MAVeC'19 Autobot Challenge

Overview of the Challenge

Name: TurtleBot3 Autobot Challenge

Platform: TurtleBot3

Description: Autonomous Driving Mission Competition using ROS and TurtleBot3 platform

Introduction

General rule

- o All algorithms should be based on ROS, the Robot Operating System.

- o Robots should operate in autonomous mode.

- o Winning team selected based on mission points.

Mission Configuration

The challenge consists of 4 missions:

i. Traffic Light Section
    - Robot must move and stop according to the traffic light signal.

ii. Parking Section
    - Robot must enter at the designated entrance and stop for a certain time period.

iii. Breaker Bar Section
    - Robot must stop when the bar is closed and pass by when open.

iv. Tunnel Section
    - Robot must enter the tunnel and successfully avoid the obstacles move that were put randomly inside the tunnel.

Mission orders are determined on the game day.

Competition Rules

Evaluation standard

- Each team will have 5 minutes to prepare and a maximum of 5 minutes to accomplish a given mission.

- Each mission will have 2 opportunities and the higher score will be used as the final score.

- The teams will be ranked based on the sum of the Mission, Deduction, and Driving Time Points.

Mission Points

- Mission performance is evaluated based only on success and failure.

- Each mission is 25 points and the total would be 100 points should all missions are successful.

- Each failed missions are 0 points.

Deductions Points

- Once the robots starts, there will be 5 points deduction each time you touch the robot.

Driving Time Points

- The team with the fastest driving time is given the highest score and differentiated by 1 point in chronological order.
  - For example, if there are 15 teams running in this competition, 1st place is 15 points, 2nd place is 14 points, and the team with the slowest driving time will score 1 point.

- However, if the mission is not accomplished within the 5 minute running time, the score is 0 point.

Regulations for Tie Points

- In the event when the sum of Mission, Deduction, and Driving Time Points are tied, the teams will be ranked according to (1) the least Deductions points, and then (2) the highest Driving Time points.

Challenge Procedures

- The game order is determined by drawing lots.

- During the turn, participants place their robot on the starting line and their PC at the specified location.

- The timer will start when referee signal the game starts and the robot may start moving.

- If the robot is unable to accomplish a mission or leaves the driving course, participants can 'Time Out" to manually take care of their robot.

- The "Time Out" period is counted in the 5 minutes game time.

- The success of each mission is determined by the referee.

- If the mission is not accomplished within the 5 minute running time, the game ends.

<u>**Determining Success/Failure of Each Mission**</u>

i.   Traffic Light Section
   - Successful if the robot stops at the red signal and passes through at the green signal.
   - Fails if the robot passes when the signal is not green.

ii.   Parking Section
   - Successful if the robot enters and stop in the designated parking space.
   - Fails if the robot is unable to enter the parking space or leaves the parking space.

iii.   Breaking Bar Section
   - Successful if the robot stops when the bar is down and passes by when it goes up.
   - Fails if the robot runs into the bar or bypasses it.

iv.   Tunnel Section
   - Successful if the robot exits the tunnel.
   - Fails if the robot unable to exit the tunnel.

Robot and System Configuration

All teams must use the TurtleBot3 platform.

Robots must operate in autonomous mode using recognition systems and should not be controlled.

Robots can be customized but must comply with the following exceptions:

- All teams must use the OpenCR controller and Dynamixel actuators.

- To add-on driving devices, only Dynamixels can be used regardless of models.

- There are no limits to the robot's size and weight, but should be built to look like a car and it must be within the range that does not interfere with mission performance.

- Team server must be visible to the audience, except during the tunnel mission.

- Wireless routers and devices must be prepared by each teams.
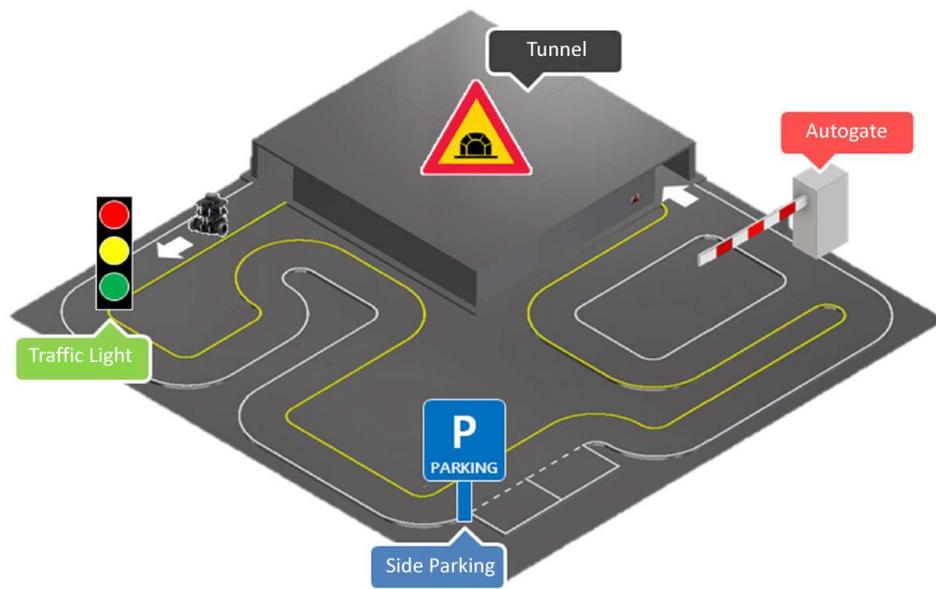
Track Specifications

Size: 4m x 4m
- Mission area size is a 2m x 2m, with 4 mission areas.

Material: Formax

Floor Color: Black
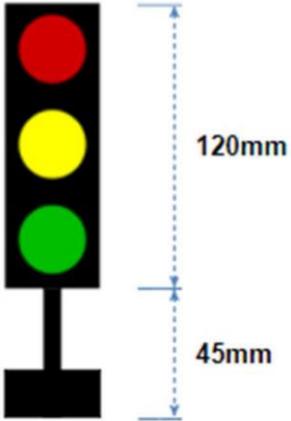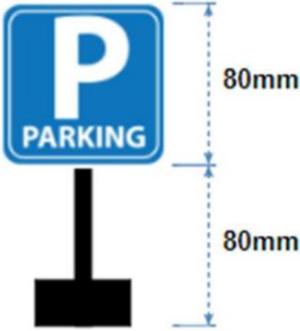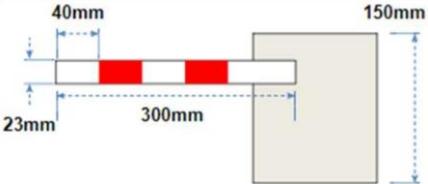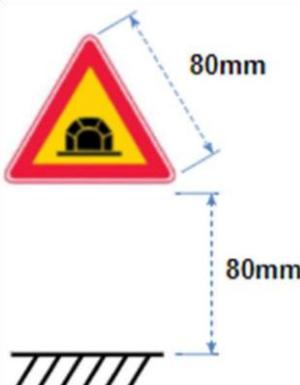
Runway: 2cm higher than the floor
- There are yellow and white lanes 1.5cm thick on both sides of the road.
- Various types of structures and fake signs may be installed in spaces other than the runway.

Stadium Specifications:

Starting line	Parking Area	Breaking Bar Area

Device Specifications:

Traffic Signal	Parking (Mandatory)
120mm 45mm	80mm 80mm
Breaking Bar	**Tunnel Entrance Sign (Mandatory)**
40mm 150mm 23mm 300mm	80mm 80mm