To the Resistance,

I have found a Sith Wayfinder, and I am heading to the planet Exegol to confront Emperor Palpatine and his new fleet of Star Destroyers. Since there is only one Sith Wayfinder available, you won't be able to find Exegol by your own. I will be leaving clues on the way for you to follow to reach Exegol. I advise you to build a Wayfinder Robot to decode the clues. The Hope of galaxy depends on the efficiency of your Wayfinder Robot. May the Force be with you!!!

Rey.

It is discovered that the evil Emperor Palpatine is still alive and have been building a new fleet of Star Destroyers all these years hiding in the uncharted planet of Exegol. The only way to reach Exegol is by navigating using a Sith Wayfinder. Jedi Rey of the resistance is in possession of the only existing Sith Wayfinder and wishes to lead the resistance freedom fighters to Exegol. She will leave behind several clues in way for the resistance fighters to follow. To reach Exegol in time the resistance must build a Wayfinder Robot, to decode the clues left behind by Rey. As the lead Engineer of the Resistance, your task is to build this Robot. May the Force be with you!

Task description

- The final round will be conducted using Webots R2021a.

- A sample arena will be provided to you with the task document. **You are not provided with a Wayfinder Robot. A simple and basic Wayfinder Robot must be built by the contestants. However, you are provided with a second robot named "Receiver Robot" along with the sample arena.**

- The wayfinder robot must have the following capabilities:
    - Line following and wall following
    - Detecting pillars on the sides of the robot and measuring distance to the pillars.
    - Transmitting (emitting) a signal.

- The wayfinder robot must be placed on the first white square.

- Then the wayfinder robot must continue to follow the white line.

- At every 90-degree junction there will be a pillar to the opposite side of the junction. The pillars can be placed at 13cm, 18cm, or 23cm distances from the center of the white line. When the wayfinder robot detects a pillar, it should print the side the pillar is in along with the distance to the pillar in the format: "Pillar at left side – 18cm", on the console.

- A running sum must be maintained until the end of the task. At the start, its value is zero. At 90-degree turns, if the pillar is on the left side, the distance value should be multiplied by 3, and if it is on the right, the distance value should be multiplied by 5. Then, that value (Distance x (3 or 5)) must be added to the running sum.

- After the wayfinder robot arrives at the second white square, it should measure the distance to the closest pillar and print the side of the closest pillar in the console as "Left side pillar is the closest" or "Right side pillar is the closest". Then, it should perform the same calculation done in 90-degree turns for both sides and accumulate it to the previous running sum.

- Next, the wayfinder robot will arrive at a 'T junction'. Using the readings you obtained at the second white square, you must decide whether to take the shortest path or the longest path. To take the shortest path you must turn to the side where the closest pillar was at the second white square, and vise versa. The shortest path will have a dotted line path which the robot should go along. The longest path will be a continuous white line.

- Next, the wayfinder robot must follow a straight wall followed by a curved wall which are placed on either side. After exiting the wall following area, the wayfinder robot must follow the white line as usual.

- When the wayfinder robot arrives at the final 'T junction' the robot must decide whether to turn right or left. If the final value of the running sum is even, the robot should turn left and if the final value of the running sum is odd, the robot should turn right. If the robot turns right, it will stop at the **Red** square, and if the robot turns left, it will stop at the **Blue** square.

- After the wayfinder robot has stopped either in **Red** or **Blue** square, it should print the color of the square as, "Red" or "Blue" along with the final value of the running sum.
  Example:
    <color> : <value>   that is, Red : 54

- At the same time, the wayfinder robot should transmit the color of the square to the Receiver Robot which is included in the webot world provided to you. The receiver robot has two LEDs named as "led_red" and "led_blue". You must light up the LED which is named after the color of the square the wayfinder robot finally arrived, with the color of the square.

Example:
If the wayfinder robot finally arrived at the red color square, the receiver robot should light up the "led_red" with red color.

For that you must code the controller of the Receiver Robot. You have done a similar task at the qualifying round.
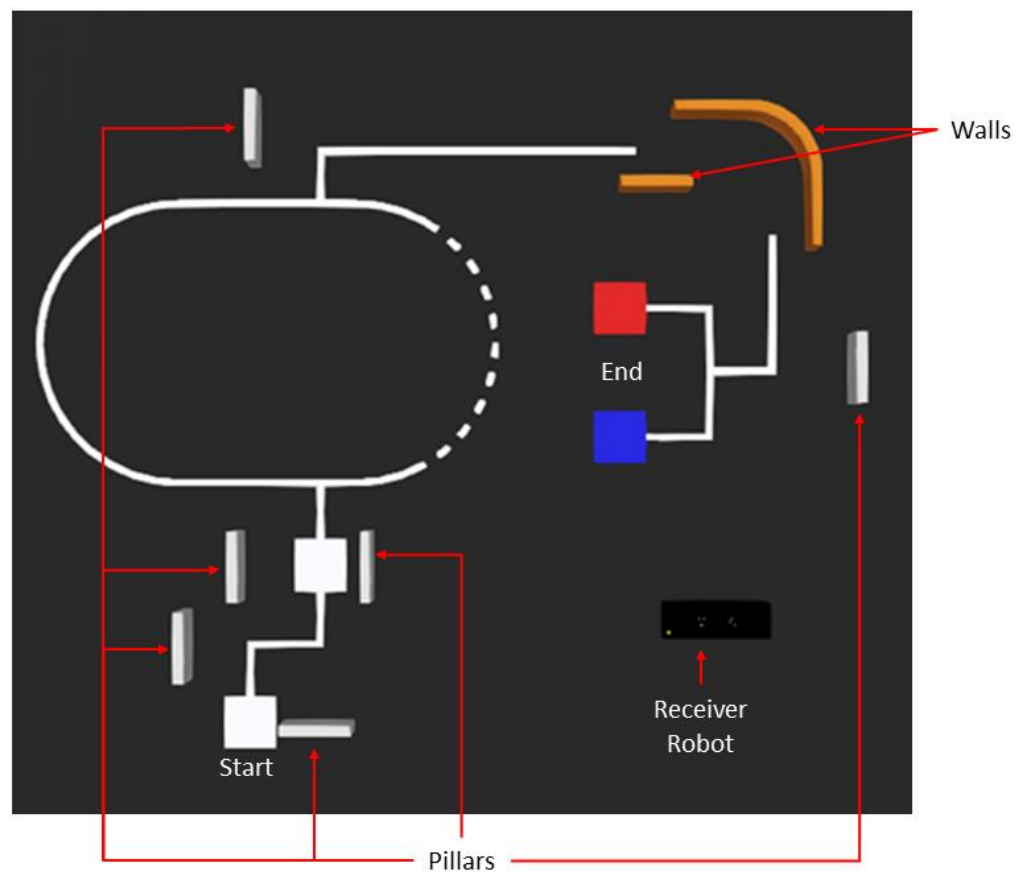
Sample arena

- The full layout.

Fig 1. *Sample arena of the final task. (Note: The placement of the white and colored squares will be the same, but the placement of the pillars, the shape of the walls, and the track of the white lines can be different in the evaluation arena)*
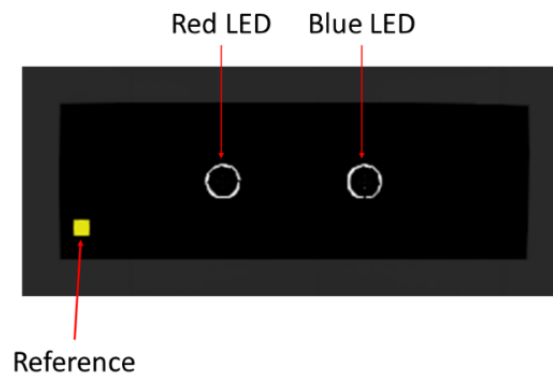
- Receiver robot

Fig 2. *The receiver robot provided to you with the sample arena. The LED closest to the reference is the red LED and the other is the blue LED.*

- All the squares in the arena are 15cm x 15cm.

- All the paths are of 2cm wide.

- When you load the webots world provided to you, it may be missing the two colored squares. To add those two squares, follow the following path in the scene tree:
  Squares Group -> children -> Patch Solid -> children -> Shape -> Mesh -> url
  and select the path to the STL file as,
  SLRC Schools Final – test/STL designs/Square.STL.
  Follow the same method for both squares.
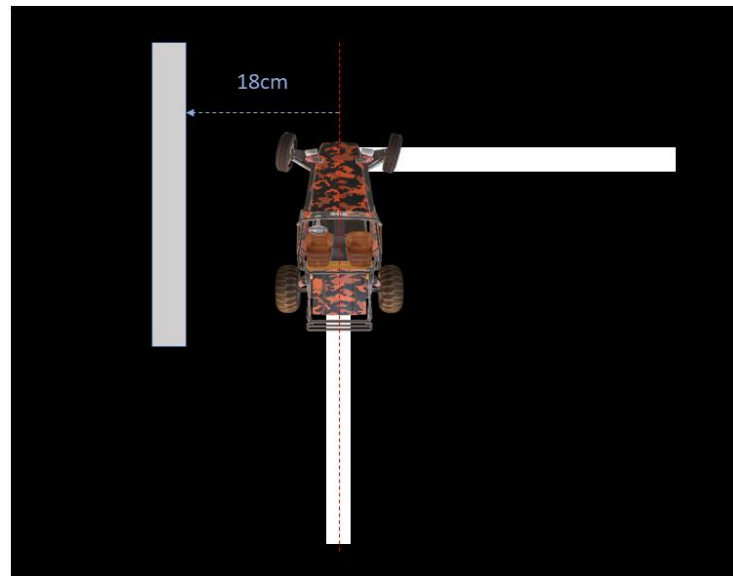
- Sample calculation of a pillar:

Fig 3. *Wayfinder robot arriving at a 90-degree turn*

The pillar is placed at the left side of the robot

The distance to the pillar = 18

The value = 18 x 3 = 54

Restrictions

- The maximum size of the robot is 15cm x 15cm, and the minimum size of the robot is 10cm x 10cm.

- Maximum speed of the robot is 15cms^{-1}.

- You cannot use a camera in your robot.

- Contestants are not allowed to use built-in Proto Robots. Contestants should build their own robots.

- C++ is the only allowed language for coding.

- Each team is given 3 attempts within 20mins to complete the task. Code changes will not be allowed after submission.

Evaluating areas

- Time taken to complete the task.

- Displaying the side and distance to pillar at every 90-degree junction.

- Displaying the closest pillar at the second white square.

- If you choose the shortest path with dotted lines correctly, you will be awarded bonus marks.

- Accuracy and smoothness of line following and wall following.

- Proceeding to the correct colored square.

- Displaying the correct color along with the correct final value of the running sum.

- Lighting the correct LED of the Receiver Robot with the correct color.