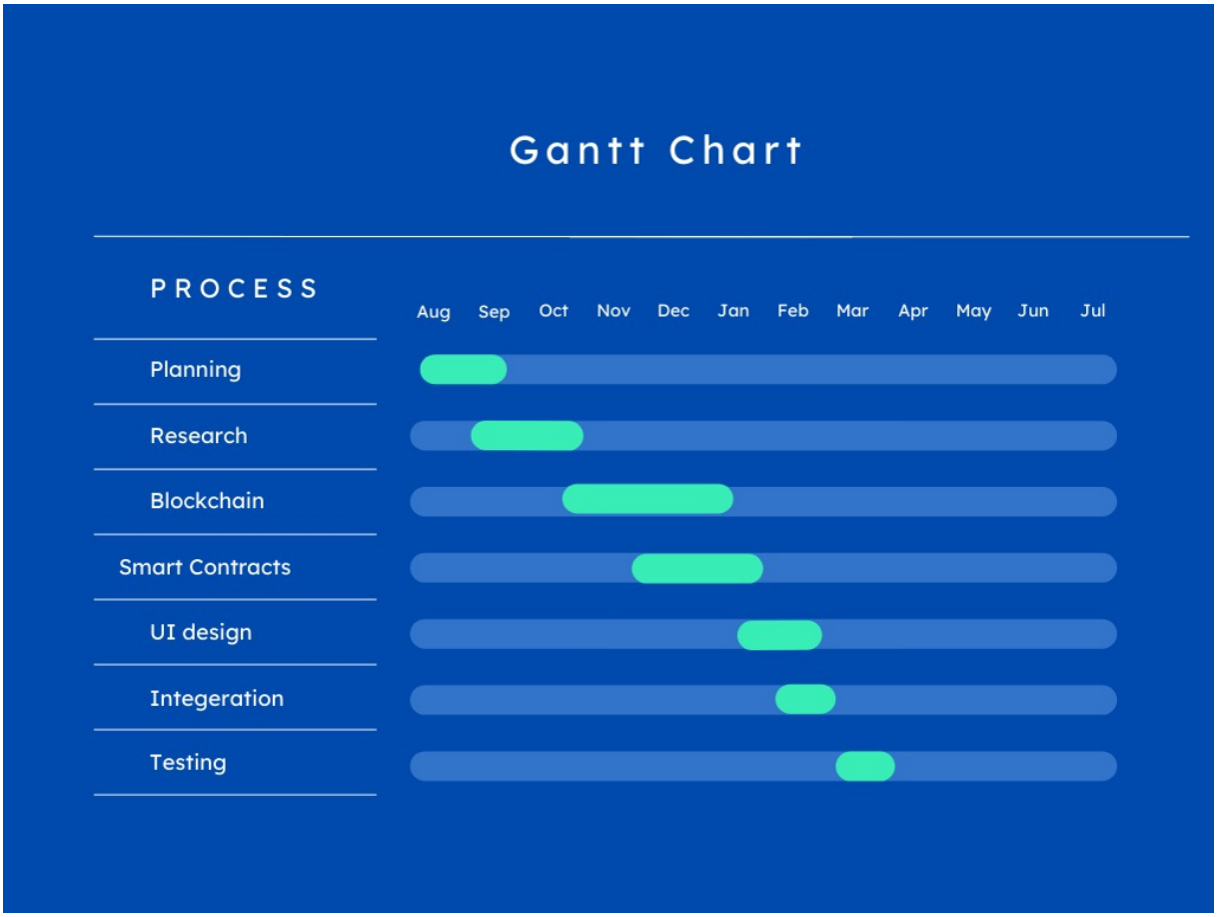

Figure 3.4: Gantt Chart

Chapter 4

Results and Discussions

4.1 Results

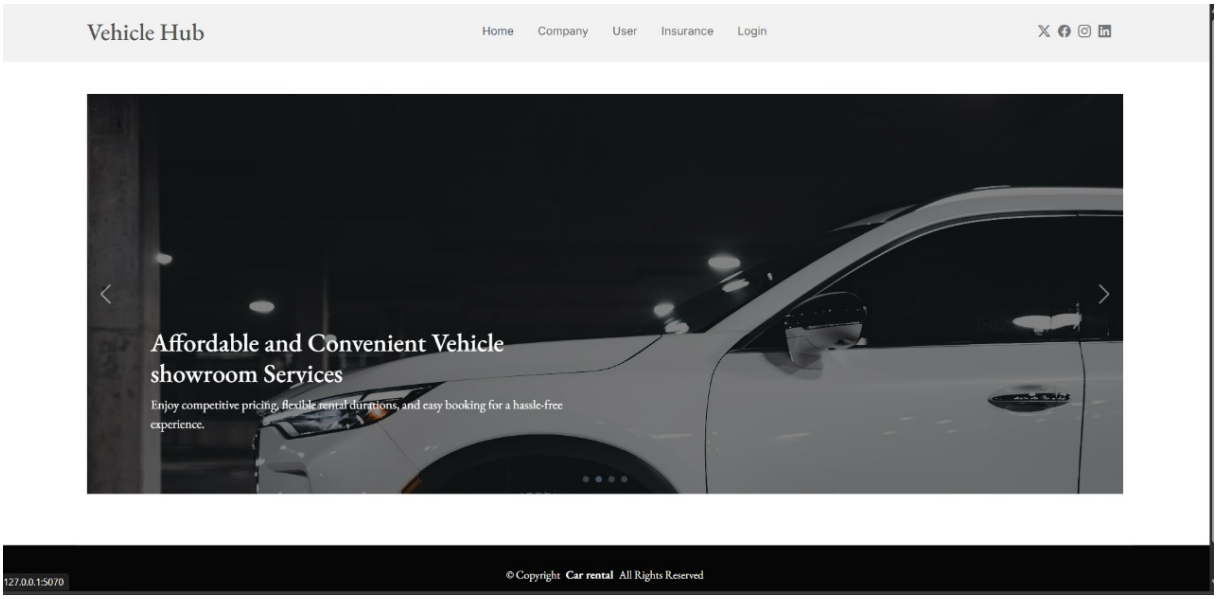

Figure 4.1: Homepage

The above diagram shows the homepage of the proposed system. It contains links for the registration of the User, Company(Dealer) and Insurance Agency. After the corresponding entity registers they can login into their corresponding dashboard.

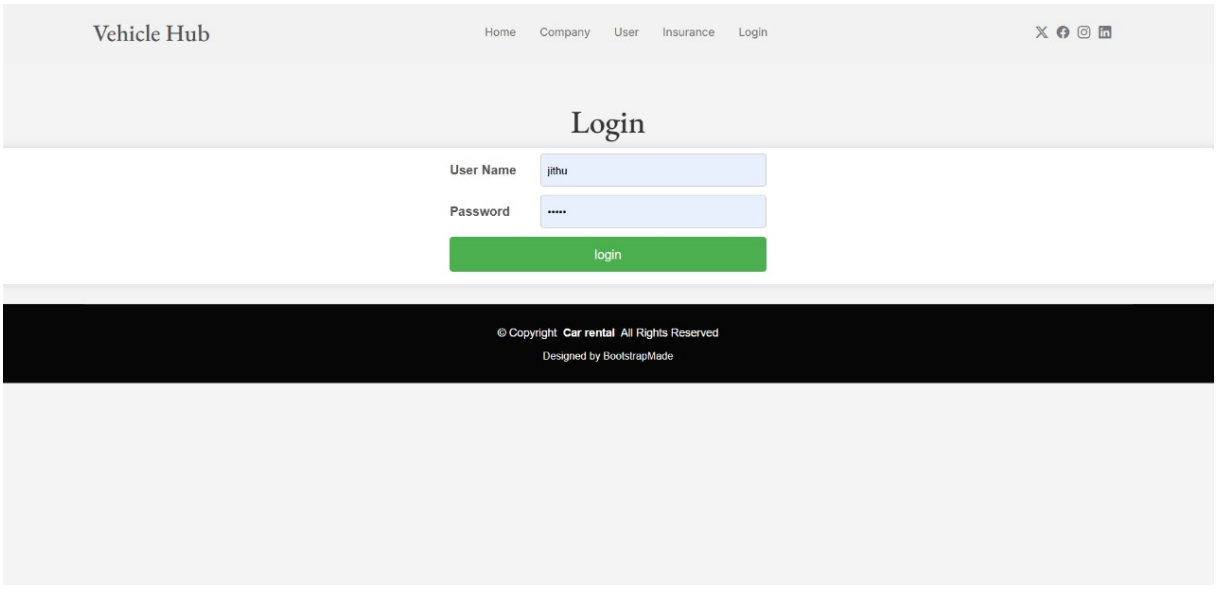

Figure 4.2: Login Page

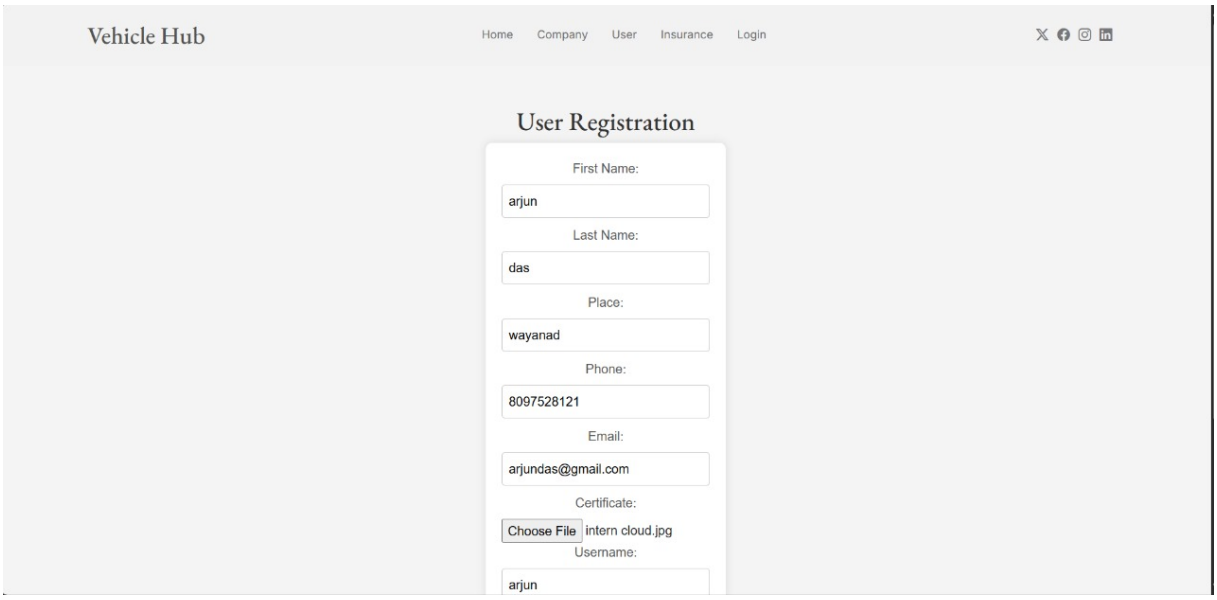

Figure 4.3: User Registration

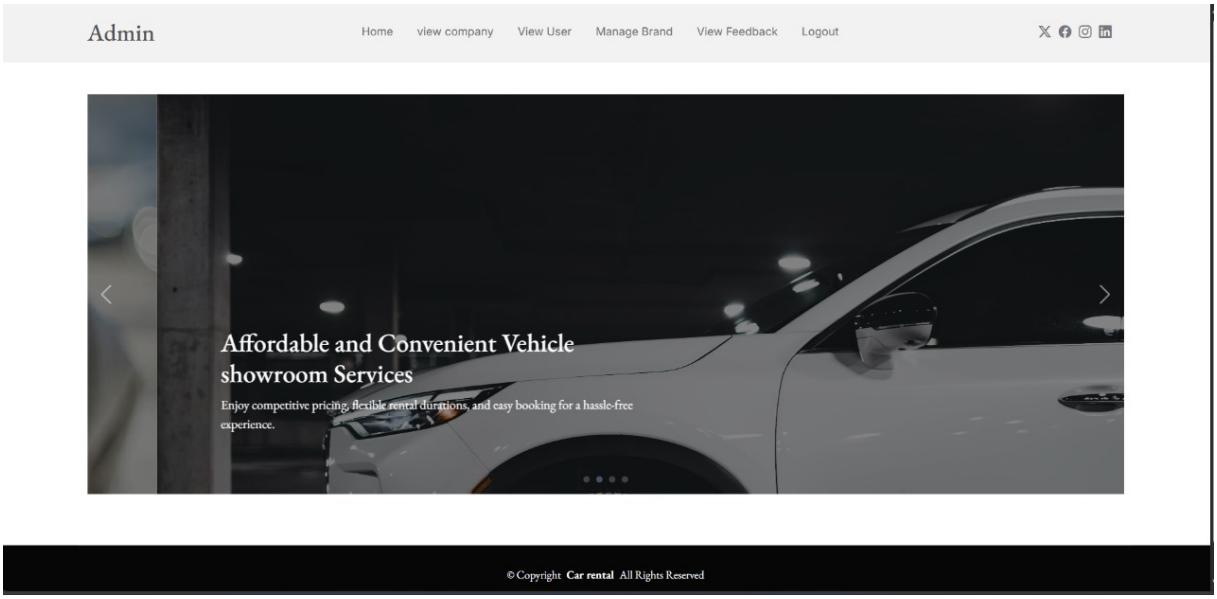

Figure 4.4: Admin homepage

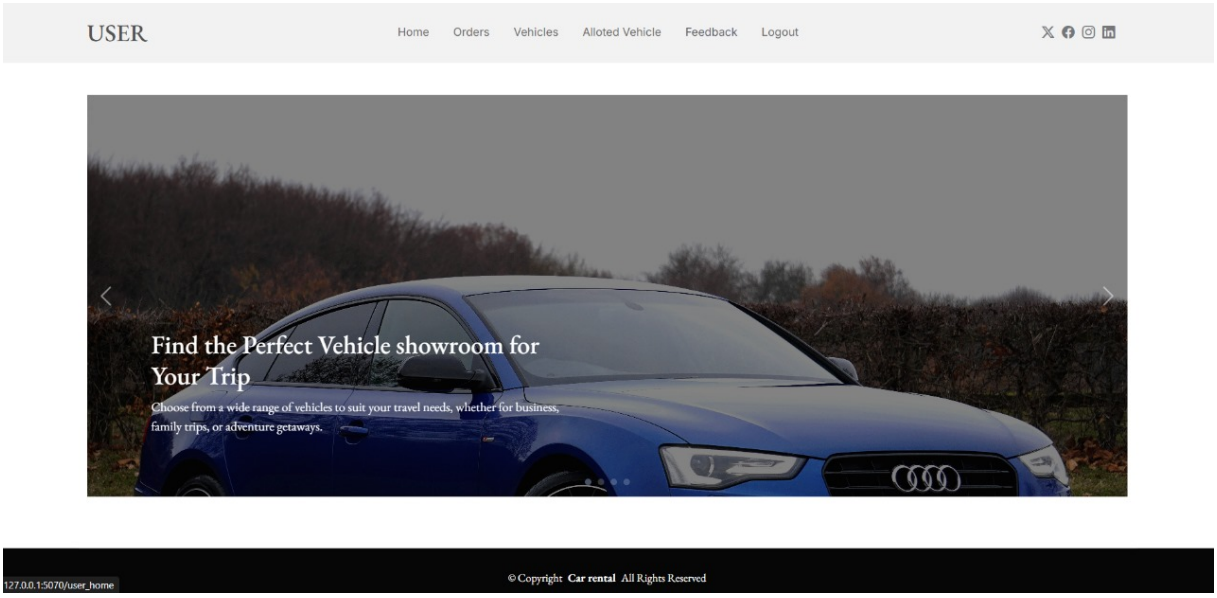

Figure 4.5: User Dashboard

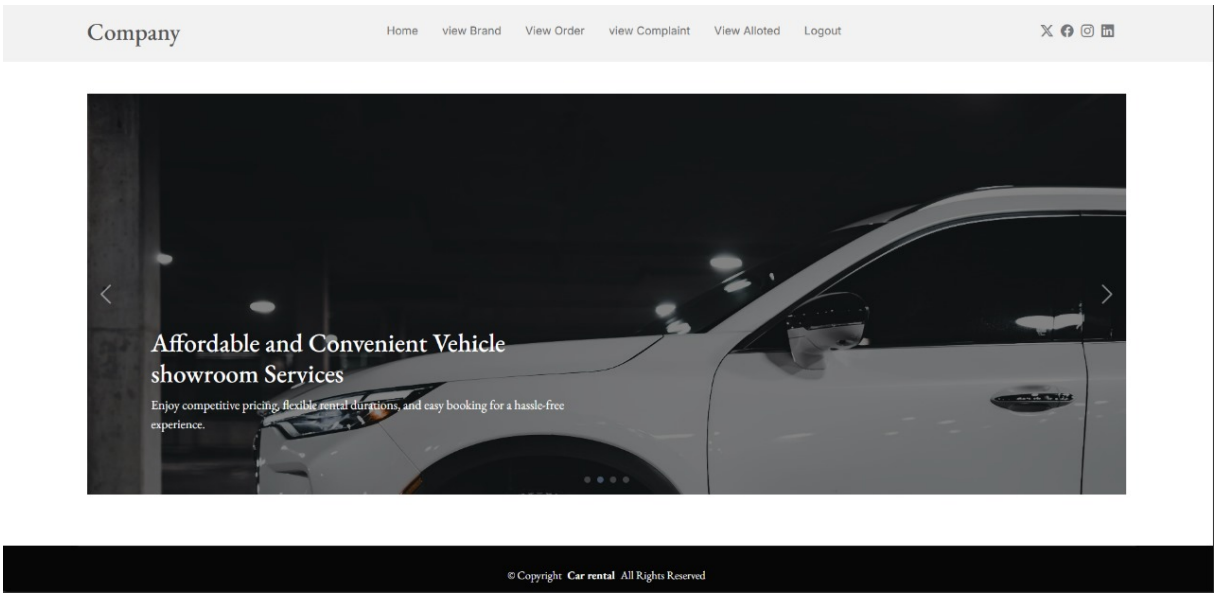

Figure 4.6: Dealer Dashboard

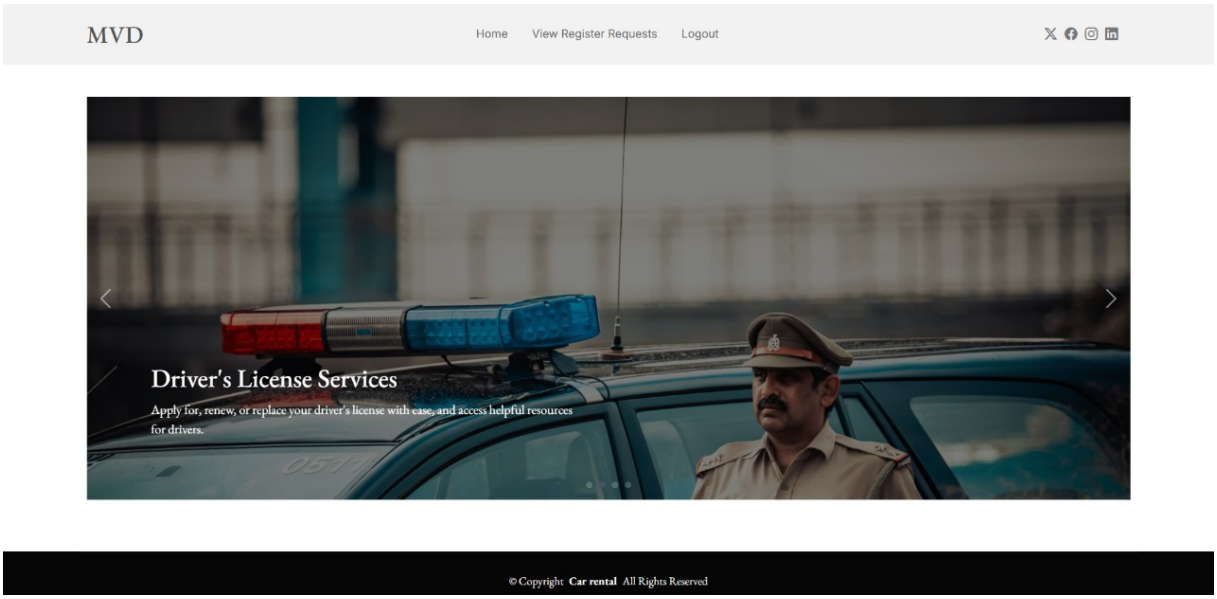

Figure 4.7: Vehicle Registration Authority Dashboard

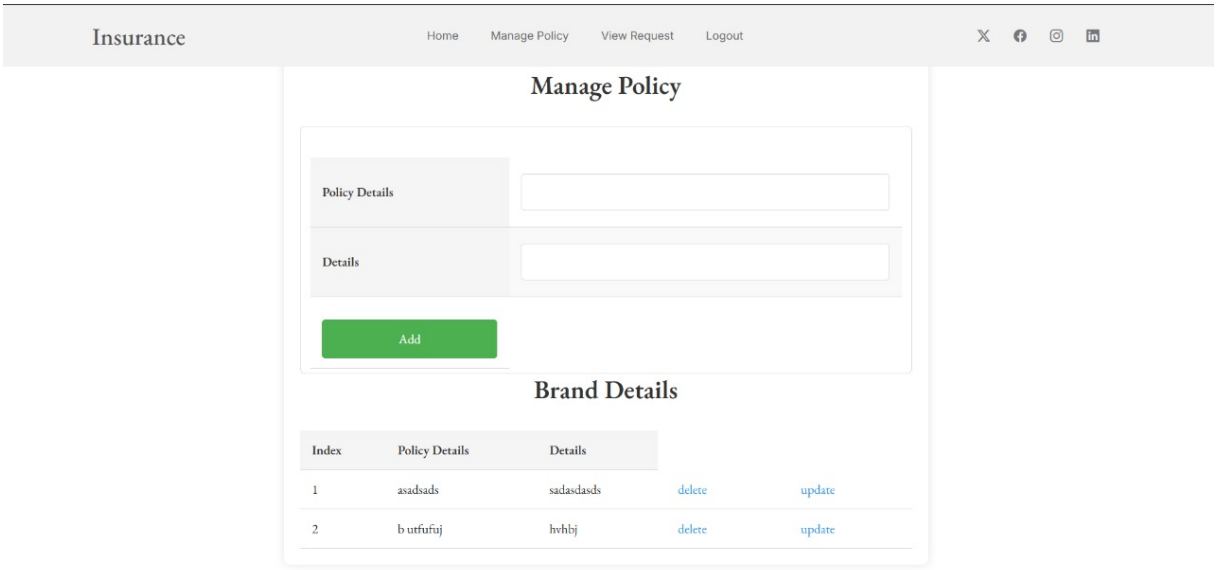

Figure 4.8: Insurance Agency Dashboard

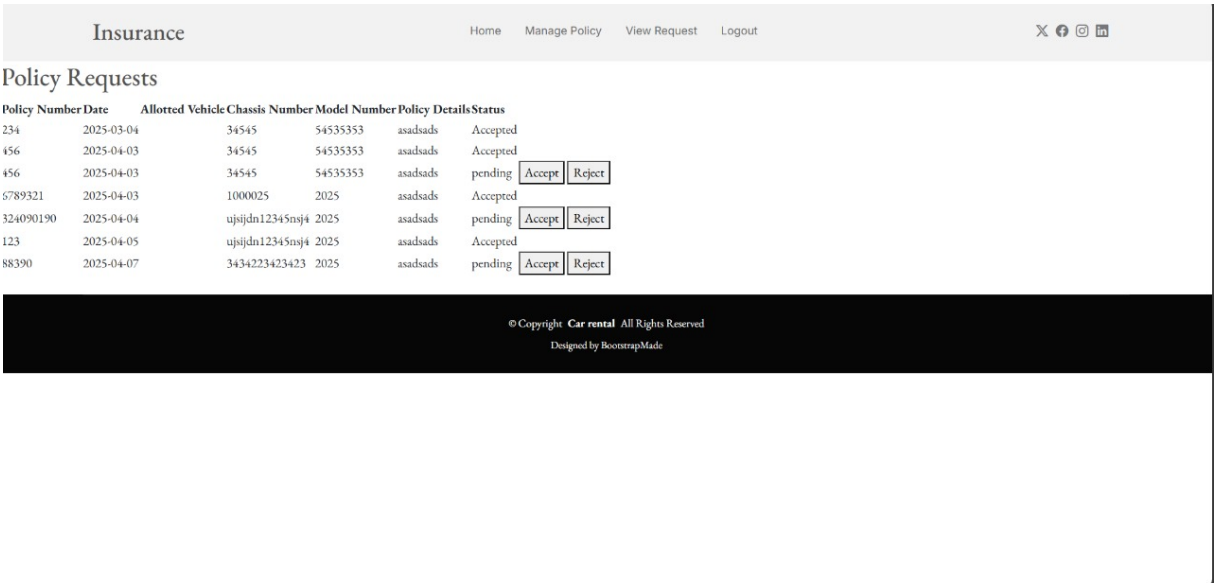

Figure 4.9: Insurance Agency Dashboard

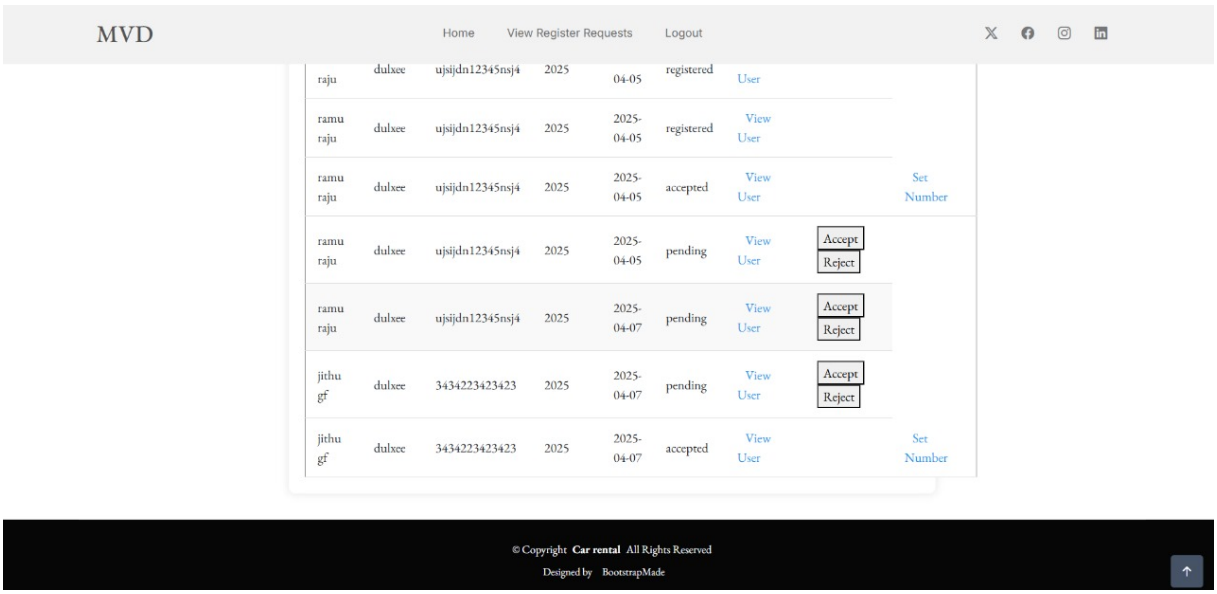

Figure 4.10: MVD Dashboard

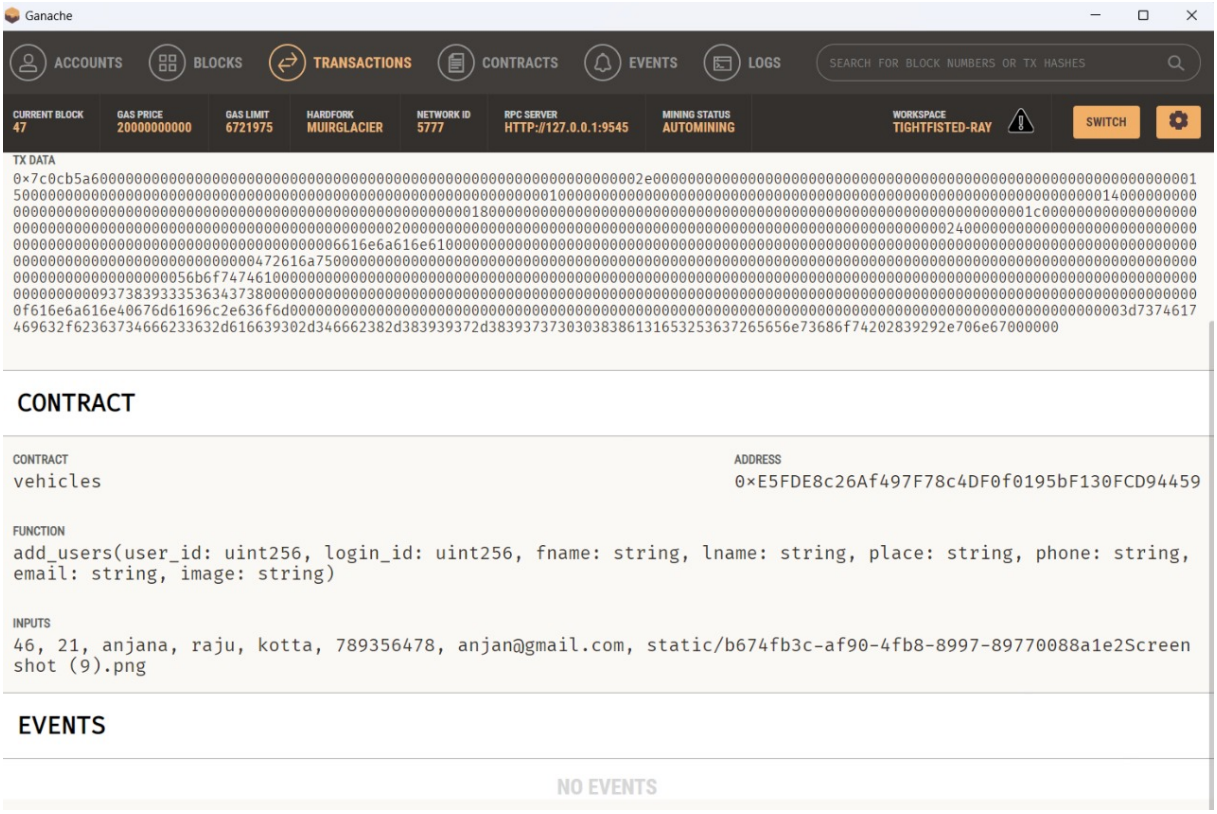

Figure 4.11: User added in block

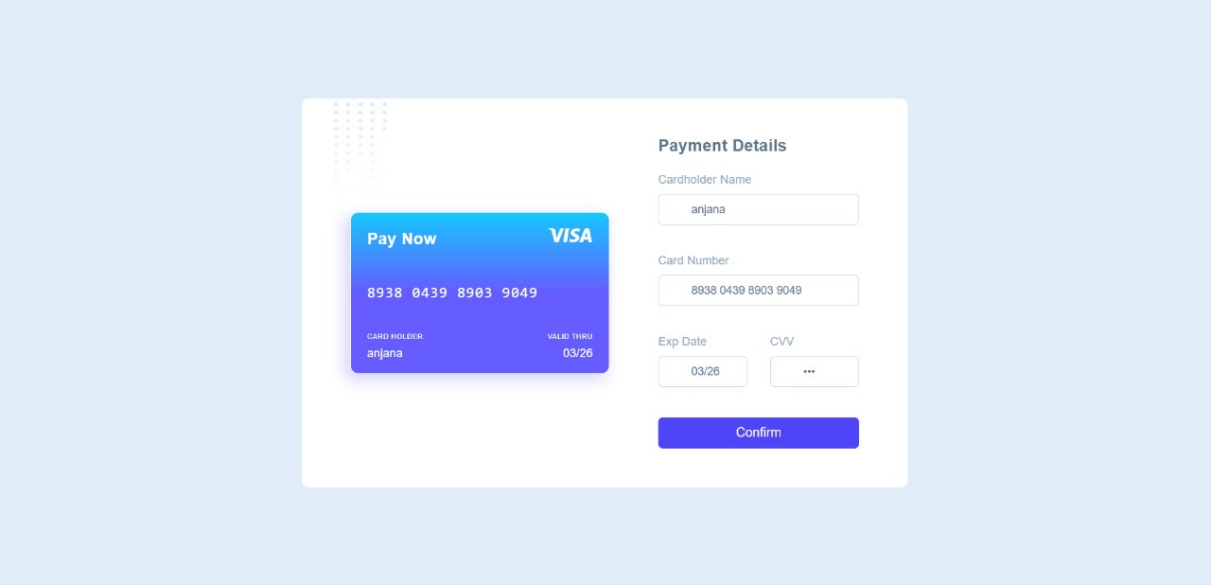

Figure 4.12: Simulation of Payment

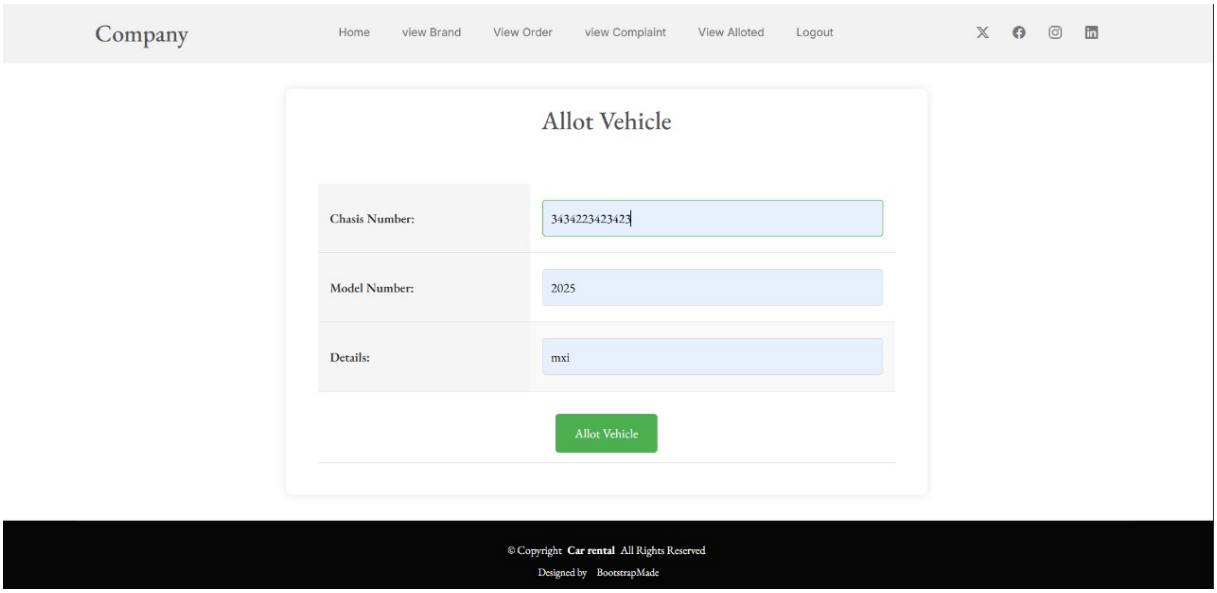

Figure 4.13: Dealer allots the vehicle

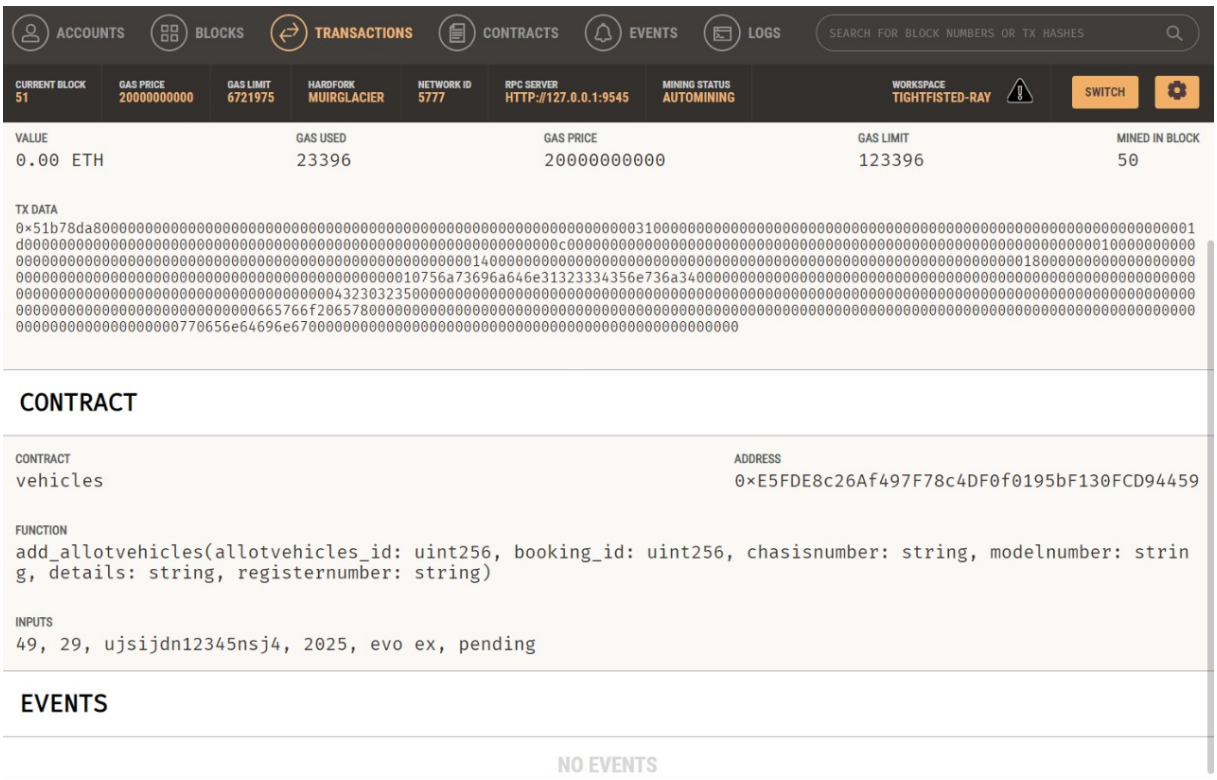

Figure 4.14: Allotted Vehicle in block

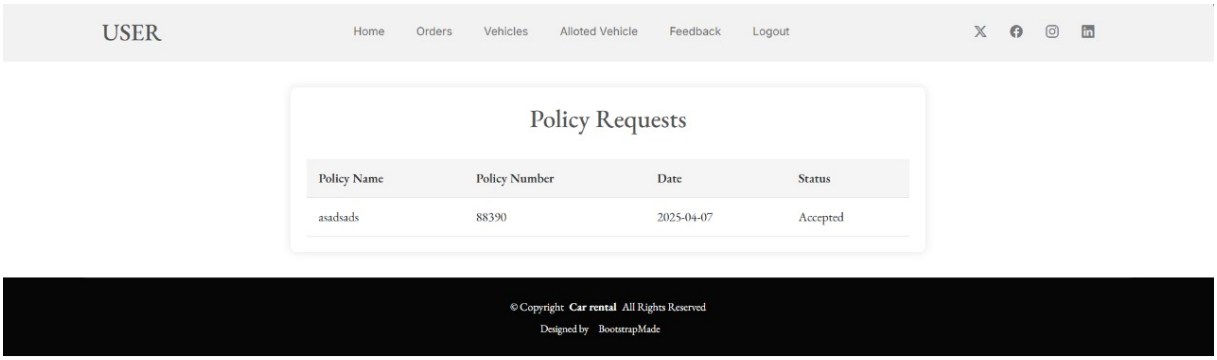

Figure 4.15: User Dashboard

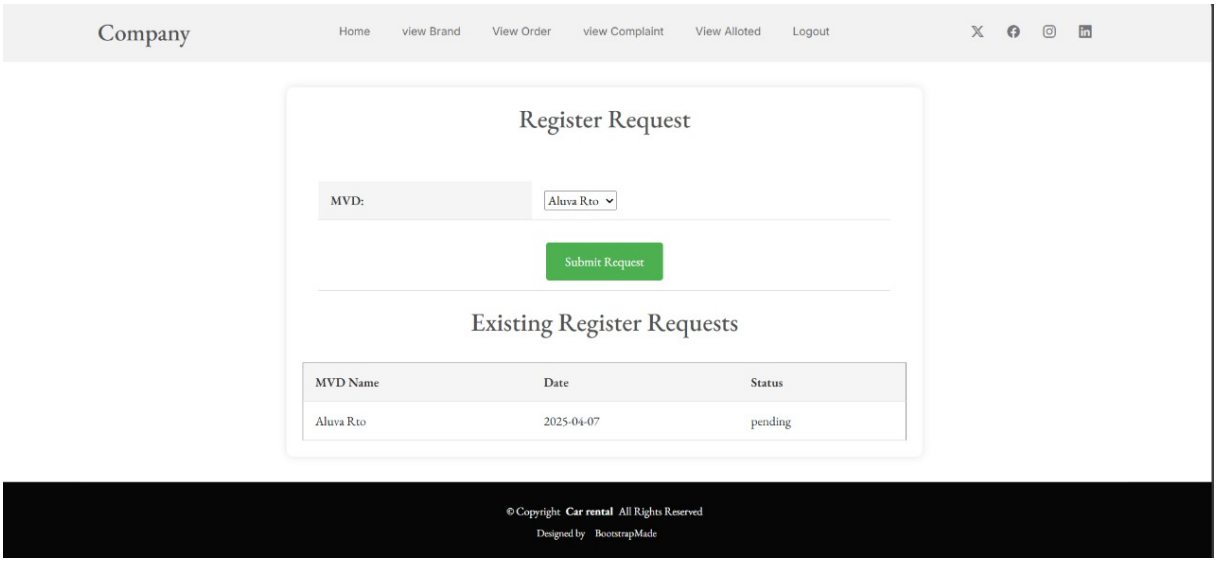

Figure 4.16: Registering with Vehicle Authority

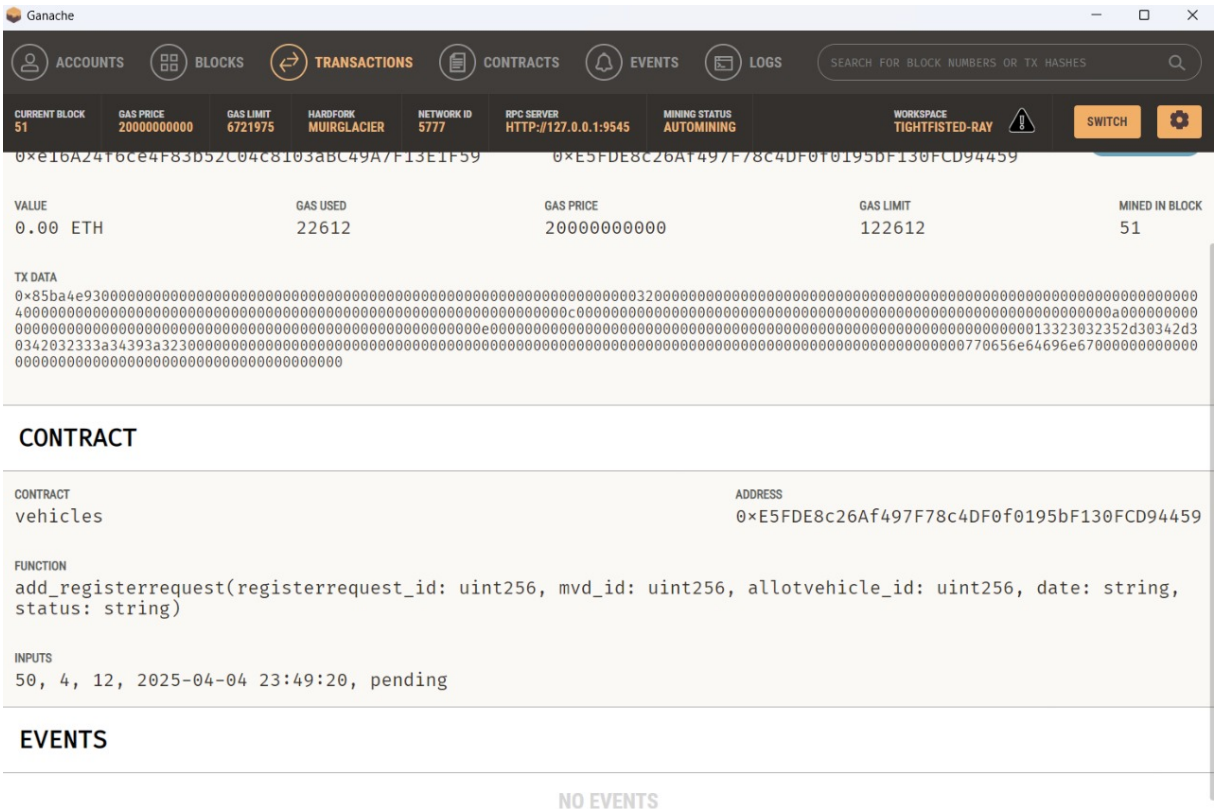

Figure 4.17: Block with the registration details

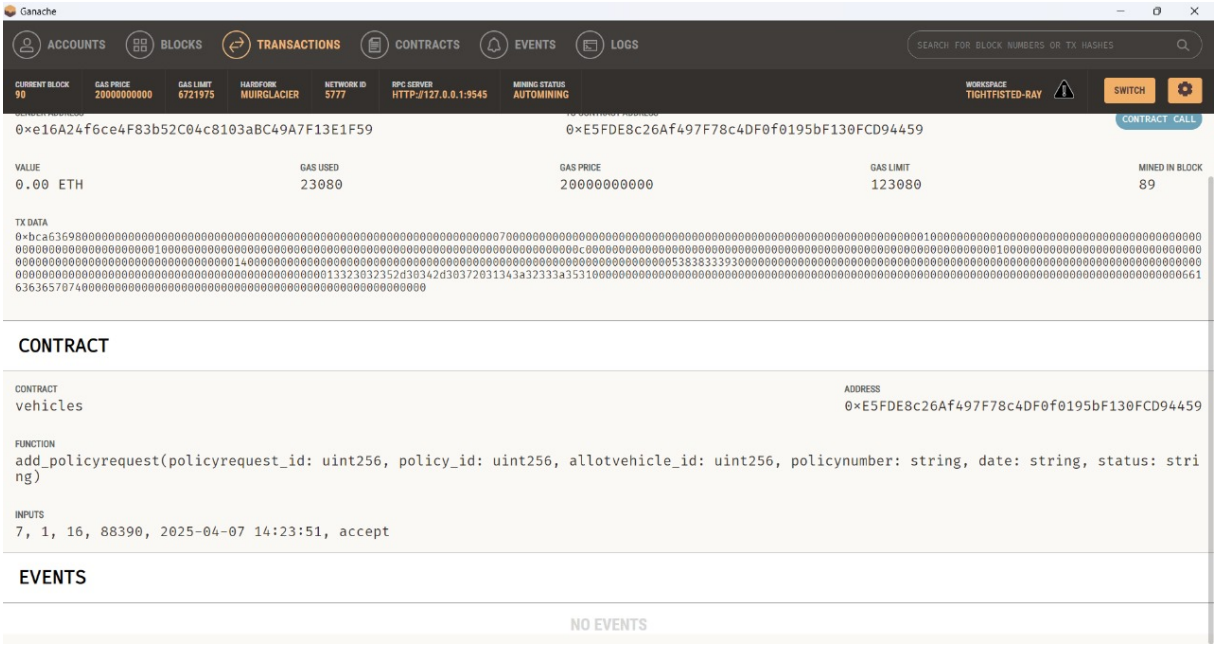

Figure 4.18: Policy gets accepted

4.2 Conclusion

In conclusion, the proposed blockchain-based vehicle management system addresses the inefficiencies, fraud, and complexity of the traditional vehicle registration process. By leveraging blockchain's decentralized and secure architecture, the system ensures transparency, trust, and automation in managing vehicle data. Smart contracts streamline key processes such as owner authentication and data validation. This innovative solution integrates multiple stakeholders, including vehicle owners, dealers, insurance agencies, and regulatory bodies, fostering seamless collaboration and secure data sharing. With its focus on scalability, data privacy, and user convenience, this system has the potential to revolutionize vehicle management, paving the way for a more efficient and reliable automotive ecosystem.

Chapter 5

Conclusions & Future Scope

5.1 Conclusion

The blockchain-based vehicle management system offers a transformative approach to handling vehicle registration and related processes. By leveraging blockchain's decentralized and secure architecture, it ensures transparency, reduces fraud, and eliminates unnecessary delays caused by manual procedures. Smart contracts automate key tasks such as owner authentication, data validation, and ownership updates, enhancing efficiency while minimizing human intervention. Additionally, integrating biometric verification and real-time alerts strengthens security, ensuring that only authorized individuals can access and operate vehicles.

This system brings together multiple stakeholders—vehicle owners, dealers, insurance agencies, and regulatory authorities—into a unified and tamper-proof network. With seamless data sharing and automated verification, it simplifies complex transactions and boosts trust in vehicle-related processes. As the automotive industry embraces digital transformation, this blockchain-powered solution has the potential to set new standards for efficiency, security, and transparency in vehicle management.

5.2 Future Scope

- *Ownership Transfer-* The system can be enhanced with ownership transfer which facilitates the transfer of ownership of a vehicle between users. This can help include all scenarios in vehicle purchase.

- *Bank Loan-* The system can be incorporated with the feature of availing loan from banks.

- *Integration with IoT and Telematics* – The system can be enhanced by integrating

IoT sensors and telematics to track real-time vehicle data such as mileage, fuel efficiency, and driving behavior. This could improve insurance assessments, vehicle servicing, and overall safety monitoring.

- *Cross-Border Vehicle Registration* – Expanding the system to support international vehicle registration and ownership transfer can simplify cross-border vehicle trade and reduce fraud in global transactions.

- *AI-Powered Predictive Analytics* – AI algorithms can be incorporated to analyze vehicle usage patterns, predict maintenance needs, and provide insights for insurers, regulators, and vehicle owners, ensuring proactive decision-making.

- *Decentralized Financing and Leasing* – The platform can introduce decentralized finance (DeFi) solutions, enabling peer-to-peer vehicle financing and leasing without intermediaries, making loans and leasing more accessible and transparent. The system can also be enhanced with the help of transfer of cryptocurrency.

- *Government Adoption for Smart Mobility* – Governments and transport authorities can integrate the system into smart city initiatives to streamline public vehicle registration, enforce traffic regulations, and enhance urban mobility management.

References

[1] C. Malintha, D. Diyasena, and T. Madushanka, "Blockchain for vehicle registration, transferring and management process in sri lanka," *SSRN Electronic Journal*, 2024.

[2] J. Chen, Y. Ruan, L. Guo, and H. Lu, "Bcvehis: A blockchain-based service prototype of vehicle history tracking for used-car trades in china," *IEEE Access*, vol. 8, pp. 214 842–214 851, 2020.

[3] D. Das, S. Banerjee, U. Ghosh, U. Biswas, and A. Bashir, "A decentralized vehicle anti-theft system using blockchain and smart contracts," *Peer-to-Peer Networking and Applications*, vol. 14, 2021.

[4] T. A. Syed, M. S. Siddique, A. Nadeem, A. Alzahrani, S. Jan, and M. A. K. Khattak, "A novel blockchain-based framework for vehicle life cycle tracking: An end-to-end solution," *IEEE Access*, vol. 8, pp. 111 042–111 063, 2020.

Appendix A: Presentation

BLOCKCHAIN BASED VEHICLE MANAGEMENT SYSTEM

PHASE 2 FINAL PRESENTATION

1

Guided by:
Mr. Sandy Joseph
Asst. Professor
DCS

Abhishek P S (U2103009)
Akshay M S (U2103019)
Albin John Johny (U2103022)
Amith Krishnan (U2103033)

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- Project Objective
- Literature Survey
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- Architecture Diagram
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- Assumptions
- Hardware and Software Requirements
- Gantt Chart
- Risks and Challenges
- Output
- Work Division
- Conclusion
- References

PROBLEM DEFINITION

- Vehicle ownership management involves various processes including registration, insurance, and tracking of vehicle history. Traditional systems often face issues related to security, transparency, and efficiency. This project aims to highlight these challenges and propose the integration of blockchain technology to improve the overall management system.

PURPOSE AND NEED

- The integration of blockchain technology into the vehicle ownership management system addresses key challenges such as fraud, lack of transparency, inefficiency, data security, and regulatory compliance. By leveraging the features of blockchain, the proposed system ensures secure, transparent, and efficient management of vehicle ownership records, benefiting all stakeholders involved.

PROJECT OBJECTIVE

- To develop a robust blockchain-based system to effectively manage vehicle ownership records, automate registrationprocesses, and guarantee secure, transparent, and tamper-proof transactions. This system will seamlessly integrate with existing platforms, ensure regulatory compliance, and demonstrate adaptability for use in diverse regions, delivering significant benefits to vehicle owners, authorities, and other stakeholders.

LITERATURE SURVEY

Research Paper	Key Takeways
"Blockchain-based Vehicle Lifecycle Management" (Chen, 2020)	Blockchain provides a reliable way to track vehicle history and ownership. However, system scalability needs to be improved for real-world applications involving vast datasets.
"Blockchain for Vehicle Ownership Management System" (Chamod, 2022)	Implementing blockchain enhances security and prevents tampering. However, regulations need to catch up with the technology.
"A Decentralized Vehicle Anti-Theft System using Blockchain" (Das, 2021)	A blockchain-based anti-theft system ensures vehicle security but has challenges in terms of cost and complexity.
"A Novel Blockchain-Based Framework for Vehicle Lifecycle Tracking" (IEEE Access, 2020)	This paper proposes a blockchain framework that enables secure, end-to-end lifecycle management of vehicles, offering better transparency but with challenges in system complexity and resource requirements.

PROPOSED METHOD

1. Blockchain Selection and Architecture

- **Truffle** and **Ganache** will be used for deploying smart contracts that manage vehicle registration and ownership transfer.
- **Smart Contracts** written in **Solidity** will automate the processes of vehicle registration, transfer, and validation.

2. Vehicle Registration Process

- Vehicle owners will initiate registration through the front-end interface, entering details such as Vehicle Identification Number (VIN), model, etc.
- The system will generate a smart contract containing the vehicle's data and link the ownership to the user's blockchain address.
- Each transfer will be recorded as an immutable transaction, accessible to all participants.

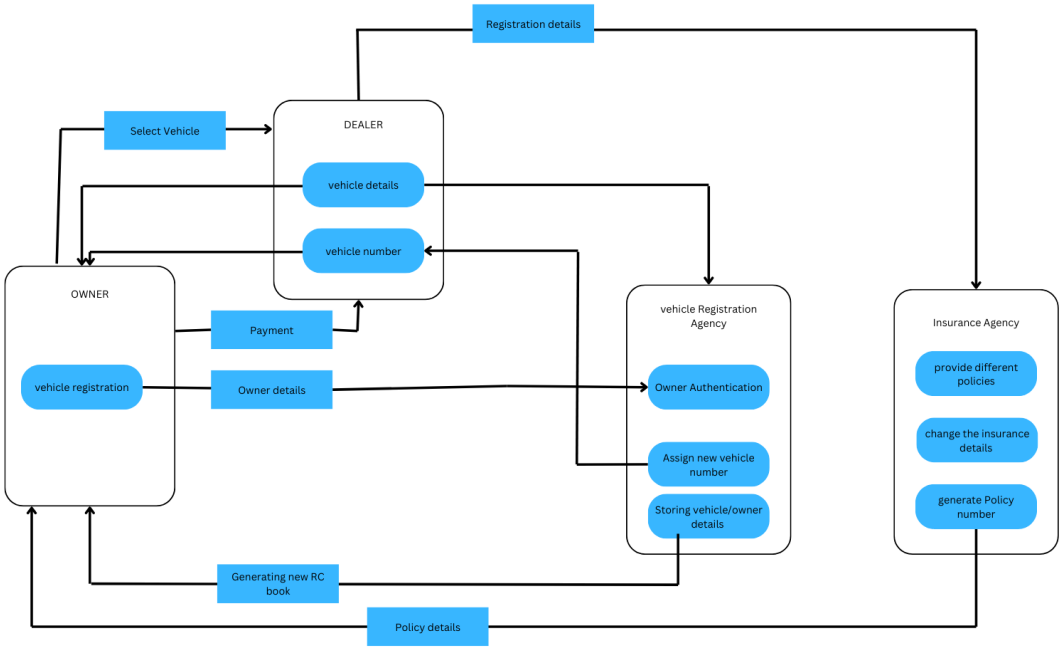
- **3. Smart Contract Development and Deployment**
- Smart contracts will be used to define:

  Vehicle registration process, including document verification.

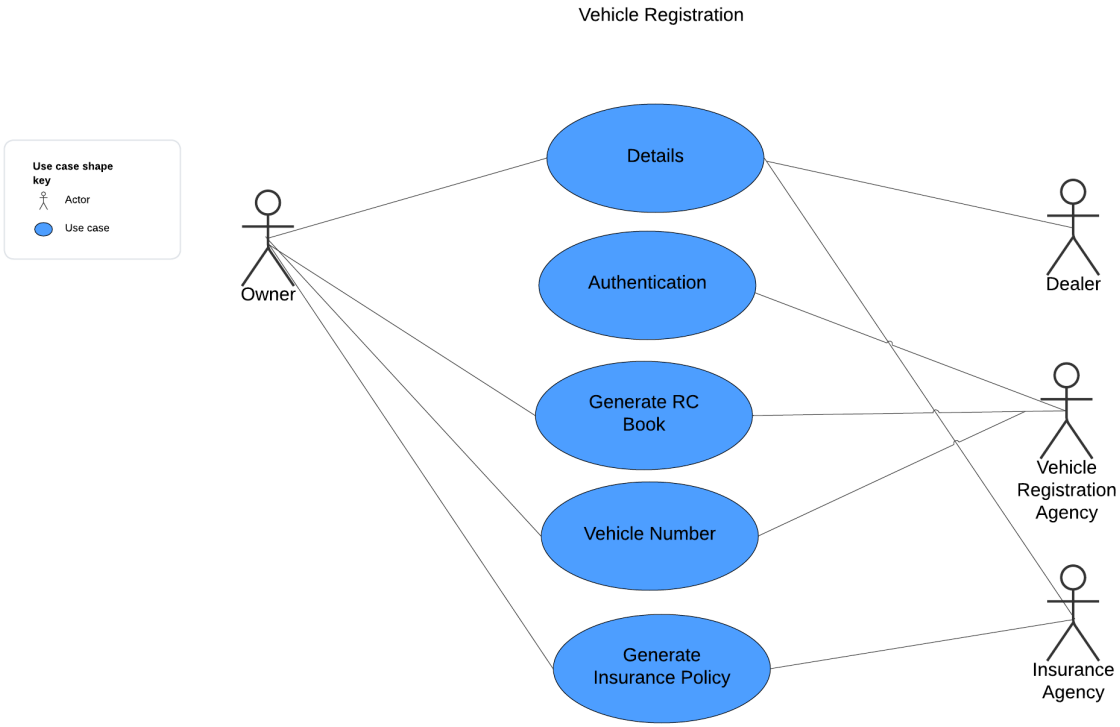
  Conditions for executing transfers.
- The contracts will handle interactions between vehicle owners, authorities, and other third parties

- **4. Analytics and Reporting**
- The system will feature reporting tools for viewing vehicle ownership history, transaction details, and system usage analytics.
- Ownership analytics will allow users to see the status, and associated documents for any registered vehicle.

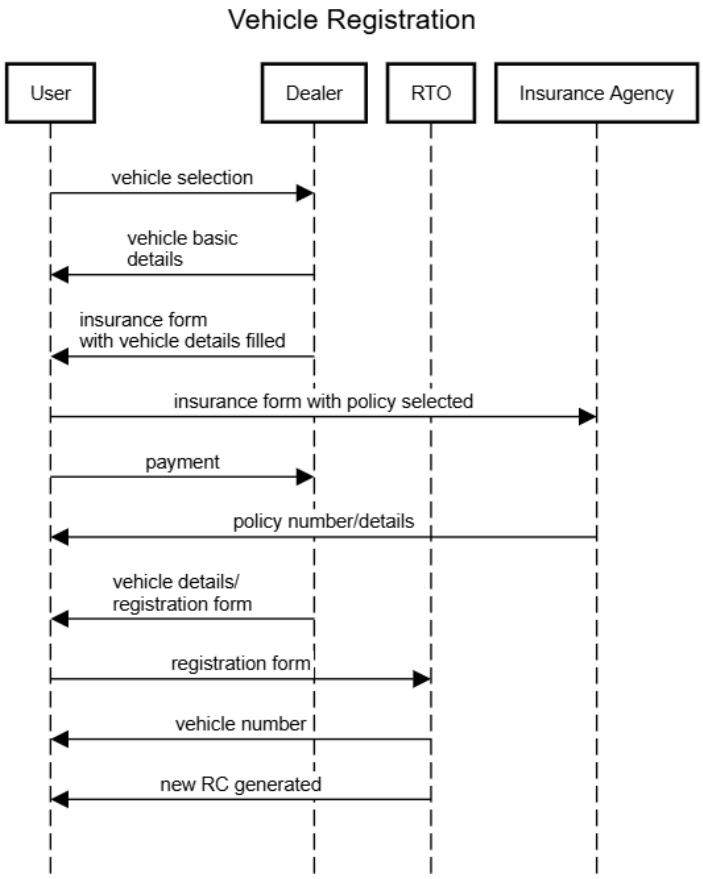
ARCHITECTURE DIAGRAM



USE CASE DIAGRAM



SEQUENCE DIAGRAM



MODULES

- **1. Owner Module**
- **Vehicle Registration:** The owner selects the vehicle to purchase from the dealer and initiates the registration process by providing vehicle details, owner details.
- The vehicle details are provided by the dealer. These details cannot be modified by the user. These details are entered and modified from the dealer side.

- **2. Dealer module**
- **Provide Vehicle Details:** Supply the vehicle details to relevant authorities.
- **Vehicle Number Assignment:** Facilitate assigning vehicle numbers during the registration process.

- **3. Vehicle Registration Agency Module**
- **Owner Authentication:** The agency authenticates the owner and validates their credentials before proceeding with vehicle registration.
- **Vehicle Registration:** After successful authentication, the vehicle is registered in the owner's name. A new vehicle number is assigned if necessary, and all details are securely stored in the system.
- **Blockchain Integration:** All vehicle and ownership details are securely stored on the blockchain to ensure transparency, immutability, and traceability across all transactions.

- **4. Insurance Agency Module**
- **Policy Generation:** The Insurance Agency provides a variety of insurance policy options to the owner based on the vehicle details submitted by the Dealer.
- **Policy Number Generation:** After finalizing the policy, the agency generates a unique policy number and forwards it to the owner.
- **Policy Updates:** If the owner requests a change in the policy details (such as ownership or vehicle modifications), the Insurance Agency processes the update and generates a new policy number.

MODULE DIVISION

- **Vehicle Registration Module-** Amith
- **Owner Module-** Akshay
- **Insurance Module and Dealer Module-** Albin
- **Environment Setup and Node Management-** Abhishek
- **Frontend and Integration-** Abhishek and Albin
- **Testing-** Akshay and Amith

ASSUMPTIONS

- **Government Collaboration**:
  - It is assumed that the Indian government and regulatory bodies (like RTOs) will adopt and support blockchain technology for vehicle registration and Authentication.
  - Necessary legal frameworks and policies will be in place to facilitate the use of blockchain for this purpose.
- **User Willingness**:
  - Vehicle owners and relevant Authorities (RTO officers, law enforcement) will adopt and use the blockchain system for vehicle registration and verification.
- **User Verification**:
  - Users will be able to authenticate their identities using Aadhaar e-KYC or other government-approved methods for secure transactions.

- **Scalability of the Blockchain Network**:
  - The blockchain solution will be scalable enough to handle large volumes of vehicle registrations and verifications without performance degradation, especially in a country as large as India.
- **Smart Contract Accuracy**:
  - The smart contracts deployed for vehicle registration and verification will be error-free and able to execute transactions without unintended consequences.

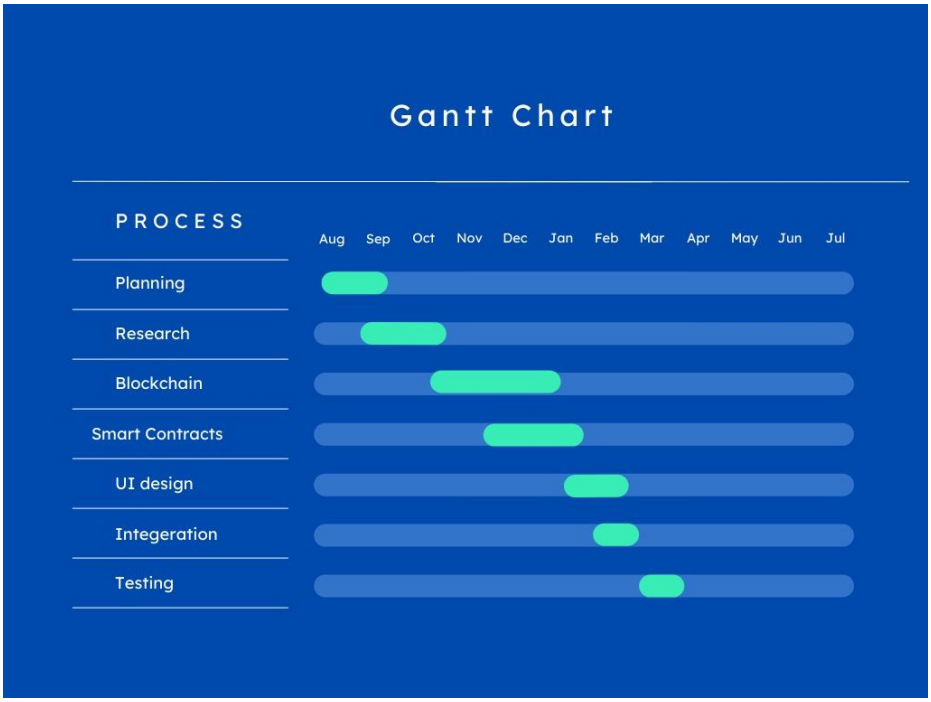
HARDWARE REQUIREMENTS

- 8 GB RAM
- Windows, macOS, Linux
- 500 GB of disk space

SOFTWARE REQUIREMENTS

- Ethereum- Blockchain-based computing platform to build and deploy decentralized applications
- Solidity- To create smart contracts for blockchain platforms(Remix IDE)
- Truffle
- Python
- Ganache
- HTML, CSS, JS- Frontend
- MySQL-Database Management

GANTT CHART



RISKS AND CHALLENGES

- As the number of users, transactions, and registered vehicles grows, the blockchain may experience scaling issues, leading to slower transaction times and higher costs.
- API integration of DigiLocker and mParivahan is difficult since these are government applications.

OUTPUT

Vehicle Hub

Home Company User Insurance Login

User Registration

First Name:

arjun

Last Name:

das

Place:

wayanad

Phone:

8097528121

Email:

arjundas@gmail.com

Certificate:

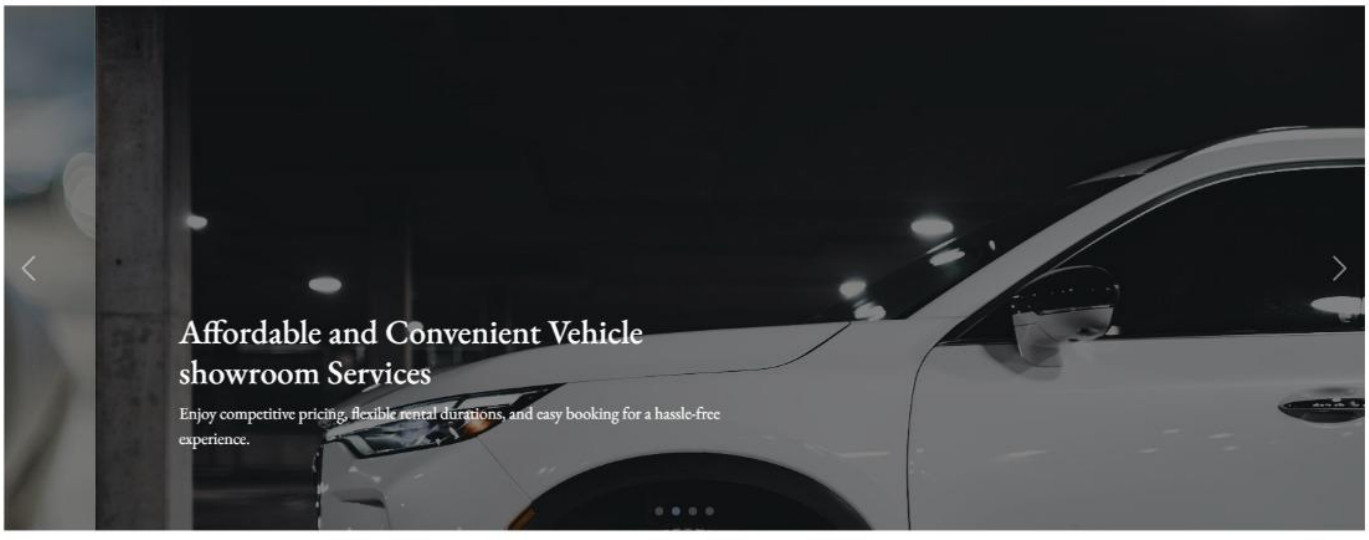
Choose File intern cloud.jpg

Username:

arjun

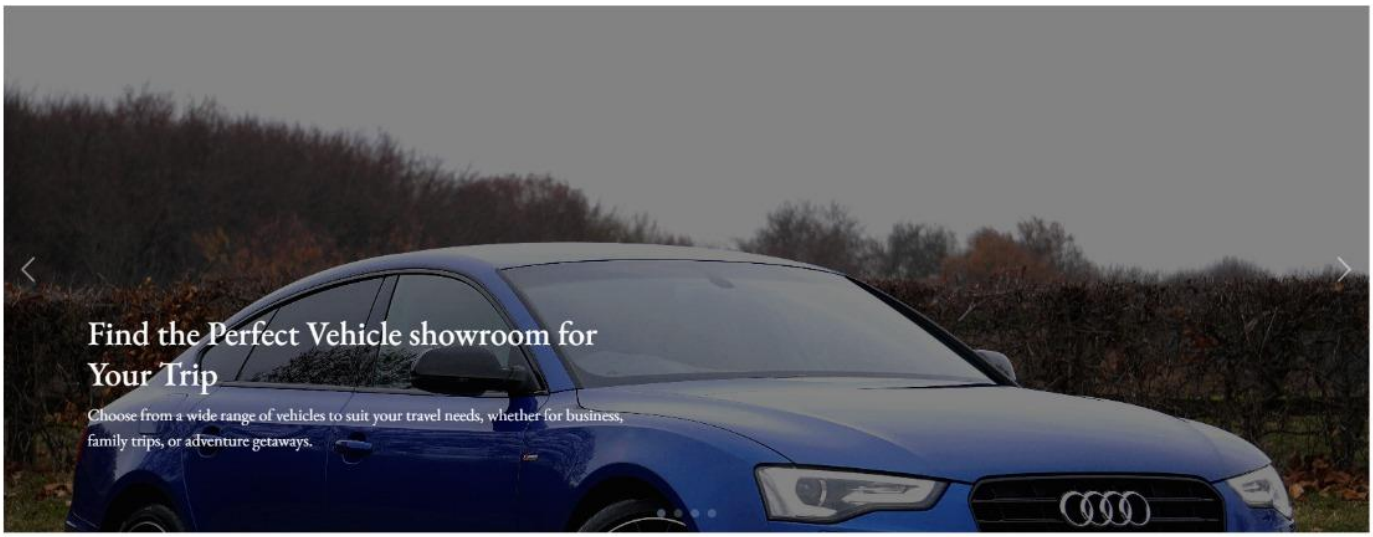
Admin

Home view company View User Manage Brand View Feedback Logout



USER

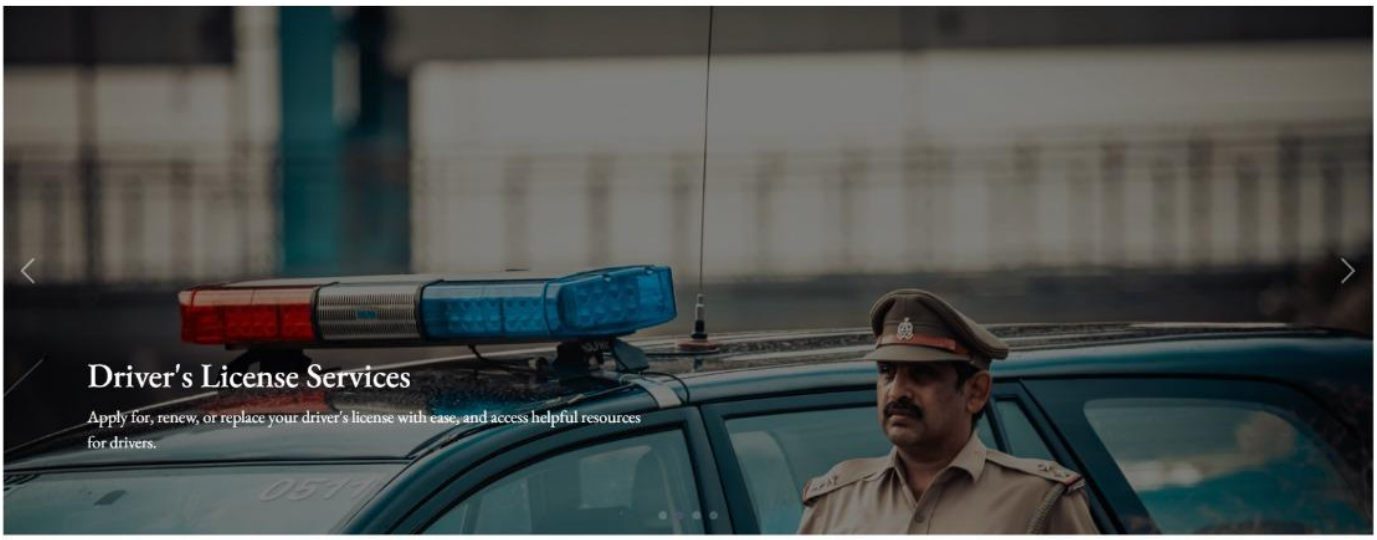
Home Orders Vehicles Alloted Vehicle Feedback Logout



127.0.0.1:5070/user_home

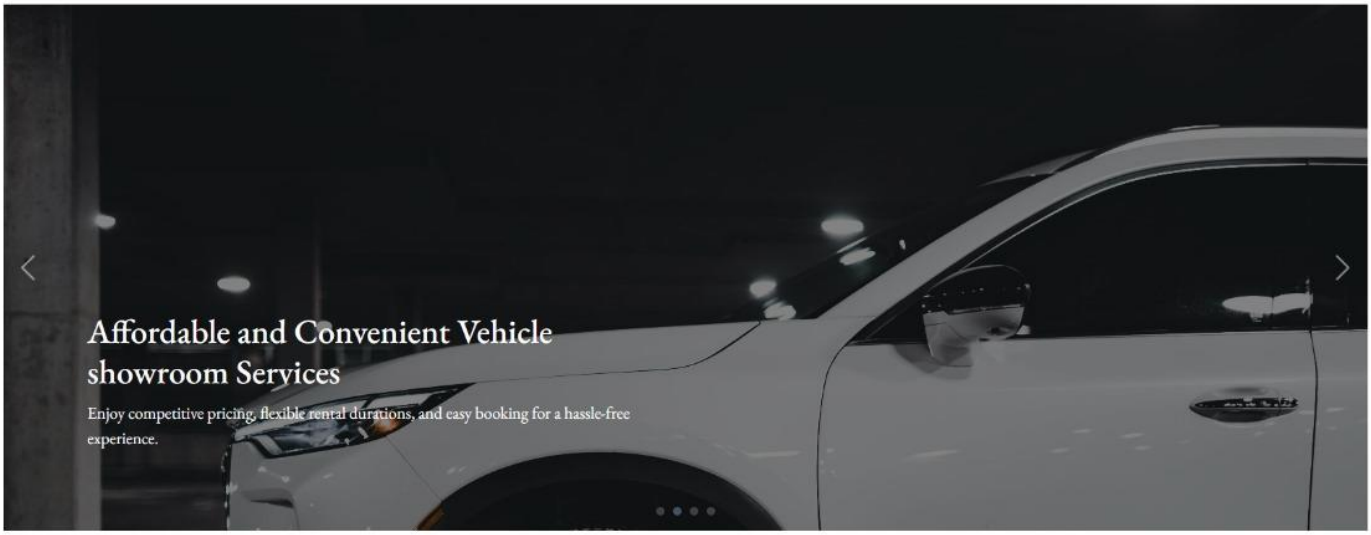
MVD

Home View Register Requests Logout



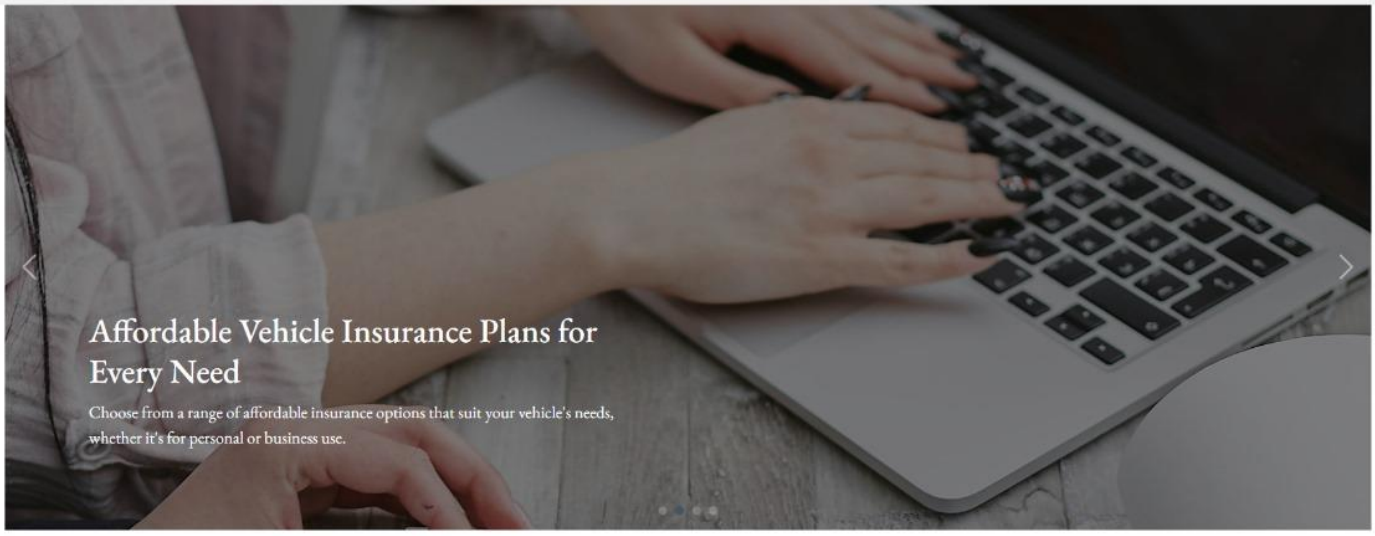
Company

Home view Brand View Order view Complaint View Alloted Logout



Insurance

Home Manage Policy View Request Logout



MVD

Home View Register Requests Logout

raju				04-05		User		
ramu raju	dulxee	ujsijdn12345nsj4	2025	2025-04-05	registered	View User		
ramu raju	dulxee	ujsijdn12345nsj4	2025	2025-04-05	registered	View User		
ramu raju	dulxee	ujsijdn12345nsj4	2025	2025-04-05	accepted	View User		Set Number
ramu raju	dulxee	ujsijdn12345nsj4	2025	2025-04-05	pending	View User	Accept Reject	
ramu raju	dulxee	ujsijdn12345nsj4	2025	2025-04-07	pending	View User	Accept Reject	
jithu gf	dulxee	3434223423423	2025	2025-04-07	pending	View User	Accept Reject	
jithu gf	dulxee	3434223423423	2025	2025-04-07	pending	View User	Accept Reject	

33

127.0.0.1:5070 says

User Accepted

OK

34

CURRENT BLOCK	GAS PRICE	GAS LIMIT	HARDFORK	NETWORK ID	RPC SERVER	MINING STATUS	WORKSPACE	
47	20000000000	6721975	MUIRGLACIER	5777	HTTP://127.0.0.1:9545	AUTOMINING	TIGHTFISTED-RAY	SWITCH

TX DATA

0×7c0cb5a60000000000000000000000000000000000000000000000000000000000000000000000000000002e0000000000000000000000000000000000000000000000000000000000000001
5000000000000000000000000000000000000000000000000000000000000001000000000000000000000000000000000000000000000000000000000000000140000000
0000000000000000000000000000000000000000000000000000000000000018000000000000000000000000000000000000000000000000000000000000001c0000000000000000
0000000000000000000000000000000000000000000000000000000000000002000000000000000000000000000000000000000000000000000000000000000240000000000000000000000000
0000000000000000000000000000000000000006616e6a616e6100000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000472616a7500000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000056b6f74746100000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000937383933353634373800000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0f616e6a616e40676d61696c2e636f6d0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000003d7374617
469632f62363734666233632d616639302d346662382d383939372d383937373030383861316532536372656 56e73686f74202839292e706e67000000

CONTRACT

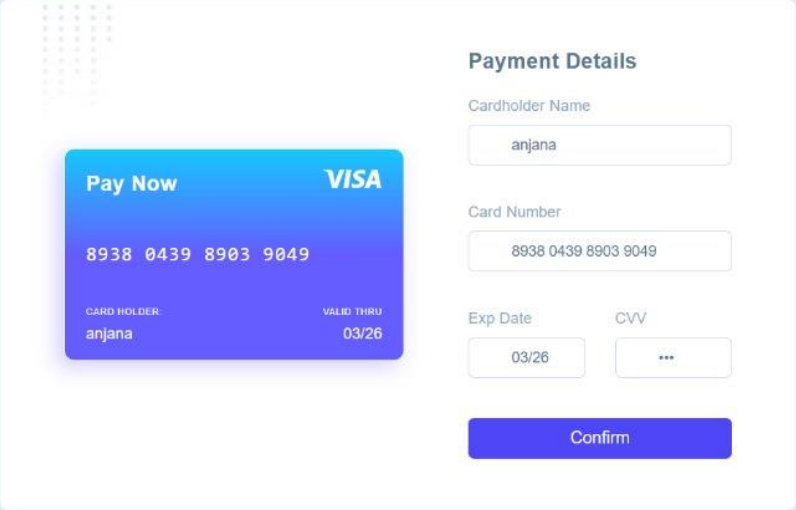
CONTRACT
vehicles

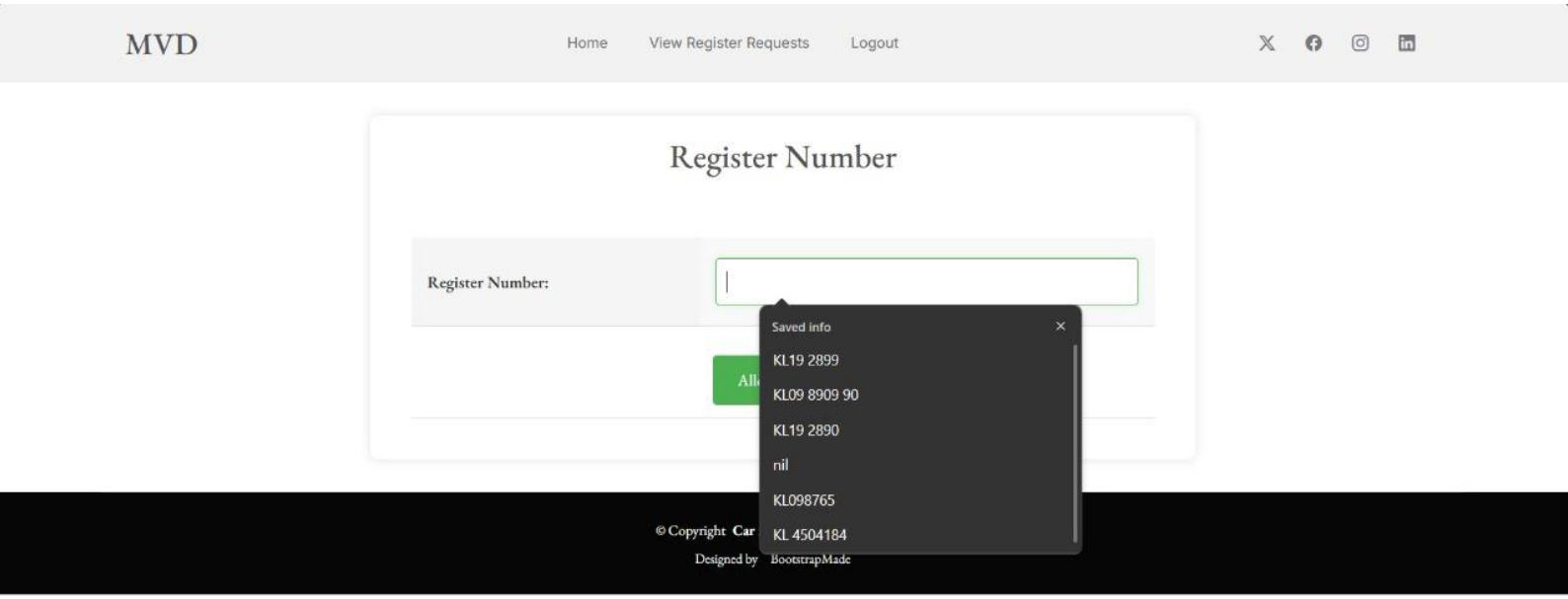
ADDRESS
0×E5FDE8c26Af497F78c4DF0f0195bF130FCD94459

FUNCTION
add_users(user_id: uint256, login_id: uint256, fname: string, lname: string, place: string, phone: string, email: string, image: string)

INPUTS
46, 21, anjana, raju, kotta, 789356478, anjan@gmail.com, static/b674fb3c-af90-4fb8-8997-89770088a1e2Screenshot (9).png

EVENTS





CURRENT BLOCK	GAS PRICE	GAS LIMIT	HARDFORK	NETWORK ID	RPC SERVER	MINING STATUS	WORKSPACE		
51	20000000000	6721975	MUIRGLACIER	5777	HTTP://127.0.0.1:9545	AUTOMINING	TIGHTFISTED-RAY	SWITCH	

VALUE	GAS USED	GAS PRICE	GAS LIMIT	MINED IN BLOCK
0.00 ETH	23396	20000000000	123396	50

TX DATA

0×51b78da8000000000000000000000000000000000000000000000000000000000000000310000000000000000000000000000000000000000000000000000000000000001
d000000000000000000000000000000000000000000000000000000000000000c000000000000000000000000000000000000000000000000000000000000010000000000
0000000000000000000000000000000000000000000000000000000000000140000000000000000000000000000000000000000000000000000000000000018000000000000000000
0000000000000000000000000000000000000000000010756a73696a646e31323334356e736a340000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000432303235000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000665766f2065780000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000770656e64696e67000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

CONTRACT

CONTRACT	ADDRESS
vehicles	0×E5FDE8c26Af497F78c4DF0f0195bF130FCD94459

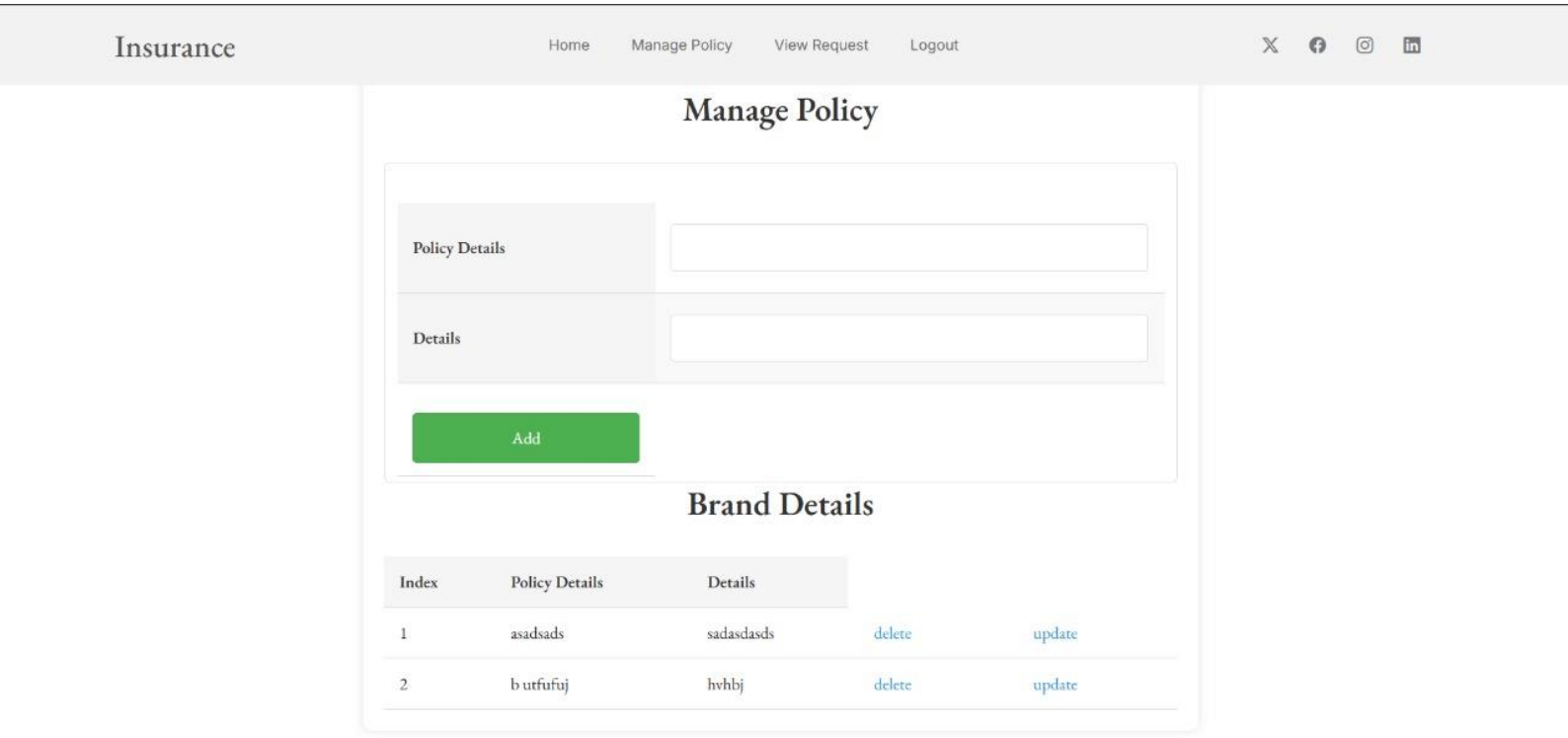
FUNCTION

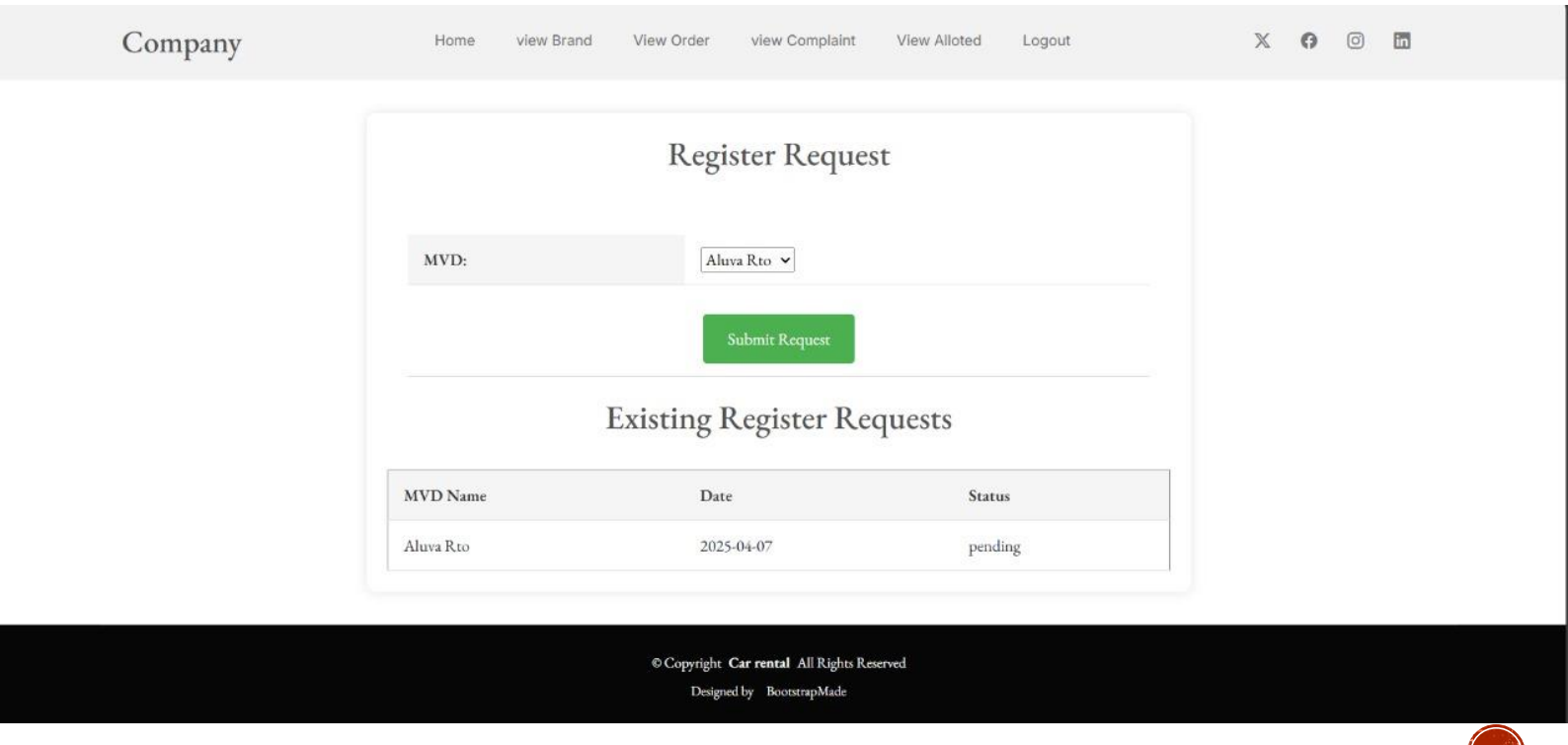
```
add_allotvehicles(allotvehicles_id: uint256, booking_id: uint256, chasisnumber: string, modelnumber: strin
g, details: string, registernumber: string)
```

INPUTS

```
49, 29, ujsijdn12345nsj4, 2025, evo ex, pending
```

EVENTS





CURRENT BLOCK	GAS PRICE	GAS LIMIT	HARDFORK	NETWORK ID	RPC SERVER	MINING STATUS	WORKSPACE		
51	20000000000	6721975	MUIRGLACIER	5777	HTTP://127.0.0.1:9545	AUTOMINING	TIGHTFISTED-RAY	SWITCH	

0×e16A24f6Ce4F83b52C04c8103aBC49A7F13E1F59 0×E5FDE8c26Af497F78c4DF0f0195bF130FCD94459

VALUE	GAS USED	GAS PRICE	GAS LIMIT	MINED IN BLOCK
0.00 ETH	22612	20000000000	122612	51

TX DATA

0×85ba4e9300000000000000000000000000000000000000000000000000000000000000000000000000000000320000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
4000000000000000000000000000000000000000000000000000000000000000000000000000000000000000c0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000a000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000e0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000013323032352d30342d3
0342032333a34393a323000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000770656e64696e67000000000000
0000000000000000000000000000000000000000

CONTRACT

CONTRACT	ADDRESS
vehicles	0×E5FDE8c26Af497F78c4DF0f0195bF130FCD94459

FUNCTION

```
add_registerrequest(registerrequest_id: uint256, mvd_id: uint256, allotvehicle_id: uint256, date: string,
status: string)
```

INPUTS

```
50, 4, 12, 2025-04-04 23:49:20, pending
```

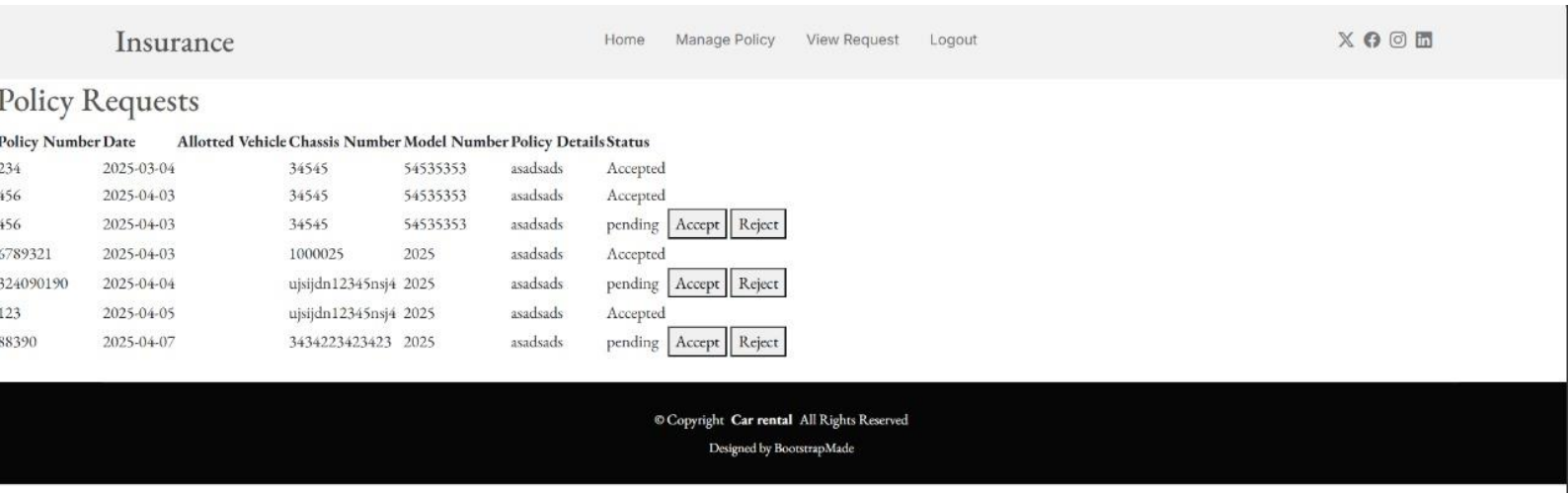
EVENTS

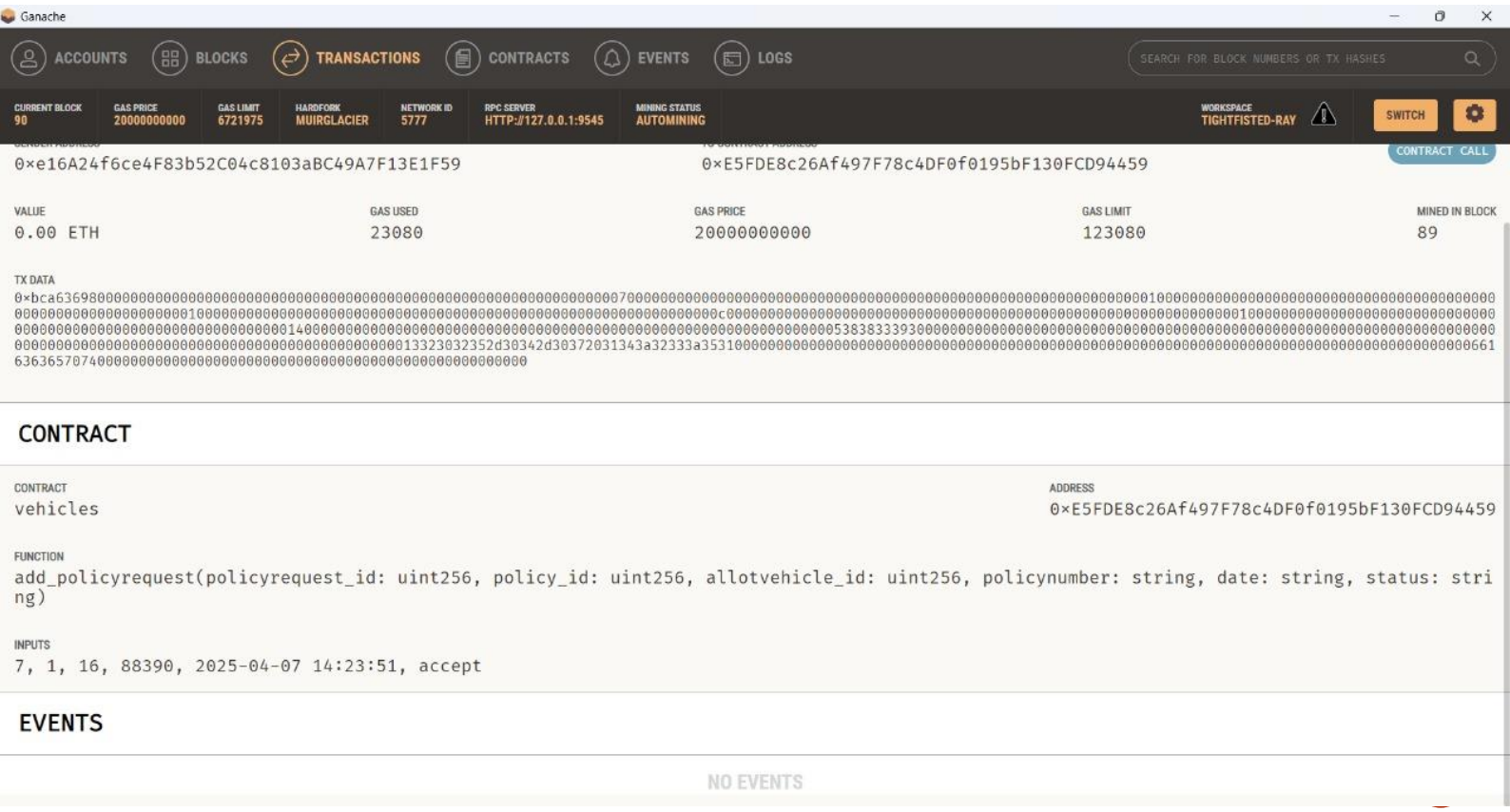
USER

Home Orders Vehicles Alloted Vehicle Feedback Logout

Policy Requests

Policy Name	Policy Number	Date	Status
asadsads	88390	2025-04-07	Accepted


Insurance
Home
Manage Policy
View Request
Logout
Policy Requests
Policy Number Date Allotted Vehicle Chassis Number Model Number Policy Details Status
234 2025-03-04 34545 54535353 asadsads Accepted
456 2025-04-03 34545 54535353 asadsads Accepted
456 2025-04-03 34545 54535353 asadsads pending Accept Reject
6789321 2025-04-03 1000025 2025 asadsads Accepted
324090190 2025-04-04 ujsijdn12345nsj4 2025 asadsads pending Accept Reject
123 2025-04-05 ujsijdn12345nsj4 2025 asadsads Accepted
88390 2025-04-07 3434223423423 2025 asadsads pending Accept Reject
© Copyright Car rental All Rights Reserved
Designed by BootstrapMade


Ganache
ACCOUNTS
BLOCKS
TRANSACTIONS
CONTRACTS
EVENTS
LOGS
SEARCH FOR BLOCK NUMBERS OR TX HASHES
CURRENT BLOCK 90
GAS PRICE 20000000000
GAS LIMIT 6721975
HARDFORK MUIRGLACIER
NETWORK ID 5777
RPC SERVER HTTP://127.0.0.1:9545
MINING STATUS AUTOMINING
WORKSPACE TIGHTFISTED-RAY
SWITCH
0x0e16A24f6ce4F83b52C04c8103aBC49A7F13E1F59
0x0E5FDE8c26Af497F78c4DF0f0195bF130FCD94459
CONTRACT CALL
VALUE 0.00 ETH
GAS USED 23080
GAS PRICE 20000000000
GAS LIMIT 123080
MINED IN BLOCK 89
TX DATA
CONTRACT
vehicles
ADDRESS
0x0E5FDE8c26Af497F78c4DF0f0195bF130FCD94459
FUNCTION
add_policyrequest(policyrequest_id: uint256, policy_id: uint256, allotvehicle_id: uint256, policynumber: string, date: string, status: string)
INPUTS
7, 1, 16, 88390, 2025-04-07 14:23:51, accept
EVENTS
NO EVENTS

WORK DIVISION

Abhishek
- Vehicles (SC)
- Integration with frontend
- SQL Management and Integration

Amith
- Vehicles (SC)
- SQL Management and Integration
- Frontend

Akshay
- Migrations (SC)
- Frontend
- SQL Management and Integration

Albin
- Migrations (SC)
- SQL Management and Integration
- Integration with frontend

CONCLUSION

- This blockchain-based vehicle ownership management system offers a secure, transparent, and efficient solution to automate vehicle registration.
- By leveraging blockchain technology, the system ensures tamper-proof records, real-time updates, and regulatory compliance, benefiting vehicle owners, RTOs, and other stakeholders.
- It delivers a streamlined and user-friendly experience that enhances trust and transparency in vehicle management processes.

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- T. A. Syed, M. S. Siddique, A. Nadeem, A. Alzahrani, S. Jan and M. A. K. Khattak, "A Novel Blockchain-Based Framework for Vehicle Life Cycle Tracking: An End-to-End Solution," in IEEE Access, vol. 8, pp. 111042-111063, 2020, doi: 10.1109/ACCESS.2020.3002170.
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THANK YOU!

Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

Vision, Mission, Programme Outcomes and Course Outcomes

Institute Vision

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To become a centre of excellence in Computer Science and Engineering, moulding professionals catering to the research and professional needs of national and international organizations.

Department Mission

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation and creativity to come out with solutions meeting societal needs.

Programme Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

A graduate of the Computer Science and Engineering Program will demonstrate:

PSO1: Computer Science Specific Skills
The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

PSO2: Programming and Software Development Skills
The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

PSO3: Professional Skills
The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur.

Course Outcomes (CO)

Course Outcome 1: Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).

Course Outcome 2: Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).

Course Outcome 3: Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).

Course Outcome 4: Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).

Course Outcome 5: Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).

Course Outcome 6: Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).

Appendix C:
CO-PO-PSO Mapping

Course Outcomes

After completion of the course the student will be able to:

SL.NO	Description	Bloom's Taxonomy Level
CO1	Model and solve real-world problems by applying knowledge across domains.	Level 3: Apply
CO2	Develop products, processes, or technologies for sustainable and socially relevant applications.	Level 3: Apply
CO3	Function effectively as an individual and as a leader in diverse teams to comprehend and execute designated tasks.	Level 3: Apply
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms.	Level 3: Apply
CO5	Identify technology/research gaps and propose innovative/creative solutions.	Level 4: Analyze
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms.	Level 3: Apply

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	2	2	1	1	-	2	1	-	-	-	-	3
2	3	3	2	3	-	2	1	-	-	-	-	3
3	3	2	-	-	3	-	-	1	-	2	-	3
4	3	-	-	-	2	-	-	1	-	3	-	3
5	3	3	3	3	2	2	-	2	-	3	-	3

CO-PSO Mapping

CO	PSO 1	PSO 2	PSO 3
1	3	1	2
2	3	2	2
3	2	2	-
4	3	-	3
5	3	-	-

Justification for CO-PO Mapping

Mapping	Level	Justification
101003/CS822U.1-PO1	M	Knowledge in the area of technology for project development using various tools results in better modeling.
101003/CS822U.1-PO2	M	Knowledge acquired in the selected area of project development can be used to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions.
101003/CS822U.1-PO3	M	Can use the acquired knowledge in designing solutions to complex problems.
101003/CS822U.1-PO4	M	Can use the acquired knowledge in designing solutions to complex problems.
101003/CS822U.1-PO5	H	Students are able to interpret, improve and redefine technical aspects for design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS822U.1-PO6	M	Students are able to interpret, improve and redefine technical aspects by applying contextual knowledge to assess societal, health and consequential responsibilities relevant to professional engineering practices.
101003/CS822U.1-PO7	M	Project development based on societal and environmental context solution identification is the need for sustainable development.
101003/CS822U.1-PO8	L	Project development should be based on professional ethics and responsibilities.
101003/CS822U.1-PO9	L	Project development using a systematic approach based on well-defined principles will result in teamwork.
101003/CS822U.1-PO10	M	Project brings technological changes in society.
101003/CS822U.1-PO11	H	Acquiring knowledge for project development gathers skills in design, analysis, development and implementation of algorithms.
101003/CS822U.1-PO12	H	Knowledge for project development contributes engineering skills in computing and information gatherings.
101003/CS822U.2-PO1	H	Knowledge acquired for project development will also include systematic planning, developing, testing, and implementation in computer science solutions in various domains.
101003/CS822U.2-PO2	H	Project design and development using a systematic approach brings knowledge in mathematics and engineering fundamentals.
101003/CS822U.2-PO3	H	Identifying, formulating, and analyzing the project results in a systematic approach.
101003/CS822U.2-PO5	H	Systematic approach is the tip for solving complex problems in various domains.

Mapping	Level	Justification
101003/CS822U.2-PO6	H	Systematic approach in the technical and design aspects provides valid conclusions.
101003/CS822U.2-PO7	H	Systematic approach in the technical and design aspects demonstrates the knowledge of sustainable development.
101003/CS822U.2-PO8	M	Identification and justification of technical aspects of project development demonstrates the need for sustainable development.
101003/CS822U.2-PO9	H	Apply professional ethics and responsibilities in engineering practice of development.
101003/CS822U.2-PO11	H	Systematic approach also includes effective reporting and documentation which gives clear instructions.
101003/CS822U.2-PO12	M	Project development using a systematic approach based on well-defined principles will result in better teamwork.
101003/CS822U.3-PO9	H	Project development as a team brings the ability to engage in independent and lifelong learning.
101003/CS822U.3-PO10	H	Identification, formulation and justification in technical aspects will be based on acquiring skills in design and development of algorithms.
101003/CS822U.3-PO11	H	Identification, formulation and justification in technical aspects provides the betterment of life in various domains.
101003/CS822U.3-PO12	H	Students are able to interpret, improve and redefine technical aspects with mathematics, science and engineering fundamentals for the solutions of complex problems.
101003/CS822U.4-PO5	H	Students are able to interpret, improve and redefine technical aspects with identification, formulation and analysis of complex problems.
101003/CS822U.4-PO8	H	Students are able to interpret, improve and redefine technical aspects to meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.
101003/CS822U.4-PO9	H	Students are able to interpret, improve and redefine technical aspects for design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS822U.4-PO10	H	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for better products.
101003/CS822U.4-PO11	M	Students are able to interpret, improve and redefine technical aspects by applying contextual knowledge to assess societal, health and consequential responsibilities relevant to professional engineering practices.
101003/CS822U.4-PO12	H	Students are able to interpret, improve and redefine technical aspects for demonstrating the knowledge of, and need for sustainable development.

Mapping	Level	Justification
101003/CS822U.5-PO1	H	Students are able to interpret, improve and redefine technical aspects, apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/CS822U.5-PO2	M	Students are able to interpret, improve and redefine technical aspects, communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
101003/CS822U.5-PO3	H	Students are able to interpret, improve and redefine technical aspects to demonstrate knowledge and understanding of the engineering and management principle in multidisciplinary environments.
101003/CS822U.5-PO4	H	Students are able to interpret, improve and redefine technical aspects, recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
101003/CS822U.5-PO5	M	Students are able to interpret, improve and redefine technical aspects in acquiring skills to design, analyze and develop algorithms and implement those using high-level programming languages.
101003/CS822U.5-PO12	M	Students are able to interpret, improve and redefine technical aspects and contribute their engineering skills in computing and information engineering domains like network design and administration, database design and knowledge engineering.
101003/CS822U.6-PO5	M	Students are able to interpret, improve and redefine technical aspects and develop strong skills in systematic planning, developing, testing, implementing and providing IT solutions for different domains which helps in the betterment of life.
101003/CS822U.6-PO8	H	Students will be able to associate with a team as an effective team player for the development of technical projects by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS822U.6-PO9	H	Students will be able to associate with a team as an effective team player to identify, formulate, review research literature, and analyze complex engineering problems.
101003/CS822U.6-PO10	M	Students will be able to associate with a team as an effective team player for designing solutions to complex engineering problems and design system components.
101003/CS822U.6-PO11	M	Students will be able to associate with a team as an effective team player to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data.

Mapping	Level	Justification
101003/CS822U.6-PO12	H	Students will be able to associate with a team as an effective team player, applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/CS822U.1-PSO1	H	Students are able to develop Computer Science Specific Skills by modeling and solving problems.
101003/CS822U.2-PSO2	M	Developing products, processes or technologies for sustainable and socially relevant applications can promote Programming and Software Development Skills.
101003/CS822U.3-PSO3	H	Working in a team can result in the effective development of Professional Skills.
101003/CS822U.4-PSO3	H	Planning and scheduling can result in the effective development of Professional Skills.
101003/CS822U.5-PSO1	H	Students are able to develop Computer Science Specific Skills by creating innovative solutions to problems.
101003/CS822U.6-PSO3	H	Organizing and communicating technical and scientific findings can help in the effective development of Professional Skills.