Two Page Summary

Team Name: Cosmo

1 Overall Strategy

1.1 Sub Task 01

Our robot relies on a precise IR sensor panel comprising eight transmitter and receiver pairs to track a white line on a black surface. The middle two sensors detect the white line, while the other three sensors on the left monitor the left side, and the remaining sensors on the right monitor the right side. Using a PID control algorithm, our robot adjusts motor speeds based on sensor inputs, ensuring smooth navigation back to the white line and we utilize magnetic encoders to navigate 90-degree bend with precise accuracy.

1.2 Sub Task 02

This task is accomplished through the use of Sharp IR sensors. If two sensors at the front side of the bot detect the wall, the bot is gently turned to maintain a consistent distance between the wall and the ultrasonic sensor on the corresponding side of the bot (either left or right based on the detected wall side). This adjustment continues until the bot realigns with the line. The remaining adjustments are handled by the PID control algorithm.

1.3 Sub Task 03

Firstly, unnecessary sensors are turned off to conserve torque. We use a gyroscope to measure the angle, ensuring the robot moves straight on the ramp in the absence of the line. When the robot reaches the top of the ramp, an IR array can detect whether the robot has moved out of the platform, while encoders maintain the straight movement. The algorithm guides the robot to the checkpoint 4 through known bends.

After reaching checkpoint 4, the algorithm detects the T-junction and utilizes predefined distances to navigate to specific locations. i.e., after reaching the T-junction, the robot takes a right turn and moves forward for a known distance with the assistance of IR sensors until it reaches the object. Once the object is within range, the mechanical arm grabs it and pulls back approximately 55 cm before releasing it. Subsequently, the robot moves backward until it detects the junction and then takes a right turn, making necessary adjustments, and continues moving until it reaches checkpoint 5.

1.4 Sub Task 04

We implement a cross-junction detection algorithm to identify cross-junctions, and the robot recognizes boxes using distance sensors. Using a color sensor, the robot can scan and detect colors. Upon returning to the cross-junction, the robot determines a suitable path based on the identified color using the color sensor. We employ a node tree algorithm to traverse through the maze and the robot uses analog IR readings to detect blue and red lines. Traversal stops when the white box is detected. To unload the colored box, the robot moves forward a known distance and then returns to its original position.

1.5 Sub Task 05

The robot is equipped with a sound sensor to trigger the movements. It determines the direction to turn based on a pre-selected color. When a sound is detected using the sound sensor, the robot freezes. Conversely, in the absence of sound, the robot moves forward. Using this approach, the robot takes turns based on bend detection algorithms and continues moving until it reaches checkpoint 7.

1.6 Sub Task 06

The robot will wait at the checkpoint until the guard robot's movements are detected by the distance sensors. It utilizes the trigger time of the two sensors to identify the direction in which the guard robot moved. After detecting that the guard robot moved to the left side, the robot initiates its movements. It continues moving until a junction is encountered, then takes a right turn and moves until it reaches the final destination.

2 Robot Mechanical Design

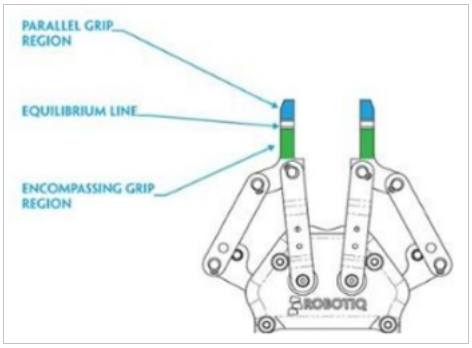

Figure 1: Mechanical Arm

Figure 2: Two Wheel Design and Two Supporting Wheels

3 Task Delegation

- B.Y.N. Basnayake - Mechanical Design, Maze Traversal and Navigation
- M.M.H.H.B. Gallella - Mechanical Arm design and Implementation, Algorithm Development
- H.L.N.B. Haputhanthri - Algorithm Development, PCB design, Battery, and Power Management
- R.M.K.C. Jayathissa - Circuit Implemntation, Algorithm Refinements, Troubleshooting and Debugging
- R.M.L.H. Ratnayake - Sensor Implementation, Simulation, Documentation and Reporting