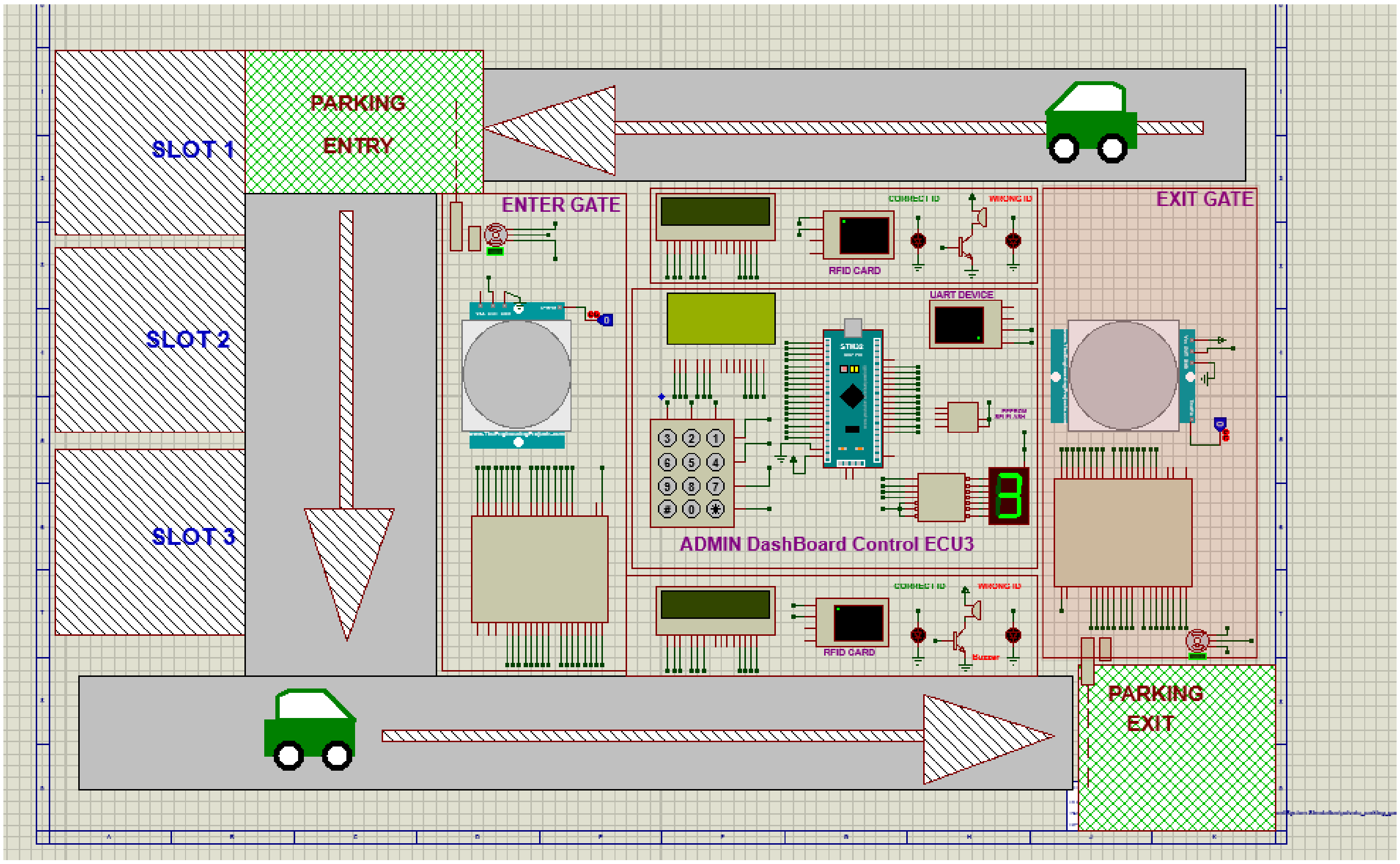
Second _Term_ Final_ Project



Mastering Embedded System Diploma

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Private Parking Garage

Description

This Project aims to make a design for a private parking garage area for people in a specific area or garage for a company. This system is split into three ECUs:

First ECU for the entrance gate

This ECU is responsible for the gate that is based on the servo motor, the RFID reader based on UART for the user interface, Buzzer for the beep sound when the driver enters an unauthorized ID, and Some LEDs like green and red for authorized and unauthorized ID.

Second ECU for admin dashboard

This ECU is responsible for the admin privileges to add, delete, and edit driver data. The system may have more than one admin, each one of them has its username and password.

The ECU has an LCD and keypad as an admin interface, a UART device for entering admin data, and a seven-segment to display the number of available slots in the garage.

Third ECU for the exit gate

This ECU is responsible for the gate that is based on the servo motor, the RFID reader based on UART for the user interface, Buzzer for the beep sound when the driver enters an unauthorized ID, and Some LEDs like green and red for authorized and unauthorized ID.

LCD will display some messages for the driver to determine what will do.

The Whole system is connected together. when a driver enters a valid ID the ECU1 sends data through SPI to ECU2, and the ECU2 starts checking if the ID is valid or not and checking if it is inside the garage and wants to exit from the entrance gate then the ECU2 return the result of checking to ECU1 to display the result of computing on the LCD is valid ID or invalid ID.

When the driver wants to exit the garage space and enter the ID the ECU3 sends the driver data to ECU2, and the ECU2 starts checking if the ID is valid or not and checking if it is outside the garage and wants to enter from the exit gate then the ECU2 return the result of checking to ECU1 to display the result of computing on the LCD is valid ID or invalid ID.

System Specifications

ECU1

1- Control The servo motor of the entrance gate.
2- Display the states on LCD

ECU2

1- Holds Predefined admins data.
2- Validate the driver data.
3- Display admin dashboard.
4- Display number of available slots in garage.

ECU3

1- Control The servo motor of the exit gate.
2- Display the states on LCD

System Assumptions:

1- The Distance between the ECU1 and ECU2 is shorter than 50 cm.
2- The Distance between the ECU3 and ECU2 is shorter than 50 cm.
3- Sensors never fail.
4- Communication wires are never damaged.

System Architecture

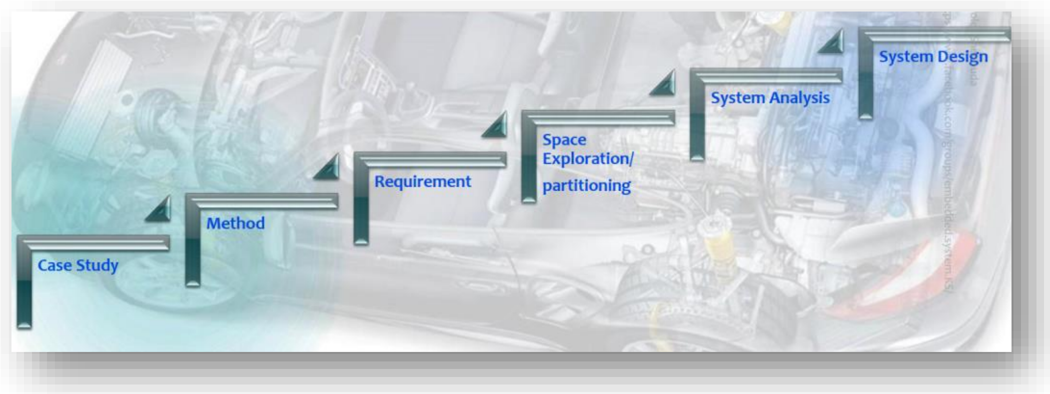

Figure 1:System Architecture

1- Case study

software that controls the private parking garage.

2- Method

Adaptive Technique: Agile Scrum Methodology

3- Requirement

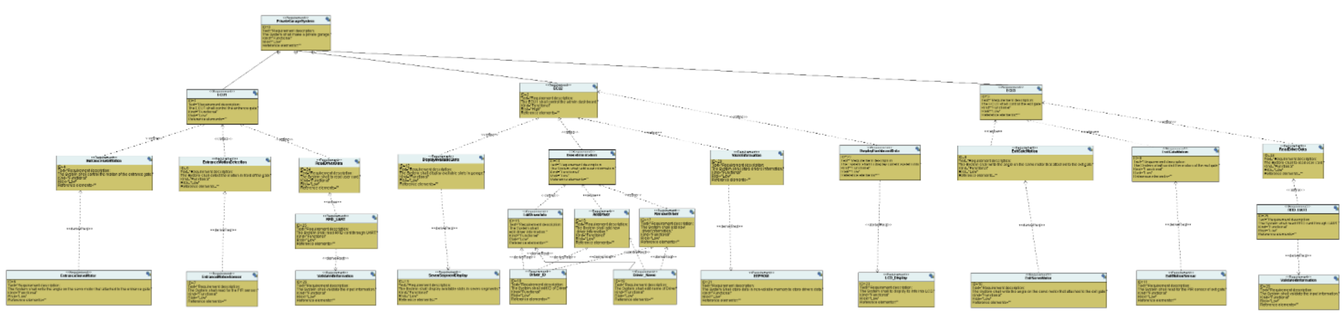

Figure 2:System Requirement

4- Space exploration/partitioning

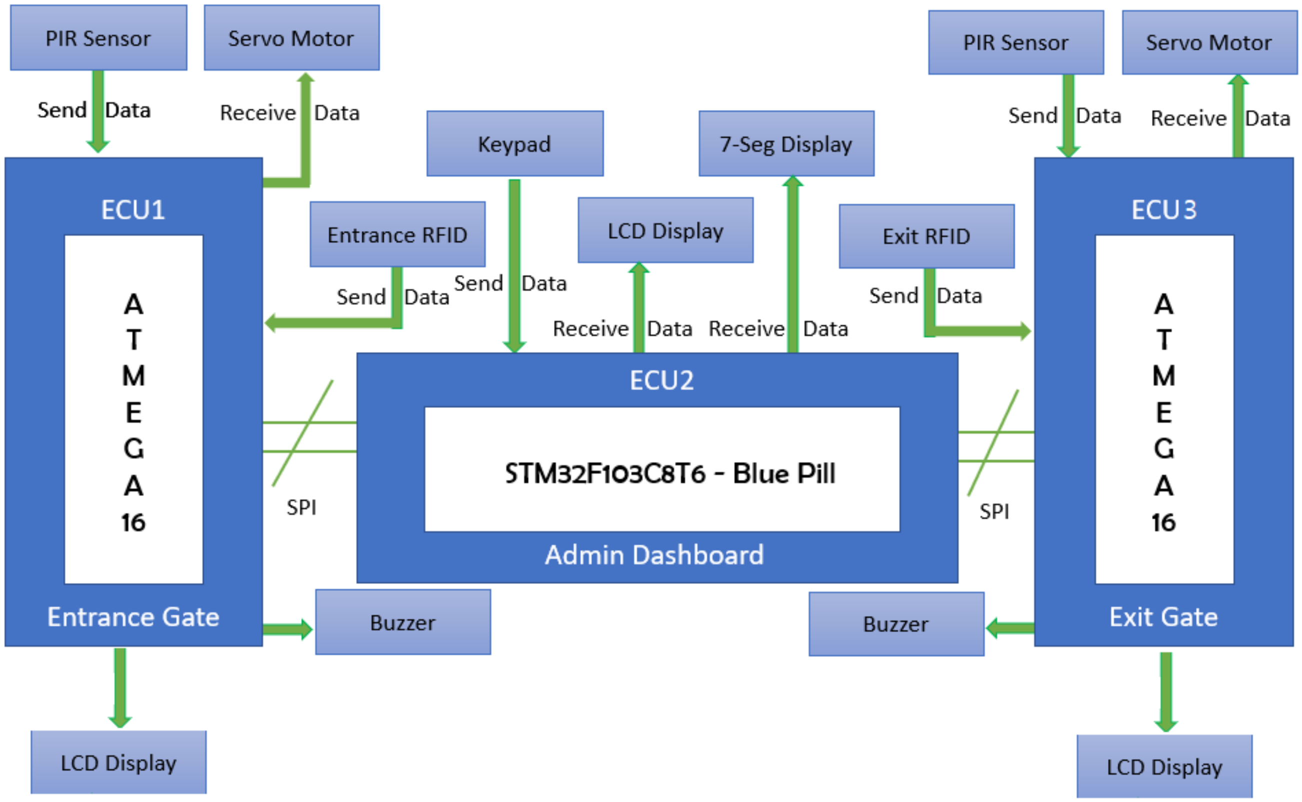

Figure 3:System Partitioning

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microprocessor its specification

1- ARM 32-bit Cortex™-M3 CPU Core
   i) 72 MHz maximum frequency
   ii) Single-cycle multiplication and hardware division.
2- Memories
   i) 32 Kbytes of Flash memory
   ii) 10 Kbytes of SRAM
3- Clock, reset and supply management
   i) 2.0 to 3.6 V application supply and I/Os.
   ii) 4-to-16 MHz crystal oscillator.
   iii) 32 kHz oscillator for RTC with calibration

And used ATmega16 For ECU1 and ECU3

Program Memory Type	Flash
Program Memory Size (KB)	16
CPU Speed (MIPS/DMIPS)	16
Data EEPROM (bytes)	512

5- System Analysis

i- Use Case Diagram

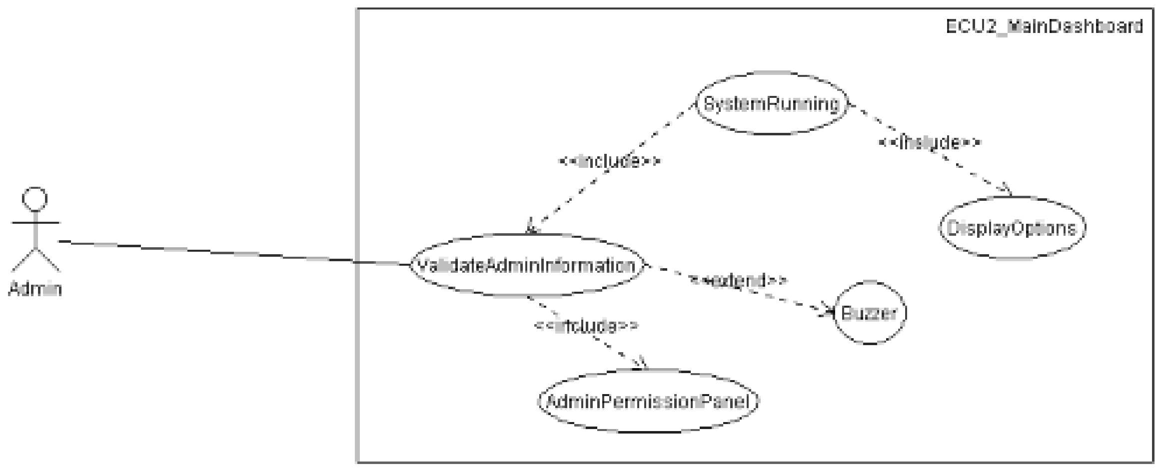

Figure 4:ECU2 Use Case Diagram

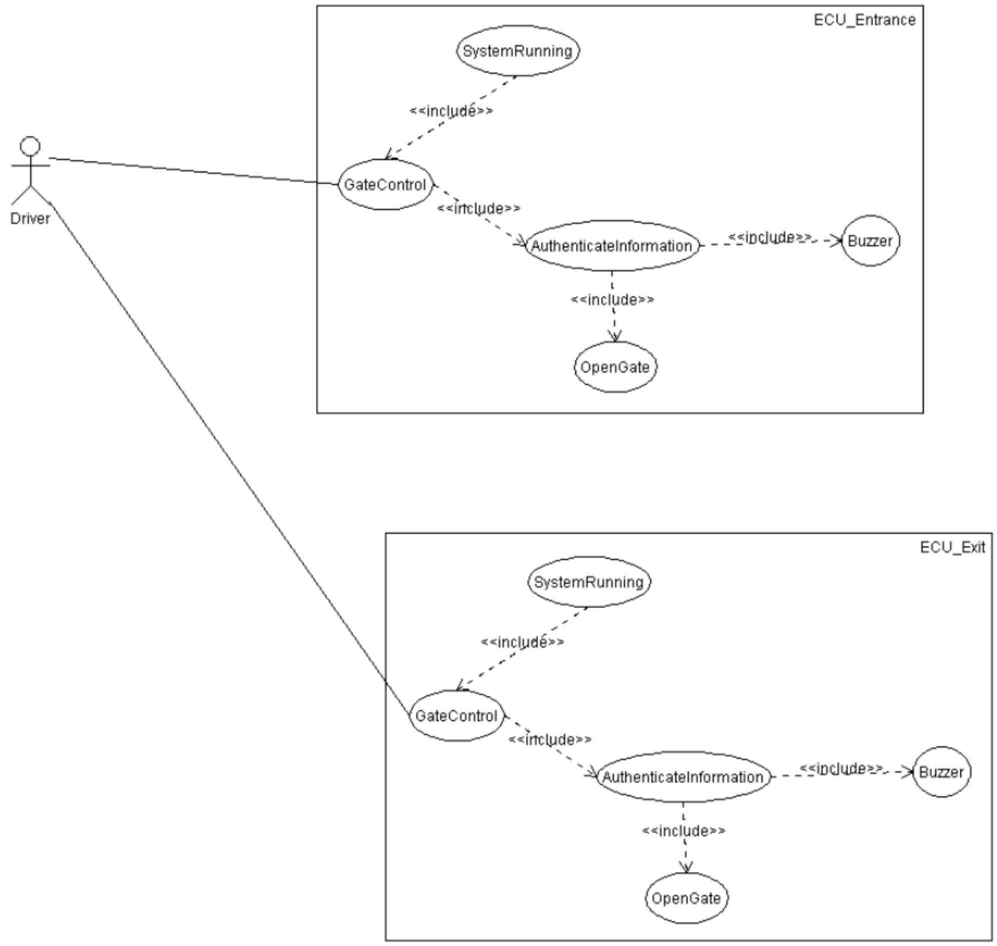

Figure 5: ECU1 & ECU3 Use Case Diagram

ii- Simple Activity Diagram

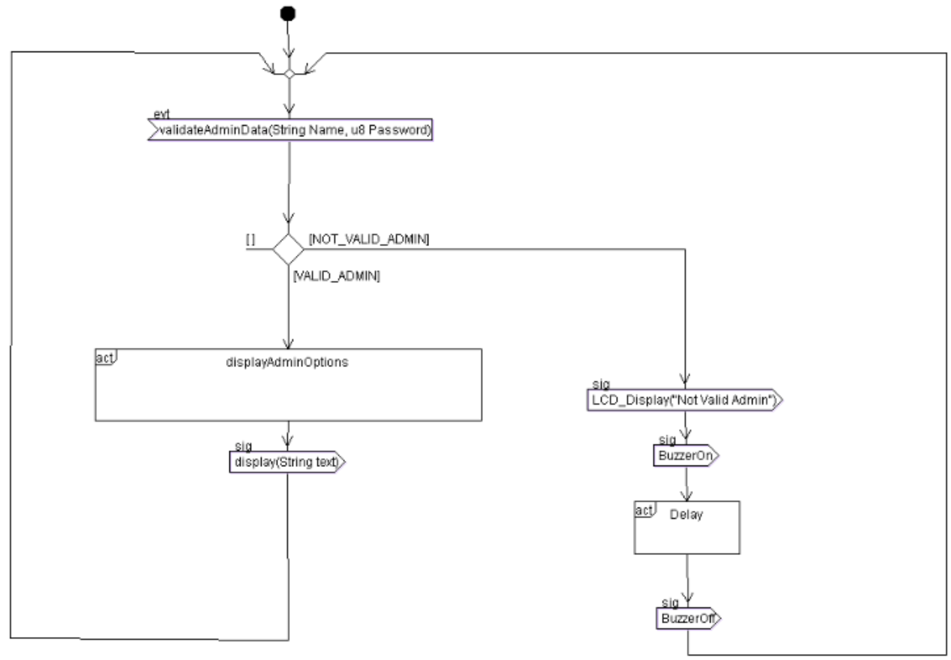

Figure 6:ECU2 Activity Diagram

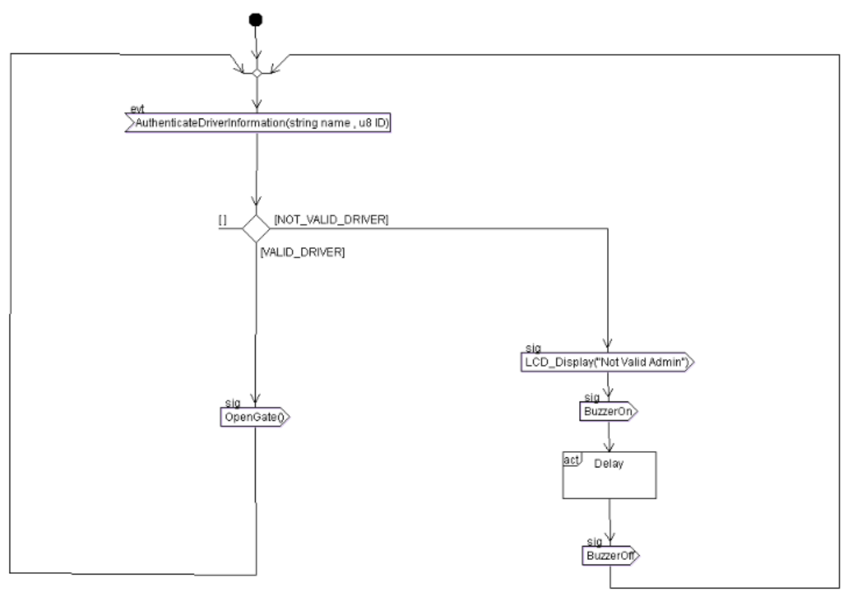

Figure 7:ECU1 Activity Diagram

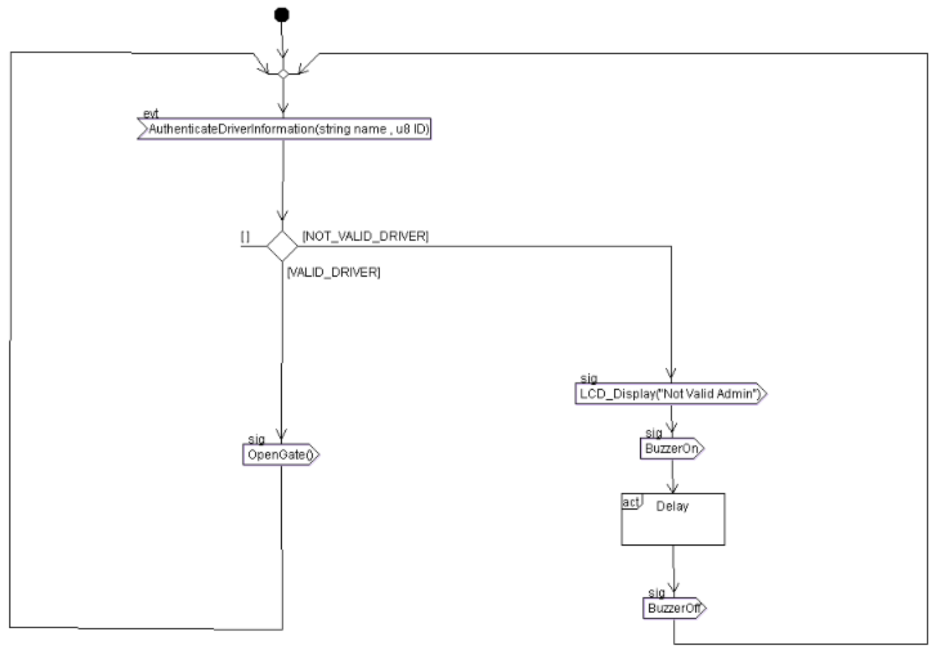

Figure 8:ECU3 Activity Diagram

iii- Sequence Diagram (UML)

- ECU1 UML

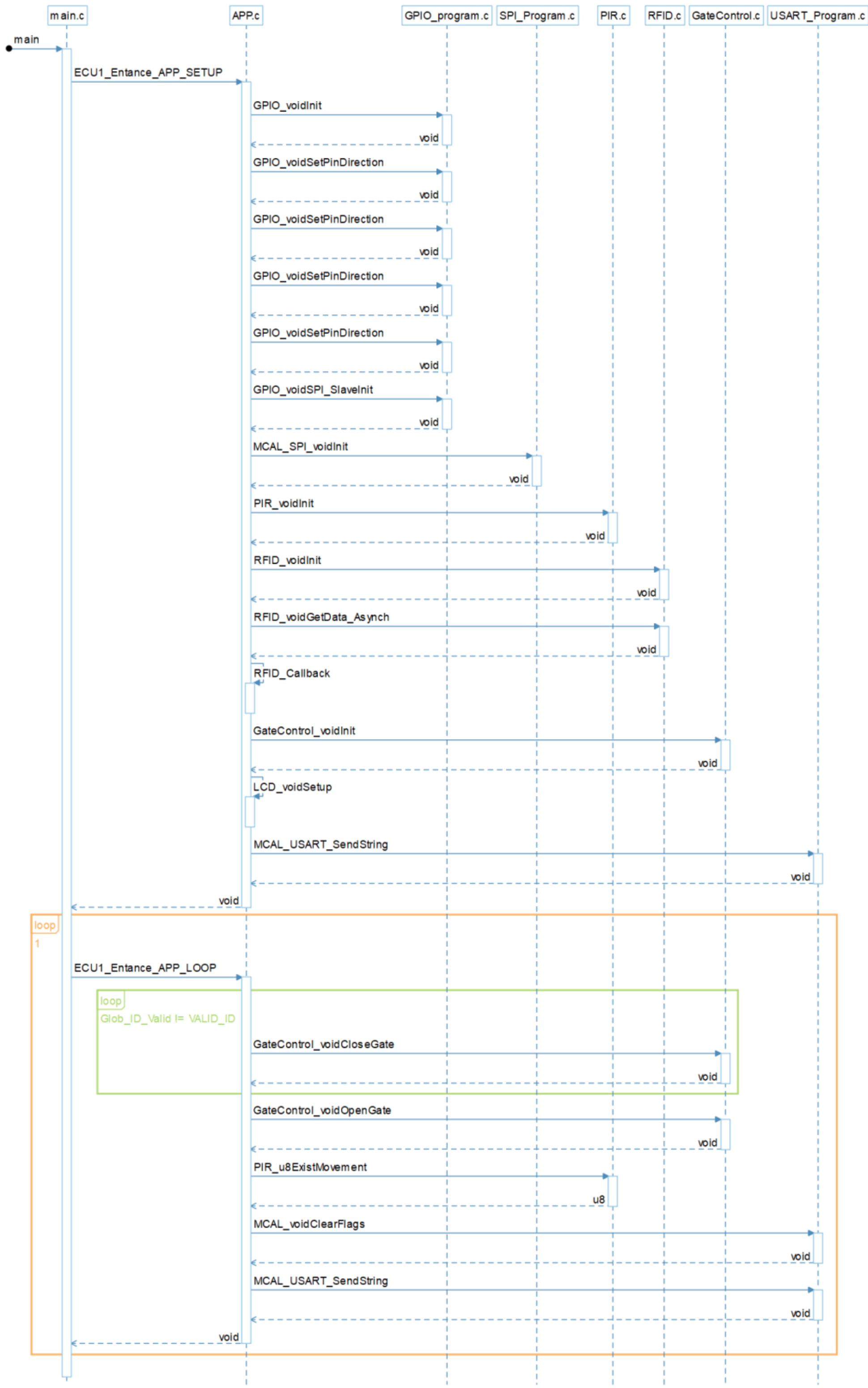

Figure 9:ECU1 UML Diagram

- ECU2 UML

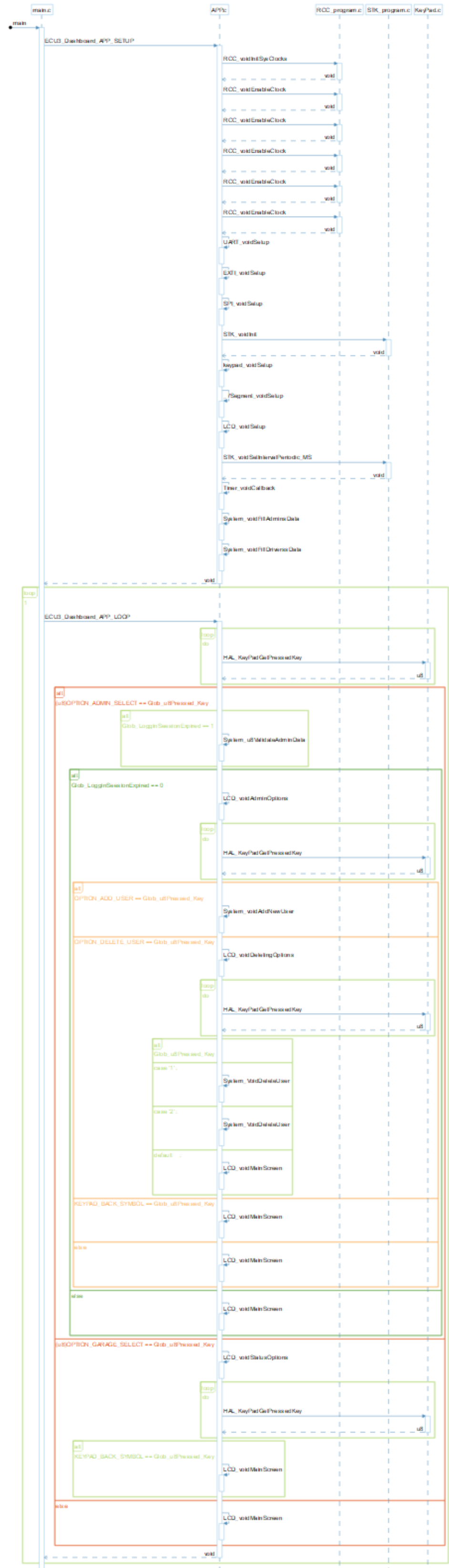

Figure 10:ECU2 UML Diagram

- ECU3 UML

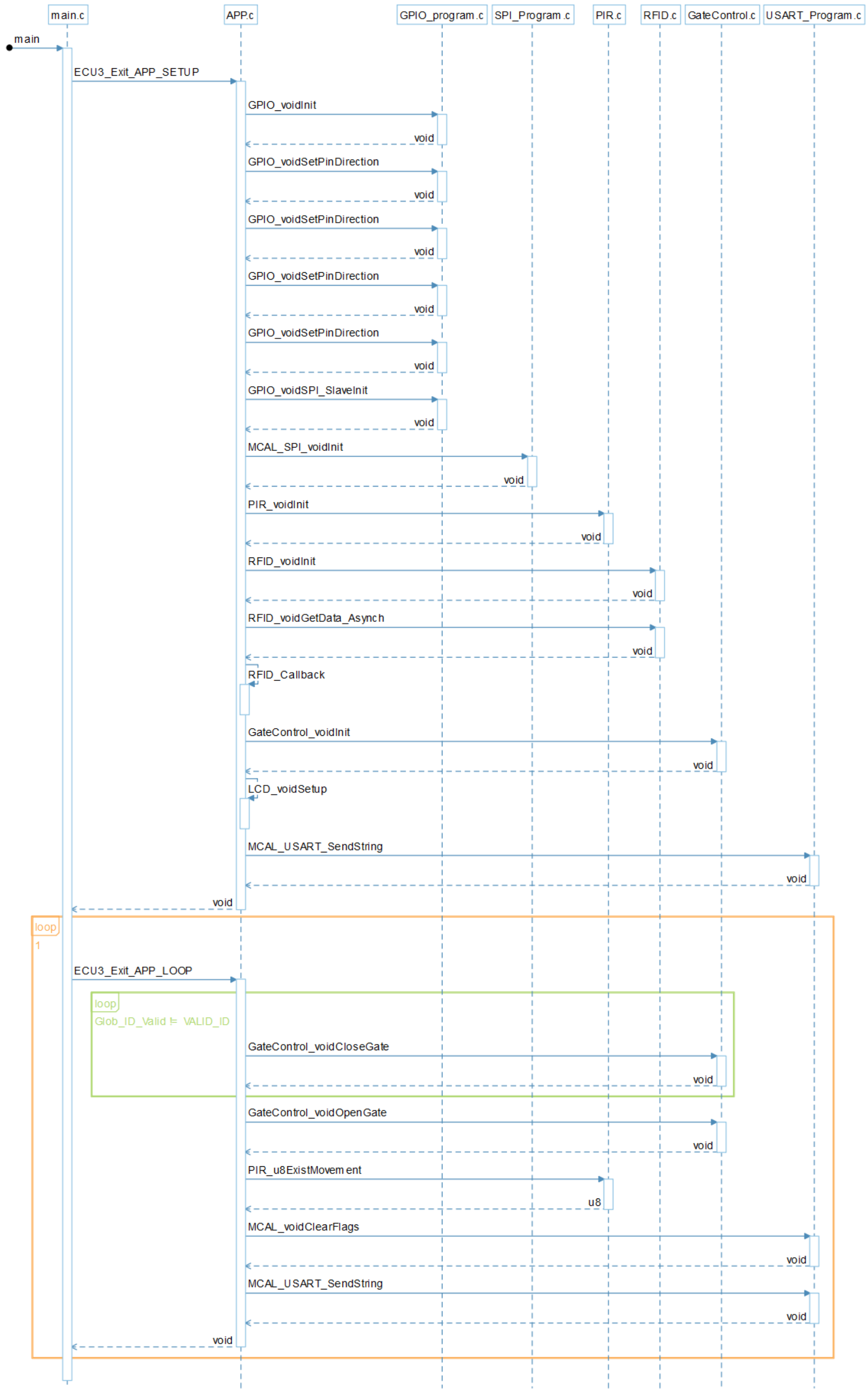

Figure 11:ECU3 UML Diagram

6- System Design

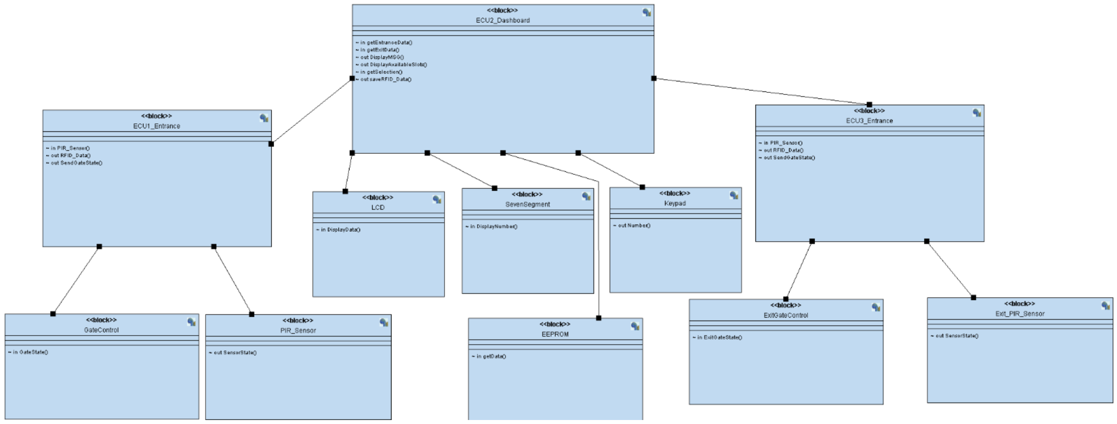

Figure 12:System Design