

Embedded Systems

Team Number:-

34

Team Name:-

Royal Rumble

Team Members:-

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Project Assigned:-

APA+FI+RS

Description:-

___Our project is a parking system not a huge one ofCourse it is just a car with a rain module sensor that turns the servo motor on when it detects rain and we have a 7segment decoder that display the amount of fuel we have and it is detected by water level sensor and it also we have a buzzer to alarm the car about collisions when it goes back to park

Components

- 1-Arduino Uno
- 2-Arduino Mega
- 3- Servo motor
- 4- 3 Ultrasonic Sensors
- 5- LCD Screen
- 6- Radio sensor
- 7-H Bridge
- 8-7 segment Display
- 9- Battery 9 volt
- 10-Water Level Sensors
- 11-4 wheels and motors

Libraries:-

- 1-FREERTOS Library
- 2-wire.h Library
- 3-Servo.h Library
- 4-Adafruit_GFX.h
- 5-TouchScreen.h
- 6- TEA5767 FM Radio Library

4- How we handle inputs and configure outputs:

For Ultrasonic Sensors, a 40 000 Hz ultrasound is produced, which then moves through the air. If the ultrasound strikes an obstacle on its track, it will get reflected back to the module. The travel time and the speed of sound can easily be used to calculate the distance between the module and the obstacle. The module contains those 4 pins: vcc, ground, trig and echo. To generate the ultrasound, the trig pin is set to high, afterwards, its reflection is obtained through the echo pin. The time in microseconds will then be the output of this echo pin, and using $\text{time} = \text{speed}/\text{distance}$ the distance will be calculated. Three ultrasonic sensors were used in our project as follows: back, right, and front.

Water Level sensors are basically used to calibrate the level of liquids. A total of ten exposed copper traces can be found on the sensor, five are power traces, and the other five are sense traces. The sensor has three pins: vcc, gnd, and s. The s pin stands for the signal, it's an analogue output connected to one of Arduino's analogue inputs. A function was made setting the sensor pin to high, also we implemented a function that displays

the liquid level on 7Segment; if the level is higher than lowerthreshold=315 and lower than higherthreshold=400.

LCD screen contains the coming pins: vcc, gnd, write/read pin, and numerous data pins. The screen was connected to the Arduino Uno board.

The servo motor contains three pins. Vcc, gnd, and pwm. The angle of rotation was given to the servo through a wire as a pwm signal.

The buzzer worked as follows, it receives an analogue output according to the position of the obstacle. When the obstacle approaches, the delay between the buzzes decreases resulting in frequent recurring sound.

Lastly, the motor and the wheels are connected to the h-bridge, so the speed and direction can be monitored. The h-bridge contains two inputs and a pwm pin, as well as two inputs for each motor.

Scheduling Algorithm:-

```
Master_RTOS | Arduino 1.8.14 Hourly Build 2020/12/15 11:33
File Edit Sketch Tools Help

Master_RTOS

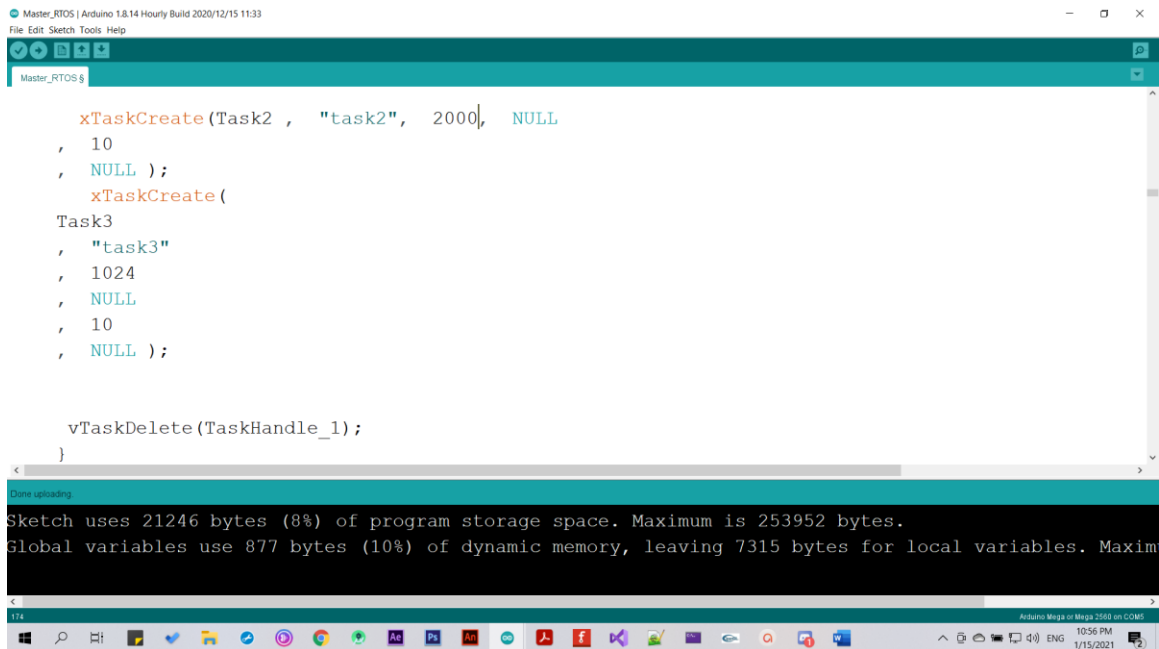
//////////////////////////////////////////RTOS
void Task1( void *pvParameters );
void Task2( void *pvParameters );
void Task3( void *pvParameters );
TaskHandle_t TaskHandle_1;
TaskHandle_t TaskHandle_2;
TaskHandle_t TaskHandle_3;

void setup() {
  Done uploading
  Sketch uses 21246 bytes (8%) of program storage space. Maximum is 253952 bytes.
  Global variables use 877 bytes (10%) of dynamic memory, leaving 7315 bytes for local variables. Maxim
  174
  Arduino Mega or Mega 2560 on COM5
  10:55 PM
  1/15/2021
```

```
Master_RTOS | Arduino 1.8.14 Hourly Build 2020/12/15 11:33
File Edit Sketch Tools Help

Master_RTOS
// digitalWrite(52,HIGH);
// Radio.init();
// Radio.set_frequency(95.4);
xTaskCreate(
  Task1
  , "task1"
  , 500
  , NULL
  , 10
  , &TaskHandle_1 );
vTaskStartScheduler();
}

void loop() {
  Done uploading
  Sketch uses 21246 bytes (8%) of program storage space. Maximum is 253952 bytes.
  Global variables use 877 bytes (10%) of dynamic memory, leaving 7315 bytes for local variables. Maxim
  157 - 148
  Arduino Mega or Mega 2560 on COM5
  10:55 PM
  1/15/2021
```



```
void Task2(void *pvParameters) {

    ////////////////////////////////////7SEG & FUEL SETUP

    pinMode(a, OUTPUT);

    pinMode(b, OUTPUT);

    pinMode(c, OUTPUT);

    pinMode(d, OUTPUT);

    pinMode(e, OUTPUT);

    pinMode(f, OUTPUT);

    pinMode(g, OUTPUT);

    ////////////////////////////////////RAINDROP&SERVO SETUP

    Servo1.attach(servoPin);

    pinMode(rainDrop,INPUT);

    while(1){

        Seg_Fuel();

        raindrop_servo();

        Serial.print("here3");
```

```

        vTaskDelay( 200 / portTICK_PERIOD_MS );
    }
}

void Task3(void *pvParameters) {
    //////////////////////////////////////RADIO SETUP
    pinMode(52, OUTPUT);
    digitalWrite(52,HIGH);
    Radio.init();
    Radio.set_frequency(95.4);
    while(1){
        radio();
        vTaskDelay( 200 / portTICK_PERIOD_MS );
    }
}

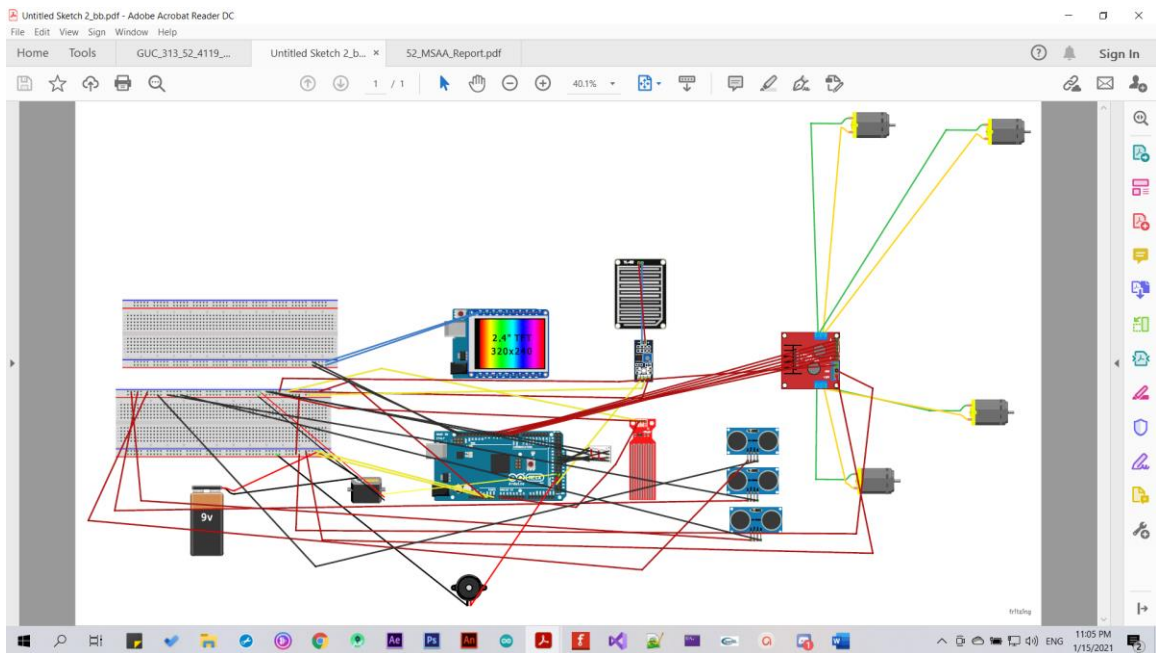
```

We made 3 tasks .First task is the APA only and w created a handler for this task as we can use the handler after we finish parking to delete the first task . When w finished parking we created also the second and the third task .Those two tasks will work in parallel . one task for the radio and the another for the fluids indicators .

Problems and Limits:-

- The touch screen were resetting at the beginning till we attached its reset pin with the reset pin of the Arduino uno .
- We needed more PWM pins to use anther H bridge to move the remaining wheels but we could not so we attached all the wheels to the same H bridge
- the body of the car is too small to carry all the components we have .

Project Circuit:-



How were the tasks divided?!

Mohamed Ayman :

- Display channel
- On/Off

Omar Ashraf:

- Car movement
- Audible Warning

Adham Gamal:-

- Rain detection and windshields

- Fuel Level

Abdel Rahman Mohamed Omar:-

- obstacle Detection

- Change frequency

Mohamed Tarek:-

- Pulse Width Modulation

- Parking