Cairo Uni Racing Team

Communication & IOT Sub-team

CAIRO UNIVERSITY RACING TEAM

Communications & IOT Task

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 a Communication & IOT team member for the Cairo University Racing Team.

The answers of this task MUST be filled in a formal report; therefore, you first may need to search about how to write formal reports.

Important Notes:

1. Be obvious, no need for too long answers.
2. Searching on the internet is **ALLOWED**.
3. All questions in the second part must be answered.
4. Make your answers show what you understand, too long and informative answers will not help.
5. Try your best, we care about Quality not Quantity.
6. Code reusability is okay but using a code that you do not fully understand is a **PROBLEM**.
7. 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.

PART 1 (Implementation)

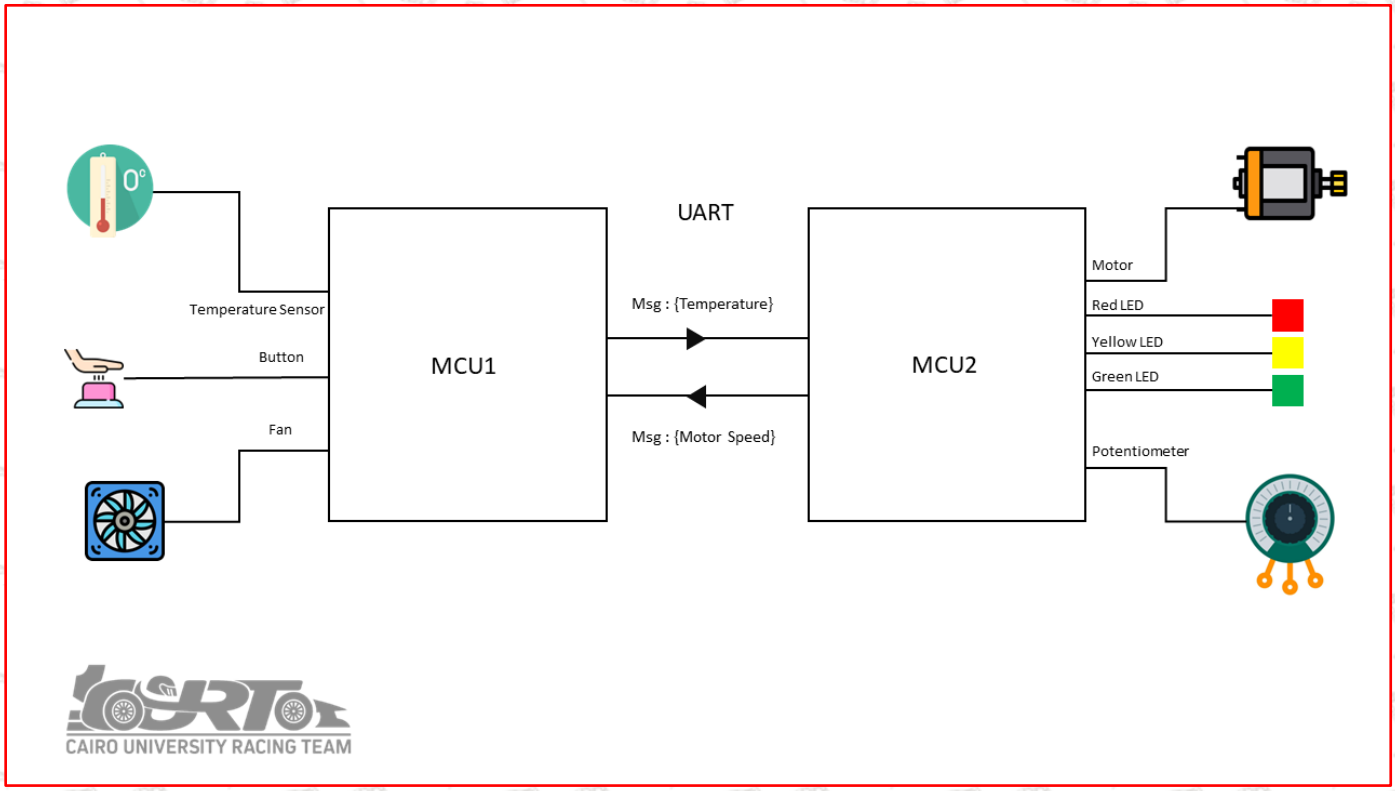

Figure 1 : System

PLEASE READ CAREFULLY!!

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

System description:

MCU1:

Inputs: Push Button – Temperature sensor – UART Message (Motor Speed)

Outputs: UART Message (Temperature) – Fan (DC Motor)

Behavior:

1. **MCU1** reads the temperature and then send it to **MCU2**
2. If The motor speed is greater than 70% the fan will start
3. If The emergency button is down **MCU1** will send a special code (200) to **MCU2** thought UART to start slowing down the motor

MCU2:

Inputs: Potentiometer – UART Message (Temperature)

Outputs: UART Message (Motor Speed) – Motor (DC Motor)

Behavior:

1. **MCU2** sends the motor speed to **MCU1** through UART
2. The Motor speed is controlled by the Potentiometer
3. If the temperature **less than 20 green LED is ON**

   If the temperature **between 20 and 40 Yellow LED is ON**

   If the temperature **larger than 40 Red LED is ON**

   If the temperature is **200** the emergency button is down in **MCU1**

PART 2 (Questions and Research)

- **What is the difference between declaration and definition of a variable (give an Example for each)?**
- **Using the variable p write down some declaration**
  - An integer variable.
  - An array of five integers.
  - A pointer to an integer.
  - An array of ten pointers to integers.
  - A pointer to a pointer to an integer.
  - A pointer to an array of three integers.
  - A pointer to a function that takes a pointer to a character as an argument and returns an integer.
  - An array of five pointers to functions that take an integer argument and return an integer.

  Example: an integer variable → int p.
- **Size of the integer depends on what?**
- **Differentiate between a constant pointer and pointer to a constant (give an Example for each)?**
- **What are the types of pointers and explain each type.**
- **What is a volatile variable in C, and Can we have a volatile pointer?**
- **Write a program swap two numbers without using the third variable (using 2 methods)?**
- **Write a program to print "Hello World" without using semicolon anywhere in the code.**
- **What is the DMA, when we use it and how it works with UART?**
- **What do you know about CAN Protocol and briefly Explain its Format?**
- **Why CAN Is Having 120 Ohms at Each End & What is Can Arbitration?**
- **What do you know about NVIC? (Bonus)**
- **What do you know about AT commands and give a list of commands to connect ESP8266 to WIFI. (Bonus)**
- **What do you know about MQTT & MQTT Broker? (Bonus)**

Deliverables

After finishing both parts, you should upload to google drive a compressed file including:

1. Proteus project file (if you used 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 3 minutes. The link of the google drive folder should be put in your report. **Remember to make the link accessible!**

THE DEADLINE OF YOUR TASK WILL BE ON SEPTEMBER 16, 2022, AT 12PM

If you have any question, send an email to curt.commu.iot.2023@gmail.com with subject **Commu_IOT_Q**

Wish you best of luck ^_^