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1-Title Page:

SANDSTORM Team No# 1583 We are team Sandstorm in the WRO Future Engineers 2025 competition and we'd like to represent a robot that we will hopefully reach the highest positions with so we may represent our proud country globally.

Team members: 1- Abdulaziz Al-Nujaidi 2- Abdulaziz Al-Hussaini

Coach: Abdelrahman Fatouh

Team logo



Team Photo



2-Vehicle Design:

v1.0 Design:

About The v1.0 Robot Design

We modified the RN AI robot chassis to suit our ideas, using ultrasonic sensors and adding LCD for debugging and changed the servo motor to a metal gear for better steering accuracy. We also added an MPU sensor for tracking the YAW axis of the robot and use it to count the laps. For obstacle detection we used a pixy cam instead of a husky lens since it has image calibration and is proving much more efficiency in the game field.

Feedback:

- ultrasonic sensor is bad to work with
- Chassis is very bad and has a bad mechanism for the wheels and steering

Characteristics:

Dimensions:

Height: 19 cm

Width: 16 cm

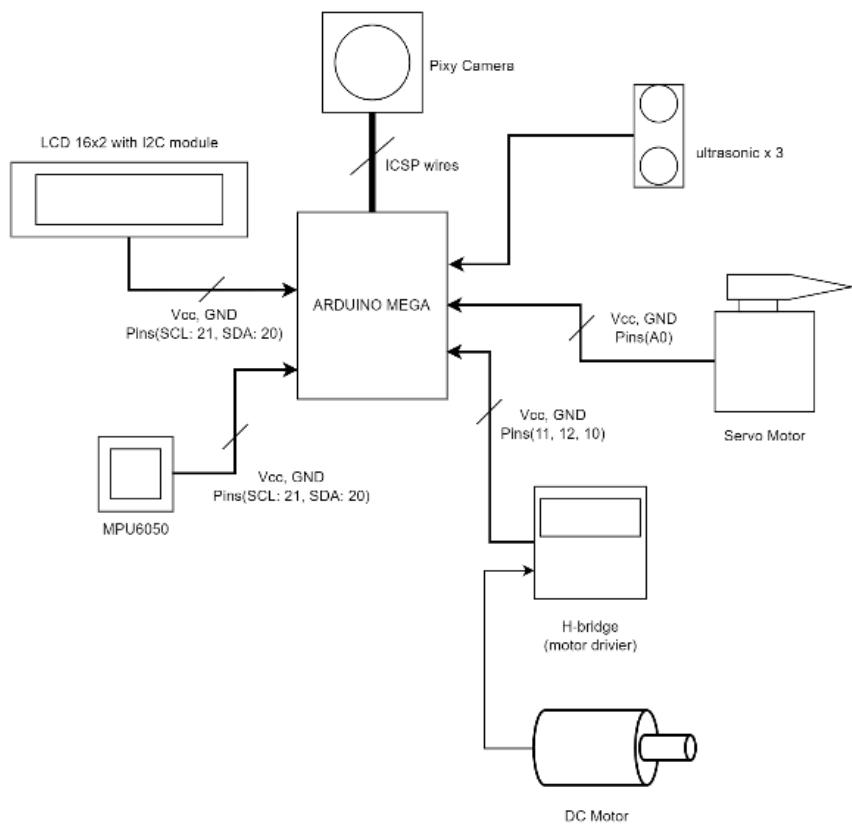
Length: 20 cm

Weight: 1030g

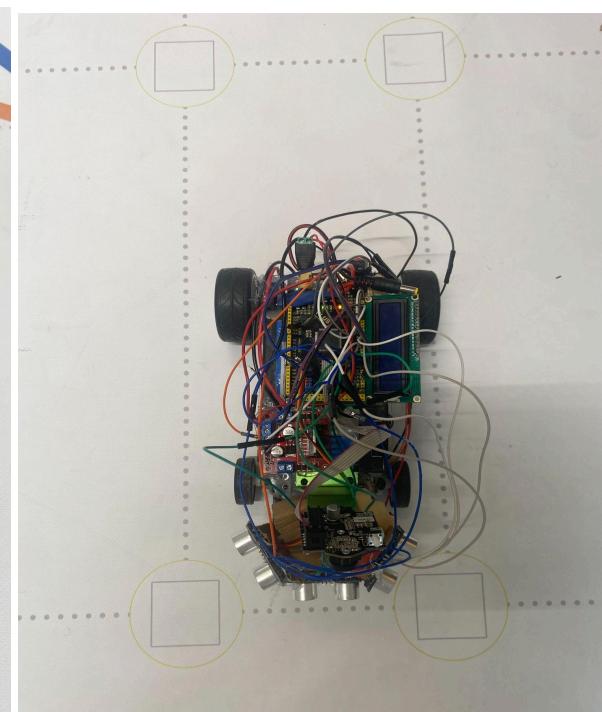
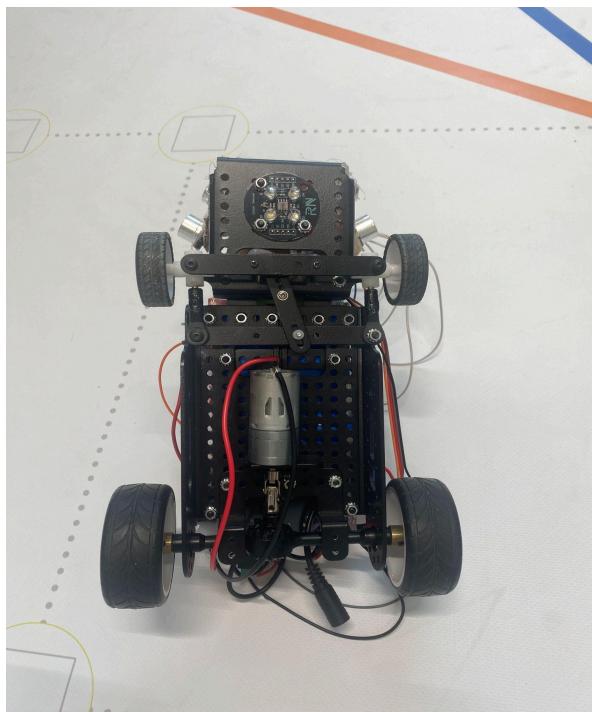
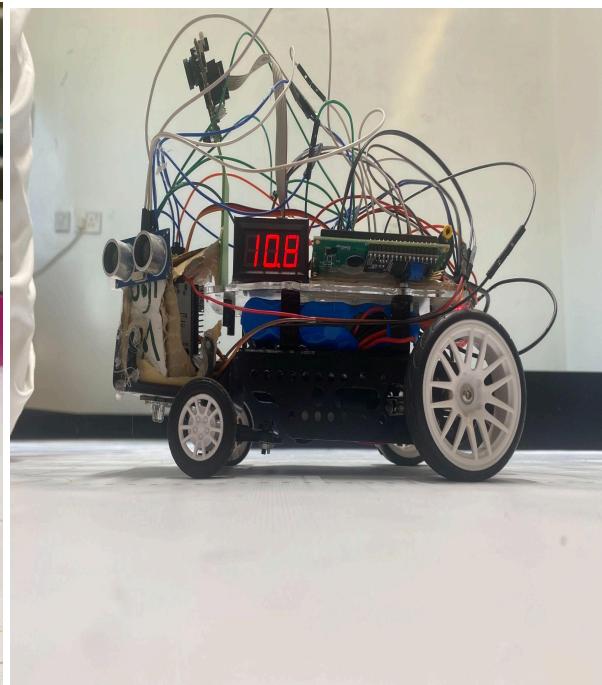
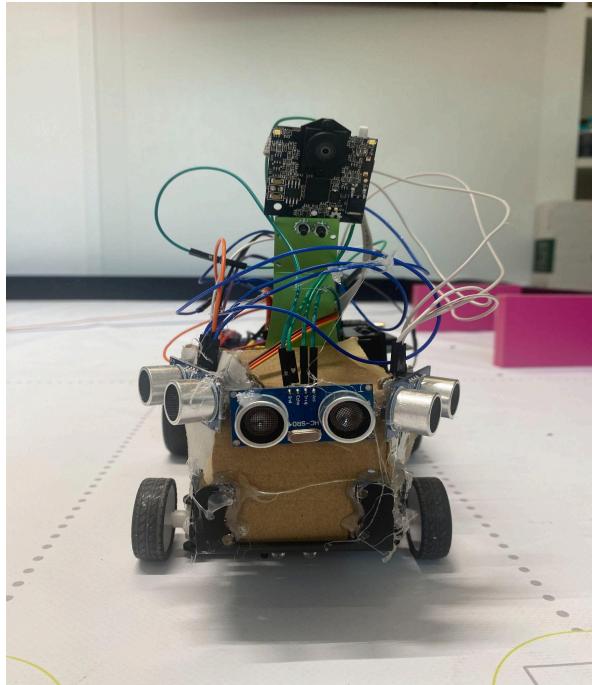
Bill Of Materials:

Object:	Price:
2 Big Back wheels	5 SAR
Battery	150 SAR
IMU	20 SAR
Pixy	400 SAR
H bridge	20 SAR
Structure	300 SAR
DC Motor	50 SAR
3 ultrasonic	10 sar per sensor
Kit of wires	20 SAR
LCD display	35 SAR
2 small front wheels	5 SAR
Arduino mega	120 SAR
Servo	25 SAR
Voltmeter	15 SAR
Total amount:	1195 SAR

The Circuit Diagram



Robot photos



v2.0 Design:

About The v2.0 Robot Design:

We have built this design from scratch, we've used a Creality K1 Max 3D printer to print the whole structure by PLA +, a Raspberry pi 5 for its high capabilities and its high image processing, got rid of the ultrasonic sensors and used a webcam instead of pixy for more accurate and efficient obstacle detection, and like the previous design we've added an MPU sensor for tracking the YAW axis of the robot and use it to count the labs.

Characteristics:

Dimensions:

Height: 17 Cm

Width: 11 Cm

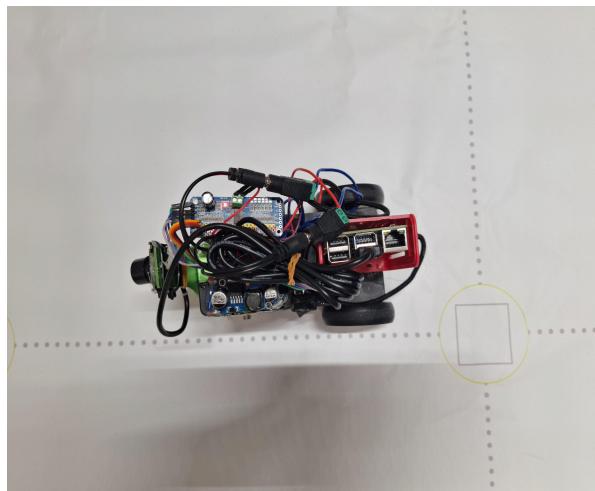
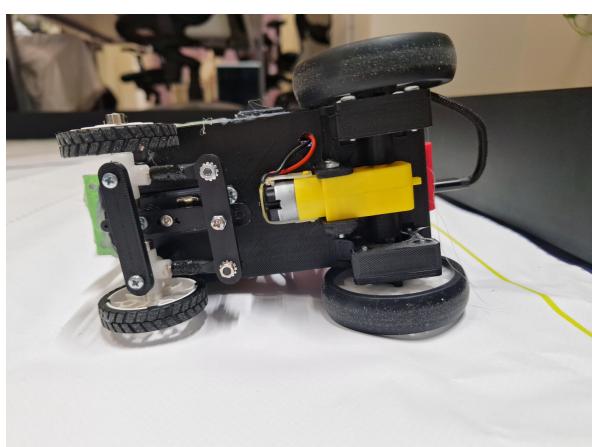
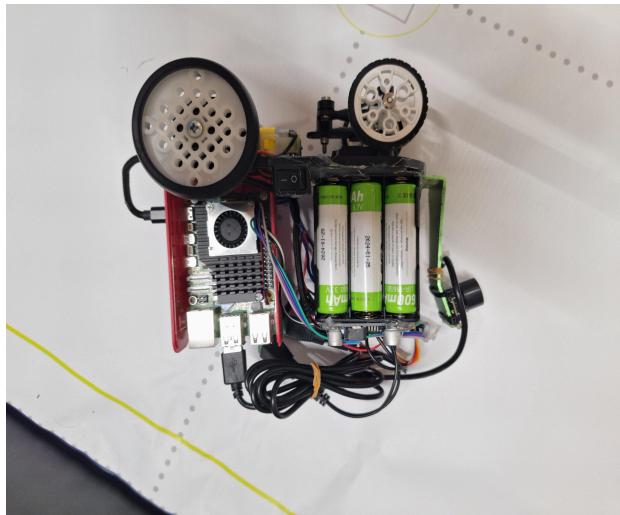
Length: 16 Cm

Weight: 911 g

Bill Of Materials:

Object:	Number of pieces:	Price Per Piece:	Total price:
Pla+	500 gram	100 SAR Per Kilo	50 SAR
Small Front Wheels	2	3 SAR	6 SAR
Big Back Wheels	2	5 SAR	10 SAR
IMU	1	10 SAR	10 SAR
Dc motor: 6v, Tshape	1	10 SAR	10 SAR
Servo motor: mg995	1	20 SAR	20 SAR
Lithium Batteries	6	20 SAR	120 SAR
Raspberry pi 5	1	450 SAR	450 SAR
Step Down transformer: DC	1	10 SAR	10 SAR
Hbridge: L298N	1	20 SAR	20 SAR
Battery Case	2	3 SAR	6 SAR
Screw & Nut Kit:	1	30 SAR	30 SAR
WebCam	1	100 SAR	100 SAR
Servo Driver	1	25 SAR	25 SAR
Kit of Wires	1	10 SAR	10 SAR
Total amount:			877 SAR

Robot Photos:



3-Technical Documentation:

Activity Log:

Date	Description
Week 1	Introduction to WRO, how the challenges work, rules and basis
Week 2	Arduino coding, Learning about sensors and buttons
Week 3	Working on the robot, learning by application
Week 4	Built the first prototype, used it for the city qualifying stage
Week 5	Working on the robot used for the national qualifying stage

4-Testing and Performance Analysis:

v1.0 Design Analysis:

Obstacle Challenge:

Lap time: 55s

Completing 3 laps journey: We had a bit of struggle in completing the obstacle challenge since it was hard to minimize the error in color detection and we had about 20-30 failed attempts until we finally completed the 3 laps successfully.

Open Challenge:

Lap time: 31s

Completing 3 laps journey: Although the open challenge was easier than the obstacle, we had to focus on the speed and the accurate rotation of the robot to minimize collisions with the walls of the field and we used pixy lens cam and ultrasonic sensors for obstacle detection.

v2.0 Design Analysis:

Obstacle Challenge:

Lap time: 1 minute 07s

Completing 3 laps journey: This time our vehicle design was much better in success rate and speed of finishing the challenge due to the applied improvements, however we still faced some difficulty in color detection due to surfaces reflection and light color and intensity in the room and we had about 10-20 failed attempts.

Open Challenge:

Lap time: 58s

Completing 3 laps journey: to improve the open challenge performance we decreased the size of the robot for sharper turns, hence increasing accuracy and precision of the challenge. And replaced ultrasonic sensors and pixy with a webcam for more accurate color detection.

5- Demonstrations Of The Robot Performance:

v1.0 Open Challenge:



v1.0 Obstacle Challenge:



v2.0 Open Challenge:



