End User Documentation

Section 1: General Systems Description and Critical Data

Hardware Specifications

	List	Specifications	Notes
Turtlebot	Dimensions (mm) (LxWxH)	Turtlebot3 & Launcher: 293x262x212	
	Weight (kg)	Launcher: 0.924 Turtlebot: 1.51 Counter-weight: 0.2 Total weight: 2.634	
	Wheel Base (mm)	80.66	From center of DYNAMIXEL to the center of ball caster
	DC Motor	2x JGB37-520	
	Servo Motor	2x SG90	
Payload	Dimensions (mm) (LxWxH)	40 x 40 x 40	Ping Pong Ball
	Weight (kg)	Ping Pong: 0.0027 Total: 0.0243	9 Ping Pong Ball
System	Battery Capacity	1800 mAh	
	Expected Operating Time	92.3 min	
	Communication Interface	GPIO,PWM,I2C,UART,USB, TTL, TCP	

Instructions before start of mission

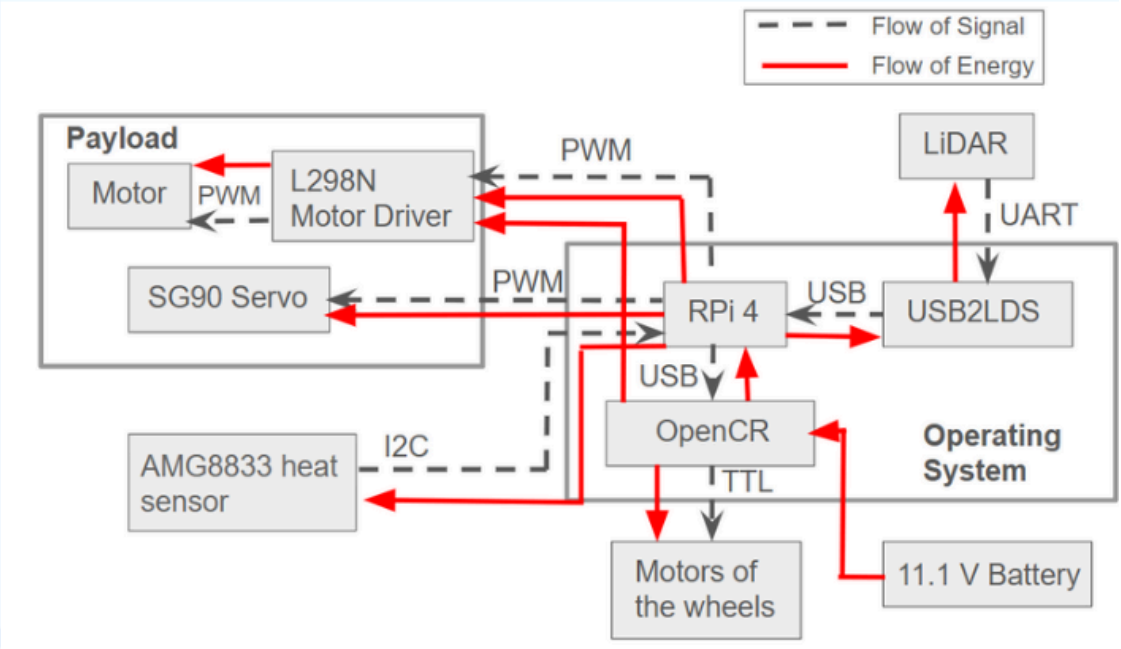
1. Put the balls in the pipe.
2. Set the servo to zero angle by the test code. (Keep the rack away from the pinion during this step).
3. Place the robot inside the maze and run the scripts.

Mission flow

1. The turtlebot navigates through the maze and creates a slam map using lidar points along with frontier exploration.
2. It simultaneously looks for heat sources using the AMG8833 sensor.
3. If the temperature measured exceeds the threshold value, the balls are fired.
4. The above steps are again repeated.

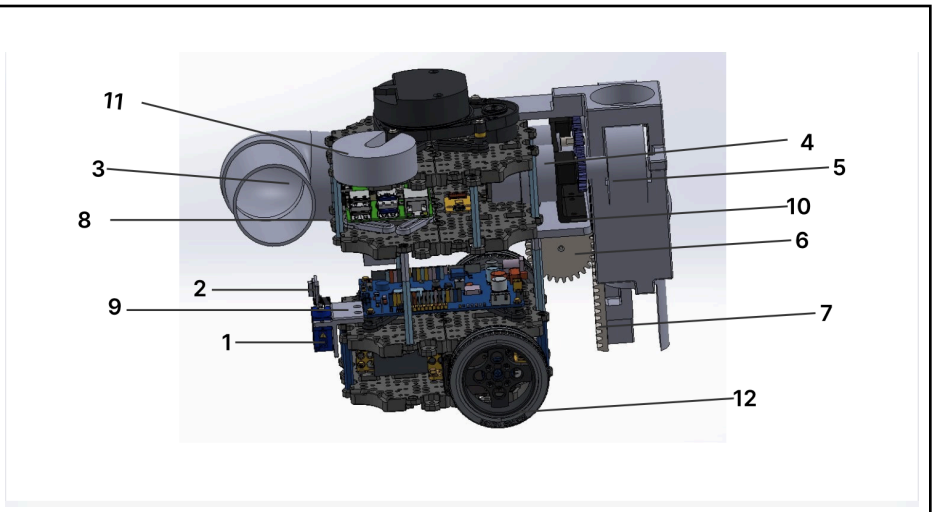
Section 2: Technical Guide

Electronic Architecture Diagram



Mechanical Assembly Instructions

Item No.	Qty	Part Name
1	1	S90 servo for heat sensor
2	1	IR sensor
3	1	Ball holder
4	2	Flywheel motor
5	2	Flywheel
6	1	S90 servo for rack and pinion
7	1	Rack and pinion
8	1	Pipe support



9	1	Sensor servo holder
10	1	Acrylic Holder for Launcher
11	1	Weight
12	1	Turtlebot3 burger

Section 3: Acceptance Defect Log

Defect	Rectification	Defect Classification		
		Critical	Major	Minor
The rubber grip on the flywheels may spoil over a long time.	Replace the rubber grip.			x

Section 4: Factory Acceptance Test

Component	To be checked	Observation
OpenCR	Able to be powered by the LiPo Battery	Green LED lights up when connected to a power source, boot up tune being played
RPi	Able to turn on the RPi when connected to OpenCR	Red light turns on while green light flashes
	Can be connected to from the remote laptop	Terminal returns “Welcome to Ubuntu…” when “ssh ubuntu@<ip-address>” is run on terminal
	RPi is able to connect to the network (Wi-Fi)	RPi appears in the hotspot’s connected devices list
LiDAR	Able to spin and collect data consistently	Environment will be mapped on Rviz with slam toolbox
SG90 (1)	Able to rotate the rack and pinion to feed payload into flywheels	Platform goes up and down launcher tube smoothly
SG90+AMG8833 sensor	Able to scan for the heat sources	The sensor prints an 8x8 array of temperature when the test code is run

JGB37-520 x2 (Flywheel motors)	Able to shoot the ball above the wall	The flywheel shoots the ball when the test code is run.
Wheels	Able to move the bot in all directions freely.	Bot can be controlled properly when running ‘rteleop’
Ball caster	Able to roll in all directions freely.	Bot able to move around in all direction smoothly with ball caster attached
Structural Stability	Structural platforms and components installed correctly	Shake Turtlebot to verify all components are mounted securely
	Verify all fasteners installed and tightened	Verify fastener count are consistent with assembly document

Section 5: Maintenance and Part Replacement Log

Log No.	Defect Date	Qty	Defect Component	Problem Description	Rectification	Close Date
1.	1 April 2024	1	SG90 servo motor	The servo was burnt as it was supplied 5 V instead of 3.3 V	The servo motor was replaced.	1 April 2024