Hardware Design Document

Innovation and Design Programme

EG2310 Group 10

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iDP Group 10 - Hardware Design Documentation

1. General System Description & Critical Data

1.1 High Level Description of Bot Purpose

The turtlebot will map out the maze thoroughly using LiDAR while running the algorithm to traverse the maze and not hit any walls. A line follower will be used to check any lines which signify the end of a stage and the start of another stage. The functional description are stated below:

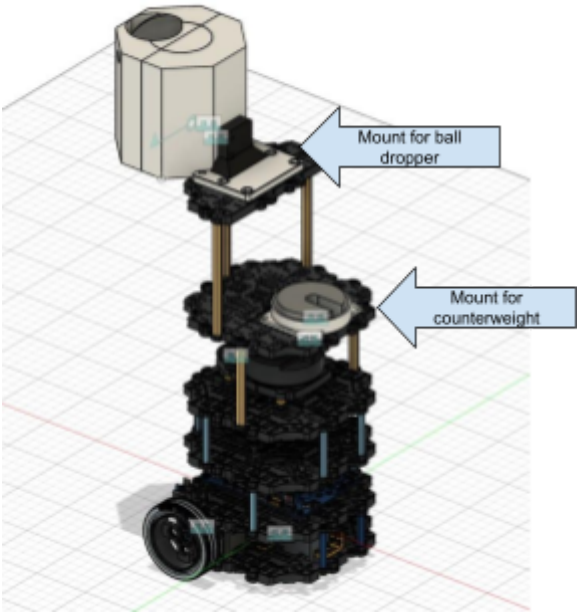
(a) Maze Navigation - Turtlebot is able to navigate and map a randomly generated environment
(b) HTTP calling - The Turtlebot is capable of initiating a HTTP call and receiving information from an ESP32 server
(c) Line Following - The Turtlebot can detect a line and follow its direction
(d) Load Deposit - System is able to deposit its load into a specified container

1.2 Specification Sheet

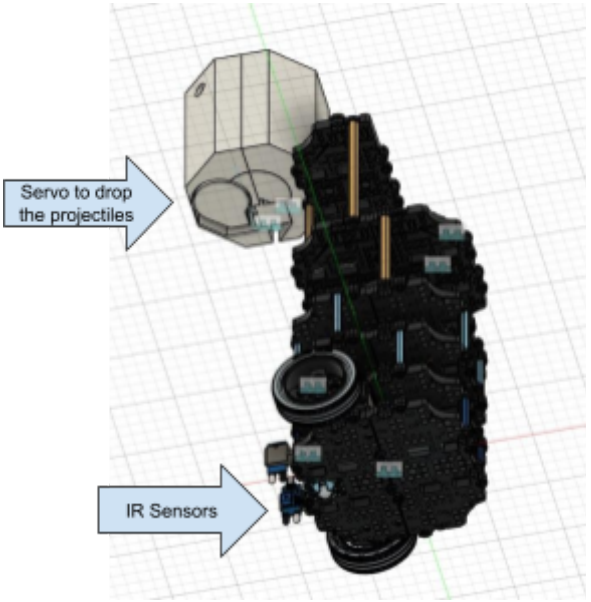
List	**Specifications**	**Remarks**
Dimension	Turtlebot: 13.8 cm x 17.8cm x 19.2 cm With ball dropper: 14.6 cm x 17.8 cm x 43.7 cm	Length x Width x Height
Weight	1 kg	Only turtlebot (from datasheet)
	1.735 kg	With additional attachments and balls
Centre of Gravity	X: 6.16 cm (width) Y: 0.04 cm (length) Z: 6.76 cm (height)	Only turtlebot
	Shown in the 1.3 Turtlebot Subsystem	With additional attachments
Battery capacity	11.1 V, 1800 mAh, 19.98 Wh	
Robot Controller	Open CR 1.0	
Single board computer	Raspberry Pi Model 4B	
Wheel Actuators	2x Dynamixel XL430 - W250	
Servo Motor	1x SG90	
Communication Interface	GPIO pins	

1.3 Turtlebot Subsystem

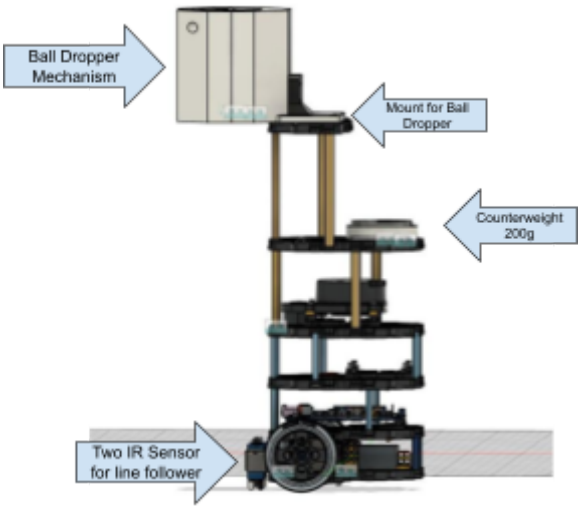
Top View



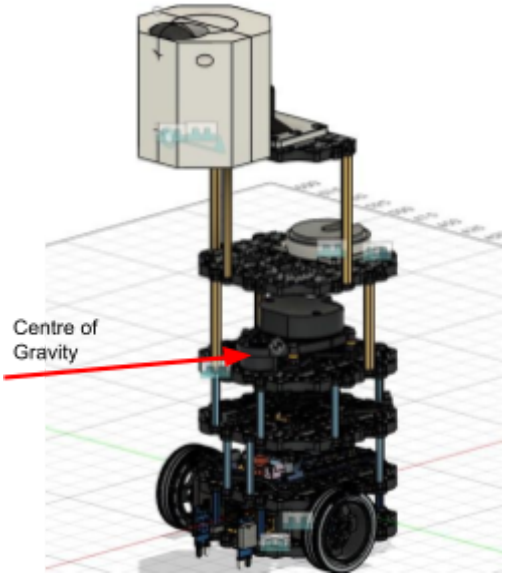
Bottom View



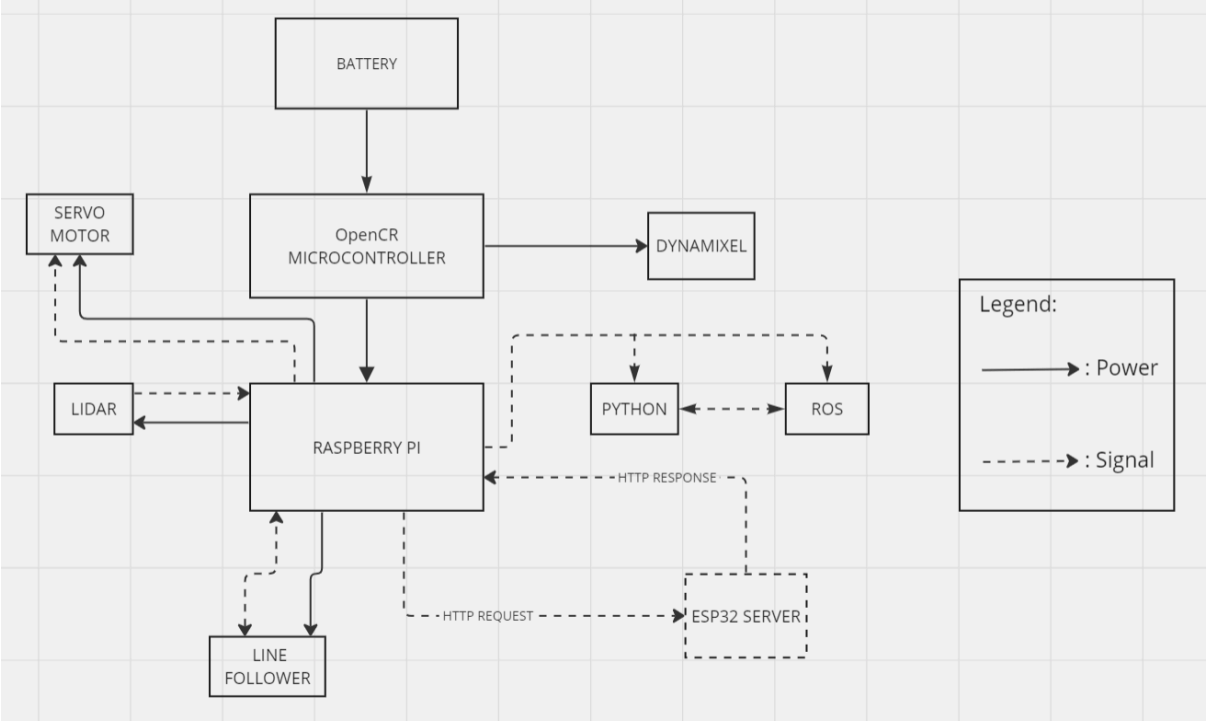
Side View



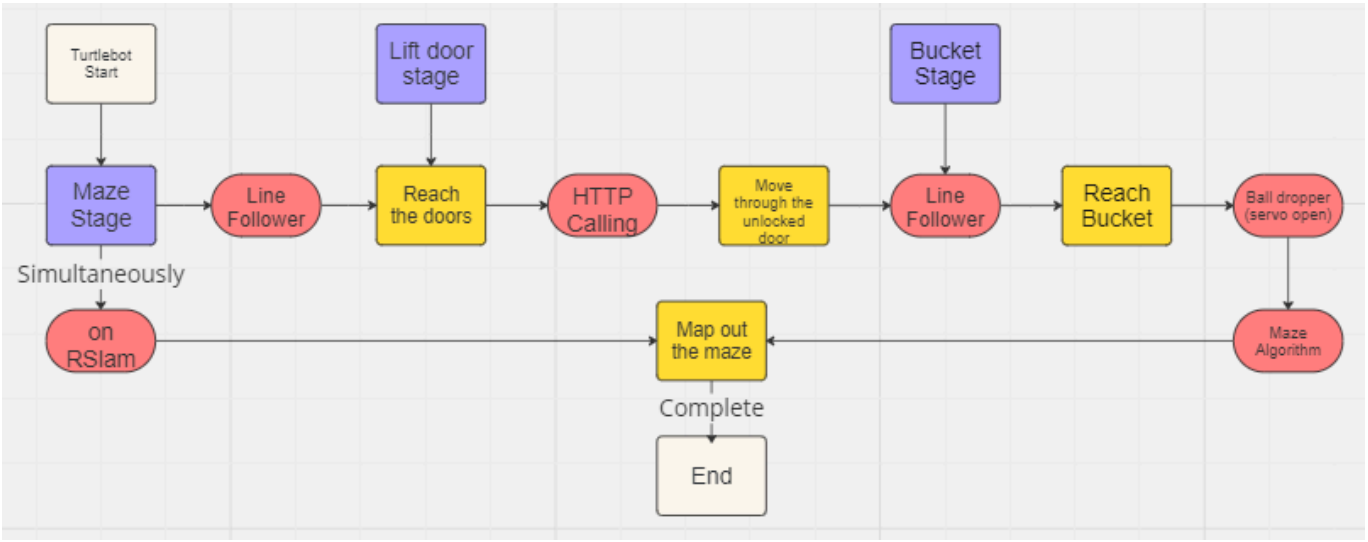
Centre of Gravity



1.4 Interface Diagram (remove DC Motor, bold arrow to servo motor)



2. Technical Guide



Flowchart of Overall System

3. Acceptable Defect Log

Defect	Acceptability Reason
LiDAR blocked by the standoff pillars	LiDAR will still be able to map out the maze
Servo motor may make an oscillating noise	Servo is still able to open and close as planned

4. Factory Acceptance Test

Part	Competence	Observation
Mechanical		
Turtlebot intact	No loose parts	Bot will move with ease and without shaky parts
Ball Dropper Mechanism	Intact, stable attachment	Able to store the ping pong balls without dropping them
LiDAR	Rotates when powered	Environment will be mapped on Rviz
Wheels (Dynamixel)	Able to move and rotate freely	Bot will traverse the maze with steady turnings and movement at any direction
Electrical		
Battery power	Sufficient power, no alerting sound	Robot is able to move through the maze without any alert sound
OpenCR	Able to be powered by the LiPo Battery	Green LED lights up when connected to power source and boot up tune played
Wiring	No loose wires	No wires sticking out and are pinned to their GPIO pins
	All connected to the correct pins	All functions can be executed well when respective code is called
Servo	Able to open and close accordingly when used	No shaky movements from the servo and opens up well
Software		
Raspberry Pi	Able to perform HTTP POST Request	A door number will be shown upon successful request

5. Maintenance and Part Replacement Log

Item	Description	Rectification
IR Sensor	IR Sensor not sensitive enough	Replaced with a new IR Sensor