AUTOMATED VEHICLE ENTRY-EXIT & FARE COUNTER

MICROPROCESSOR AND MICROCONTROLLER SESSIONAL

COURSE CODE: **CSE 306**

GROUP NO-**B8**

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Title: Automated vehicle entry-exit & fare counter

Introduction: The automated vehicle entry-exit project allows garage owners to track vehicle entry and exit, as well as calculate the total fare collected while the vehicle is still in the garage. To enhance security, radio frequency identification (RFID) is integrated, enabling the garage owner to permit a vehicle to enter and exit the garage. Additionally, a two-layer system is built, with Bluetooth modules used to establish a short-range connection between them. The first layer serves as the input side, where the garage owner can allow vehicle entry while determining the fare based on time. The second layer ensures successful entry by displaying a message on the LCD monitor. Each vehicle is assigned a unique RFID.

When a vehicle attempts to enter the garage, a gate connected to a servo motor allows it to drive inside. Two IR sensors and one ultrasonic distance sensor module are attached along the vehicle's entry path. As soon as the vehicle enters, we can determine its length based on the velocity and the time it takes to enter. This helps to identify the type of vehicle entering, whether it's a private car, truck, or bike.

Once the vehicle has entered, we can track the total fare as time progresses.

Functionalities:

Admin Control:

- The system supports central admin system. Admin can control who can enter and exit the garage using push button.
- Admin can also set the fare for each car type to determine the parking fare.

Vehicle Entry-Exit Tracking:

- The system tracks vehicle entry and exit within the garage using a combination of RFID and sensor technologies.
- Each vehicle is mapped to a unique RFID tag for identification and authorization to enter or leave the garage.

Fare Calculation:

- The system calculates the total fare for each vehicle based on the time it remains in the garage.
- Fare is determined dynamically from the moment the vehicle enters and is updated as time passes.

RFID-Based Authorization:

- Garage owners can control vehicle entry and exit by verifying RFID tags.
- Only vehicles with valid RFID tags are allowed to enter or leave the garage.

Two-Layer Communication System:

- The project features a two-layer communication system using Bluetooth modules for short-range connectivity.
- The first layer serves as the input side, allowing the garage owner to manage vehicle entry and fare settings.
- The second layer confirms successful vehicle entry by displaying a message on an LCD screen.

Automated Entry System:

- The entry gate is controlled by a servo motor, which opens when a vehicle is authorized to enter.
- Sensors along the entry path detect the vehicle's movement and size.

Vehicle Type Detection:

- The system utilizes IR sensors and an ultrasonic distance sensor to measure the length of the vehicle as it enters the garage.
- Based on the vehicle's length and entry time, the system can classify the type of vehicle (e.g., private car, truck, or bike).

Real-Time Fare Tracking:

- Once a vehicle is inside the garage, the system continuously tracks the time and updates the fare accordingly.
- Garage owners can monitor the total fare collected for any vehicle in real time.

Display of Status and Information:

- The LCD screen displays messages about the vehicle's entry status, confirming successful entry.
- Additional information, such as fare details, can also be displayed on the monitor.

Components:

Ser No	Name	Quantity
1	Arduino Uno R3	2
2	Keypad 4X4 16 Key	1
3	Servo Motor Micro SG90 180 Degree	1
4	I2C LCD Screen(16X2)	2
5	Buzzer	2
6	Infrared Obstacle Avoidance IR Sensor Module	2
7	Bluetooth HC05 Module	2
8	Ultrasonic Sonar Sensor HC-SR04	1
9	RC522 RFID Card Reader Module	1
10	DS3231 RTC	1
11	Miscellaneous (wires, connectors, etc.)	-

Methodology:

```
        ┌─────────┐                                    ┌─────────┐
        │  Start  │─────────────────────┐              │   End   │
        └────┬────┘                      │              └────▲────┘
             │                           │                   │
             ▼                           │                   │
     ┌───────────────┐                   │           ┌───────────────┐
     │ Measure vehicle│                  │           │ Vehicle exits │
     │ length, determine│                │           └───────▲───────┘
     │   category    │                   │                   │
     └───────┬───────┘                   ▼                   │
             │                   ┌───────────────┐   ┌───────────────┐
             ▼                   │ Set category based│ │  Gate opens  │
     ┌───────────────┐           │ fare per hour │   └───────▲───────┘
     │ Scanning RFID │           └───────┬───────┘           │
     └───────┬───────┘                   │                   │
             │                           │            ╱──────────────╲
             ▼                           │           │ Display fare   │
          ◇─────◇                        │            ╲──────────────╱
       Is RFID valid? ──No──► Access Denied               ▲
          ◇─────◇                        │                │
             │                           │        ┌───────────────┐
            Yes                          └───────►│ Calculate fare │
             │                                    └───────▲───────┘
             ▼                                            │
     ┌───────────────┐                           ┌───────────────┐
     │  Gate opens   │                           │ Vehicle exits, time│
     └───────┬───────┘                           │ count ends    │
             │                                   └───────▲───────┘
             ▼                                           │
     ┌───────────────┐     ╱──────────────╲      ┌───────────────┐
     │ Vehicle enters│────►│ Display entry  │────►│ (time count ends)│
     │ garage, time count│ │ confirmation   │     └───────────────┘
     │    starts     │     ╲──────────────╱
     └───────────────┘
```
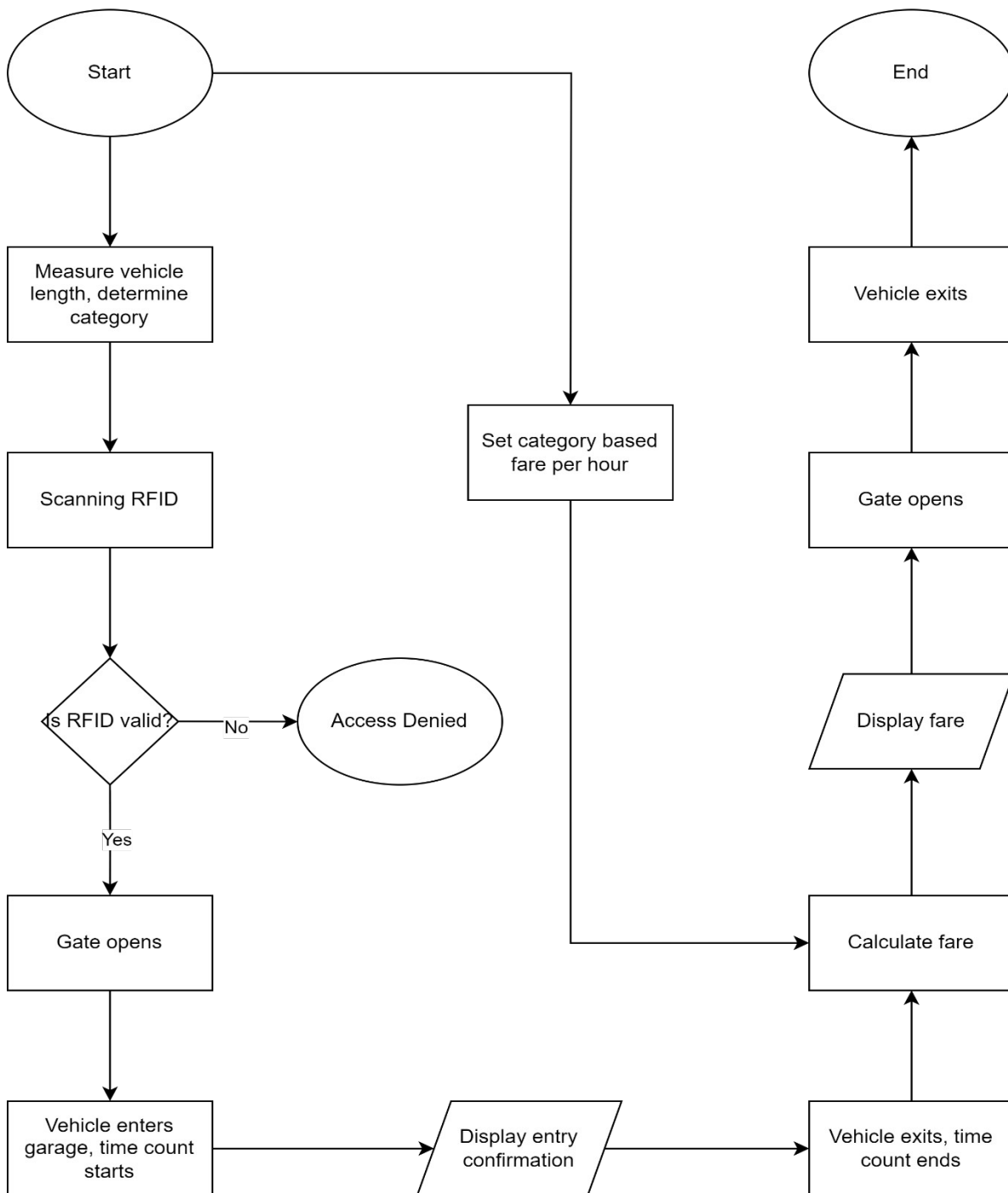
Fig: Flow Chart of Vehicle Entry-Exit and Fare Counter

Initially an admin can set the pricing tier for different types of car. There are 3 types of car.

1. Type A (Sedan, SUV or equivalent)
2. Type B (Microbus or equivalent)
3. Type C (Jeep or equivalent)

After this, admin can change the pricing using a 4X4 keypad installed along the LCD to display his actions.

He can also determine if a car can access the garage. Whenever admin uses the push button (press '1' to open and press '0' to close), the garage gate is opened and closed. Admin side Arduino controls the user side Arduino using Bluetooth modules in a master-slave relation.

Initially when a car tries to enter the garage, at first its length is measured using two IR sensors and an ultrasonic sensor. In this case the IR sensor measures the speed and ultrasonic sensor measures the duration of passing a particular point. Then multiplying the speed with the time gives us the length of the car. This matched with the car type in the system, determines the car type and its faring category.

After that the user will use his RFID to authorize the entrance and start the stay_time inside the garage. The LCD screen will print the prompt. When the user exits the garage and scans the RFID card again, the car fare is determined by using the stay_time and fare for the car's category and multiplying them. The parking fee will then be showed on the LCD screen.
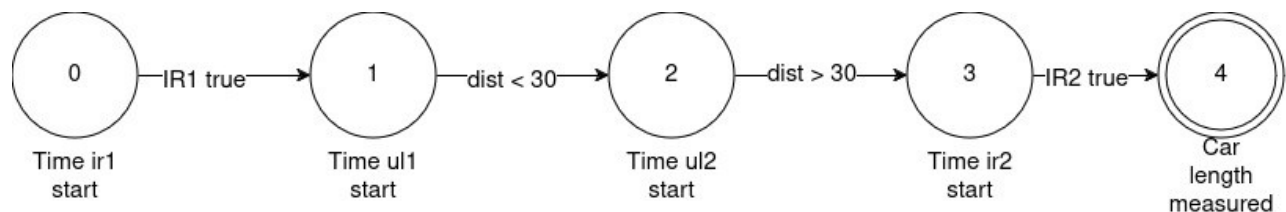
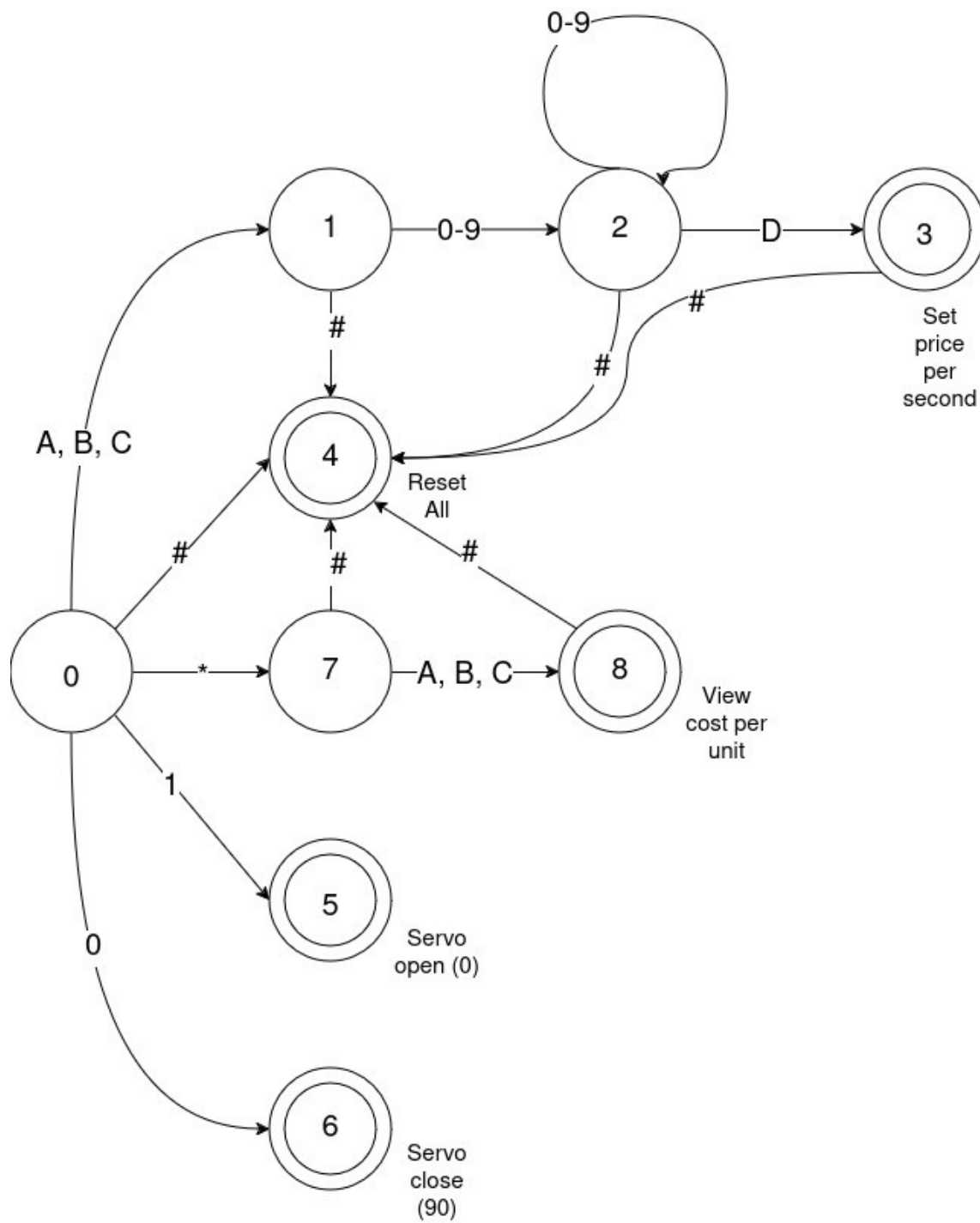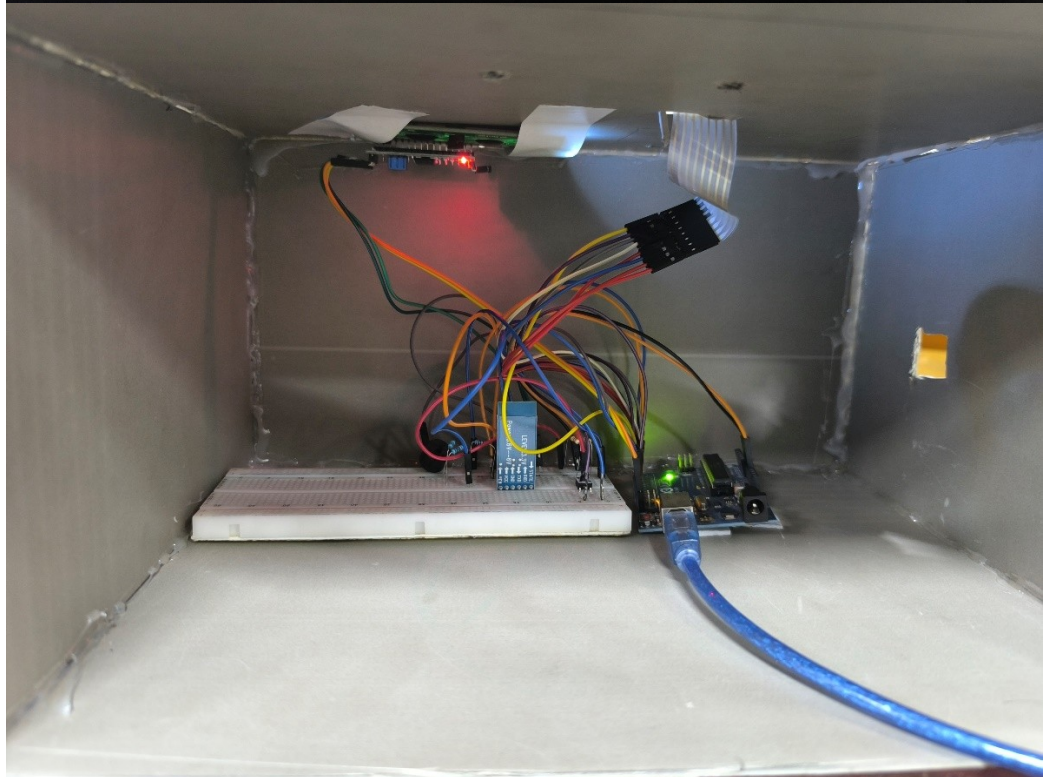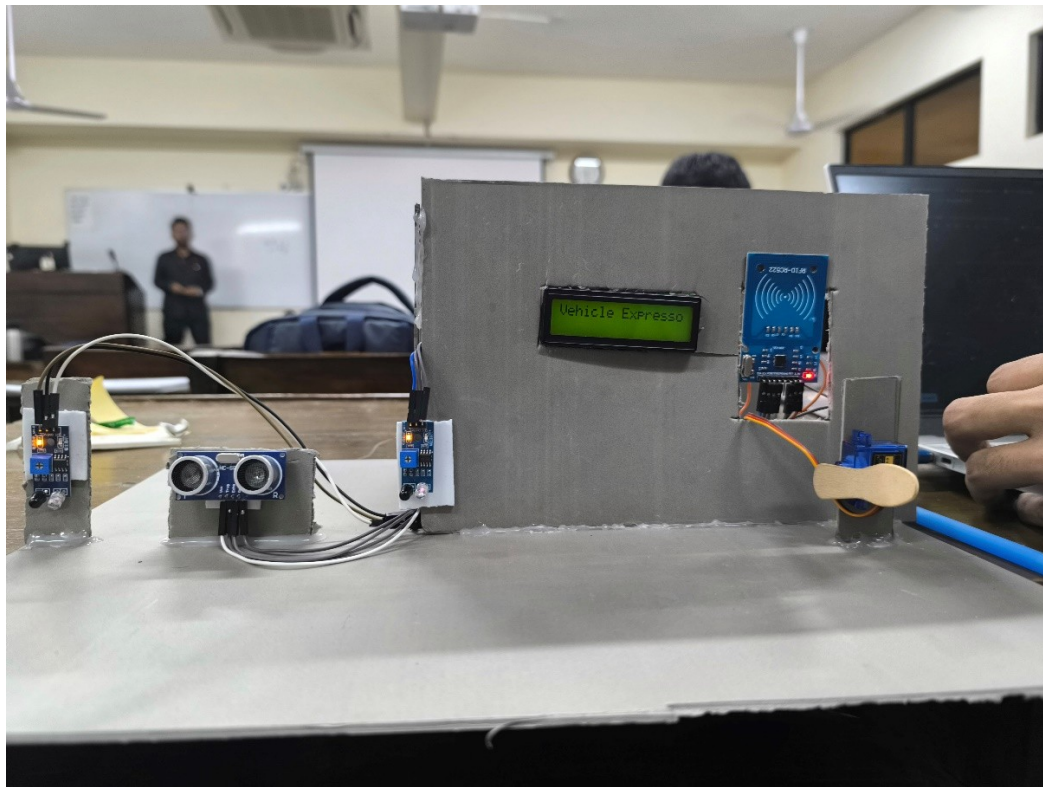

Fig: State Diagram of Vehicle Length Measurement

Fig: State Diagram of Admin Control Box

Outcome:

Contribution:

Name	Id	Contribution
Mir Sayef Ali	202214069	Vehicle length measuremesnt, category detection, Design idea.
Saief Md. Hossain Adnan	202214091	Security implementation, Report preparation
Syed Mafijul Tamal	202214105	Automata design, Bluetooth implementation, Admin End Design, Final Testing
Abrar Ibtesham	202214300	Input Output implementation, Design Idea, Servo Motor Implementation