20th IEEE UAE STUDENT DAY, 2025

Common Design Project

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.

Project Definition

Design and implement an algorithm for a small logistic robot that will detect, pick up 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 at the same colored drop-off zone. The robot must follow the black lines that define the matrix. The robot **must be** equipped with any robot arm, camera, and sensor that will allow it to do its specific task autonomously.
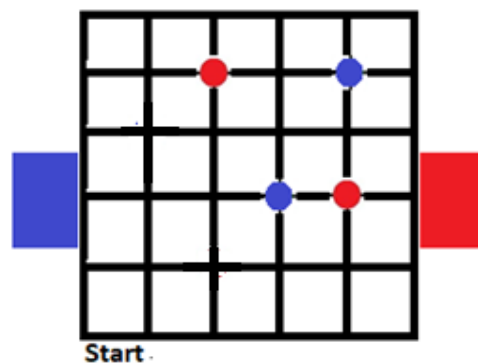

Figure 1

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 of 3-inch cubes shape (Cube Kit - VEX Robotics).

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** Only.
- 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 4 objects).

During running the competition:

- The robot must detect the colored objects using camera Only.
- 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: No budget Constrains

Constraints and Requirements

- The robot must be completely autonomous.
- For safety, the robot must be equipped with a "Kill" switch to stop the 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!!