Part I: General System Description and Critical Data

SYSTEM PURPOSE:

Software Block Diagram:

The robot is capable of autonomous maze navigation and mapping of an unseen bounded area within (range) using its LiDAR sensor and (software). It is also able to dock in the presence of NFC tags (range), where it can be loaded with up to 5 ping pong balls and then be prompted to continue on its journey. Finally, it is able to detect a target emitting IR radiation (range), aim towards it and fire the loaded ping pong balls at the target.

Robot Specifications: Hardware Specifications

Robot Name: McTruck

List	Specification	Note
Size (mm)	230 by 175 by 200	L by W by H
Weight (g)	1662.41	
Wheel Base (mm)_	185	
Sensors on board	AMG8833 Thermal Camera Sensor, Inertial Measurement Unit, LiDAR, PN532 NFC Breakout Board	
Battery Capacity	1800mAh	

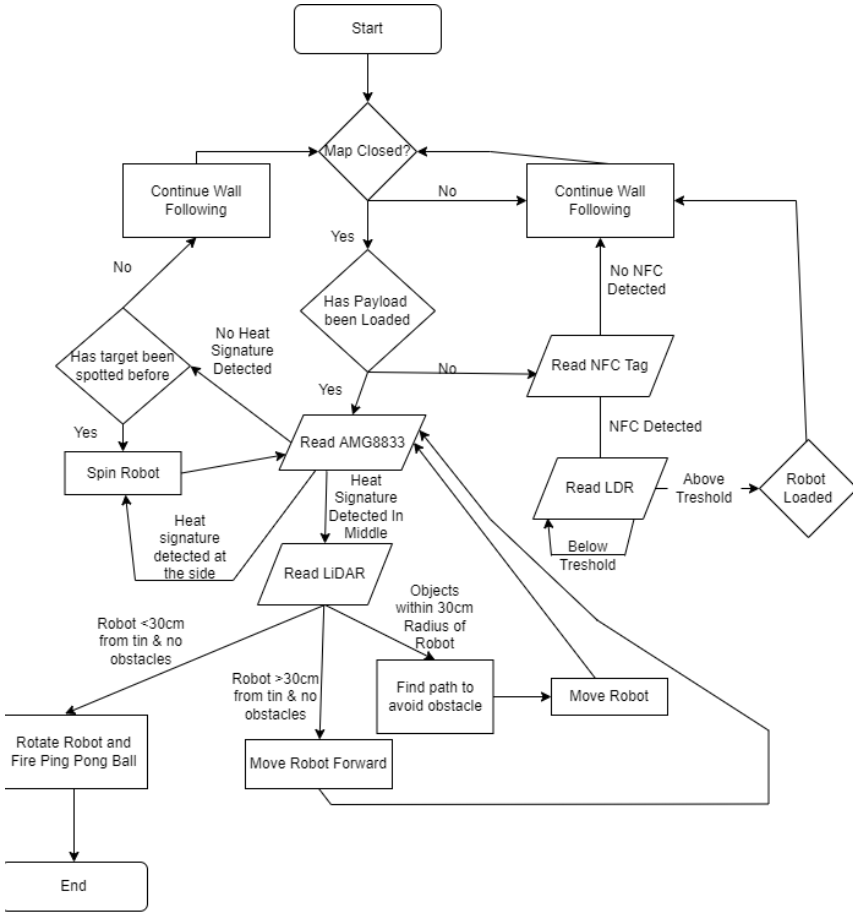
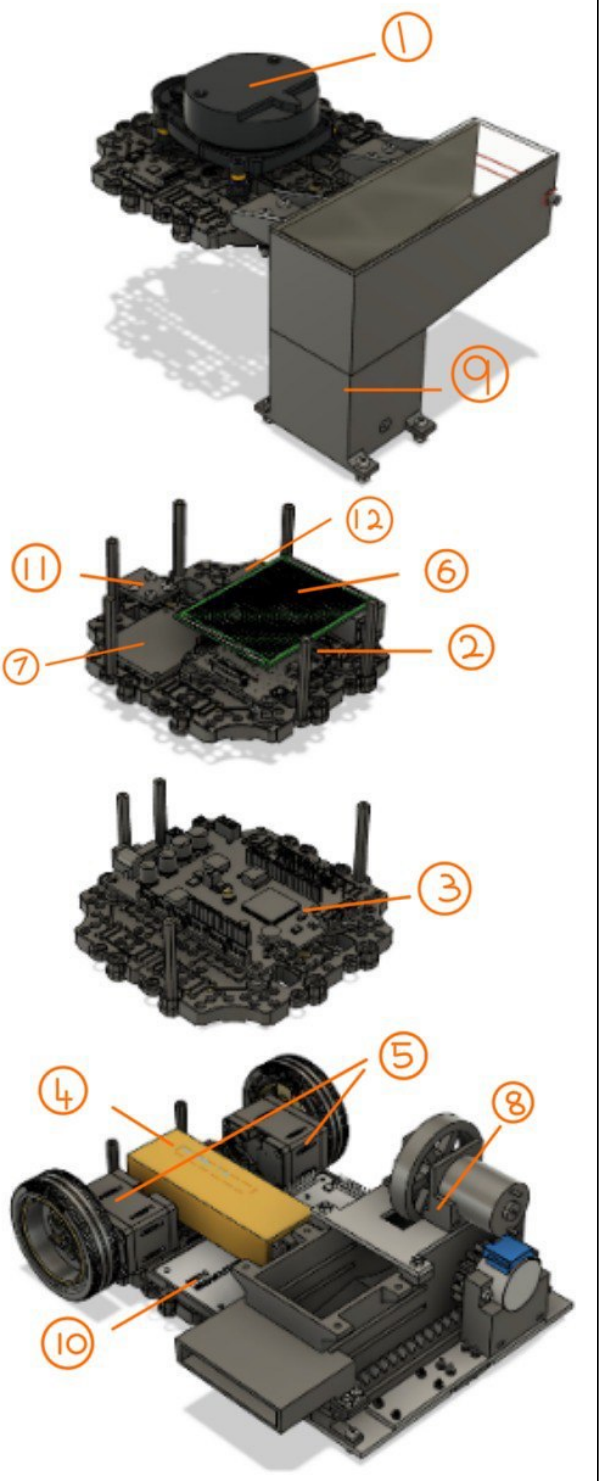


Figure 1: Block Diagram Sample

Part II: Assembly Document

Item	QTY	Description
1	1	LiDAR
2	1	Raspberry Pi
3	1	OpenCR1.0
4	1	Li-Po Battery
5	2	Dynamixel XL430-W250-T
6	1	Protoboard
7	1	Cytron MDD3A DC Motor Driver Board
8	1	Launcher System
9	1	Ball Storage System
10	1	NFC Mount and PN532 NFC Controller Breakout Board
11	1	AMG Mount and AMG
12	1	ULN2003A Breakout Board



Part III: Acceptable Defect Log

Defect Description	Defect Classification		
	Critical	Major	Minor
Supporting material could not be removed completely			X
Misaligned AMG mount holes			X
Printed Slider and Slider Guide is bent lengthwise			X
Battery capacity is lower than expected		X	
Rib for ramp broke			X

Part IV: Factory Acceptance

Subsystem	Description	Procedure	Acceptance Criteria	Results
Software	Start up procedure on laptop is complete	1) Run “rslam” in the command line 2) Run “rteleop” and input “w”	1) An occupancy grid is visible (Walls are marked in black and empty space marked in white) 2) Verify that the robot is moving forward.	
	Start up procedure on RPi is complete	1) Run “rosbu” in command line 2) Run “sudo pigpiod” followed by “ros2 run robot control” in command line	1) Check that “ros2 topic list” displays topic like “ldr”, “nfc”, “thermal”, “odom”	
Mechanical	Nuts and screws are secured tightly	1) Individually tighten each nut and screw with a screwdriver. 2) Gently shake the robot to ensure there are no loose parts	1) Nuts and screws are tightened with a screwdriver to the maximum 2) There should not be any sounds or any parts dropping while the robot travels	
	Sufficient clearance space between moving components	1) Run “flywheel.py” on the Raspberry Pi	1) Verify that the flywheel is able to spin without slowing down (no object should be in contact with the flywheel when spinning)	

			2) Verify that the slider is able to move in a linear motion	
	Sufficient storage space	1) Insert 5 Ping pong balls into the funnel	1) All 5 ping pong balls are able to fit into the funnel without any ping pong ball protruding from the top. Lid can be placed firmly	
Electrical	Wires should be connected securely	1) Check that the connections of the wire are secure 2) No wires ends are exposed 3) Wires and connections should not be bent at 90 degrees or less	Verify the following wires: 1) Wire from Stepper and DC motor should be connected to their respective drivers 2) 6x wires from the Pi HAT should be connected to the supper driver breakout board 3) 3x wires from the Pi HAT should be connected to the DC driver 4) 6x wires from the PI HAT should be connected to the PN532 Breakout Board 5) 4x wires from PI HAT should be connected to the AMG8833	
	Check Battery is functioning within required parameters	Check that battery level is above operational level	1) Using a battery level checker, read voltage level 2) Ensure that voltage level is above 12.3V	
Integration	Check NFC function	Run ‘ros2 topic echo nfc’ and place NFC tag underneath the PN532	1) When NFC tag is underneath PN532, ‘true’ should appear in the terminal, when PN532 is removed ‘false’ should appear in the terminal	
	Check LDR function	Run ‘ros2 topic echo ldr’ and shine a torchlight on the LDR	1) Values on the terminal should increase when the torch light is shone on the LDR	
	Check Thermal Sensor function	Run ‘ros2 run noob_nav r2ultra_nav’ and place the heated object in front	1) A visualisation of the image captured by the sensor will be shown in a matplotlib window	
	Check that launching mechanism is working	Run ‘python3 flywheel.py’ in the ‘~/turtlebot3_ws/src/robot/robot’ directory	1) The robot should be able to feed ping pong balls into the flywheel using the rack	

			and pinion system and the ball should be launch by the flywheel	

Part V: Maintenance and Part Replacement Log

Maintenance and Part Replacement Log

Defect Date	Description	Rectification	Close Date
20 March 22	NFC HOLDER MOUNTING HOLE DISTORTED	REPRINTED NFC HOLDER	20 March 22
20 March 22	UNABLE TO REMOVE DC MOTOR MOUNT SUPPORT STRUCTURE AND SCREW HOLE TOO SMALL	REPRINTED DC MOTOR MOUNT	22 March 22
24 March 22	SLIDER HOLES OF RAMP TOO SMALL	FILE AND CUT AWAY ADDITIONAL PARTS	24 March 22
24 March 22	SLIDER HOLES OF RAMP MELTED FROM DREMEL	FILE AND CUT AWAY MELTED PARTS	24 March 22
24 March 22	SCREW HOLES PRINTED SMALLER THAN DESIGNED	HOLES MADE LARGER USING MANUAL HAND DRILLS	29 March 22
25 March 22	SLIDER MOUNTING POINT BROKE	SUPER GLUE AND SCREW BACK	26 March 22
29 March 22	LIDAR UNABLE TO BE POWERED	REPLACED LIDAR	29 March 22
31 March 22	FLYWHEEL RIM DETACHED FROM SPOKES	REPLACED WITH ADDITIONAL FLYWHEEL	31 March 22
4 April 22	LIDAR UNABLE TO RECEIVE DATA	REPLACED LIDAR	4 April 22
6 April 22	FLYWHEEL BROKE	ATTACH NEW FLYWHEEL AND ANTI-SLIP MAT	7 April 22
12 April 22	SCREWS UNDER ROBOT CATCHING ONTO ELEMENTS OF MAZE	INVERT SCREW SUCH THAT SCREW HEAD IS ON THE UNDERSIDE OF THE ROBOT	12 April 22