SUST Autorickshaw Management System

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1 Introduction

Autorickshaw is a vital component in our university life at SUST. Given the considerable distance between the main gate, hall of residence for students, and other academic, administrative and registry buildings, autorickshaws play a crucial role in ensuring convenient and efficient transportation for students, teachers and other officers. To enhance the management and coordination of autorickshaws within the university premises, we are introducing the ”SUST Autorickshaw Management System” website. This initiative is designed to create a centralized database, organizing important data related to autorickshaws, including driver details, permissions, schedules, routes, and financial transactions. This system will empower university authorities and personnel involved in autorickshaw management to efficiently meet reporting needs. In developing this system, we gathered relevant data and insights from autorickshaw drivers and managers to understand the unique requirements of SUST’s autorickshaw management. After gathering requirements, our development process involves creating a comprehensive system blueprint. This includes utilizing use case diagrams, data flow diagrams (DFD), and designing the database structure using MySQL. We ensure that these visual representations capture the essence of our Autorickshaw Management System, outlining the interactions and data flow within the system.

The subsequent phase involves the development of a dynamic website using a technology stack that includes Node.js, ReactJS, and MySQL to seamlessly integrate the frontend and backend components. The system ensures drivers, owners and managers obtain necessary permissions from the university’s authority (proctorial bodies), and the managers can oversee the scheduling of autorickshaws. Key features of the Autorickshaw Management System include scheduling, route planning, and financial management, streamlining services and ensuring a transparent process for collecting daily payments from drivers. Expanding its reach, the system caters not only to students and teachers but also to officers across various departments and controller offices, ensuring a convenient transportation network for the entire university community.

2 Objectives

The primary objective of the SUST Autorickshaw Management System is to introduce a transparent and user-friendly platform that addresses the manual challenges faced by managers in overseeing auto rickshaw operations. The system aims to provide a practical solution to the following specific objectives:

1. Financial Transparency: Enhancing the efficiency of financial management through the implementation of an automated system for the collection and monitoring of daily payments from auto rickshaw drivers. This system is created to provide a clear and transparent summary of financial transactions, reducing the risk of errors and ensuring accountability.

2. Efficient Scheduling: Replacing manual scheduling procedures with a well-organized and automated system. This functionality will empower managers to effectively plan auto rickshaw routes and schedules, minimizing conflicts and optimizing the overall transportation service.

3. User-Friendly Interface in Bangla: Creating a user-friendly website with a Bangla-language interface to facilitate convenient usage for managers. This linguistic customization aims to improve the accessibility and usability of the platform for those involved in auto rickshaw management.

4. Centralized Data Management: Establishing a central database for autorickshaw-related information, covering driver details, permissions, and schedules. This organized system will enable managers to easily access essential data, reducing the need for manual record-keeping and improving overall efficiency.

5. Automation of Permissions: Establishing a systematic procedure to obtain required permissions from the university's proctorial bodies. Through automation, the system aims to simplify the authorization process, lessening administrative burdens, and ensuring adherence to university regulations.

6. Assistive Management Tools: Providing managers with tools to aid in decision-making and oversight, such as visual representations of schedules and financial transactions, making it easier to understand auto rickshaw operations.

3 Requirement Gathering and Analysis

3.1 Requirement Gathering

In the project's initial phase, we systematically gathered crucial information to guide the development of the Autorickshaw Management System. This process included some documents, such as:

1. Manager, Driver and Owner Details eg:
    - Name
    - NID [See in fig. 2]
    - Driving License Number for Drivers etc.
2. Permission Documents allowing auto rickshaw driving within the university area. [See in fig. 3]
3. Auto rickshaw Details eg: [See in fig. 1]
    - Auto rickshaw number
    - Auto rickshaw company
    - Auto rickshaw color
    - Auto rickshaw model
4. A a manual record-keeping system for tracking schedules on various campus routes which includes
    - Round no
    - Round date
    - Round start time
    - Round end time
    - Round area
5. Authority (Procotorial Bodies) Details eg: [See in fig. 3]
    - Authority Name
    - Authority Designation

(a) Sample Autorickshaw 1

(b) Sample Autorickshaw 2

Figure 1: Sample Autorickshaws

Figure 2: Driver's NID

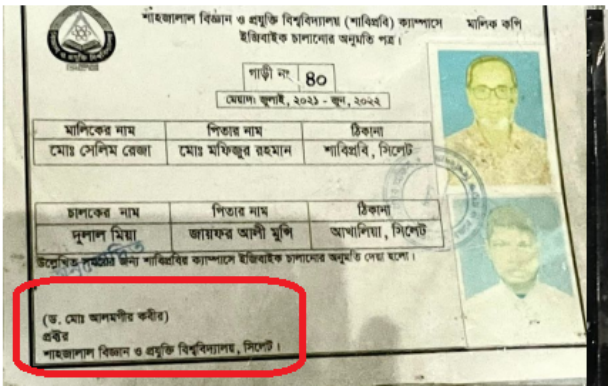
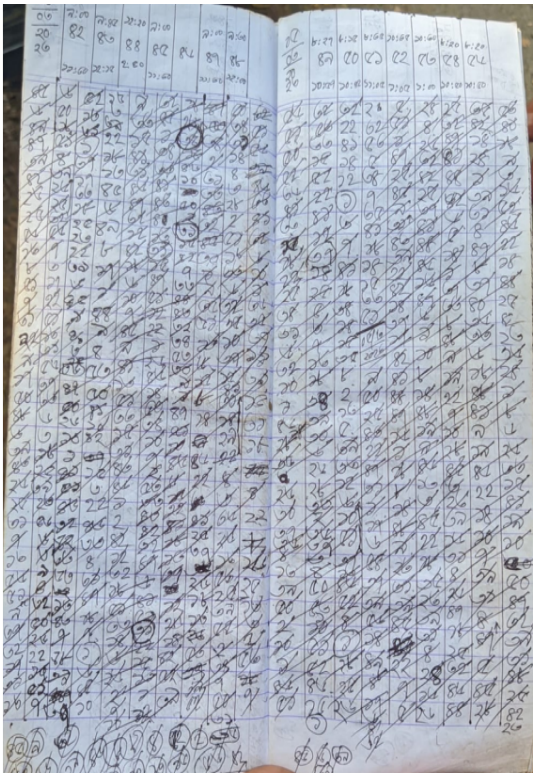


Figure 3: Authority Details Who Gave Permission

Figure 4: Permission Documents of Auto rickshaw (Owner Copy)



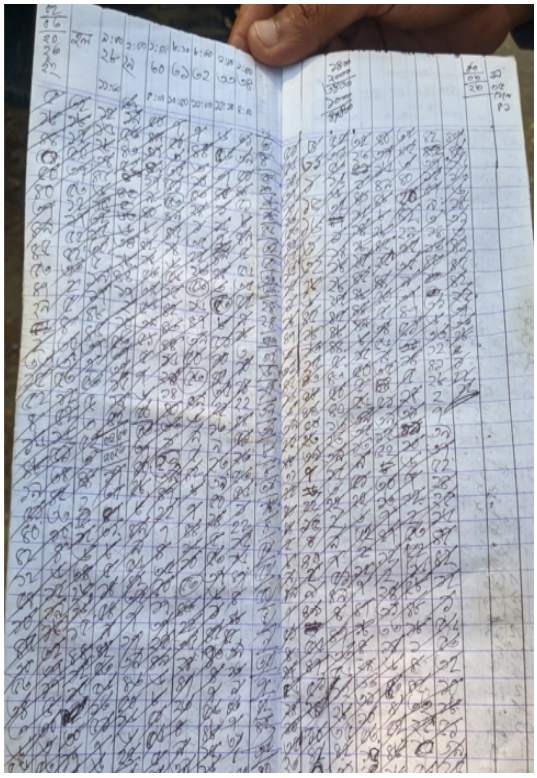


Figure 5: Manual records of serial and round management

3.2 Requirement Analysis

3.2.1 Stakeholder Identification:

- University Authority
- Owners
- Drivers
- Managers

3.2.2 Project Scope

- Authorization and Registration: Specifying the process for authorization and registration of autorickshaw drivers, owners, and managers within the university.

- Scheduling and Route Planning: Defining the system's capability to schedule autorickshaws, plan routes within the campus, and manage the overall transportation logistics.
- Financial Management: Detailing how the system will handle financial transactions, including the collection of payments from drivers and financial oversight for managers.
- Verification Processes: Describe the verification processes for auto rickshaw drivers and owners, emphasizing the need for accurate National ID (NID) information.

3.2.3 Risk Analysis

Here are some potential risks of SUST Autorickshaw Management System along with suggested mitigation strategies:

1. **Data Security Breach:** Unauthorized access to sensitive data, such as driver information or financial records. The access is restricted solely to managers and authorities.
2. **System Downtime:** Unplanned system outages that disrupt autorickshaw scheduling and operations. Regular system maintenance and establish contingency plans should be conducted to minimize downtime impact on autorickshaw scheduling.
3. **Integration Issues:** Challenges in integrating the Autorickshaw Management System with existing university databases or systems. The system should be collaborated closely with university IT teams, ensuring seamless integration and addressing any compatibility challenges promptly.
4. **User Resistance to Change:** Resistance from autorickshaw drivers, owners, or managers to adopt the new system. Comprehensive user training programs, addressing concerns and highlighting the benefits of the Autorickshaw Management System should be provided.
5. **Incomplete or Inaccurate Data:** Incomplete or inaccurate data entry during autorickshaw registration or scheduling. Validation checking and user-friendly interfaces to ensure accurate data entry during autorickshaw registration and scheduling have been implemented.
6. **Regulatory Compliance Issues:** Changes in regulations affecting autorickshaw operations within the university. Regularly monitor and adapt to changes in regulations, maintaining compliance through proactive adjustments to the system.
7. **Lack of User Training:** Insufficient training may lead to users not utilizing the system to its full potential. Develop and execute thorough training programs for autorickshaw drivers, owners, and managers to enhance system utilization.

3.2.4 Non-Functional Requirements

1. **Performance:** The system must be capable of handling a large number of autorickshaws and allowing managers for scheduling, route planning, and financial transactions.
2. **Security:** Ensure data privacy and protection against unauthorized access; only managers and authority can get access to the administrative section (dashboard).
3. **Reliability:** The system must be available for use at all times during specified operational hours.
4. **Usability:** The user interface should be intuitive and user-friendly for drivers, owners, managers, and authorities.
5. **Maintainability:** The system should be easily maintainable and allow for updates or modifications.
6. **Compliance:** The system should follow relevant legal and regulatory requirements for autorickshaw operations.
7. **Documentation:** Provide comprehensive documentation for users and system administrators.
8. **Training:** Develop training resources to familiarize users with the system functionalities.
9. **Interoperability:** The system should be able to integrate with existing university systems for seamless data sharing.

3.2.5 Use Case Diagram

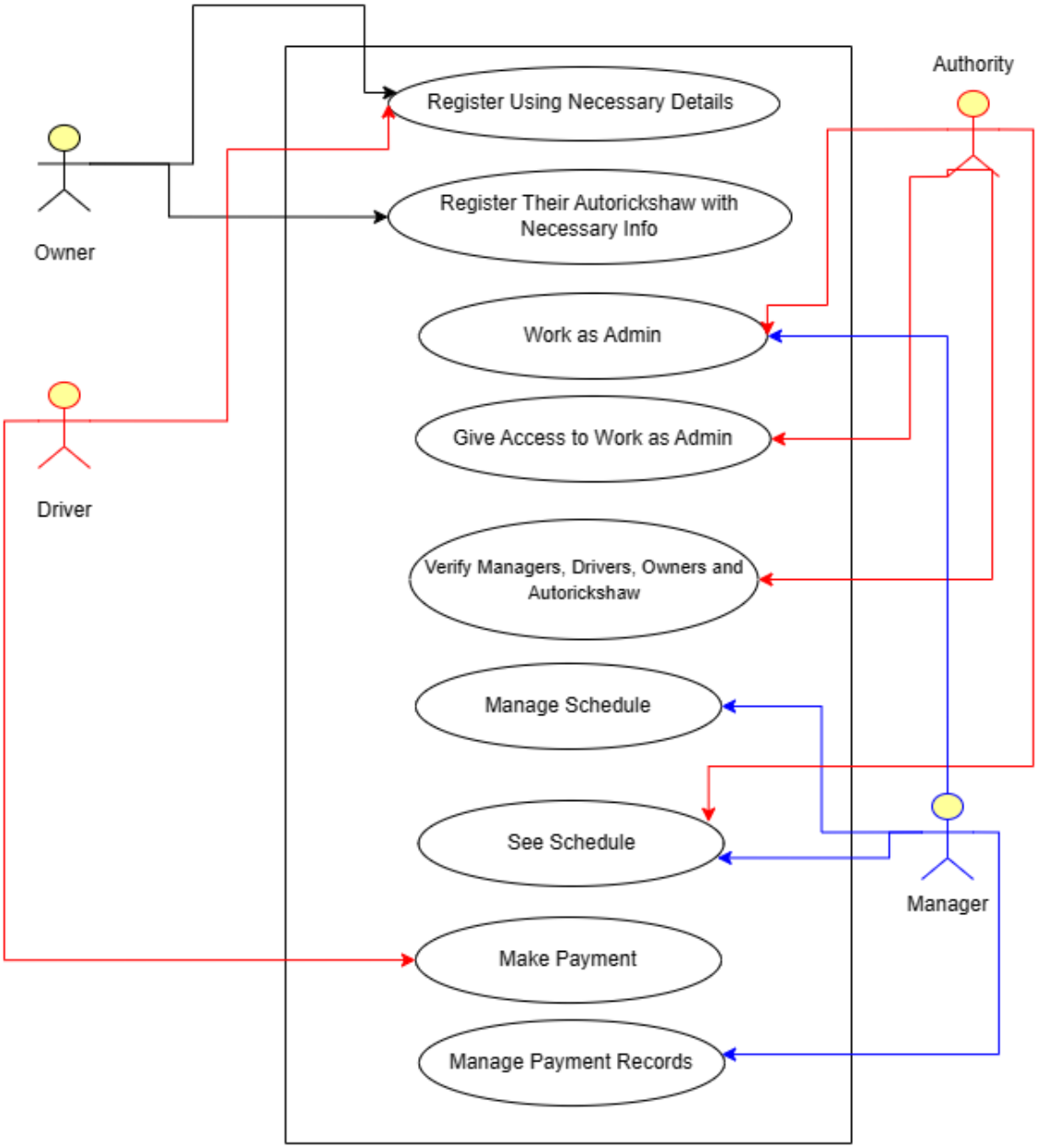


Figure 6: SUST Auto-rickshaw Management System Use Case Diagram

3.2.6 Entity Relationship Diagram

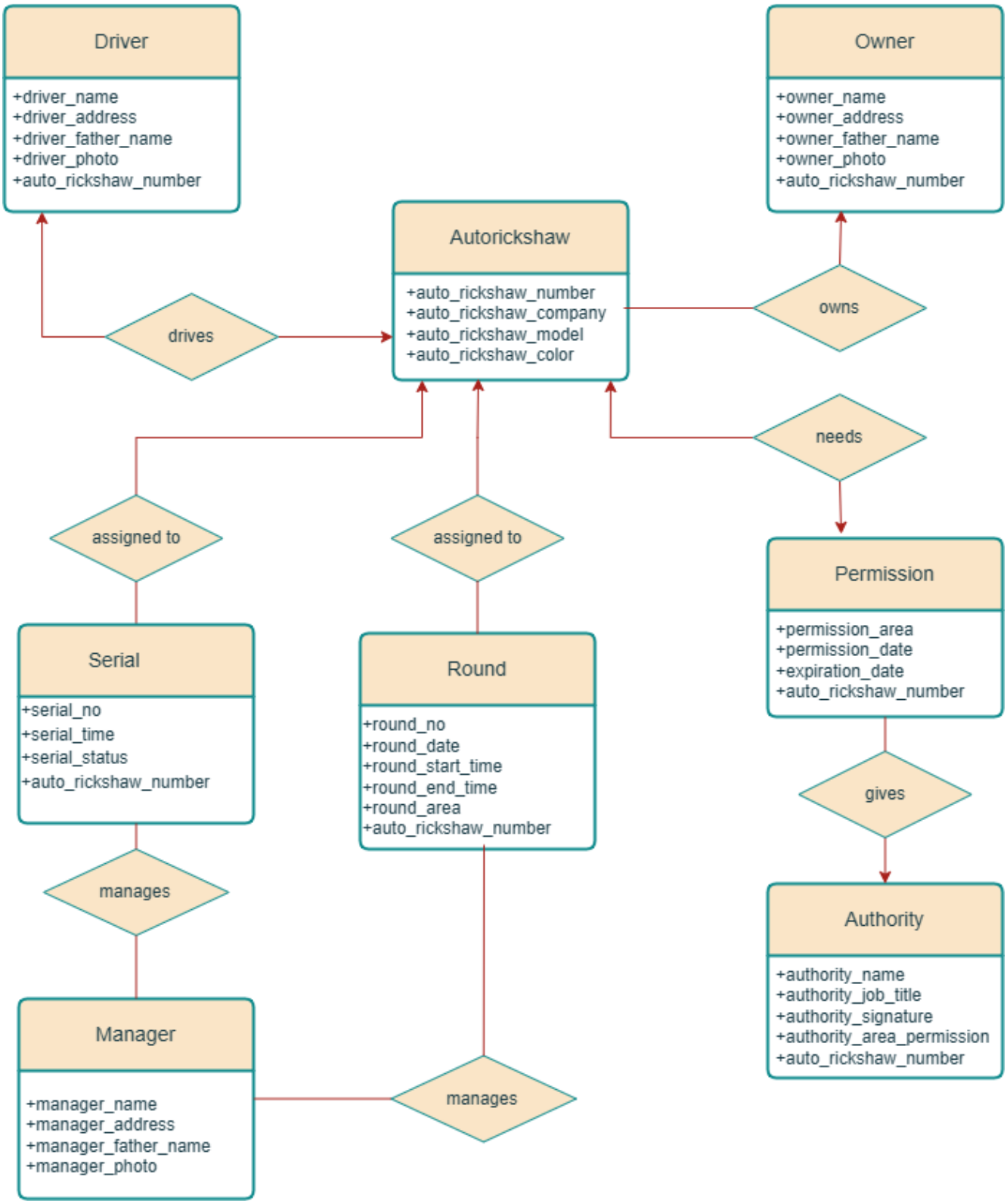


Figure 7: SUST Auto-rickshaw Management System ER Diagram

3.2.7 Data Flow Diagram

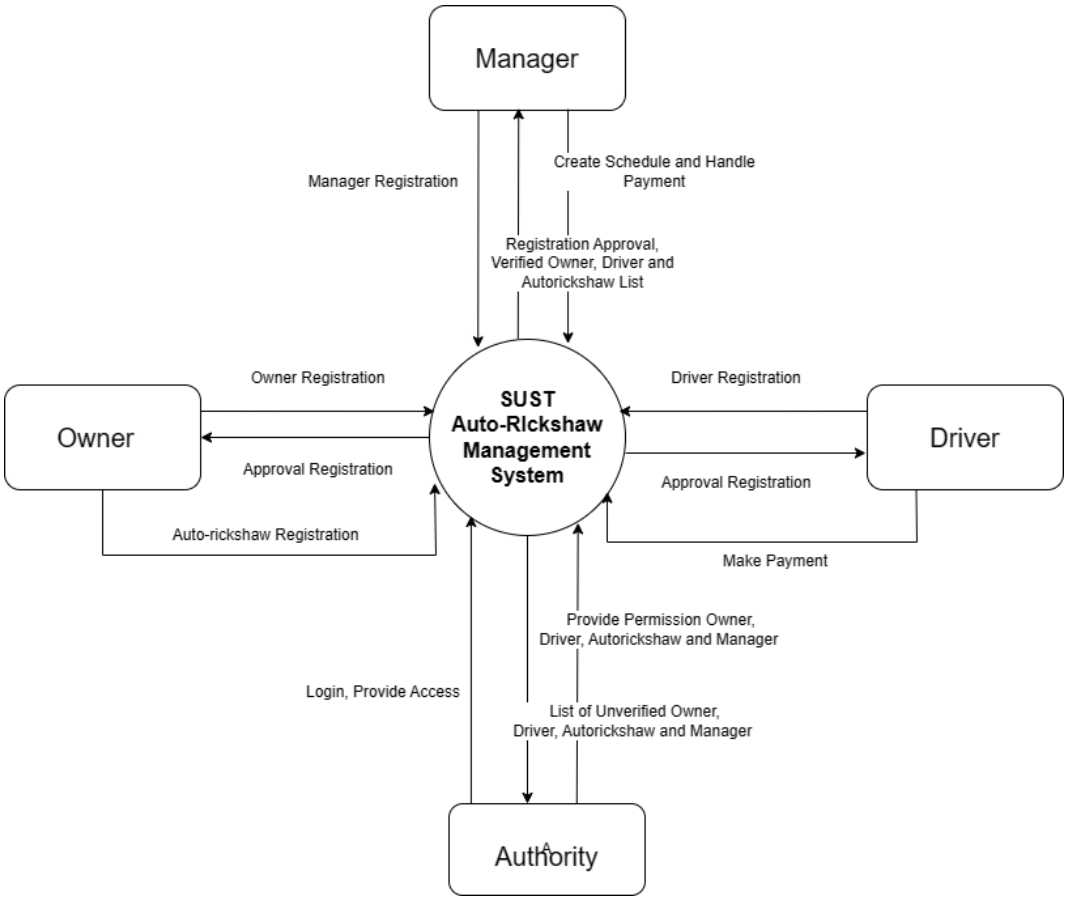


Figure 8: SUST Auto-rickshaw Management System DFD Level 0

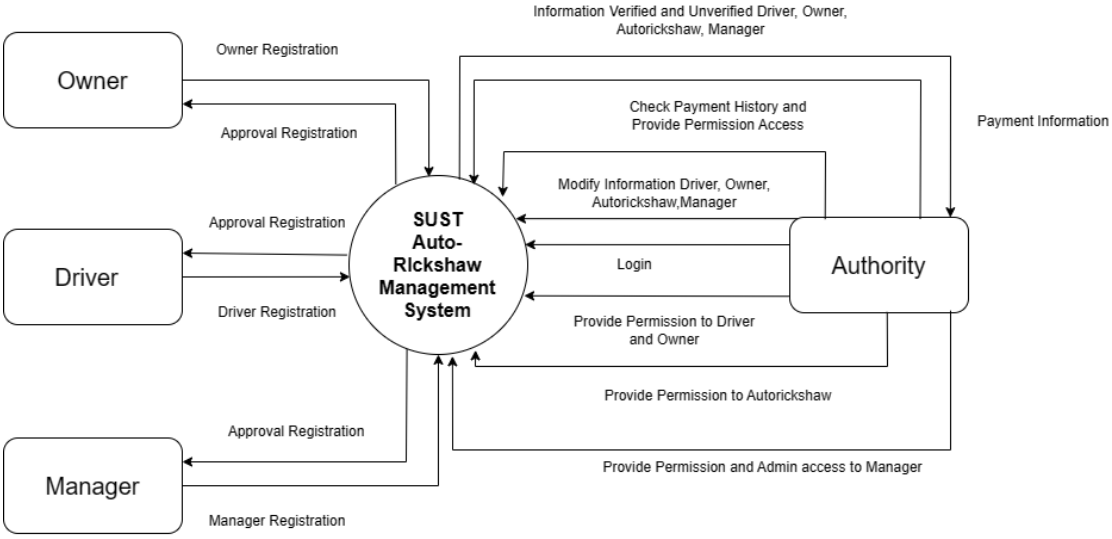


Figure 9: SUST Auto-rickshaw Management System DFD Level 1 : Authority

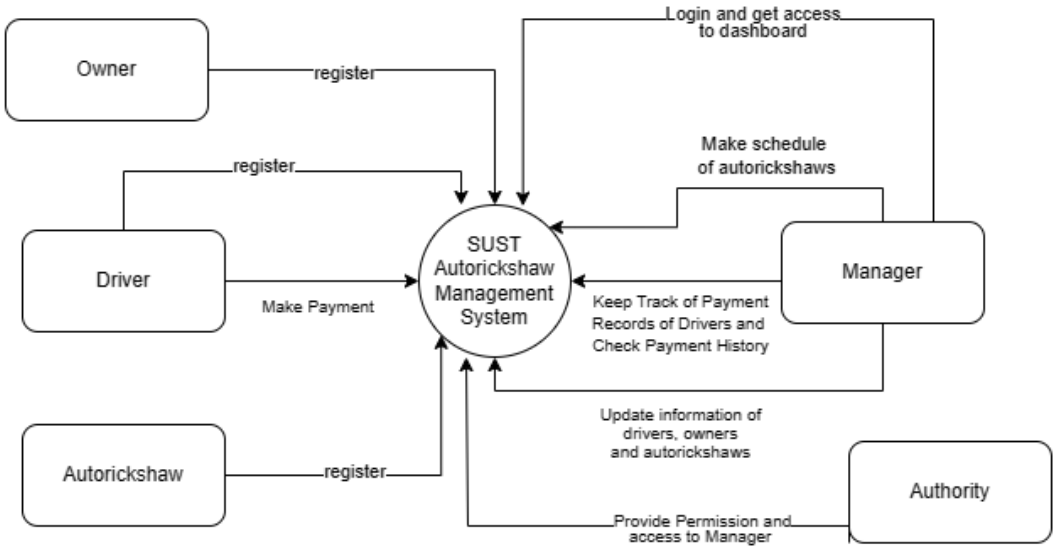


Figure 10: SUST Auto-rickshaw Management System DFD Level 2 : Manager

4 Tools and Technology

1. **Front-end :** ReactJS, JavaScript, CSS
2. **Back-end :** Node.Js and Express.Js
3. **Database :** MySQL
4. **Tools:** Visual Studio Code , XAMPP
5. **Collaboration Tool:** GitHub
6. **Testing Device:** MSI GF63 Thin 9SCR Notebook Laptop (Intel Core i5 9Th Generation, 16GB RAM, 1TB SSD, 1650Ti NVIDIA GPU)
7. **Diagram Designing Tools:** Canva, Draw.io

(a) ReactJS (b) NodeJS (c) MySQL

Figure 11: Front-end, Back-end and Database Tools

5 Implementation

5.1 Database

Table	Action	Rows	Type	Collation	Size	Overhead
authority	Browse Structure Search Insert Empty Drop	12	InnoDB	utf8mb4_general_ci	32.0 KiB	-
autorickshaw	Browse Structure Search Insert Empty Drop	11	InnoDB	utf8mb4_general_ci	48.0 KiB	-
driver	Browse Structure Search Insert Empty Drop	8	InnoDB	utf8mb4_general_ci	48.0 KiB	-
manager	Browse Structure Search Insert Empty Drop	8	InnoDB	utf8mb4_general_ci	48.0 KiB	-
owner	Browse Structure Search Insert Empty Drop	7	InnoDB	utf8mb4_general_ci	32.0 KiB	-
payment	Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	48.0 KiB	-
permit	Browse Structure Search Insert Empty Drop	1	InnoDB	utf8mb4_general_ci	32.0 KiB	-
round	Browse Structure Search Insert Empty Drop	3	InnoDB	utf8mb4_general_ci	48.0 KiB	-
schedule	Browse Structure Search Insert Empty Drop	1	InnoDB	utf8mb4_general_ci	32.0 KiB	-
user	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
10 tables	Sum	57	InnoDB	utf8mb4_general_ci	384.0 KiB	0 B

Figure 12: SUST Auto rickshaw Management Database Structure

Figure 13: SUST Auto rickshaw Management Database : Relationship between Tables

5.2 UI/UX Design

5.2.1 Home Page

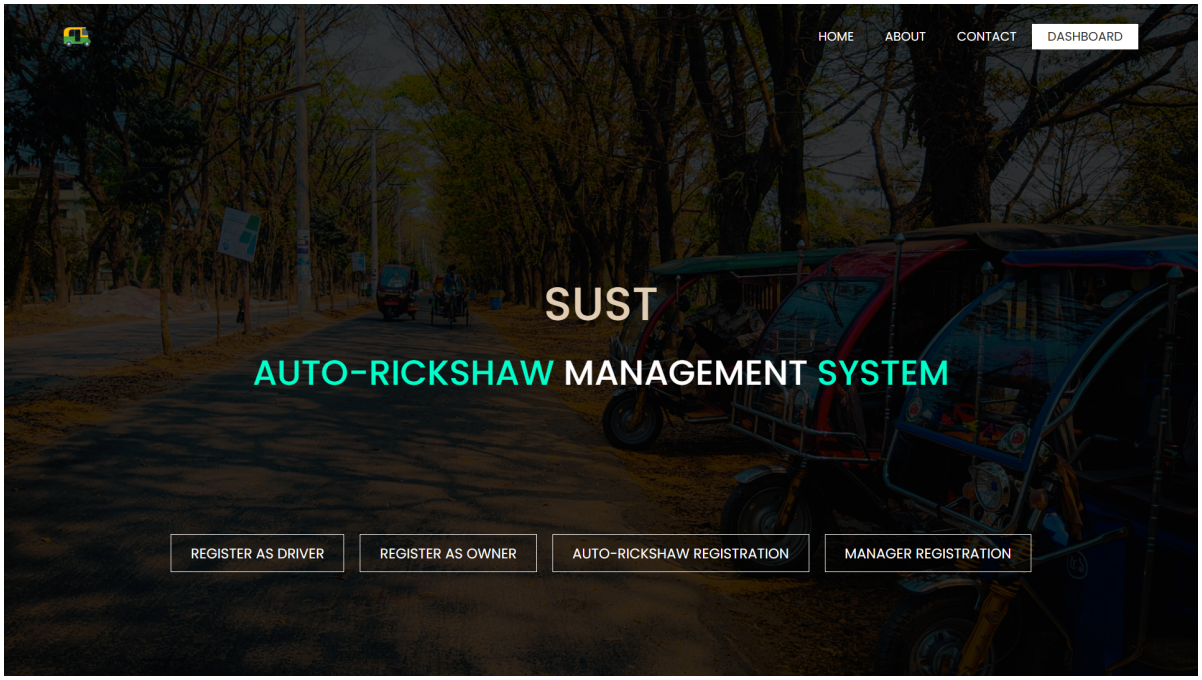
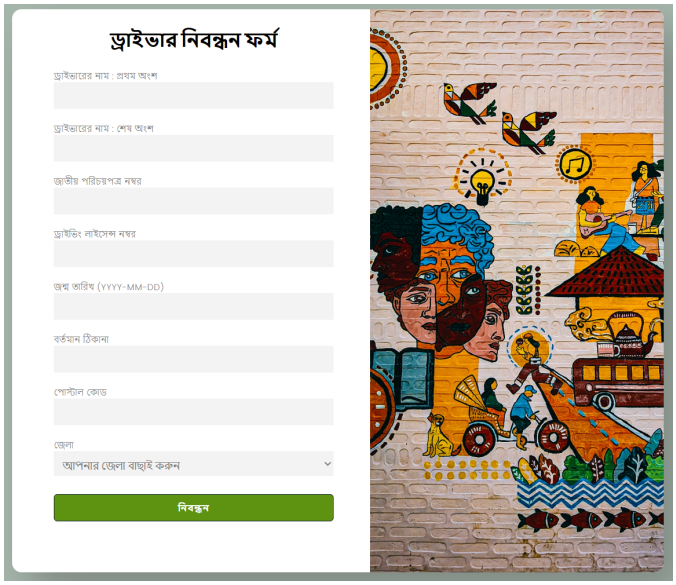


Figure 14: SUST Auto rickshaw Management Home Page

5.2.2 Registration Page

(a) Owner Registration Form



(b) Driver Registration Form

Figure 15: Owner and Driver Registration Page

Figure 16: Auto-rickshaw Registration Page

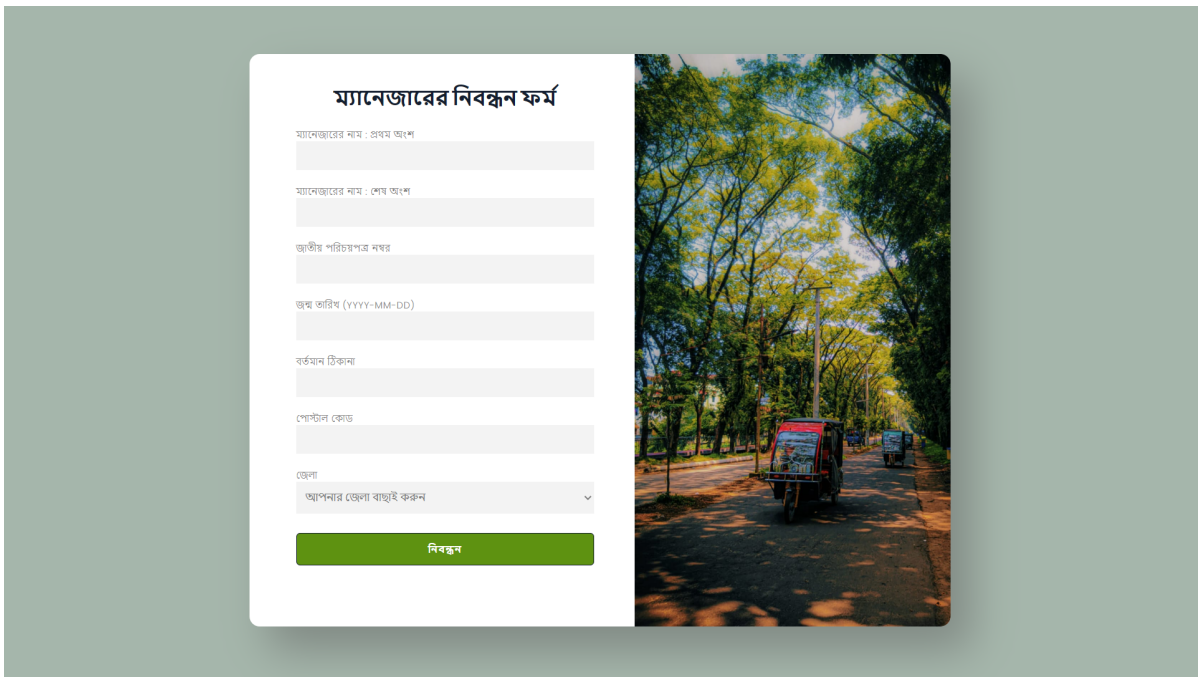
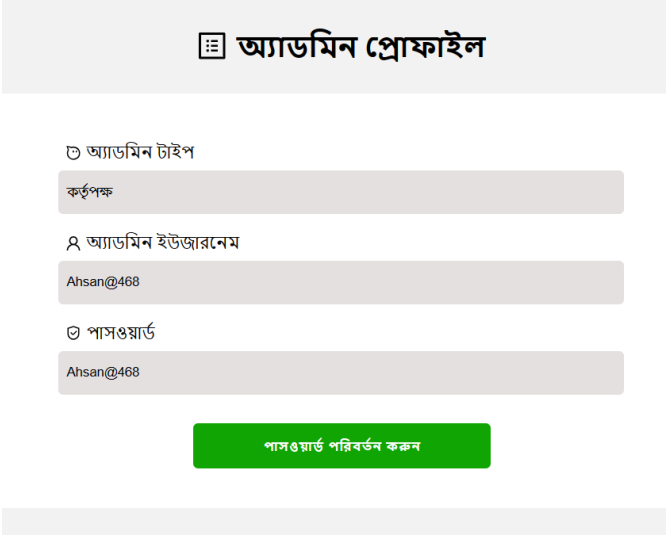


Figure 17: Manager Registration Page

5.2.3 Administrative Section

(a) Administrative Login to Dashboard



(b) Administrative Profile

Figure 18: Administrative Section

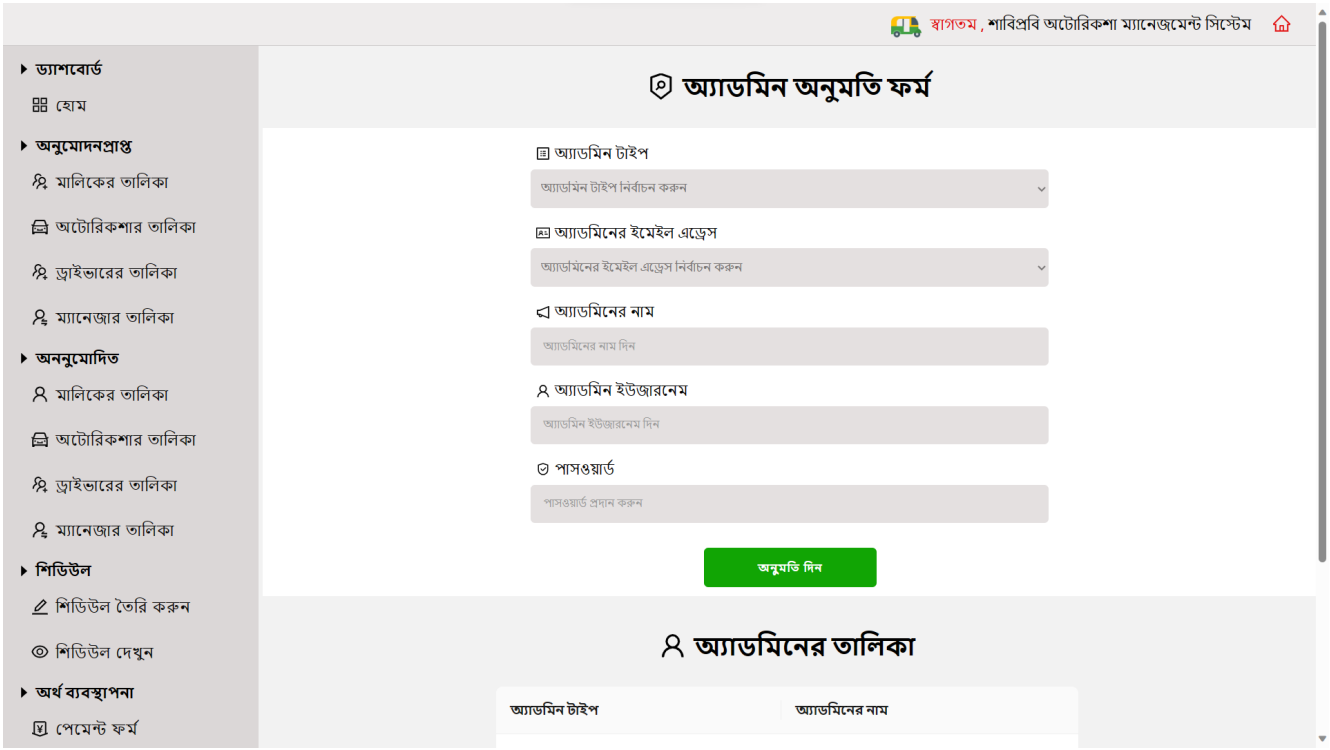
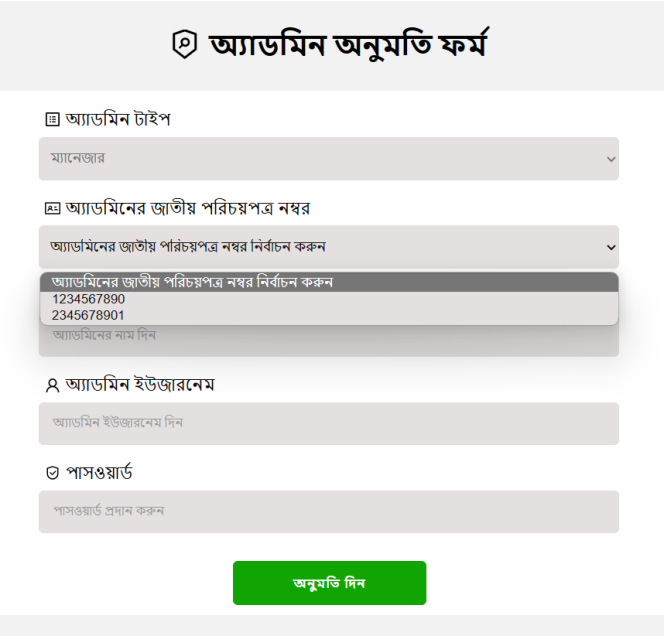
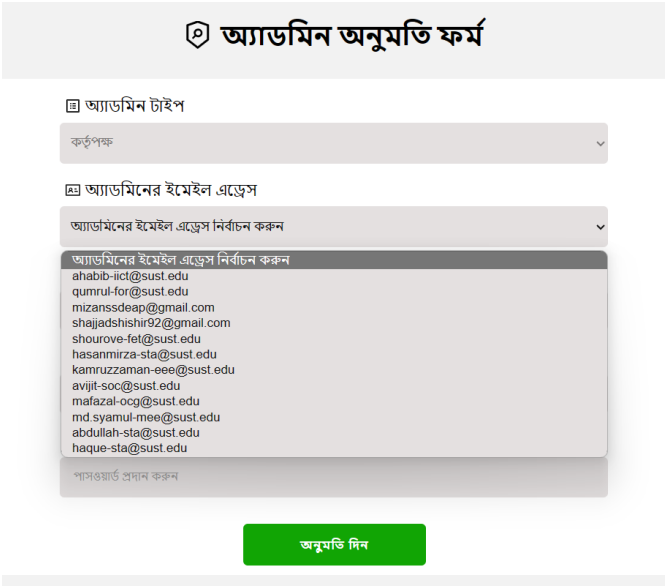


Figure 19: Permit Admin : Giving access to admin form



(a) Select From Verified Admin (Verified Managers)



(b) Select From Verified Admin (Authority)

Figure 20: Access for Other Admins (Authorities and Managers)

5.2.4 Dashboard Page

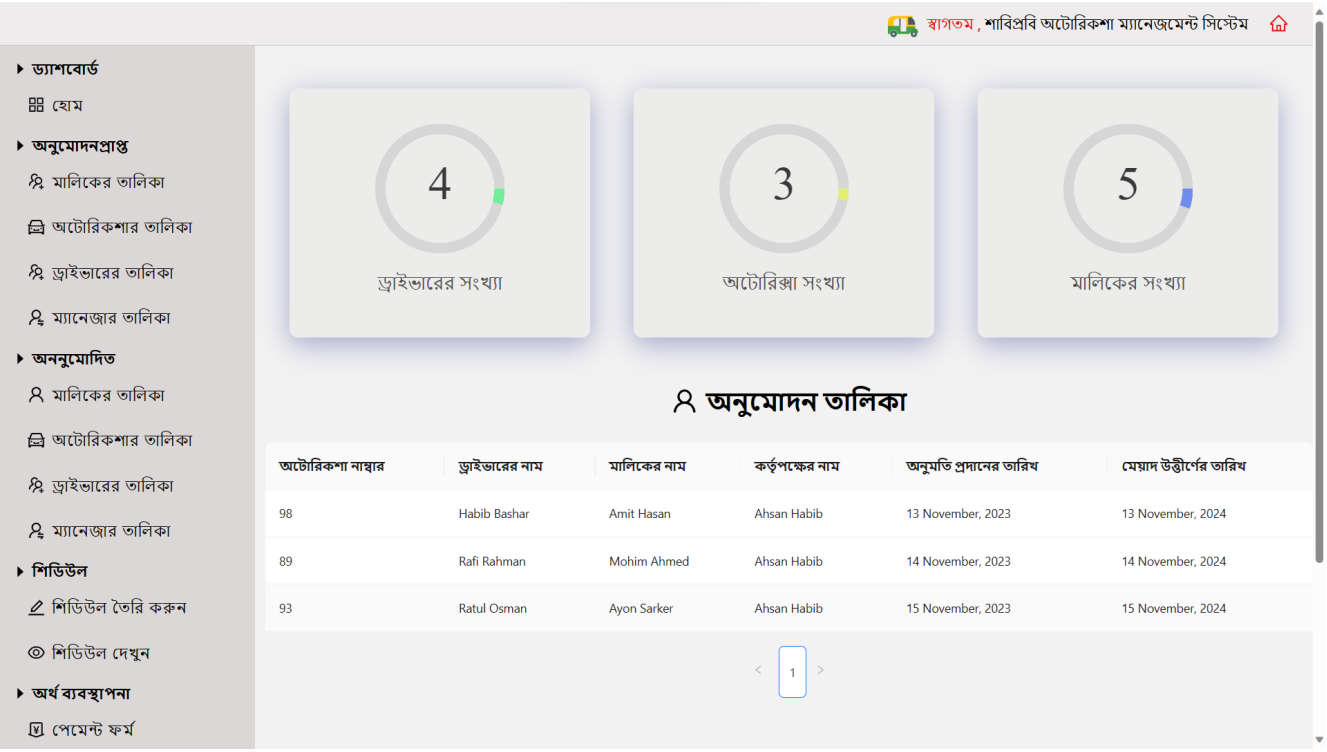
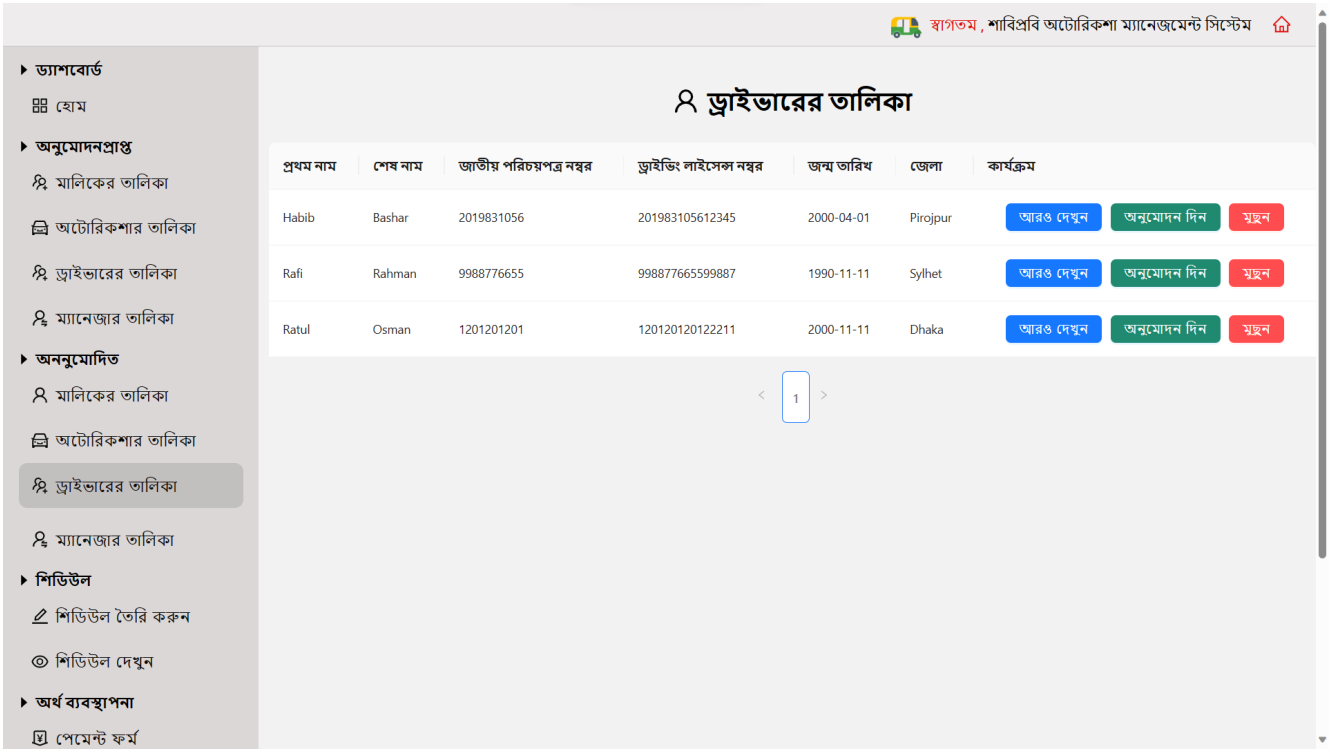
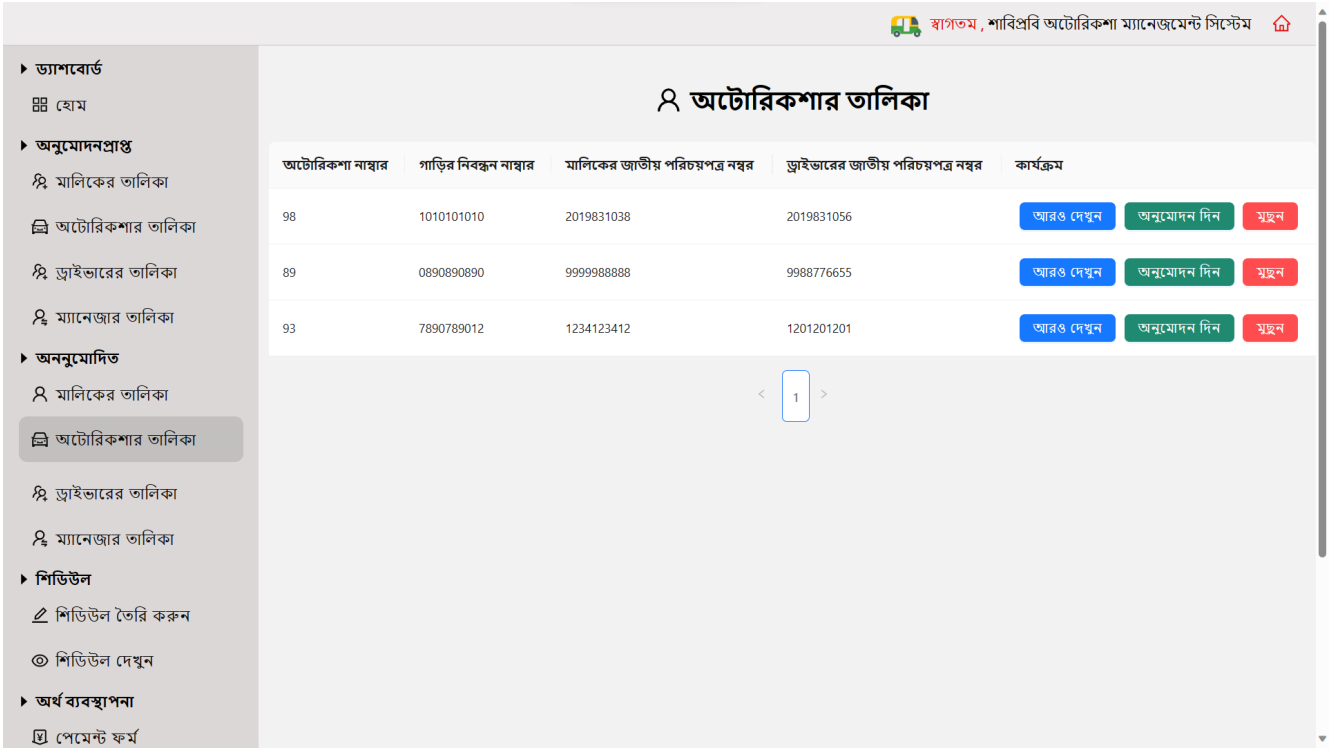


Figure 21: Dashboard for Admin

5.2.5 Unverified Driver, Owner, Auto-rickshaw and Manager Pages

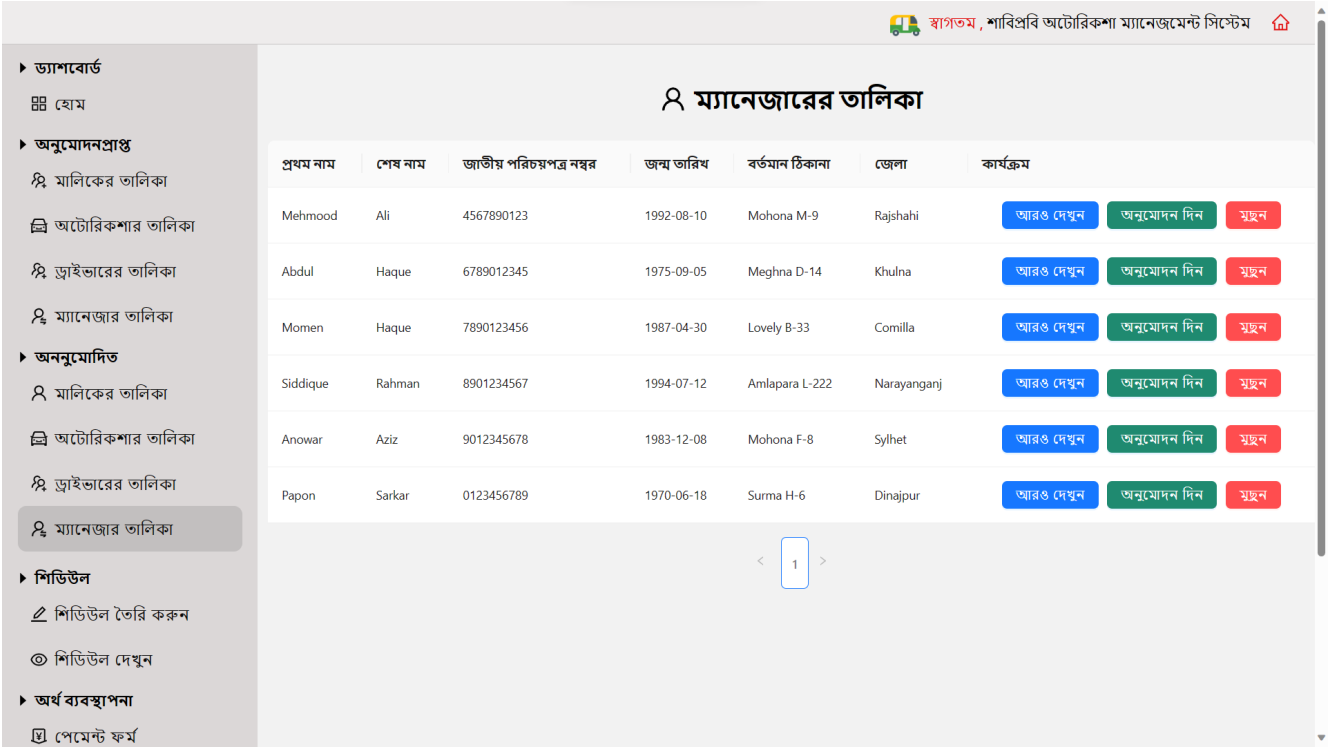


(a) Unverified Driver List

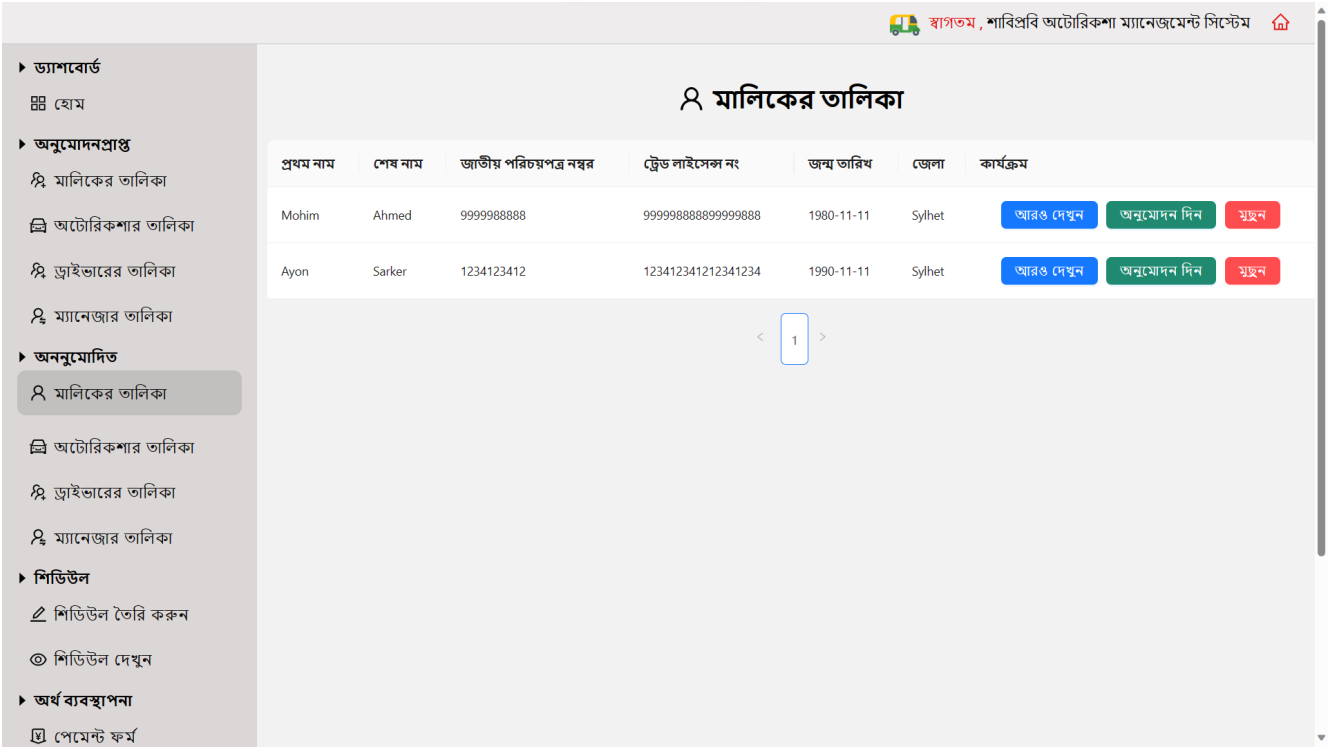


(b) Unverified Autorickshaw List

Figure 22: Unverified Driver and Autorickshaw List



(a) Unverified Manager List



(b) Unverified Owner List

Figure 23: Unverified Manager, Owner List

5.2.6 Permission Pages

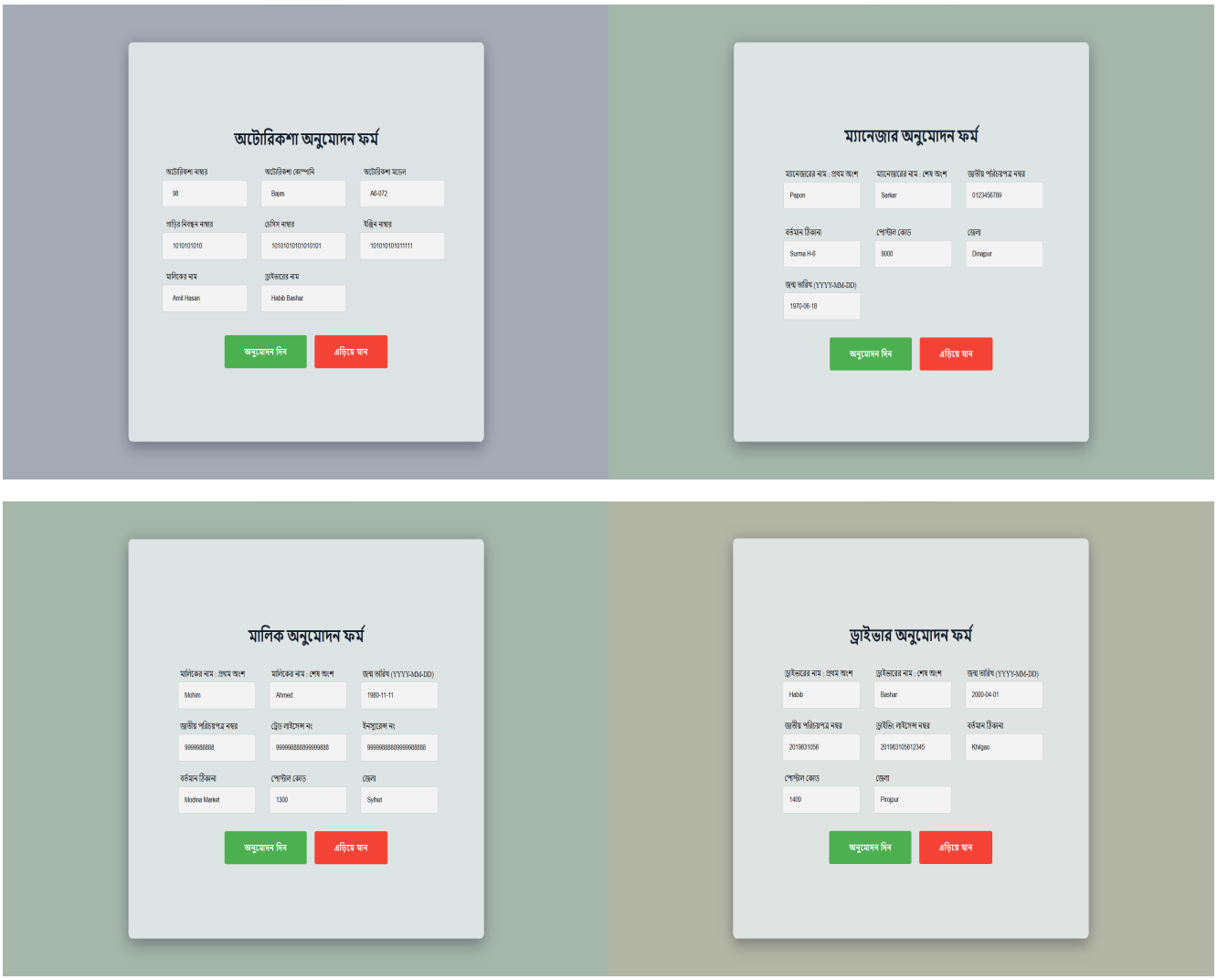


Figure 24: Permission Form of Manager, Owner, Driver and Auto rickshaw

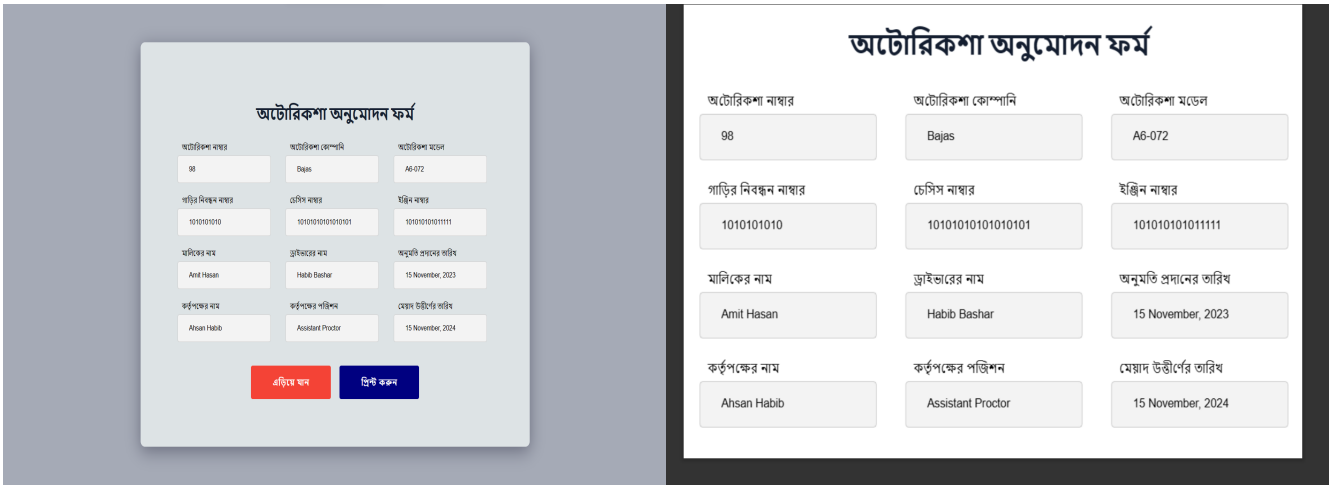


Figure 25: Print Permission Form of Auto rickshaw

5.2.7 Verified Driver, Owner, Auto-rickshaw and Manager Pages

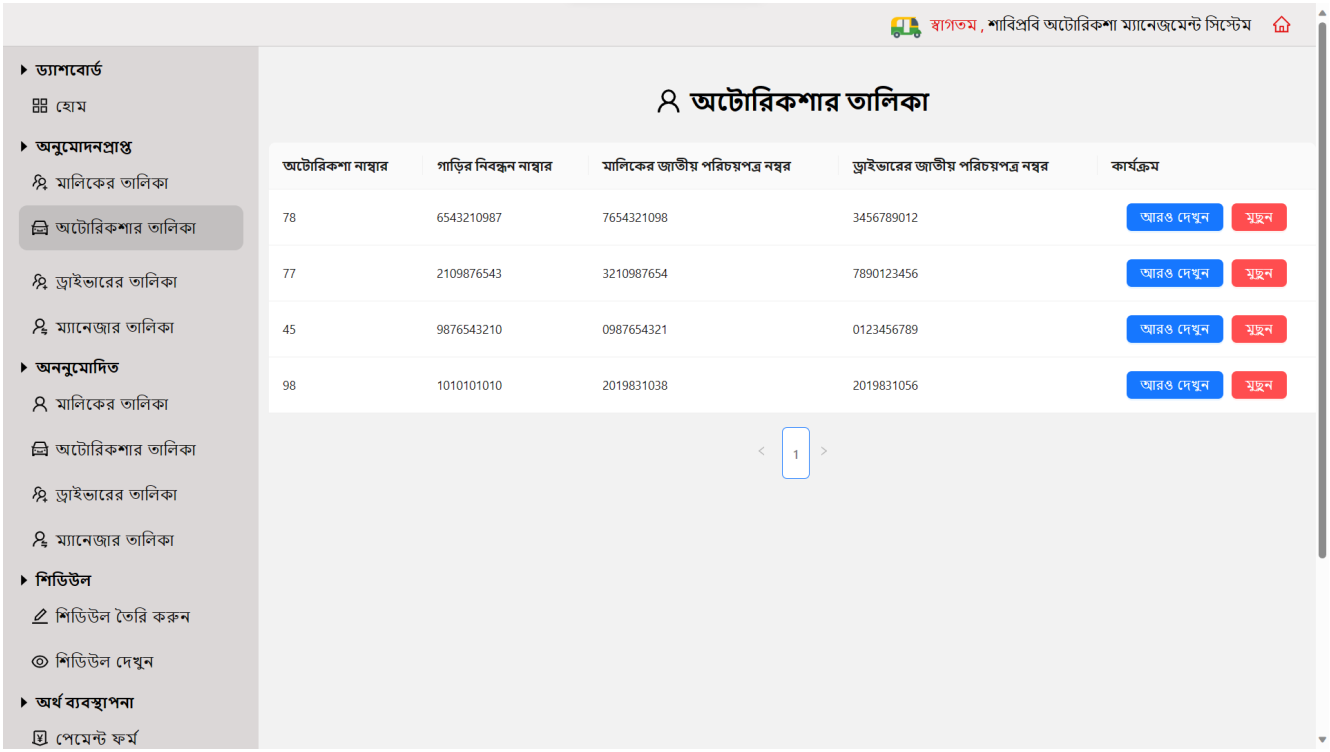


Figure 26: Verified Auto-rickshaw Page

5.2.8 Update Information Page

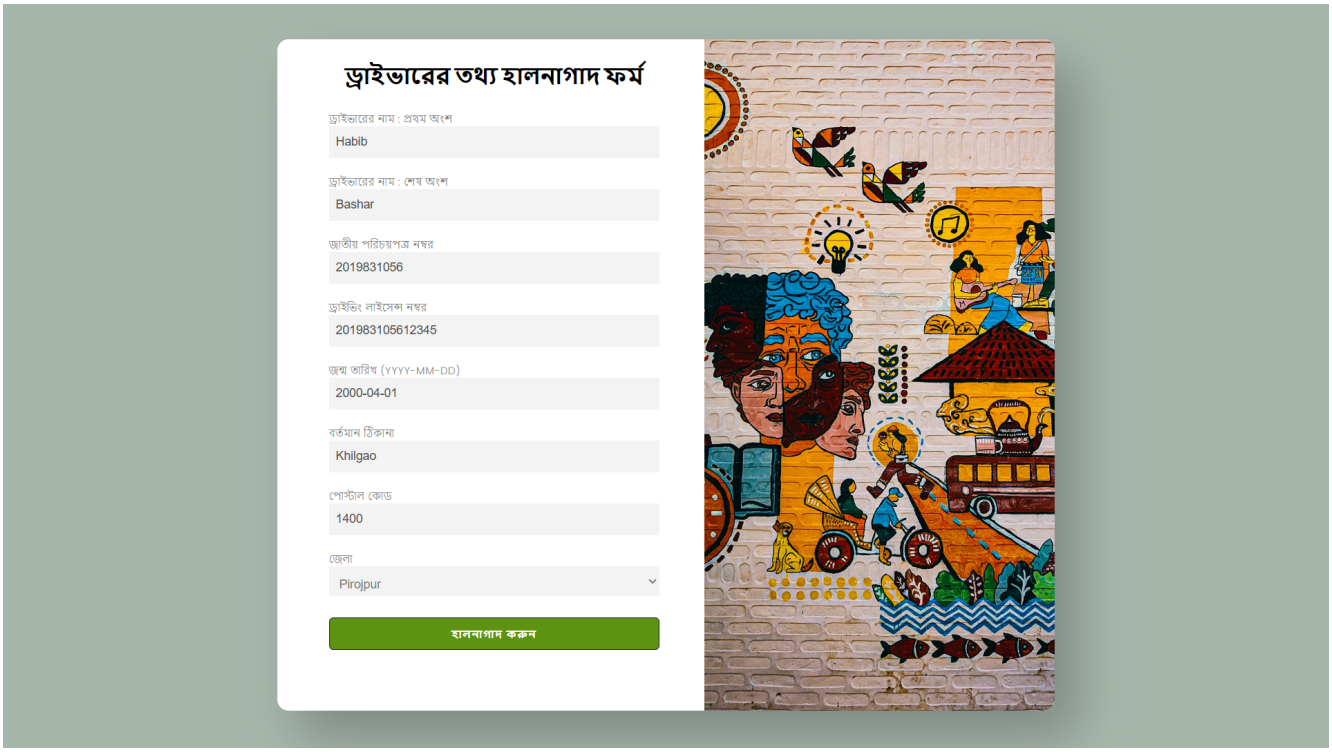


Figure 27: Update Driver Information

Figure 28: Update Owner Information

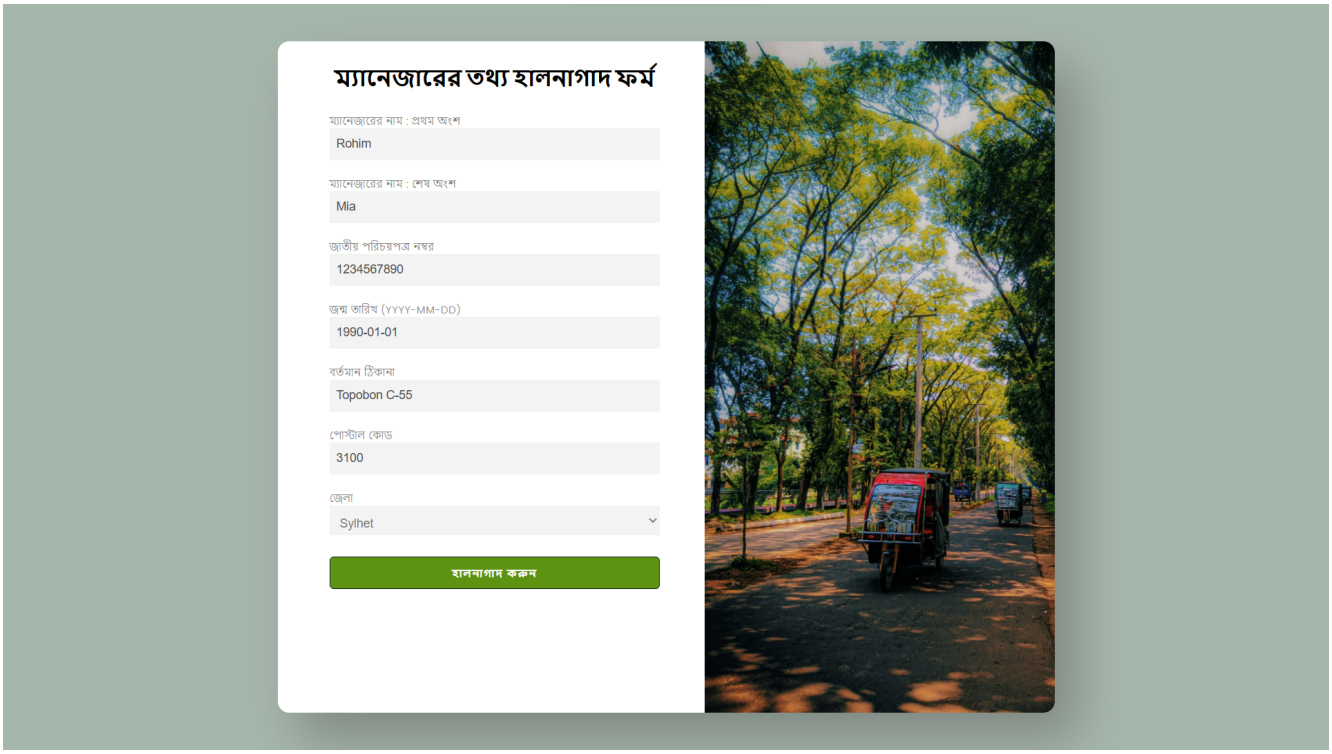


Figure 29: Update Manager Information

5.2.9 Schedule Auto-rickshaw

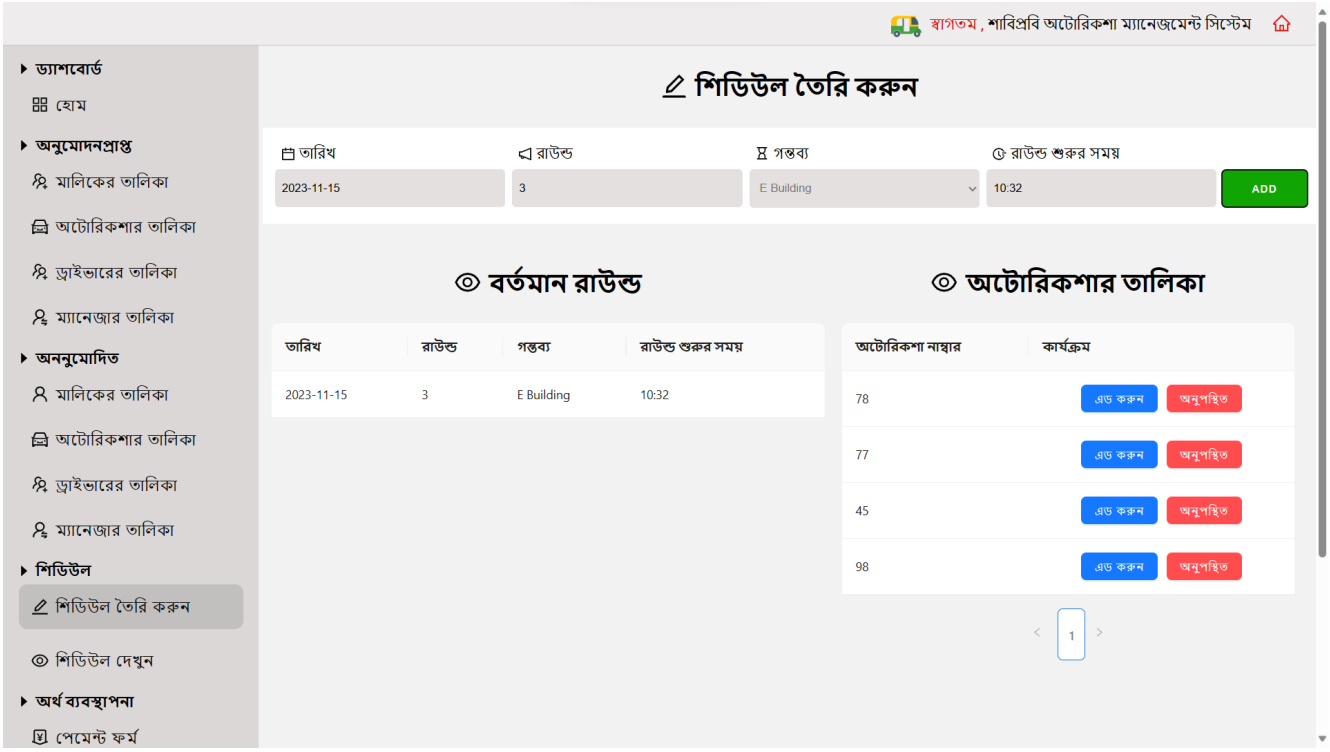


Figure 30: Create Schedule Page

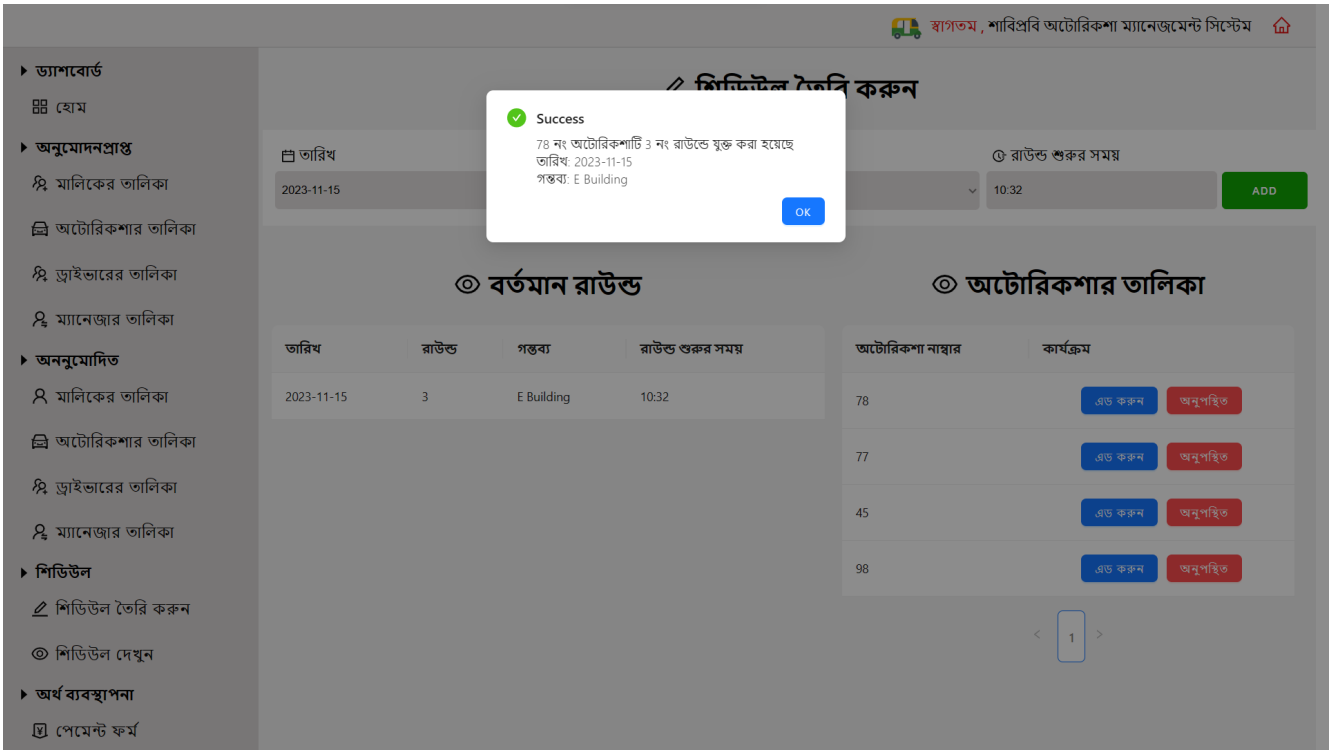


Figure 31: Choose auto-rickshaw for current round

5.2.10 Show Scheduled Auto-rickshaw

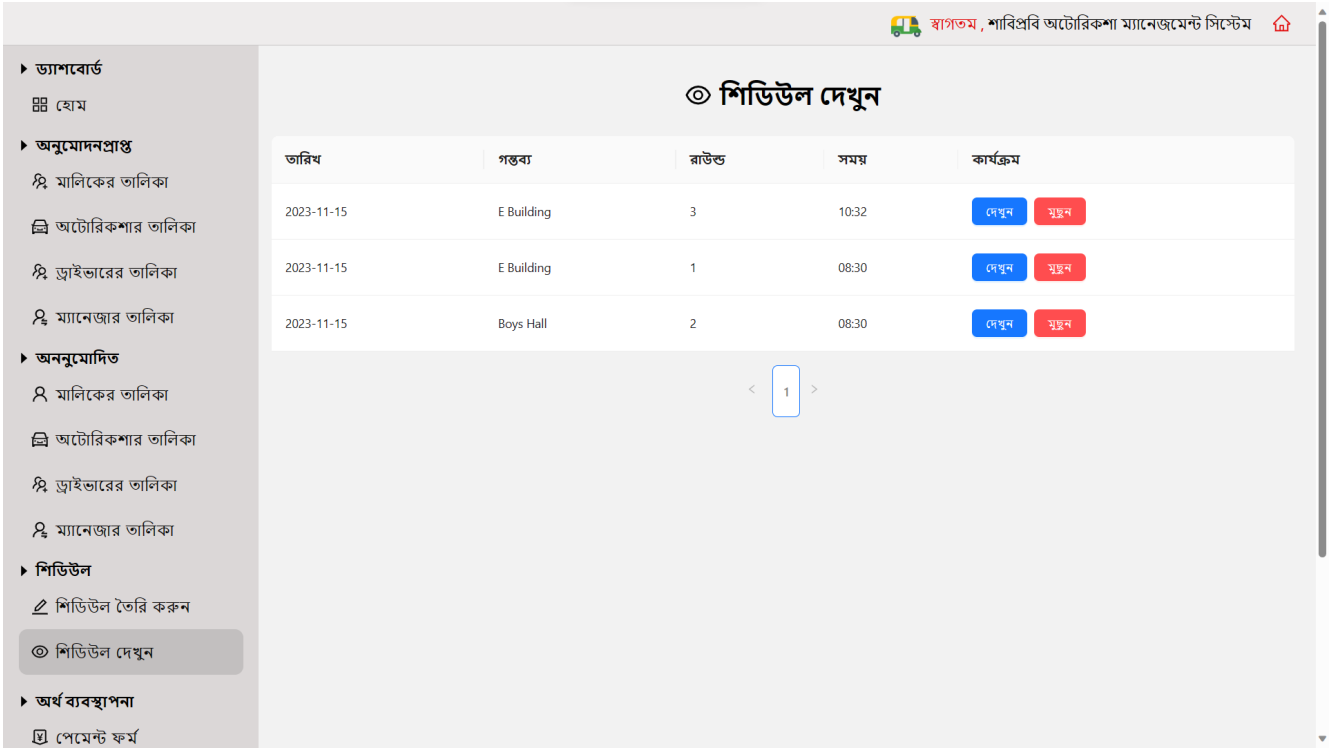


Figure 32: Show Schedule Page

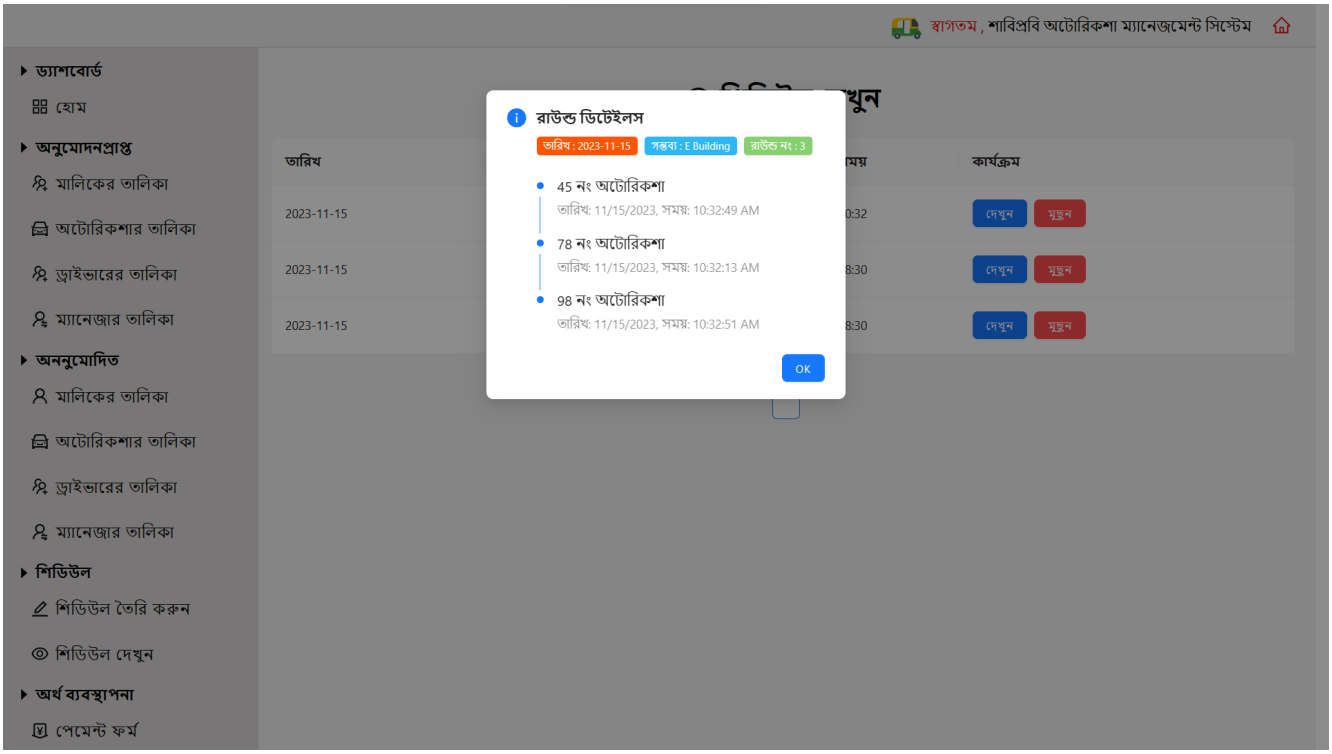


Figure 33: List of auto-rickshaw under a round

5.2.11 Payment Section

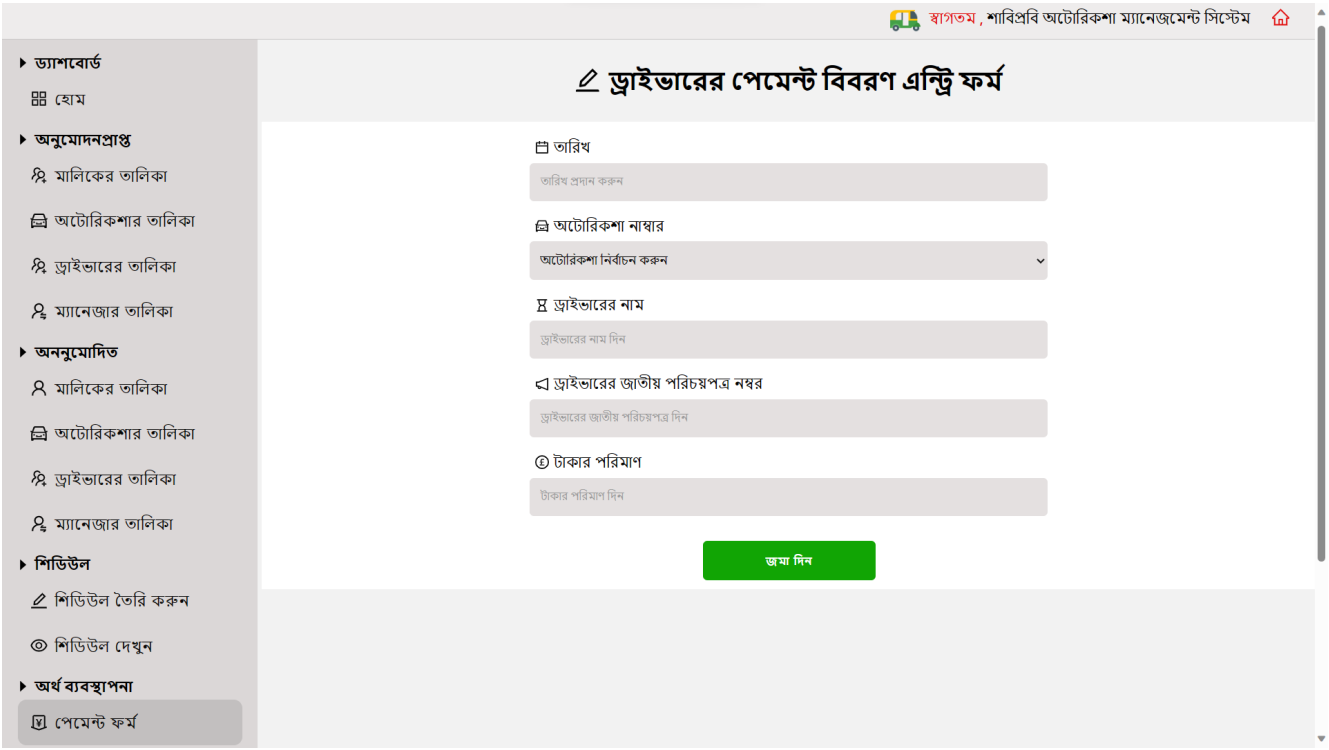


Figure 34: Make Payment Form

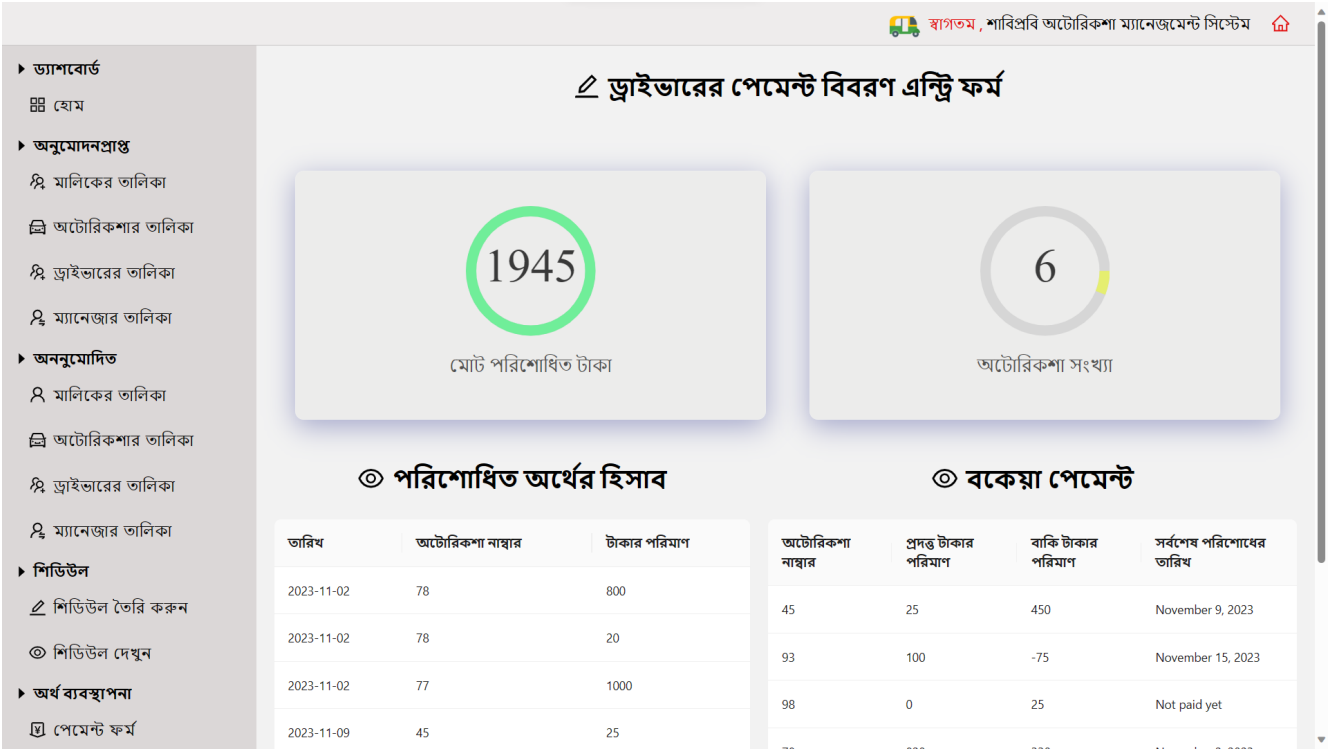


Figure 35: See Due Payment and Payment History of Drivers

5.3 Validation

Validation is essential for the Auto rickshaw Management System to confirm that it accurately registers auto rickshaws, schedules routes, manages financial transactions, and provides oversight. It ensures the system functions reliably, adheres to security standards, and delivers an efficient and error-free experience for auto rickshaw drivers, owners, and managers within the university community.

1. User Registration:

Manager, Driver, and Owner Registration: All individuals must undergo a registration process. This likely includes providing personal details, contact information, and user credentials. Validation processes prevent the input of incorrect or incomplete data maintaining the integrity of the system's database.

Figure 36: Validation Checking of Manager, Driver and Owner Registration

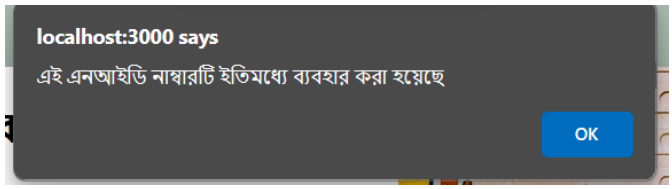


Figure 37: Validation Error in Owner, Driver and Manager Registration

Verification by Authorities: After registration, user details are verified by the relevant university authorities, ensuring that only authorized individuals gain access to the system.

2.Autorickshaw Registration:

Verification of Owner and Driver NID: To register an autorickshaw, the owner and driver must provide verified National ID (NID) information. This verification step adds an extra layer of identity validation.

Ensuring Verified Ownership: Only autorickshaws associated with verified owners can be registered, enhancing accountability and ownership validation.

Figure 38: Checking Validation of Auto rickshaw Registration

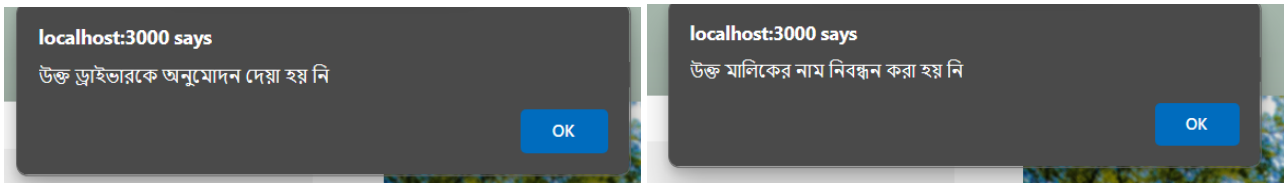


Figure 39: Some Validation Error in Auto-rickshaw Registration

3. Schedule Handling:

Creating Schedule : For only approved drivers and their auto rickshaws, schedule will be handled by managers. It will monitor the presence or absence of auto-rickshaws during specific rounds and also provide real-time tracking of specified auto-rickshaws assigned to particular rounds.

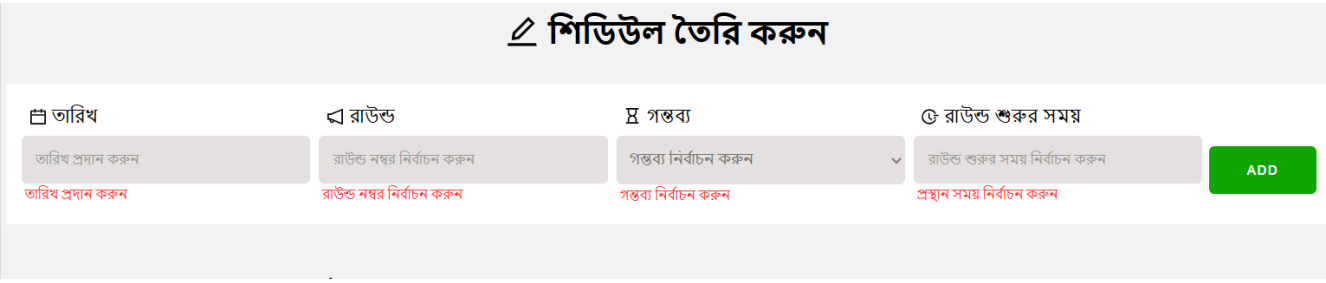


Figure 40: Checking Validation Schedule Planning

Figure 41: Some Validation Error in Scheduling

4. Payment Record Handling:

Restrictions on Unverified Drivers: Every financial transaction undergoes thorough validation checks within the system. This validation process is in place to guarantee the accuracy of payment records and actively prevent any unauthorized or erroneous transactions. Importantly, this includes a strict criterion ensuring that only verified drivers are authorized to engage in financial transactions, adding an additional layer of security to the payment validation process. This ensures a secure and reliable financial framework, safeguarding against potential discrepancies or unauthorized activities.

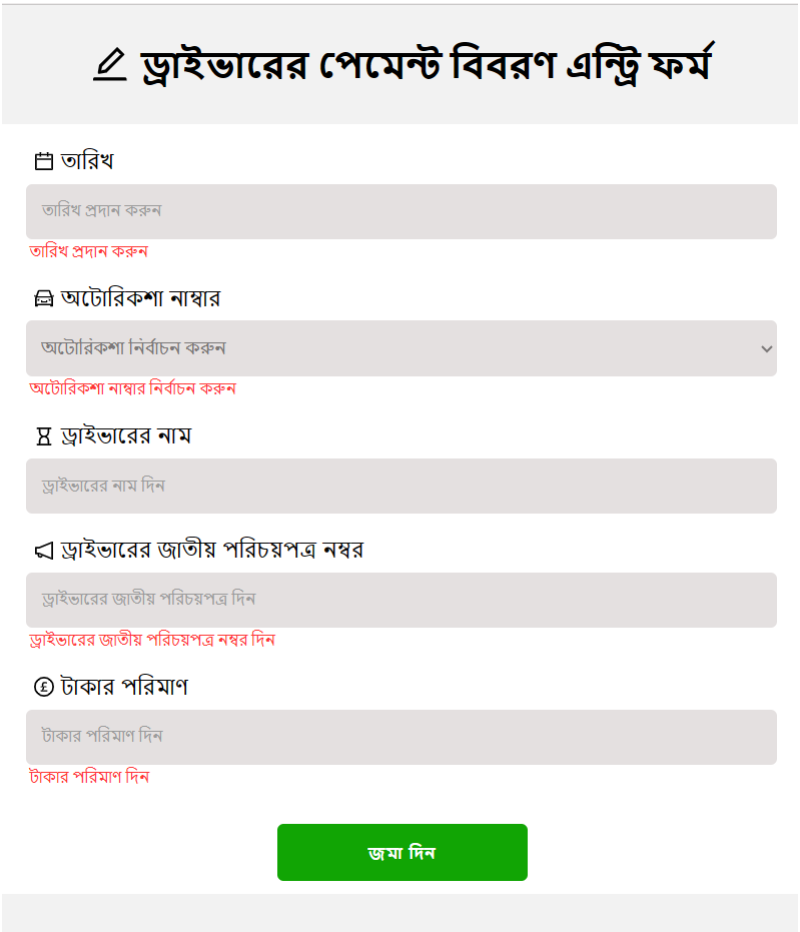


Figure 42: Checking Validation in Make Payment Section

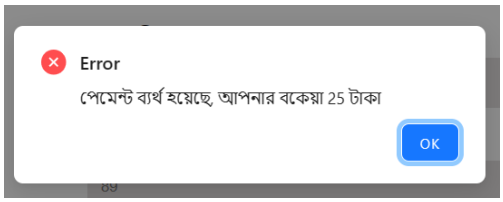


Figure 43: Some Validation Error in Payment

Limiting Payment Amounts: The system is designed to restrict drivers from paying more than the due amount. This precautionary measure serves to prevent both accidental and intentional over payments, promoting financial accuracy and preventing financial discrepancies.

6 Limitation

Due to time constraints, limited manpower, and various work-related limitations, our website currently has some limitations which we anticipate addressing and improving in the future. Such as:

1. Lack of User Responsiveness: The app is web-based and lacks responsiveness, not providing a dedicated mobile application.
2. Dependency on Manager: The app relies on the manager for updating driver information, introducing the possibility of partiality.
3. Manager-Driven Payment Tracking: Payment tracking for drivers is managed solely by the manager.
4. Scheduling System: The scheduling system is not optimized.
5. Report Generation: The system does not facilitate improved PDF report generation of permission documents.
6. User Testing: The app has not undergone real-life user testing yet.
7. Scalability Concerns: The system is not designed for scalability, potentially limiting its ability to accommodate a growing number of users or auto-rickshaws.
8. Database Adequacy: The database infrastructure may not meet optimal standards, affecting data storage, retrieval, and overall system performance.

7 Conclusion

Despite technical and other unavoidable limitations, we have successfully achieved proper validation of autorickshaws, owners, drivers, and managers registrations, permission procedures, and payment tracking, as well as managing rounds of autorickshaws on specified routes. Now, we are looking forward to improving its shortcomings, such as enhancing the database, scalability, and integrating it into the university's IT infrastructure which will enable managers and authorities to make optimal use of the system to address real-life problems in managing the autorickshaw system on the SUST campus.