CAIRO UNIVERSITY RACING TEAM

Embedded Software Development

Season 2024

CAIRO UNIVERSITY RACING TEAM

Cairo University Racing Team-Formula student

Congratulations!!

Dear applicant,

By taking this task that means that you passed our filtration process. The purpose of this task is to measure your capability of being an Embedded Software Development member for the Cairo University Racing Team.

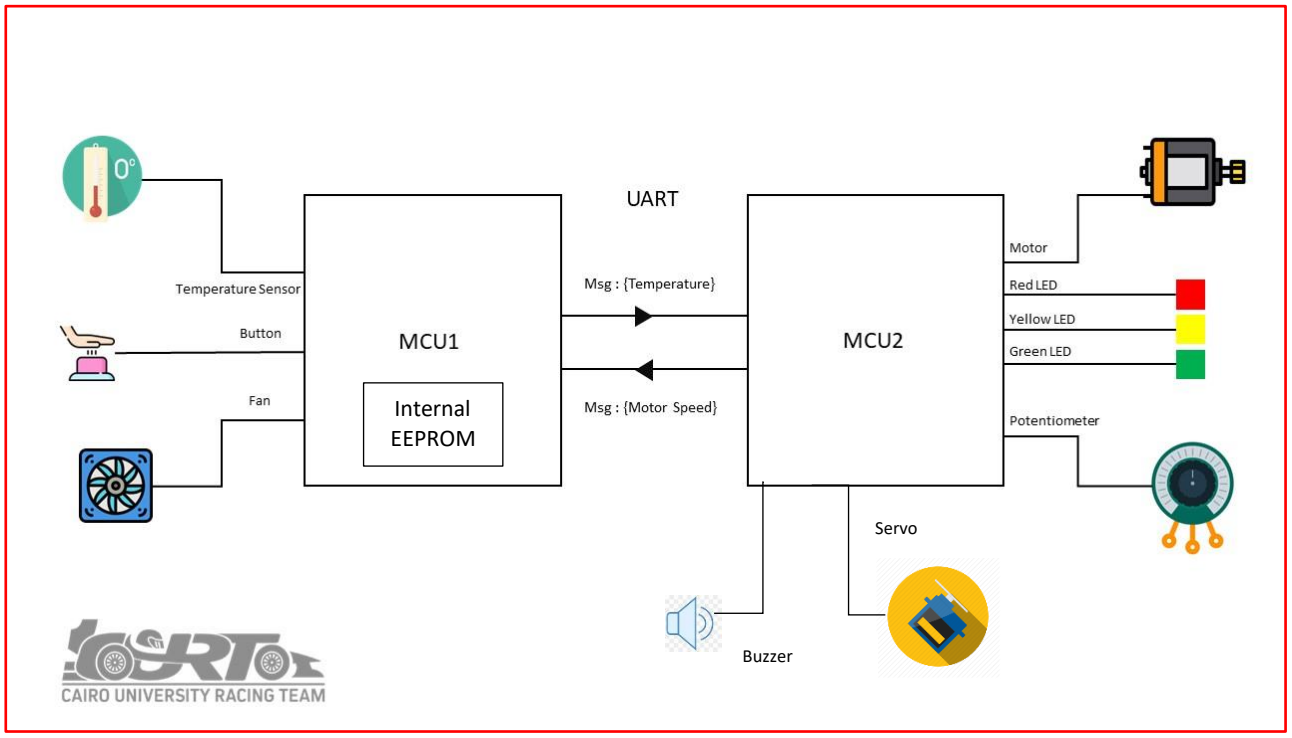
Important Notes:

1. Searching on the internet is **ALLOWED**.
2. Make sure to write any comments about the simulation behavior
3. Try your best, we care about Quality, not Quantity.
4. Code reusability is okay but using a code that you do not fully understand is a **PROBLEM**.
5. For example, if you have never worked with UART, ADC .... etc., just go and learn it then use it in the task and we will appreciate that.
6. **READ REQUIREMENTS CAREFULLY.**

CAIRO UNIVERSITY RACING TEAM

Cairo university Racing Team-Formula student

PART 1: Implementation



PLEASE READ CAREFULLY!!

It's required to implement the system in Figure 1 using **ONLY** AVR microcontroller

System description:

MCU1:

Components: Push Button - Temperature sensor - DC motor (as a fan).

Description:

1. **MCU1** reads the state from E2PROM before reading temperature to act according to it as an abnormal state or not.

2. **MCU1** reads temperature and store state as normal initially in E2PROM then moves the fan (DC motor) with acceptable speed according to states and send temperature to **MCU2** using UART.

3. If the user presses the push button and the temperature is between 40◦C and 50◦C, **MCU1** sends to **MCU2** code as shutting down the machine using UART.

MCU2:

Components: Servo motor - 3 Leds - potentiometer - Dc motor (as machine) - Buzzer.

Description:
1. **MCU2** receives massages using UART from **MCU1** and acts according it.
2. The potentiometer controls the speed of the machine (DC motor).

States:

1) Normal state

- If the temperature is lower than 20◦C, **MCU1** will stop fan and **MCU2** will lighten green led.
- Between 20◦C and 40◦C, the Fan in **MCU1** is moved with speed increasing according to increasing temperature which has max speed at 40◦C and **MCU2** lightens yellow led.
- Between 40◦C and 50◦C, **MCU1** moves the fan with max speed and **MCU2** lights a red LED and stops the machine by pressing the push button.
- Greater than 50◦C, **MCU1** and **MCU2** enter in emergency state.

2) Emergency state:

- Begin counting time.
- **MCU1** moves the fan with max speed.
- **MCU2** lightens red LED and runs buzzer.

3) Abnormal state:
- **MCU1** moves the fan with max speed.
- **MCU2** lighten red LED, open servo with 90 degrees, stop the machine and run the buzzer.

If the emergency state is activated for 7 seconds (you can use the timer with overflow mode to check on temperature 14 times with a period of 500ms) follow the following steps:

1- Write abnormal state in E2PROM.
2- **MCU1** activates the watchdog timer with the smallest time to reset **MCU1**.
3- **MCU2** follow the abnormal condition for 5 seconds.

Consider these corner cases in your video:

1- Show the temperature sensor and fan function using an oscilloscope.
2- Potentiometer and machine function using an oscilloscope.
3- Show the emergency state function.
4- Show push button function.
5- Show normal states.
6- When temperature decreases than 50◦C before 7 seconds show the normal state.

Don't forget to decrease temperature after abnormal state to prevent repetition.

You can use proteus simulation in your video.

Part 2: Deliverables

You should upload to Google Drive a compressed file including the following:

1. Proteus project file (if you used a hardware microcontroller, take a clear picture of the circuit showing all the components).

2. Your code (.c, .h files, and any other included files).

3. A video that demonstrates your project that doesn't exceed 4 minutes.

4. **MAKE SURE TO WRITE CLEAN AND NEAT CODE AS IT WILL REFLECT ON YOUR WORKING PERSONALITY.**

5. **Remember to make the link accessible!**

6. **Submit your task to** curtembeddedsystem60@gmail.com **using <TASK_ESD_2023_YourName> as a subject and write each file aside of the code files with the same format**

THE DEADLINE OF YOUR TASK WILL BE ON SEPTEMBER 2, 2023, AT 11:59 PM

If you have any questions, send an email to curtembeddedsystem60@gmail.com