UNIVERSITY OF REGINA

Faculty of Engineering and Applied Science

ENEL 351 Project: Smart Parking System

Functional Specification

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Introduction

The Smart Parking System is designed to address parking issues in urban areas and university campuses, where parking spots are limited and the number of cars is on the rise. The system will integrate a mix of digital and analog sensors, motors, LEDs, and an LCD display to manage parking operations.

Project's Tasks and Functions

- Overall: The Smart Parking System will be designed using the microcontroller board (STM32 Nucleo-64 board).

- Vehicle Detection: The IR Obstacle Avoidance Sensor will detect a car, as it is a digital sensor. It outputs a high signal (=1) when a vehicle is detected and a low signal (=0) when no vehicle is present.

- Barricade Operation: Upon vehicle detection, the Servo Motor SG-90 will operate the barricade, causing it to rotate from 0 to 90 degrees to open, and rotate in the reverse to close.

- Car Counting and Tracking: This feature will operate through the programming. Each time a car enters or exits, the system will perform counting operations within the code.

- Display Messages: The 16x2 LCD will display messages to the driver, indicating whether the parking is full or showing the count of vacant spots.

- Parking Assistance: The Sharp GP2Y0A51SK0F is an analog sensor that, upon detecting a car at a certain distance, will activate LED indicators to guide the driver.

List of all user controls and indicators

- No user controls.
- Indicators:
    - 16x2 LCD module displaying parking availability
    - Green and Red LED lights for parking guidance

List of all other inputs and outputs
- Inputs:
  - o IR Obstacle Avoidance Sensor signals (Digital)
  - o Sharp GP2Y0A51SK0F Distance Sensor signals 2-15cm (Analog)
- Outputs:
  - o Servo motor control signals
  - o 16*2 LCD display messages
  - o LED light status signals
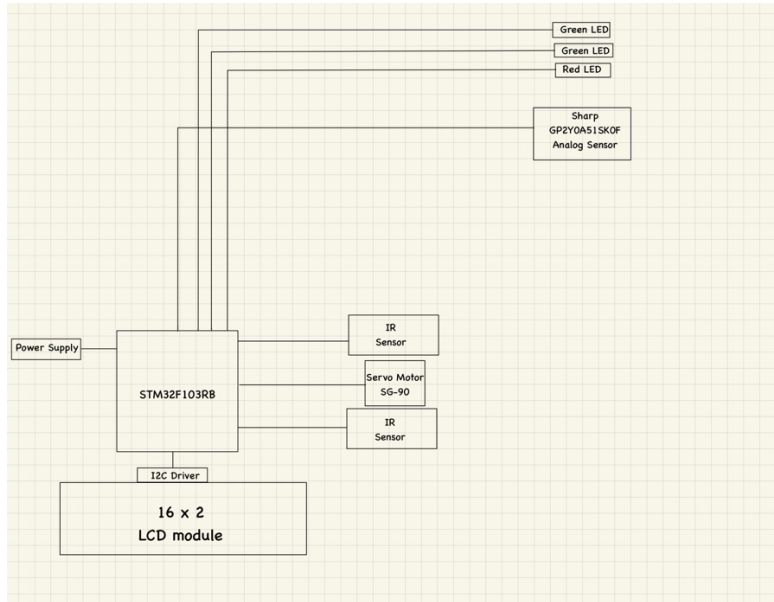
Block diagram & Schematic

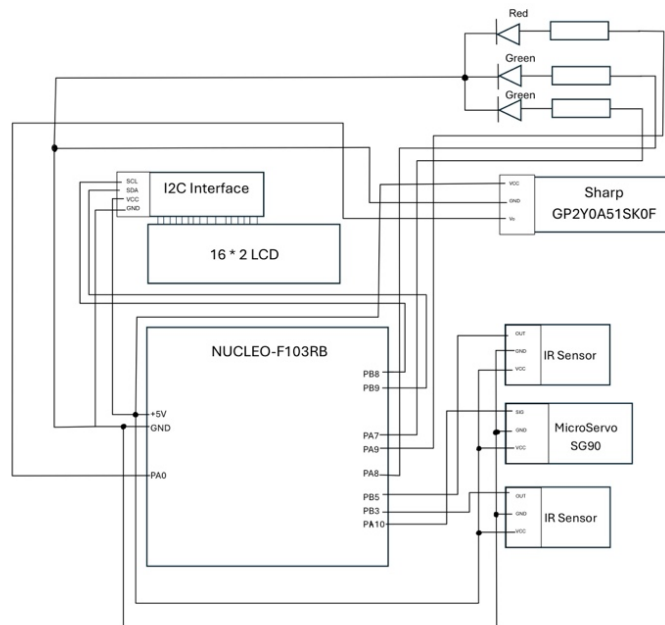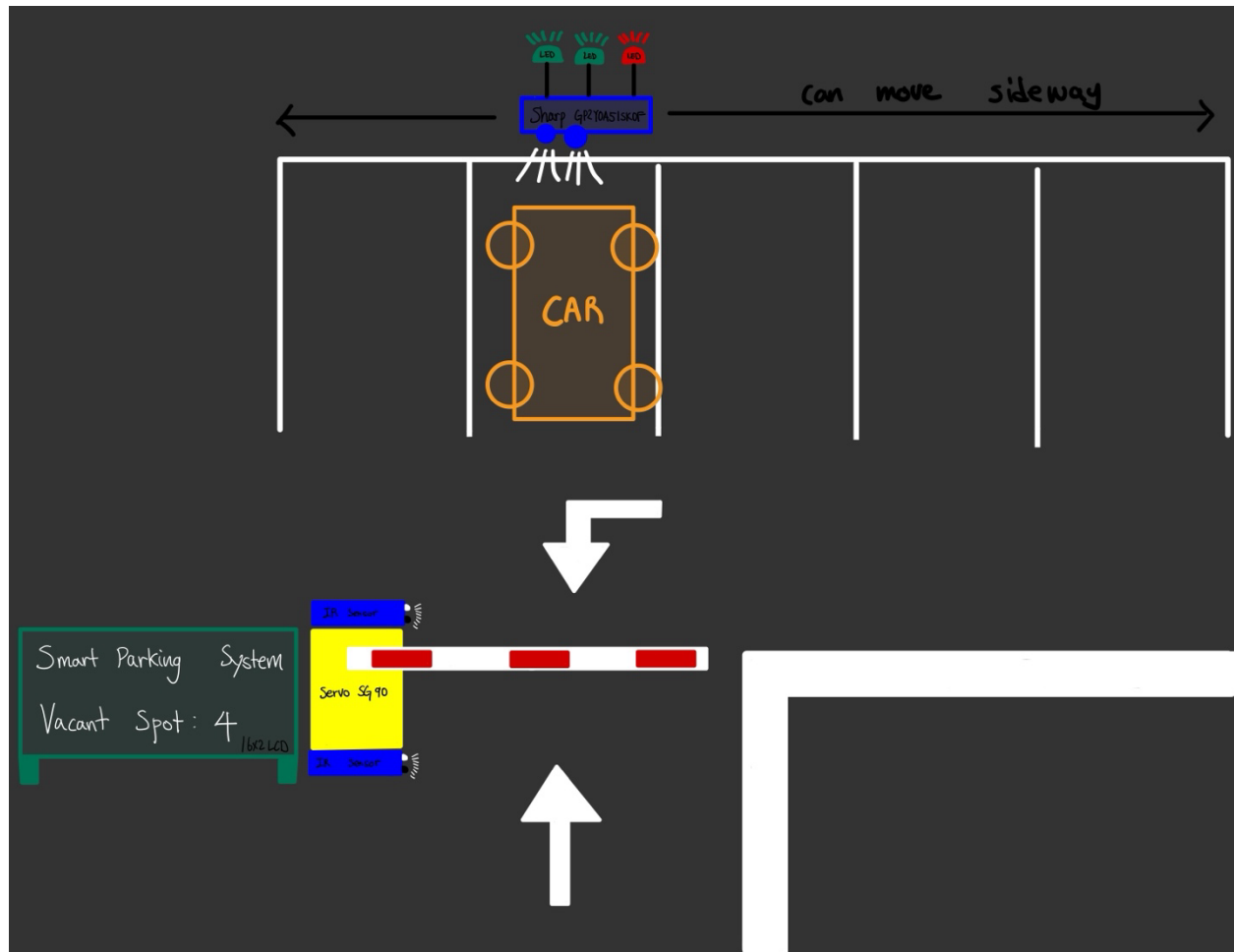*Figure 1. Block Diagram of Smart Parking System*

Figure 2. Detailed Schematic Diagram

Sketch of physical system

Connection details for all I/O components

Component	Pin	Port
16*2 LCD with I2C driver Module	SCL	PB8
	SDA	PB9
IR Sensor 1	OUT	PB5
IR Sensor 2	OUT	PB3
MicroServo SG90	SIG	PA10
Sharp GP2Y0A51SK0F	Vo	PA0
Green LED 1	-	PA7
Green LED 2	-	PA8
Red LED	-	PA9