University Category

Task specifications

08th Selona 1573 ABY.

Honorable Jedi Master,

It is with great distress; I inform you that the First Order has captured our chief engineer of the 'Anti-Starkiller-Robot '(ASR) project before the project was finished. The Resistance is again in need of help from the Jedi Order in completing the project and destroying the Starkiller. As the masters of the Force, we believe that only the Jedi can do this task in time. I have attached the plans and documents that our engineer was working on. Please, help us to save the millions of Resistance planets.

May the Force be with you!!!

Princess Leia Organa
Leader of the Resistance

University Category

Stage 1

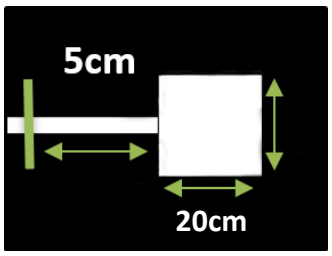
Physical Robot Specifications

In the physical round of the stage 1, you must demonstrate the integration of some of the sensors necessary to carry out the previous task, on an actual robot made by the organizing committee. This document contains detailed descriptions of the demonstrations, the specifications of the robot used and the details of the arena.

- **For the following subtasks, digital read of the Reykha sensor panel is expected from the contestants. We tune the sensor to output 0 for White and 1 for Black.**
- **For each subtask, each team will get two chances to complete it. But the contestant can score only 50% of the marks of each subtask if it was successful in the second attempt. We will do the exact same procedure for the second attempt without changing the code or the hardware.**
- **Please refer to the Solidworks design of the Physical Robot to get an idea about the sensor placement.**

Subtask 1: White Square Detection [5 marks]

The robot will be placed on the green line 5cm away from a white square, facing the square. At the starting position, Caster wheels of the robot will be placed on the green line, so IR sensor panel will not detect it while moving forward.



The line underneath the robot is 3cm wide and the square has 20cm x 20cm dimensions. The objective is to follow the line, enter the square and stop the robot within the square.

Points considered when giving marks: robot being considerably parallel to the line it followed, no part of robot is outside the square or above the black area.

Subtask 2: Color Detection [10 marks]

First, the robot will get a chance to calibrate its color sensor. We will be placing the robot on Red, Green and Blue squares in order. After placing the robot on each square, we will inform it to the robot by pressing the pushbutton. After you are done with calibration for each color, display it on the display. (e.g.: “Red done”) After the calibration phase, the robot will be placed on the R, G, B squares in a random order. After placing the robot, we will press the pushbutton, and you must output the correct color on the display. The evaluation will be done on 5 squares.

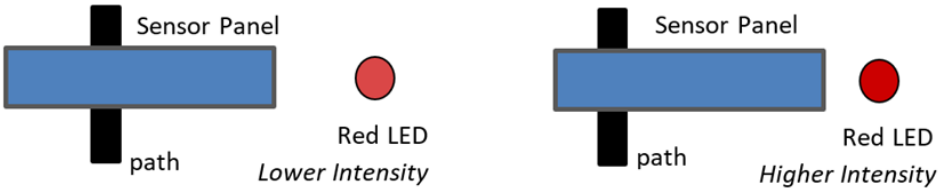
Subtask 3: Pillar Distance Measuring [10 marks]

Here also, the robot first gets to calibrate its distance sensor (a **ToF** sensor). The right bottom ToF of the robot will be used for this purpose. A pillar will be placed 4cm away from the sensor and then at 8cm away from the sensor. At each pillar location we will press the pushbutton to inform the robot that the placing is complete. After the calibration phase, we will place the pillar at random locations (3-15 cm) from the sensor. The robot must measure the distance to the pillar and output the rounded integer value in centimeters, on the display. We will not be pressing the pushbutton here. Instead, we will allow some time after placing the pillar and consider the output on the display for marking.

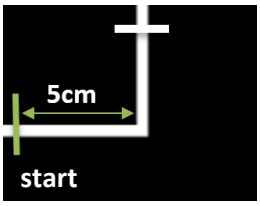
Subtask 4: IR Sensor Panel [10 marks]

The robot is placed above a 3cm wide white line. If the sensor panel has moved towards the right side of the line, the multicolor LED should light up with a shade of red color. If it moves towards the left side, the multicolor LED should light up with a shade of green color. If the sensor is balanced on the line, the LED should be turned off. The intensity of the shade of red or green color used should clearly reflect how much the robot has deviated from the line. Contestants are only expected to use the digital read inputs of the Raykha sensor to decide the deviation and decide the intensity of the shade. Marks will be given for correct color shade and the intensity variation.

We will place the IR sensor panel in different positions and check the color and its intensity.



Subtask 5: 90 Degree Turn [5 marks]

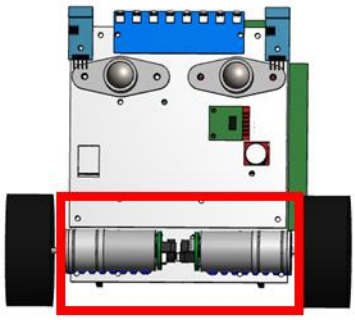


The robot will be placed 5cm away from a 90-degree turn. At the starting position Caster wheels of the robot will be placed on the green line, so IR sensor panel will not detect it while moving forward. The turn can be in either left direction or right direction. The objective is to follow the line, detect the direction and turn the robot accordingly and continue the line following until it reaches the next white cross line.

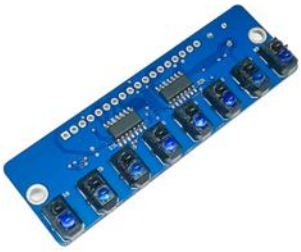
Hardware Specifications of the Robot

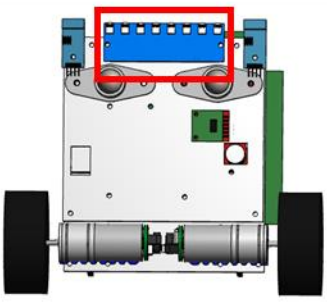
Sensors and Actuators Used

- Encoder motors: Pololu 25D (www.pololu.com/product/22_74)

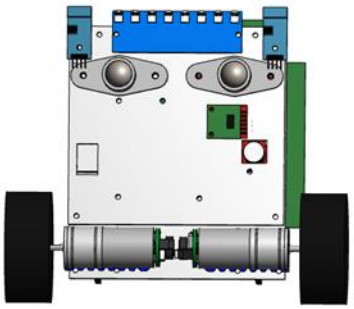


- IR sensor panel: Raykha (https://aptinex.com/product/raykha-s8/)

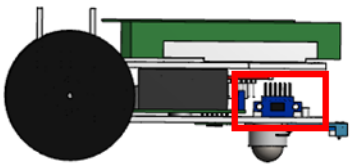




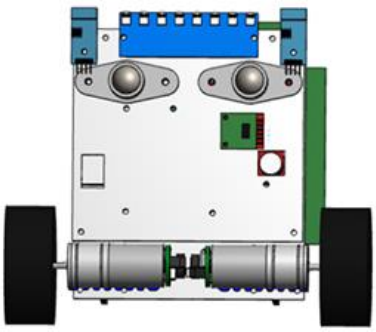
- Corner IR: TCRT 5000



- ToF distance sensors: VL53L0X



- Color sensor: TCS34725 (http://www.adafruit.com/product/1334)



- Motor Control: Dangaya 2.0 (aptinex.com/product/dangaya-2-0/)
- OLED Display: SSD1331

Pin Configuration for the Arduino Mega 2560

Raykha Sensor Panel	
from the left most sensor to the right	**A0, A1, A2, A3, A4, A5, A6, A7**
Corner IR Sensors	
Left	**A8**
Right	**A9**
Dangaya Motor Controller	
Left Motor	
In A	**23**
In B	**25**
Enable	**27**
PWM	**8**
Right Motor	
In A	**29**
In B	**31**
Enable	**33**
PWM	**9**
Encoders	
Left Motor	
En_A	**18**
En_B	**19**
Right Motor	
En_A	**2**
En_B	**3**
Push Button	**6**
Multi Color LED	
R	**46**
G	**44**
ToF Shutdown	**26**
I2C Communication Addresses	
Color Sensor	**0x29**
OLED Display	**0x27**
ToF Sensors	**0x30**

Refer the following schematics to get a clear understanding on component connectivity.

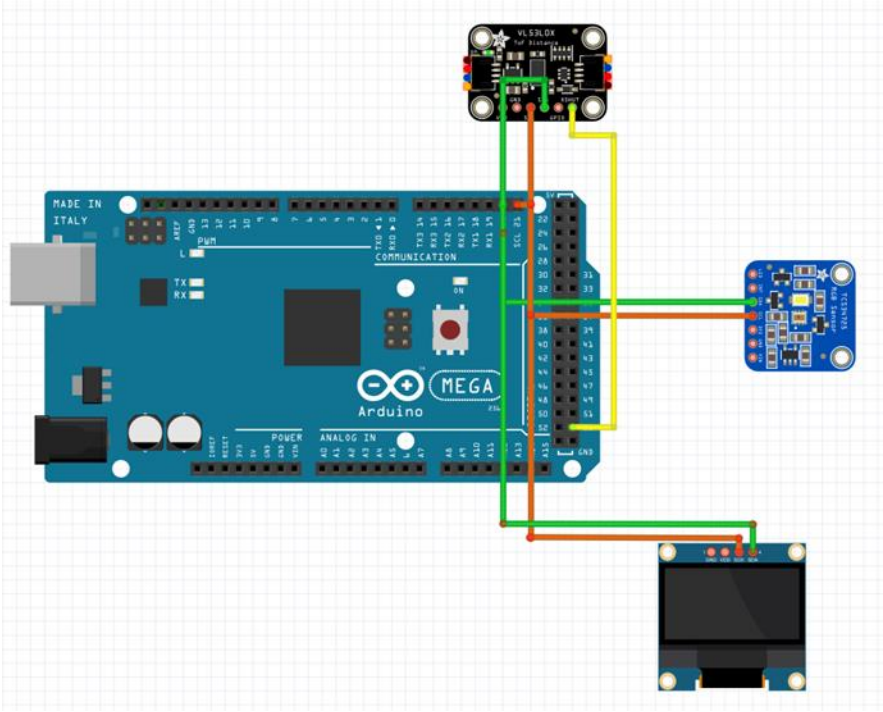


Figure 1 - I2C communication

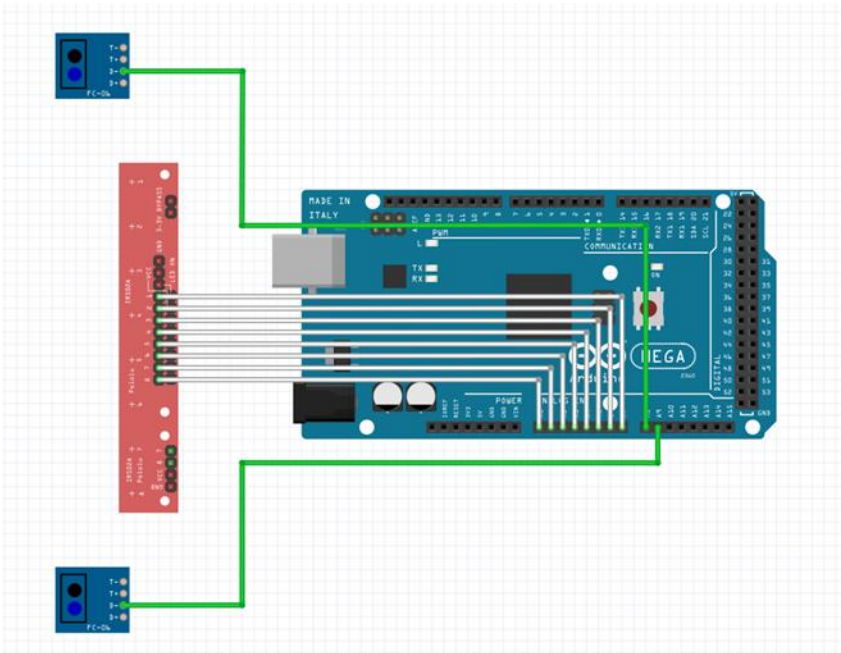


Figure 2 - IR sensor connectivity

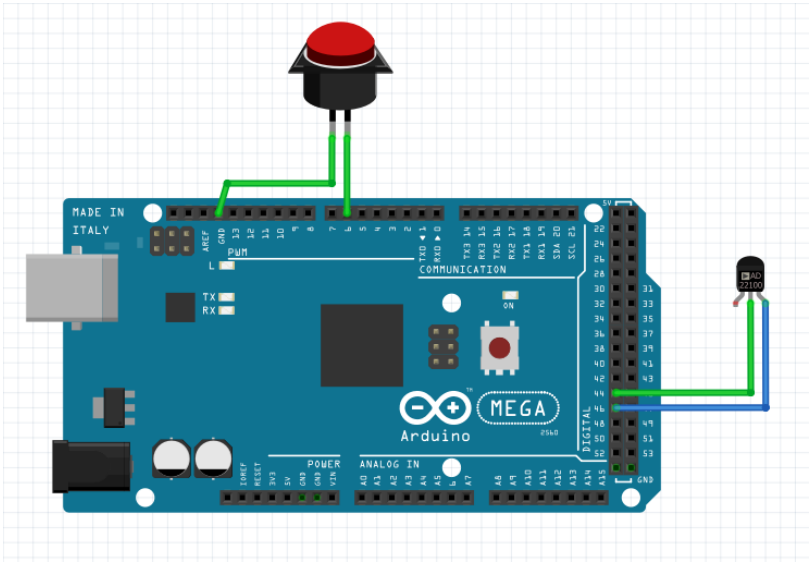


Figure 2 - Push button and the Multi color LED

To get a clear idea about the sensor placement, please refer to the Solidworks file or the 3D pdf provided.

Power Management

The robot is powered using a 11.1V LIPO battery and 9V stepped down supply is used to power the motor controller. Separate 5V stepped down supply is used to power up the sensors.

Testing

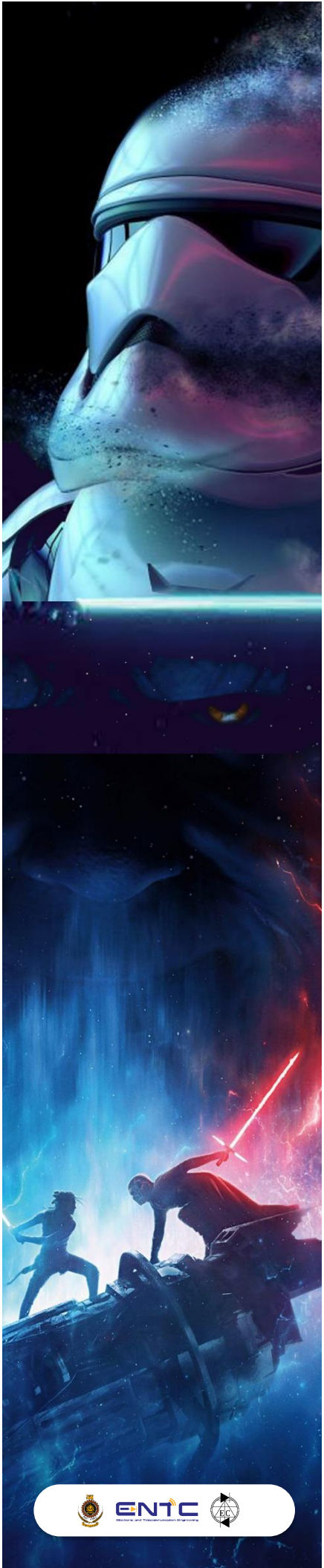
Each team will be given a specific time slot to test their codes prior to the submissions.

Submissions

• Contestants are expected to submit 5 separate files(codes) to perform each subtask. Rename them as "<***Team_name***>_<***Subtask***>". Put these five codes to a folder and Submit one zip folder renaming it with your team's name.

• Contestants are not allowed to change the codes after submitting.

• Provide codes in human readable manner. (Put some comments)



Any further changes will be informed to the team leaders via emails.

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