

# Final Project: Driving an RC Car with Automatic Parking System

## Introduction

In this project, you are required to build an RC Car with automatic parking system. When the user presses start button via Bluetooth, the RC car needs to drive by following a lane on the track. When it approaches a wall, then it should start find the parking area and park successfully on the marked area. For each mission success, you will earn points.

Final Project Score: 60% Demo+40% Report

## Hardware:

RC Car body with geared DC motor, STM32f4x for controller.

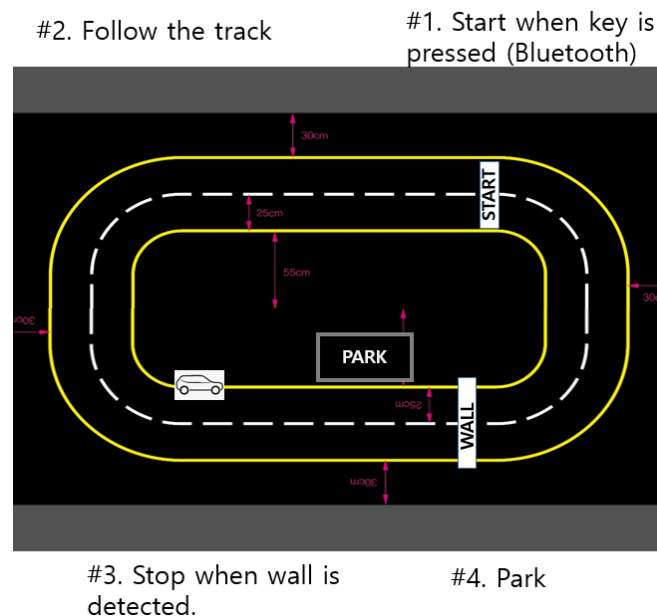
You can use up to total 10 sensor modules.

- e.g. 2 IR sensor and up to 8 ultrasonic distance sensors.
- If you want to use other sensors which was not used in class, you must get permission.
- Other sensors must be low cost, similar or lower price of ultrasonic distance sensor

You can use up to 2 motors(DC motor, RC servo motor or stepper).

If you use less sensors/actuators, you will get more points.

## Driving Scenario



## Mission & Score

Ranking(time):

- 1st: 15pt
- 2nd~3rd: 10pt
- 4~7th: 5pt
- others 0

**Mission #1: Start [10pt]**

- Starts when start button is pressed from keyboard via bluetooth [10pt]

**Mission #2: Lane Tracking [20pt]**

- Follow inner or outer lane [20pt]
- For each departure [-5pt/each]

**Mission #3: Parking [60pt]**

- Stop when wall is found [5pt]
- Parking complete[55pt]
- If it crashes on wall, parking fence [-5pt/crash]
- Parked but wheel touching or outside parking area [-10pt/wheel]

**Others: Sensor number implementation[10pt]**

- Score from 1~10 depending on the number of sensors used

**Timer Setting**

- You may need to use multiple general purpose timers. Follow the guideline for setting timers

| <b>TIMx</b> | <b>Mode</b>                     | <b>Comment</b>                           |
|-------------|---------------------------------|------------------------------------------|
| SysTick     | Periodic interrupt              | System Clock Periodic Event              |
| TIM1        | PWM output                      | DC motor PWM (CH1~CH4) (32-bit)          |
| TIM3        | PWM output                      | Ultrasonic Trigger Pulse / PWM (32-bit)  |
| TIM4, TIM4  | Input capture                   | Ultrasonic Echo / Pulse Capture (16-bit) |
| TIM5        | ADC Trigger                     | Triggering ADC (32-bit)                  |
| TIM9        | Periodic interrupt              | Periodic event                           |
| TIM10       | Time delay/<br>Time measurement | time delay. Measurement in usec unit     |
| TIM11       | Time measurement                | time measurement in millisec             |

**Report Instructions**

- Do not duplicate the program from other website or person
- But, you can refer to technical reports and use the proper citation
- Write a report in the given format. The report should include
  - Introduction
  - Methods
  - Results & Analysis
  - Conclusion
  - Appendix: program code
- Make a movie clip for demonstration. It will be posted on YouTube
- Evaluation will be based on the overall performance of demonstration, algorithm design, and the quality of the report.