IEEE UAE SECTION

17th IEEE UAE STUDENT DAY, 2023

Common Design Project

Saturday 29th, April 2023

Smart Logistics Robot

General Information

- Undergraduate engineering students within the UAE are eligible for this competition.
- Each institution can submit a maximum of two projects for judging in this competition.
- Each team shall comprise a maximum of 4 members.
- Total cost for each team must be less than 3000 AED.

Project Definition

Design and implement an algorithm for a small logistic robot that will detect, pickup and deliver specific objects to their correct distention. Two colored drop-off zones will be placed along a number of colored objects on a 5x5 matrix as shown in the figure below.

The robot must, autonomously pick up the colored objects and drop them off to the same colored drop-off zone. The robot must follow the black lines that defines the matrix. The robot can be equipped with any robot arm, camera or sensor that will allow it to autonomously do its specific task.

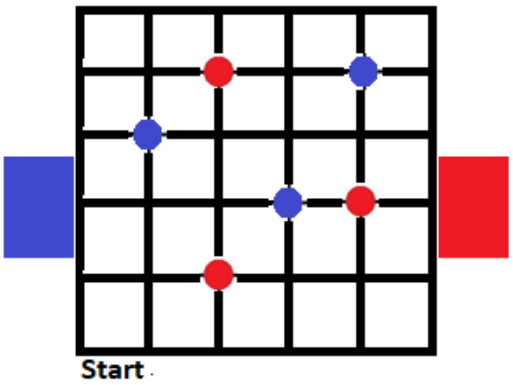

Figure 1

The Robot

The maximum width and length of Robot is 30x30 cm.

Area Specifications

The area have the following specifications:

- The shape of 5x5 square.
- Each square will be defined be an outer black line.
- The black line will be of width 2 cm.
- The outer width of each square is 60cm (meaning the inner width is 60-2=58cm).
- There will be 2 colors **RED** and **BLUE** defining the objects and their respective drop-off zone figure 1.
- The object is cylinder shape of height ≈ 9 – 11 cm, radius 1.5- 2 cm.

Task Specification

Prior to the completion:

- The position of colored object will remain unknown to the teams until running the competition (selected patterns).
- The detection technique of the colored objects and drop-off zones based on camera capturing.
- The teams must run their algorithm to determine the path/s that their robot will take.

Initial condition:

- Each team will start from allocated starting point.
- Position of colored objects are random placed (Total 6 objects).

During running the competition:

- The robot must detect the colored objects using camera.
- The robot must only walk (drive!) of the black lines to reach objects and drop-off zones.
- The robot is allowed to rotate, drive forward, backward and/or go right and left (free movement within the black lines.
- The robot must pick the colored object and then again follow the black lines to reach the same color drop off zone.
- The robot must pick and drop one object at a time.
- Each team will be allowed two adjustments by hand, in case of any failures (going out of line, hitting object…etc.) placing to previous position.
- Each team will have a time frame of 5 minutes to pick up and drop as many object as they can.

Scoring

- The scoring will be first based on the number of correct drop-offs (correct color).
- If tied, the team with less manual adjustment will be the winner.
- If tied with manual adjustment too, the fastest team to finish the task will be the winner.

Estimated Budget:

Item	Estimated Price
Arduino / Raspberry Pi	100/200 AED
Robot Chassis	200 - 500 AED
Camera	300 AED
Robot Arm	300 AED
Servo motors controller Module	100 AED
Battery (power source)	150 AED
Estimated Total	**1,150 – 1,550 AED**

Constrains and Requirements

- The robot must be completely autonomous.
- The motors should not be operated at more than 5v.
- For safety, the robot must be equipped with a “Kill” switch to stop robot if necessary.

Evaluation Criteria

1	**Poster**	10 points
2	**Competition**	
2.1	Each correct drop off.	15 points
2.2	The fastest team (in case of tie)	Extra 10 points
2.3	Each manual adjustment by hand	Negative 10 points
Score		

The score for each team is calculated according to the following formula.

$$\text{Score} = N \times 15 - \frac{T - Tmin}{T_{max} - Tmin} \times 10 - A \times 10$$

N= Number of correct drops.
A= Number of manual adjustment (max 2).
T_{max}= Maximum time (5min).
T_{min} = Minimum time among all teams.
T = Time taken by each team.

- The team with Maximum score at the end WINS!!