1 Introduction:

In our software development project, **CUET Transport Management**, we are going to develop a web application aimed at improving our university's bus service for students. We recognized the need to address issues like seat booking and ensuring fair access for everyone, especially those of us traveling long distances. Our app prevents students from reserving multiple seats in advance, promoting fair seating for all. It will provide real-time updates on bus schedules, seat availability, and track the bus's location, helping us save time and avoid overcrowded buses. Additionally, a portion of the bus will be reserved for female students to ensure a safer, more comfortable journey. We've also included time restrictions on seat reservations to prevent misuse, making the entire commuting experience more efficient, comfortable, and safe for all students.

1.1 Motivation:

We have different reasons behind selecting this project:

1. **Seat Availability Issues:** Many students can't find seats due to excessive early multiple reservations and overcrowdings. This project will ensure fair seat access for more students by managing reservations better.
2. **No Real-Time Updates:** Current systems don't give live updates on bus locations or seat availability, causing confusion. Our app will provide real-time tracking and seat updates.
3. **Challenges of female students:** Long 1 to 1.5-hour bus journeys are difficult for female students without seats. We will reserve seats for female passengers to improve comfort and safety.
4. **Safety and Punctuality Issues:** Current systems don't track bus stops or ensure timely arrivals. Our app will track bus locations, notify students about stops, and improve punctuality and safety.
5. **Better Student Experience:** Traditional systems waste students' time and make commuting inconvenient. Our app will provide detailed bus schedules, reduce wait times, and make transportation more organized and efficient.

1.2 Application and Impact:

Here are the application and impact of the CUET Transport Management App:

1. **University and Campus Transport Management**: The app can manage transportation systems in universities or educational institutions, ensuring smooth and fair transport services for students and staff.
2. **Public Transportation Services**: It can be used by public transportation authorities to manage bus routes, seat reservations, and provide real-time updates, improving commuter experiences in cities with heavy traffic.
3. **Corporate Shuttle Services**: Corporations can utilize the app to streamline shuttle services for employees, offering seat reservations, bus schedules, and real-time updates for a smoother commute.
4. **Event and Conference Transportation**: The app can organize shuttles and manage seat reservations for large events or conferences, ensuring participants have a convenient transport experience.
5. **Tourism and Travel Services**: Tourism companies can apply the app to manage bus tours and shuttle services, allowing tourists to reserve seats, track buses, and view schedules for a better travel experience.
6. **Airport Shuttle Management**: The app can manage airport shuttle services, helping passengers track shuttle locations, book seats, and receive updates, enhancing their airport transportation experience.
7. **School Bus Systems**: Schools can adapt the app for managing school buses, allowing parents and students to view bus locations, schedules, and seat availability.
8. **Private Bus Companies**: Private bus operators can use the app to allow passengers to reserve seats and track intercity or chartered buses, improving long-distance travel experiences.
9. **Healthcare and Hospital Shuttle Services**: Hospitals can use the app for shuttle services, offering patients and staff efficient and timely transport within large campuses.
10. **Sports and Entertainment Event Transport**: The app can manage transport for sports teams or fans traveling to stadiums or arenas, providing seat reservations and real-time bus tracking.

11. **Government Employee Transport Services**: Government offices can use the app for employee transport services, enhancing efficiency by managing routes, reservations, and real-time tracking.
12. **Festival and Large-Scale Public Event Transport**: The app can organize transportation for festivals or large public events, helping manage shuttle services and crowd control through reservations and tracking.
13. **Hotel Shuttle Services**: Hotels can use the app to manage guest shuttle services, allowing guests to reserve seats, track shuttle locations, and receive real-time updates for better service.

Note: Though our web app has a vast application in different sectors, currently we are developing the app exclusively for the students of Chittagong University of Engineering and Technology (CUET). Its primary goal is to improve bus services within the university, providing fair seat allocation, real-time bus tracking, and better transport management for students.

2 Project Overview:

The overview is illustrated by the hierarchical flowchart given below:

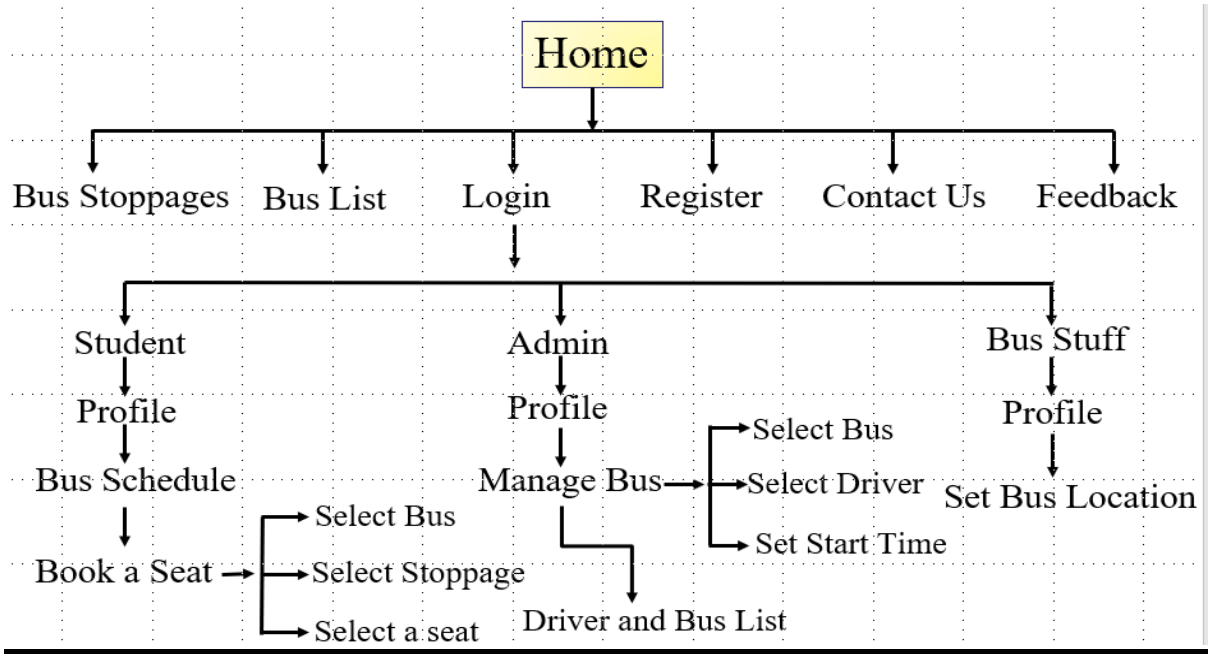

Fig 1 : Preject Overview

3 Required Technology:

1. **Front-End:**
    - **React.js:** For building a responsive and dynamic front-end web application.
2. **Back-End:**
    - **Java Spring Boot:** For back-end operations.
3. **Database Management:**
    - **PostgreSQL:** For relational database management, ensuring data storage and retrieval for students, buses, reservations, etc...

4 E-R Diagram:

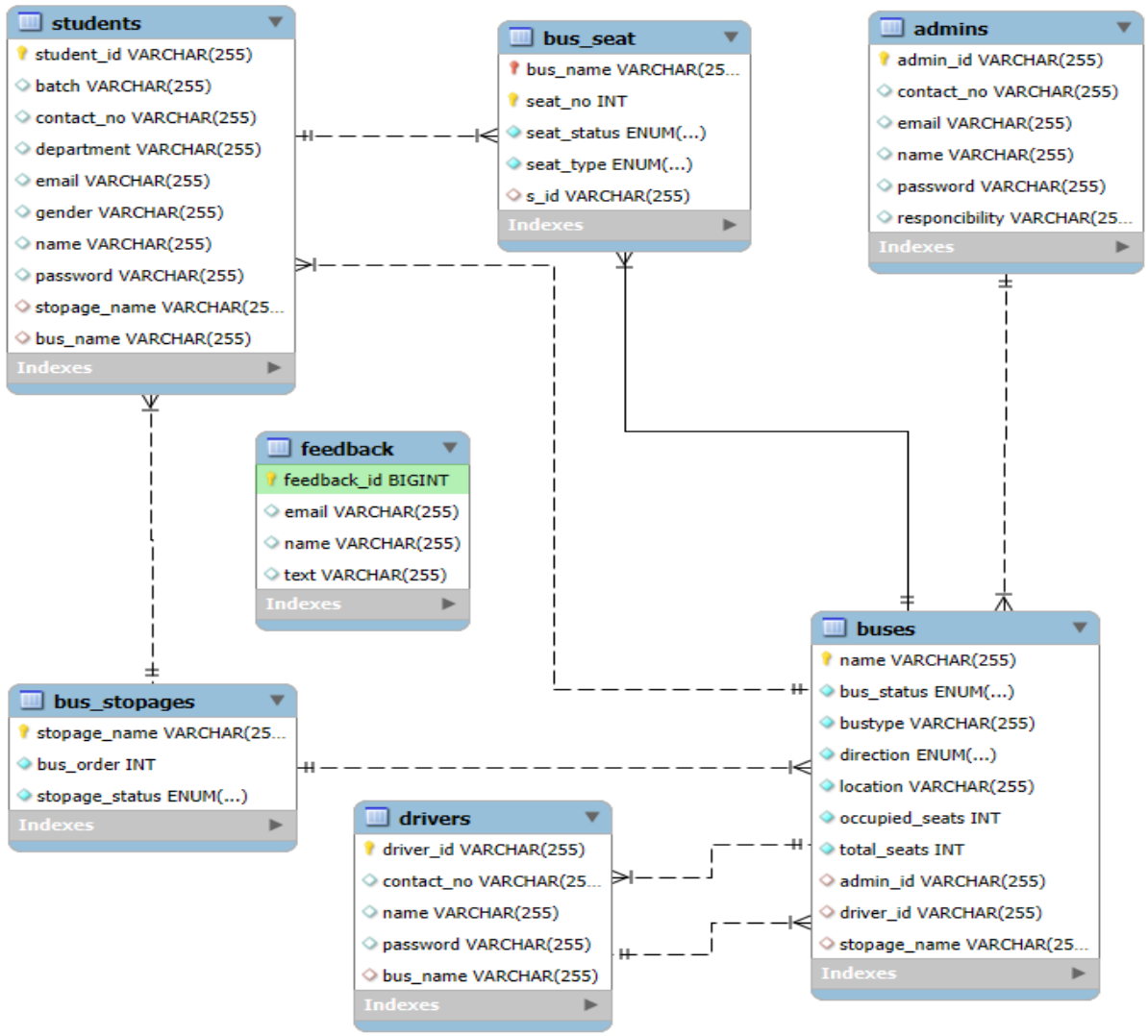

Fig 2 : ER Diagram

4.1 Description of ER diagram:

This ER diagram represents the database structure for a transport management system designed for students. The database connects various entities, including students, buses, drivers, admins, bus stops, and feedback. Students are linked to specific buses and bus stops, with seat assignments managed through the bus_seat table. Buses are connected to drivers, stops, and admins, with each driver assigned to a single bus. Bus stops are associated with buses to indicate routes and locations. Feedback records store user reviews about the system. This structure ensures efficient management of bus assignments, routes, seat bookings, and user feedback, creating a streamlined and organized transport system.

5 Relational Mapping:

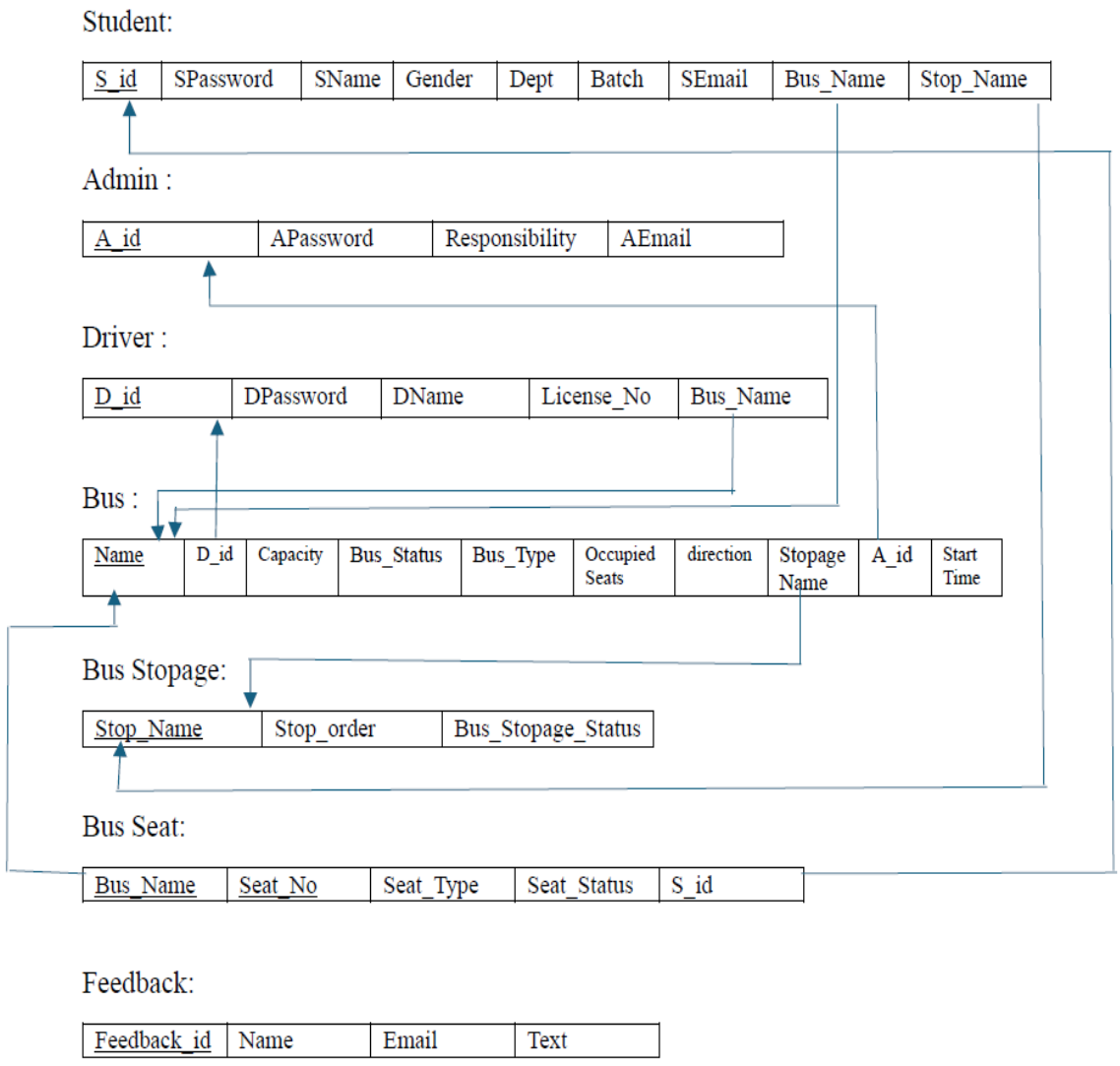

Fig 3 : Relational Mapping

5.1 Description of Relational Mapping:

This relational mapping illustrates the relationships between various entities (tables) and their attributes. Here's a breakdown of each entity and its connections:

Entities and Attributes:

1. **Student**:
    - Attributes: S_id, SPassword, SName, Gender, Dept, Batch, SEmail, Bus_Name, Stop_Name
    - Relationships:
        - Linked to the **Bus** entity through Bus_Name.
        - Linked to the **Bus Stopage** entity through Stop_Name.
        - Linked to the **Bus Seat** entity through S_id.
2. **Admin**:
    - Attributes: A_id, APassword, Responsibility, AEmail
    - Relationships:
        - Linked to the **Bus** entity through A_id (responsible for bus management).
3. **Driver**:
    - Attributes: D_id, DPassword, DName, License_No, Bus_Name
    - Relationships:
        - Linked to the **Bus** entity through D_id and Bus_Name.
4. **Bus**:
    - Attributes: Name, D_id, Capacity, Bus_Status, Bus_Type, Occupied Seats, Direction, Stopage Name, A_id, Start Time
    - Relationships:
        - Linked to the **Driver** entity through D_id.
        - Linked to the **Admin** entity through A_id.
        - Linked to the **Bus Stopage** entity through Stopage Name.
        - Connected to the **Bus Seat** entity through Bus_Name.
5. **Bus Stopage**:
    - Attributes: Stop_Name, Stop_order, Bus_Stopage_Status
    - Relationships:

        - Linked to the **Bus** entity through Stop_Name.
6. **Bus Seat**:
    - Attributes: Bus_Name, Seat_No, Seat_Type, Seat_Status, S_id
    - Relationships:
        - Linked to the **Bus** entity through Bus_Name.
        - Linked to the **Student** entity through S_id.
7. **Feedback**:
    - Attributes: Feedback_id, Name, Email, Text
    - Relationships:
        - Standalone table used for collecting feedback from users (no direct relationships to other entities).

Key Points:

- **Primary Keys**: These are unique identifiers for each table, such as S_id for **Student**, A_id for **Admin**, D_id for **Driver**, etc.
- **Foreign Keys**: Establish relationships between tables. For instance:
    - Bus_Name in the **Student** and **Bus Seat** tables is a foreign key referencing the **Bus** table.
    - Stop_Name in the **Bus Stopage** table references the **Bus** table.
- **One-to-Many Relationships**:
    - A single bus (Bus_Name) can have multiple stopages (Stop_Name).
    - A bus can have multiple seats (Seat_No).
    - A driver (D_id) can manage one or more buses.
- **Many-to-One Relationships**:
    - Multiple students can be assigned to the same bus (Bus_Name).

7 Database Implementation:

The SQL database implementation is given below:

```
--Create database

CREATE database finalone;

USE finalone;
```

7.1 SQL for creating tables:

```
-- Create students table
CREATE TABLE students (
    studentId VARCHAR(10) PRIMARY KEY,
    name VARCHAR(100),
    department VARCHAR(50),
    batch VARCHAR(10),
    gender VARCHAR(10),
    contactNo VARCHAR(15),
    email VARCHAR(100),
    password VARCHAR(255),
    stopage_name VARCHAR(50),
    bus_name VARCHAR(50),
    FOREIGN KEY (stopage_name) REFERENCES bus_stopages(stopageName),
    FOREIGN KEY (bus_name) REFERENCES buses(name)
);
-- Create admins table
CREATE TABLE admins (
    adminId VARCHAR(10) PRIMARY KEY,
    name VARCHAR(100),
    contactNo VARCHAR(15),
    email VARCHAR(100),
    password VARCHAR(255),
    responsibility VARCHAR(255) NULL
```

```
);
-- Create buses table
CREATE TABLE buses (
    name VARCHAR(50) PRIMARY KEY,
    stopage_name VARCHAR(50),
    totalSeats INT NOT NULL DEFAULT 50,
    occupiedSeats INT NOT NULL DEFAULT 0,
    bustype VARCHAR(50) NOT NULL,
    busStatus ENUM('ACTIVE', 'INACTIVE') NOT NULL DEFAULT 'INACTIVE',
    direction ENUM('FROM_CUET', 'TO_CUET') NOT NULL,
    admin_id VARCHAR(10),
    driver_id VARCHAR(10),
    FOREIGN KEY (stopage_name) REFERENCES bus_stopages(stopageName),
    FOREIGN KEY (admin_id) REFERENCES admins(adminId),
    FOREIGN KEY (driver_id) REFERENCES drivers(driverId)
);
-- Create bus_stopages table
CREATE TABLE bus_stopages (
    stopageName VARCHAR(50) PRIMARY KEY,
    busOrder INT NOT NULL,
    stopageStatus ENUM('REACHED', 'NOT_REACHED') NOT NULL
);
-- Create bus_seat table
CREATE TABLE bus_seat (
```

```
    bus_name VARCHAR(50),
    seat_no INT,
    seat_type ENUM('General', 'Female') NOT NULL,
    seat_status ENUM('Vacant', 'Booked', 'Occupied') NOT NULL,
    s_id VARCHAR(10) NULL,
    PRIMARY KEY (bus_name, seat_no),
    FOREIGN KEY (bus_name) REFERENCES buses(name),
    FOREIGN KEY (s_id) REFERENCES students(studentId)
);
-- Create drivers table
CREATE TABLE drivers (
    driverId VARCHAR(10) PRIMARY KEY,
    name VARCHAR(100),
    contactNo VARCHAR(15),
    password VARCHAR(255),
    bus_name VARCHAR(50),
    FOREIGN KEY (bus_name) REFERENCES buses(name)
);
-- Create feedback table
CREATE TABLE feedback (
    Feedback_id INT AUTO_INCREMENT PRIMARY KEY,
    Text TEXT,
    Name VARCHAR(100),
    Email VARCHAR(100)
```

);

7.2 SQL for important operations:

--Query for Adding a New Student

INSERT INTO students(student_id, batch, contact_no, department, email, gender, name , password)

VALUES (“2104003”, “21”, “0133131031”, “CSE”, “u2104003@student.cuet.ac.bd”, “Male”, “Jahed” , “11”);

student_id	batch	blood_group	contact_no	department	email	gender	hall	name	password	stopage_name	bus_name
2104003	21	NULL	.0133131031	cse	u2104003@student.cuet.ac.bd	Male	NULL	Jahed	11	NULL	NULL

--Making a Seat Occupied When a Student Confirms a Seat

UPDATE bus_seat

SET seat_status = 'Occupied', s_id = '2104033’

WHERE Bus_name = ‘’Jamuna’ AND seat_no = 41;

--show student's booked bus and seat

SELECT a.student_id, a.name, b.name AS bus_name, s.stopage_name, bs.seat_no, bs.seat_status

FROM students a

JOIN buses b ON a.bus_name = b.name

JOIN bus_stopages s ON a.stopage_name = s.stopage_name

LEFT JOIN bus_seat bs ON bs.Bus_name = b.name AND bs.s_id = a.student_id

WHERE a.student_id = '2104033';

student_id	name	bus_name	stopage_name	seat_no	seat_status
2104033	priyansho	Jamuna	GEC	41	Occupied

--Update Bus Stoppage of a Student

UPDATE students

SET stopage_name = 'Badam Toli'

WHERE studentId = '2104028';

student_id	stopage_name
2104028	Badam Toli
2104033	GEC
2104003	Khwaish
2104009	Khwaish
2104007	Muradpur
2104001	Station
NULL	NULL

--Making a Bus Status Active and Assigning a Driver

UPDATE buses

SET bus_status = 'ACTIVE', admin_id = '001'

WHERE name = 'Shurma';

UPDATE drivers

SET bus_name = 'Shurma'

WHERE driver_id = 'driver02';

--Query to Show Bus Associated with Driver

SELECT d.driver_id, d.name, d.contact_no, b.name AS bus_name, b.bustype

FROM drivers d

LEFT JOIN buses b ON d.bus_name = b.name;

driver_id	name	contact_no	bus_name	bustype
driver01	kashem	0123456789	Megna	Teacher
driver02	hashem	0123456089	Jamuna	Teacher
driver03	tareq	0123452289	Padma	Student

--Query for inactive all bus

UPDATE buses

SET bus_status = 'INACTIVE' AND d_id=Null ;

--Query for inactive all bus

UPDATE drivers

SET bus_name = NULL;

driver_id	name	contact_no	bus_name	bustype
driver01	kashem	0123456789	NULL	NULL
driver02	hashem	0123456089	NULL	NULL
driver03	tareq	0123452289	NULL	NULL

name	bus_status
Jamuna	INACTIVE
Megna	INACTIVE
Padma	INACTIVE
Shurma	INACTIVE
Turag	INACTIVE

--Update the bus location based on the bus name and driver_id

UPDATE buses b

JOIN drivers d ON b.name = d.bus_name

SET b.location = ‘Oxygen'

WHERE b.name = ‘Jamuna' AND d.driver_id = ‘Driver01’

name	stopage_name
Jamuna	Oxygen
NULL	NULL

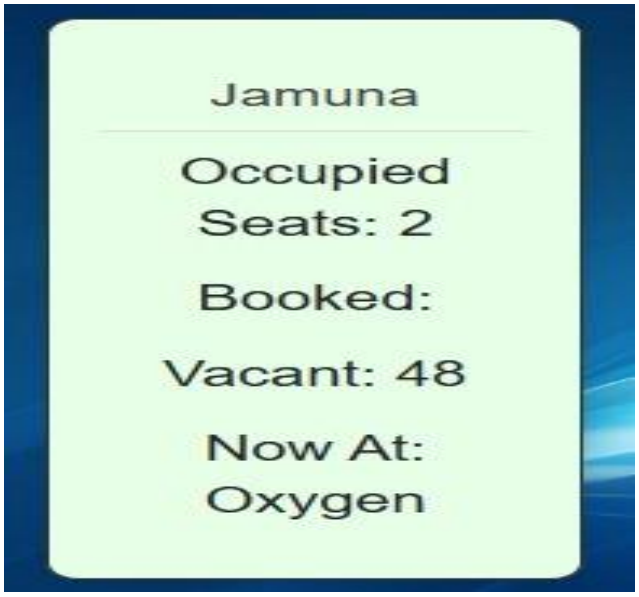

Fig 5 : Bus Status

8 System Implementation:

Fig 6 : Home Page

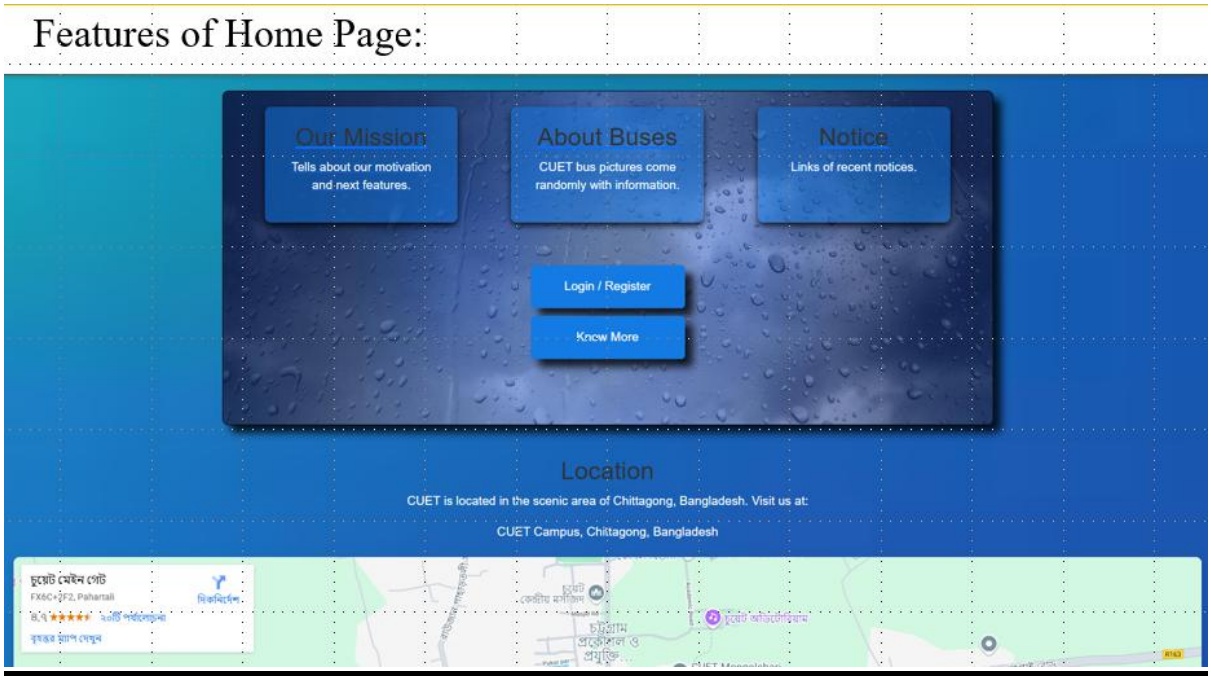

Fig 7 : Features of Home Page

About Buses Page:

Fig 8 : About Buses Page

Identity:

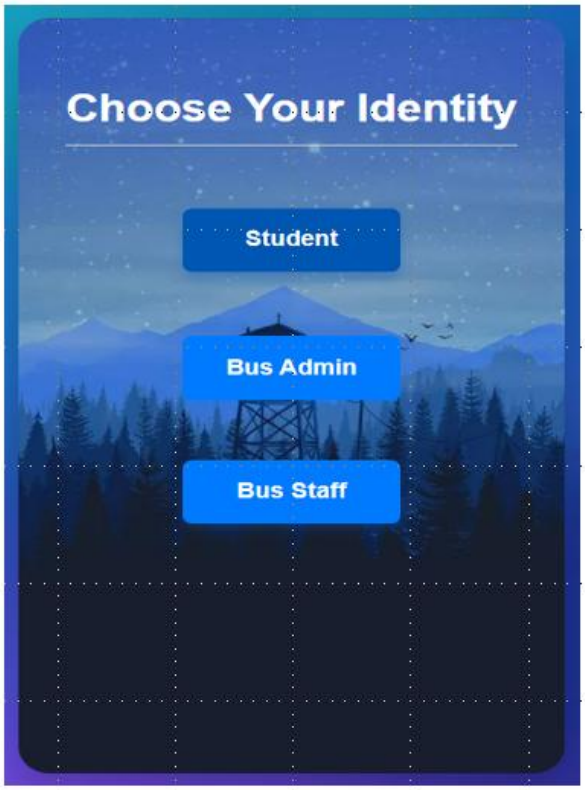

Fig 9 : Identity

Student Login Page:

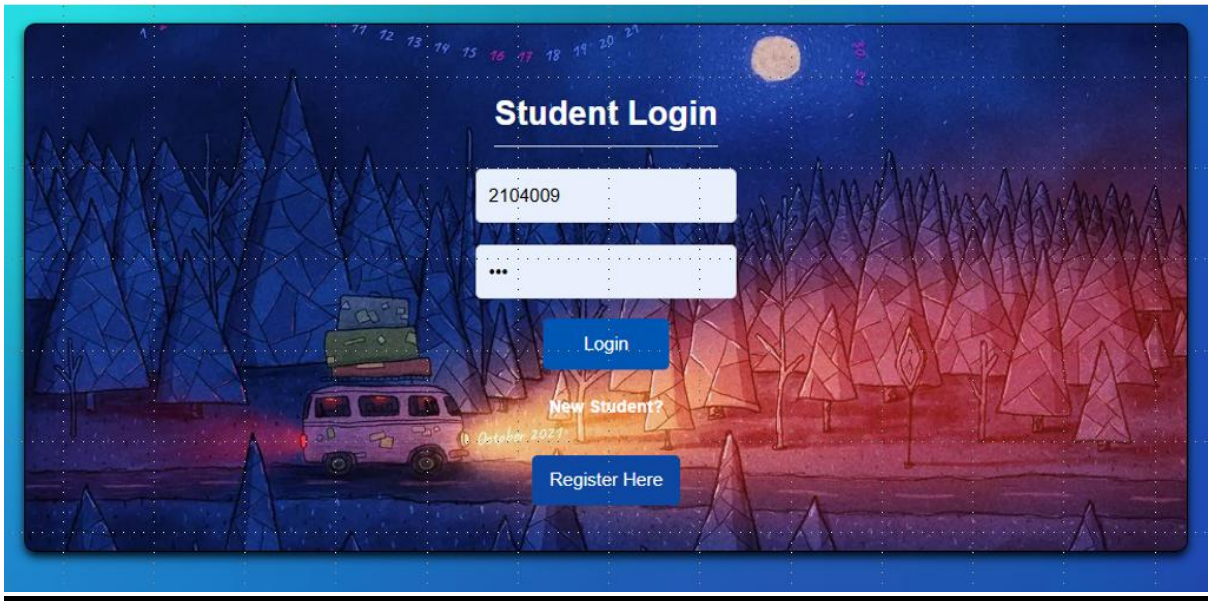

Fig 10 : Student login Page

Student Profile Page:

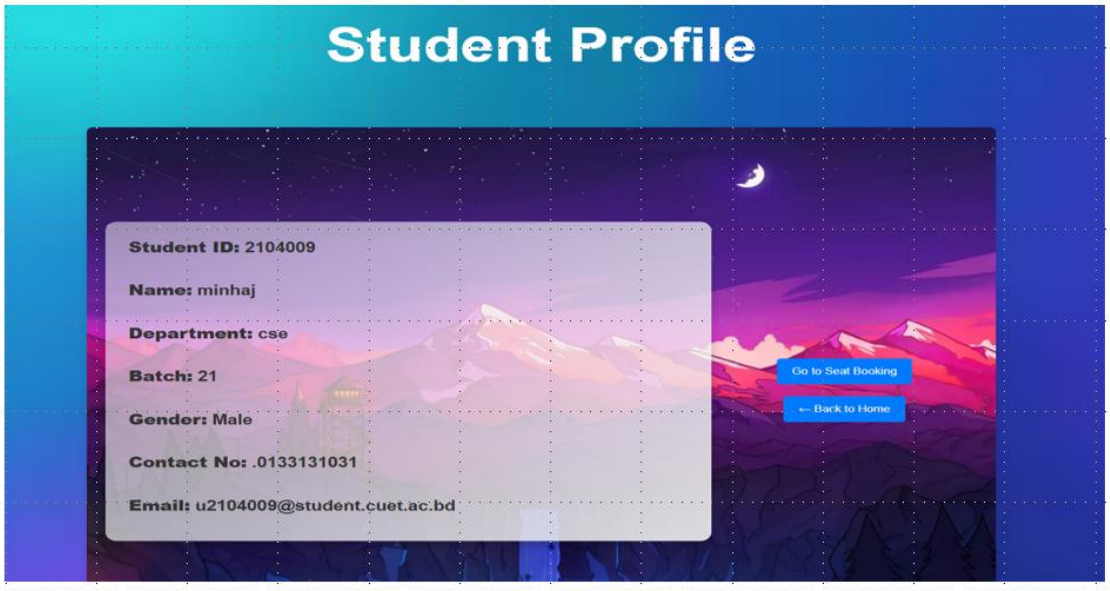

Fig 11 : Student Profile Page

Bus Schedule Page:

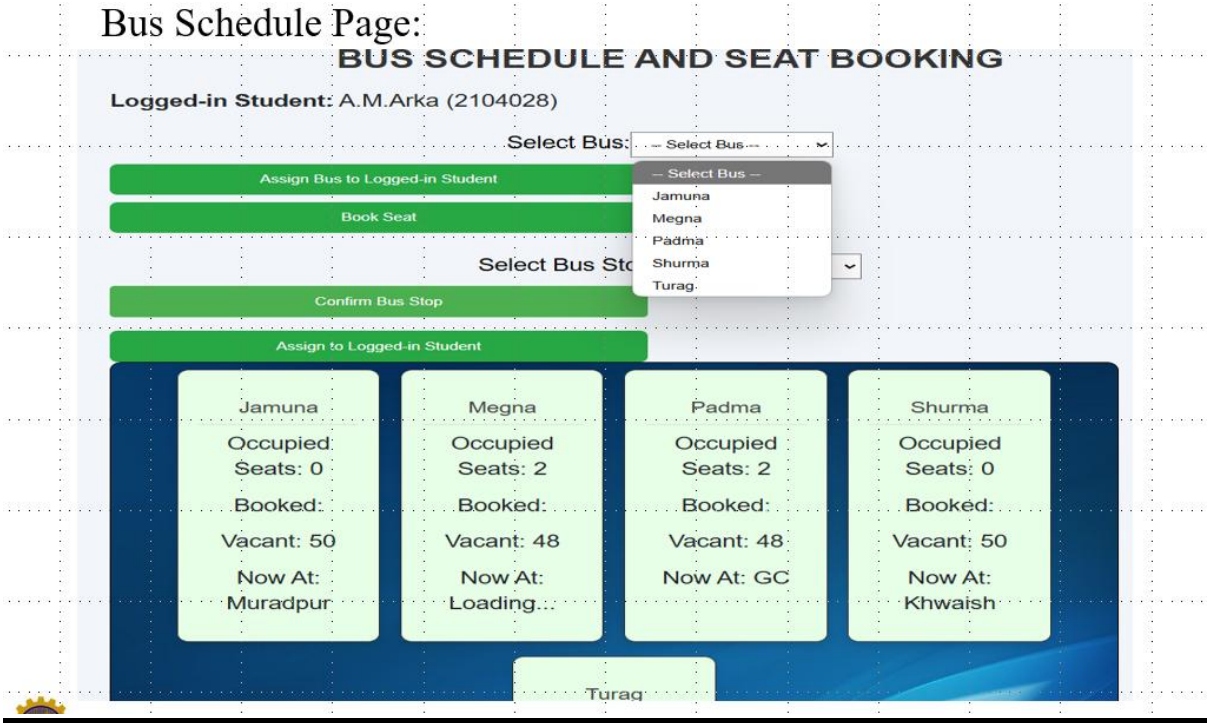

Fig 12 : Bus Schedule Page

Bus Seat Booking Page:

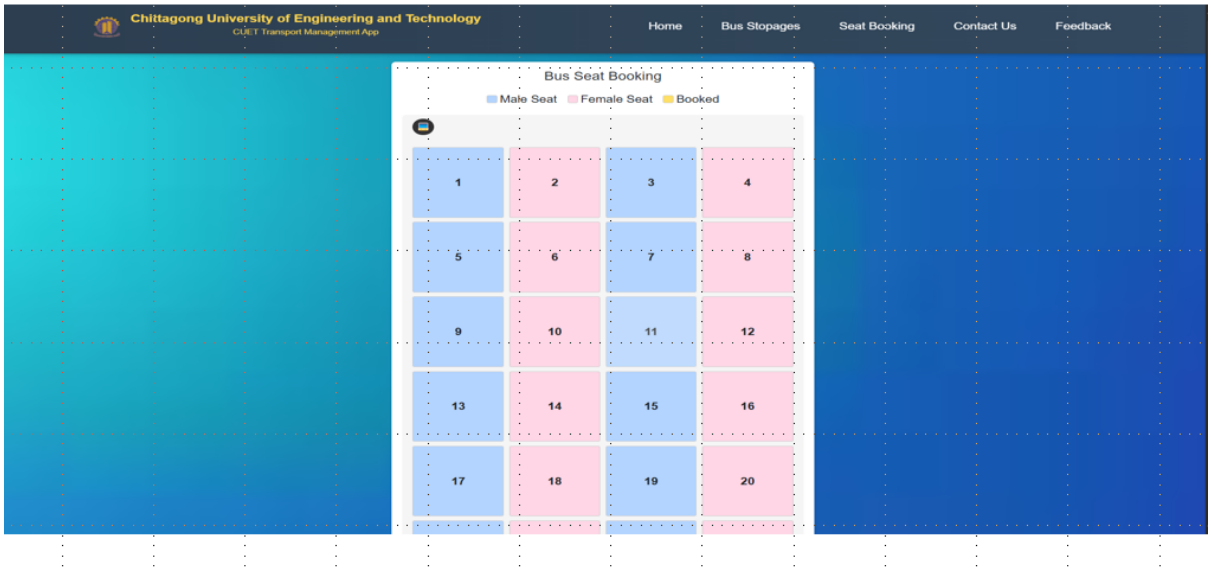

Fig 13 : Bus Seat Booking Page

Student Registration Page:

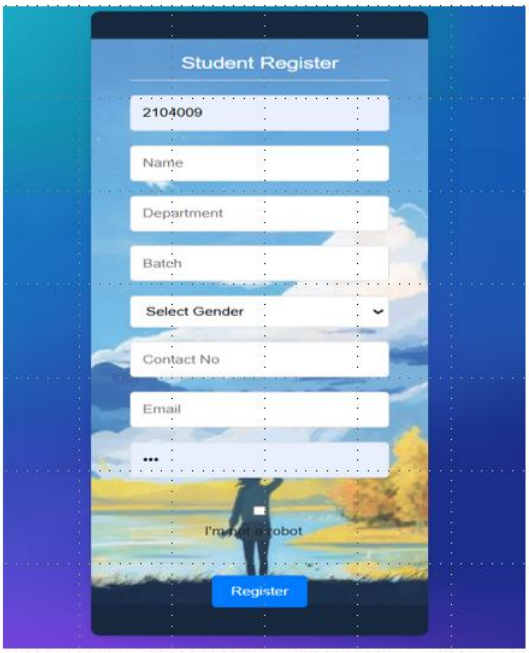

Fig 14 : Student Registration Page

Bus Admin Login Page:

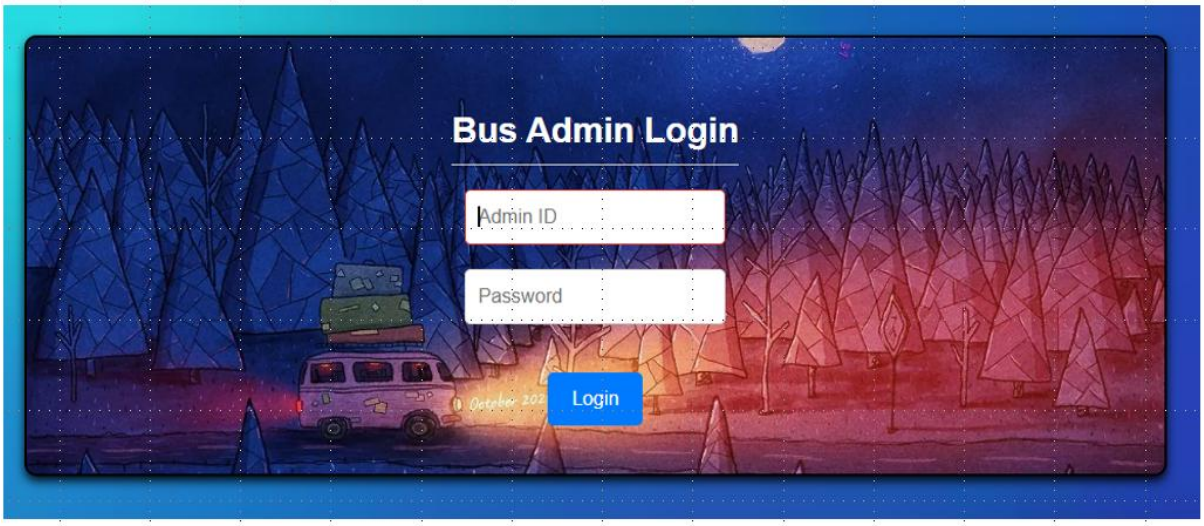

Fig 15 : Bus Admin Login Page

Bus Admin Profile Page:

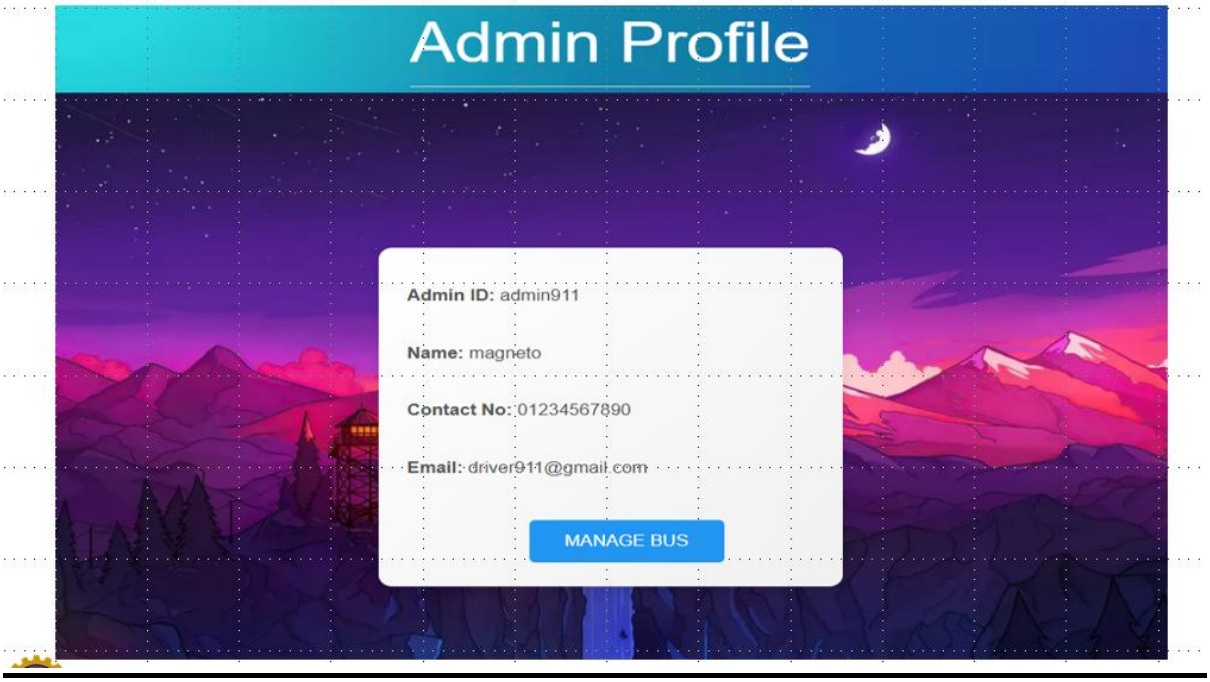

Fig 16 : Bus Admin Profile Page

Assign Driver Page:

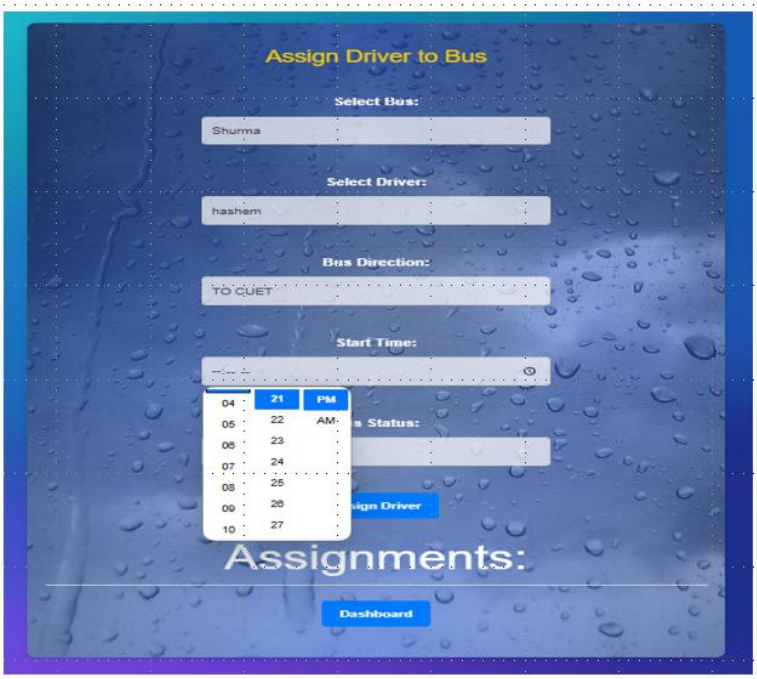

Fig 17 : Assign Driver Page

Active Buses Page:

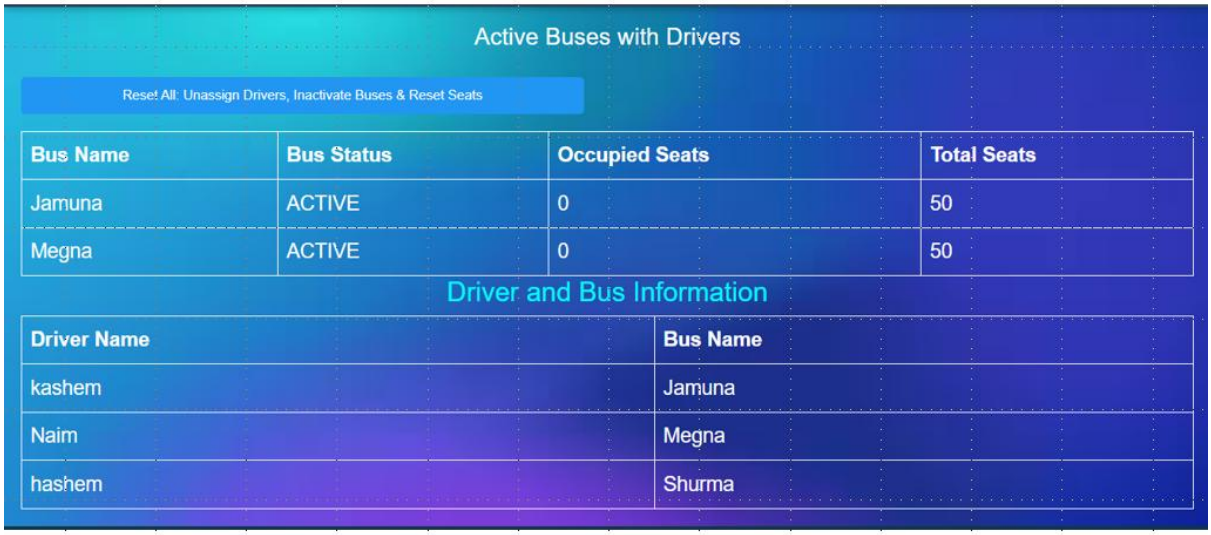

Fig 18 : Active Buses Page

Driver Login Page:

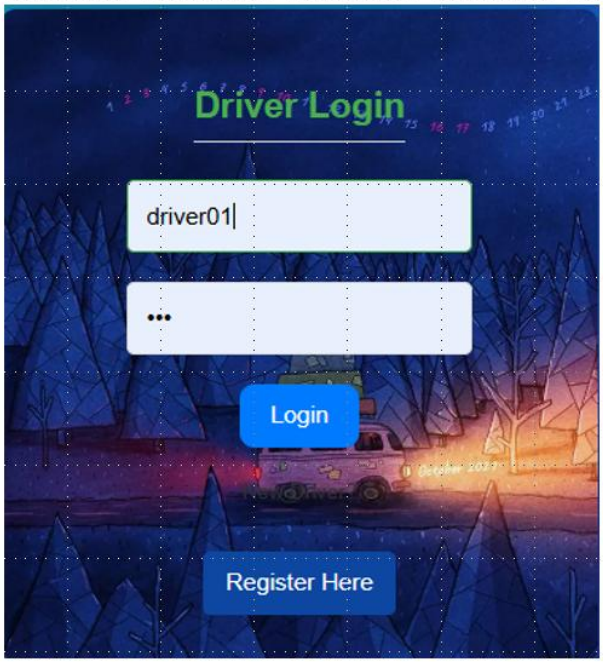

Fig 19 : Driver Login Page

Driver Profile Page:

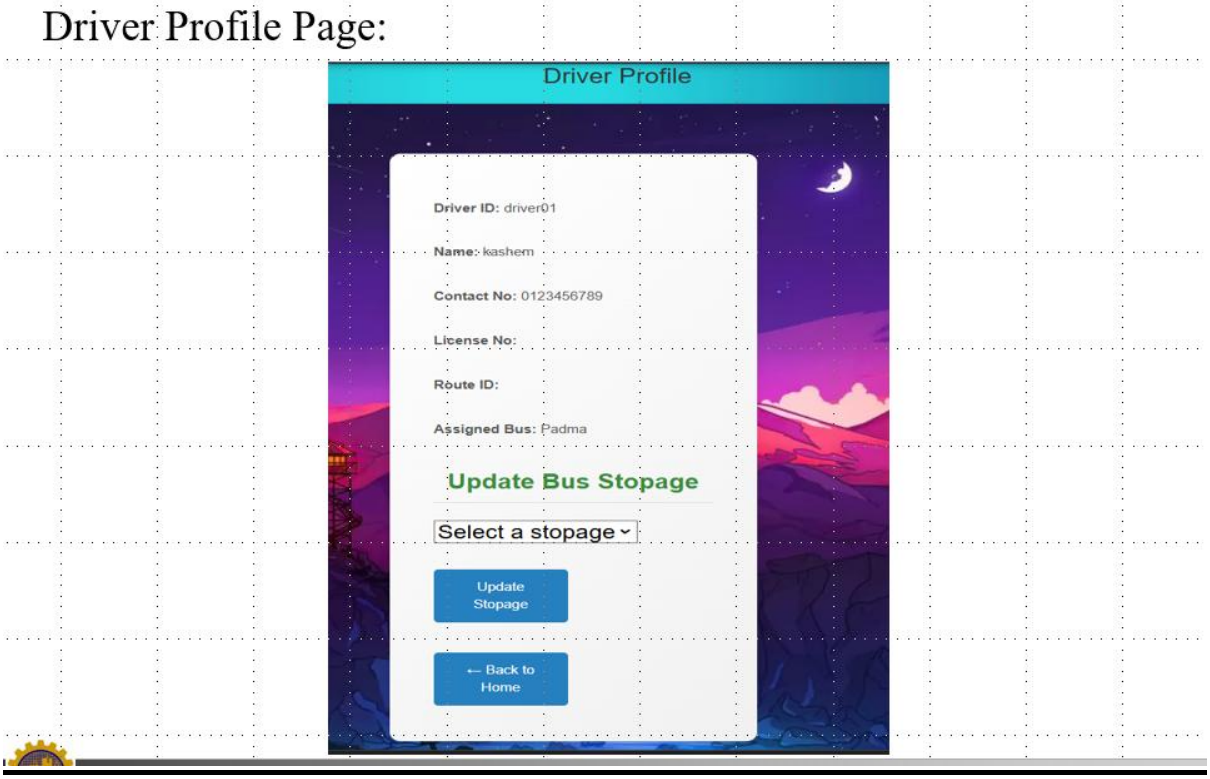

Fig 20 : Driver Profile Page

Driver Profile Page:

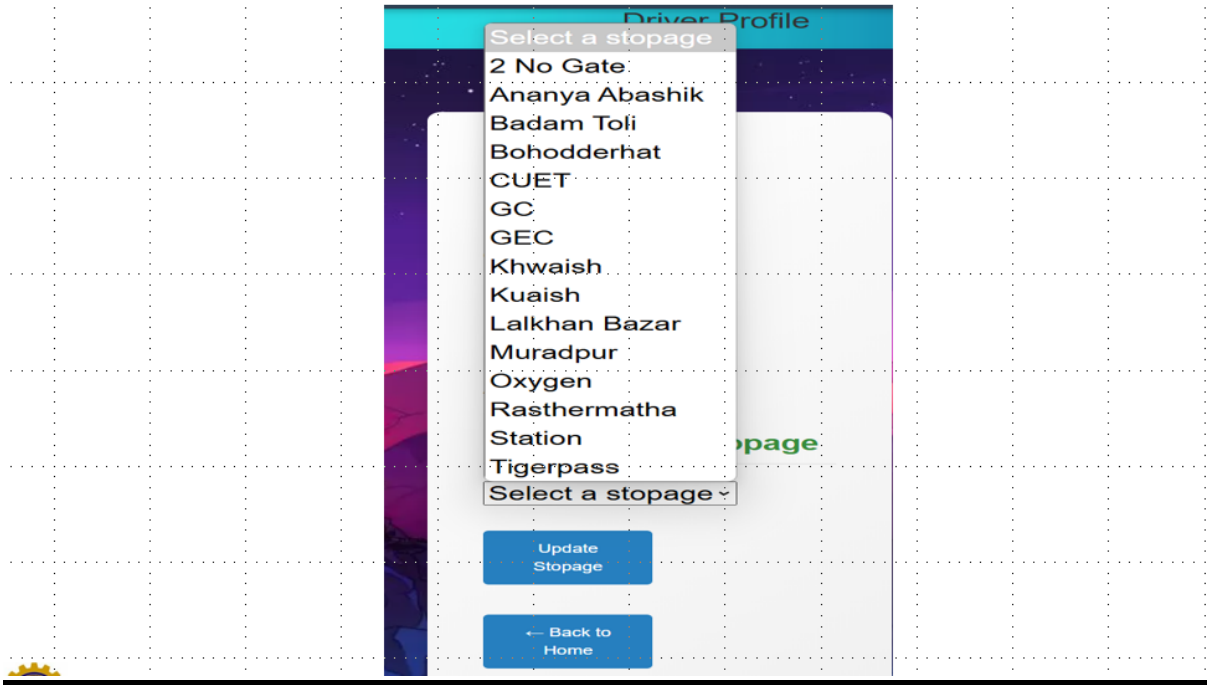

Fig 21 : List of Bus Stoppages

Contact Us Page:

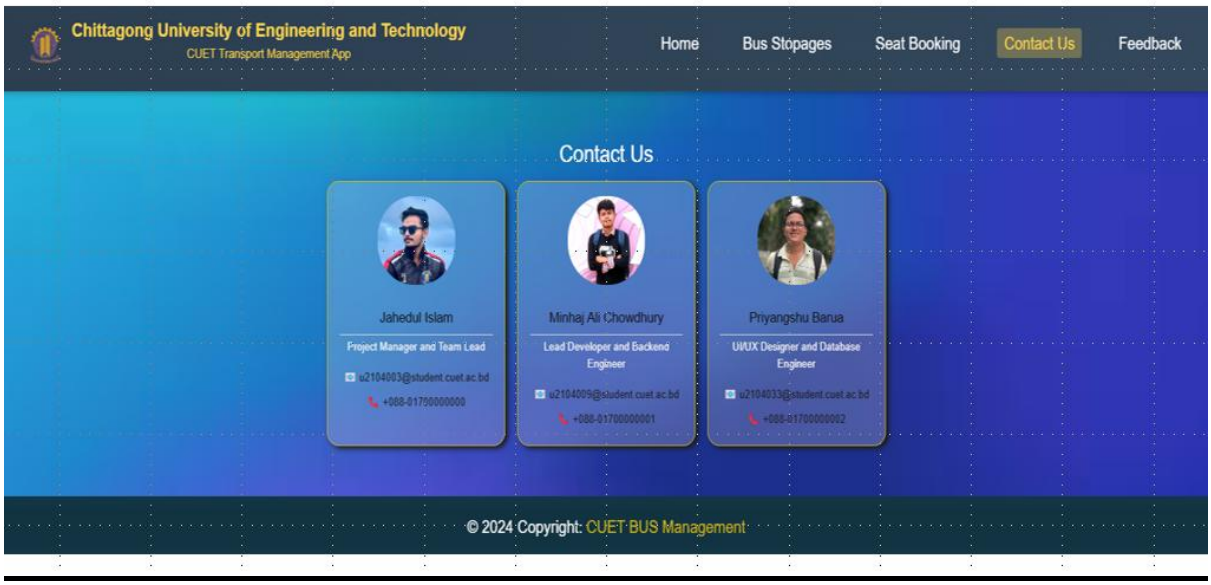

Fig 22 : Contact Us Page

9 Conclusion:

The **CUET Transport Management App** will greatly improve our university's transportation system and enhance our commuting experience. By ensuring fair seat allocation, the app will give everyone equal access to bus seating, especially those of us traveling from farther away. With real-time bus tracking and updated schedules, we'll get timely information that helps reduce our wait times and stress.

The app also focuses on our safety and comfort, particularly for female students, by reserving specific seats and optimizing bus routes for on-time arrivals. Overall, I believe the **CUET Transport Management App** will set a new standard for our university's transportation services, promoting fairness and reliability, boosting our satisfaction, and making commuting easier for all of us.

9.1 Future recommendations:

Estimated booking time for bus stoppages.

Response time for occupying seat.

Confirmation of occupied seat by stuff.

Live location of bus by using GPS.