

Pick-and-Place Robot

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Introduction

Automation is creating a revolution in the present industrial sector. According to the International Federation of Robotics (2020), the manufacturing sector accounts for 39% of global robot installations. Robots provide a substitute for human labour. So, the robot has been designed to do two tasks: assembly and material handling, which increase technology usage. It draws attention to the advantages, which include improved production, cost savings, safety, and efficiency.

Methods

Hardware:

1.Mechanical:

- Body Material: Acrylic plastic
- Structure: Three compartments for housing components - one for the microprocessor, one for electrical components, and one for the robotic arm.
- Robotic Arm: 3D printed using PETG plastic, with four degrees of freedom.

2.Electrical and Electronics:

- Microprocessor: Arduino UNO R3
- Motors:
 - 4 DC Motors for general movement.
 - 4 Servo Motors for the robotic arm.
- Sensors:
 - 2 IR Sensors for line detection.
 - 1 Ultrasonic Sensor for object detection.

Software:

Arduino IDE:

- Used for programming, compiling, and uploading code to the Arduino UNO R3 microprocessor.
- Facilitates the integration of commands to control the electrical components and motor movements based on the provided code.

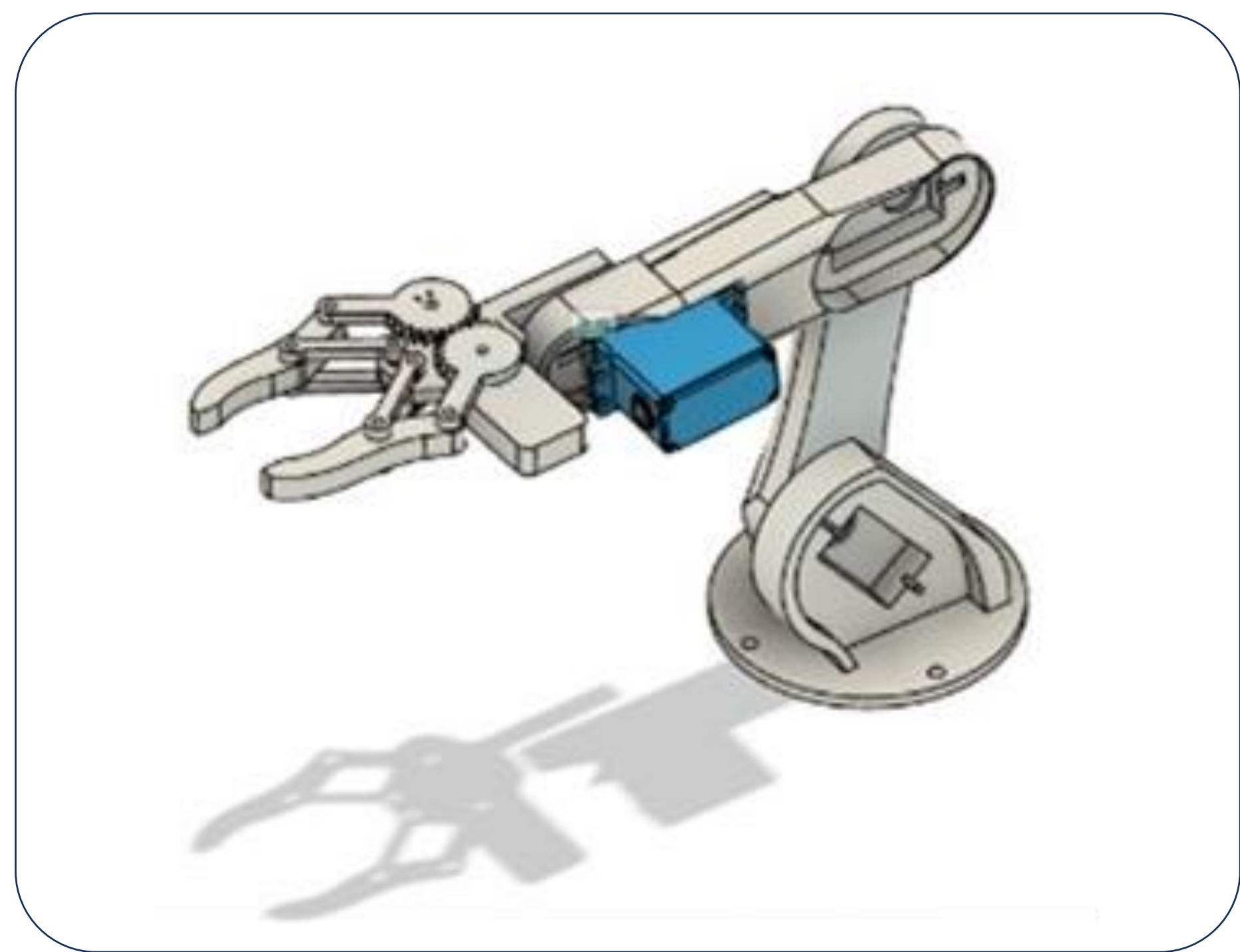


Fig (1): Fusion350 Sketch of The Robotic Arm

Data Analysis

The prototype underwent several assessments to determine its performance and whether it would be able to maintain weights up to 0.6 kg :

Line Following Test:

- The body showed smooth movement and followed the black line accurately while maintaining a relatively good speed of 5cm/s

Object Detection and Pick and Place Test:

- The robotic arm showcased its ability to handle heavy loads and picked an object once the ultrasonic sensor detected it and placed it with precision and accuracy
- The movement of the arm to pick the object was timed with the distance the ultrasonic stops the body created by the Arduino UNO's programming.

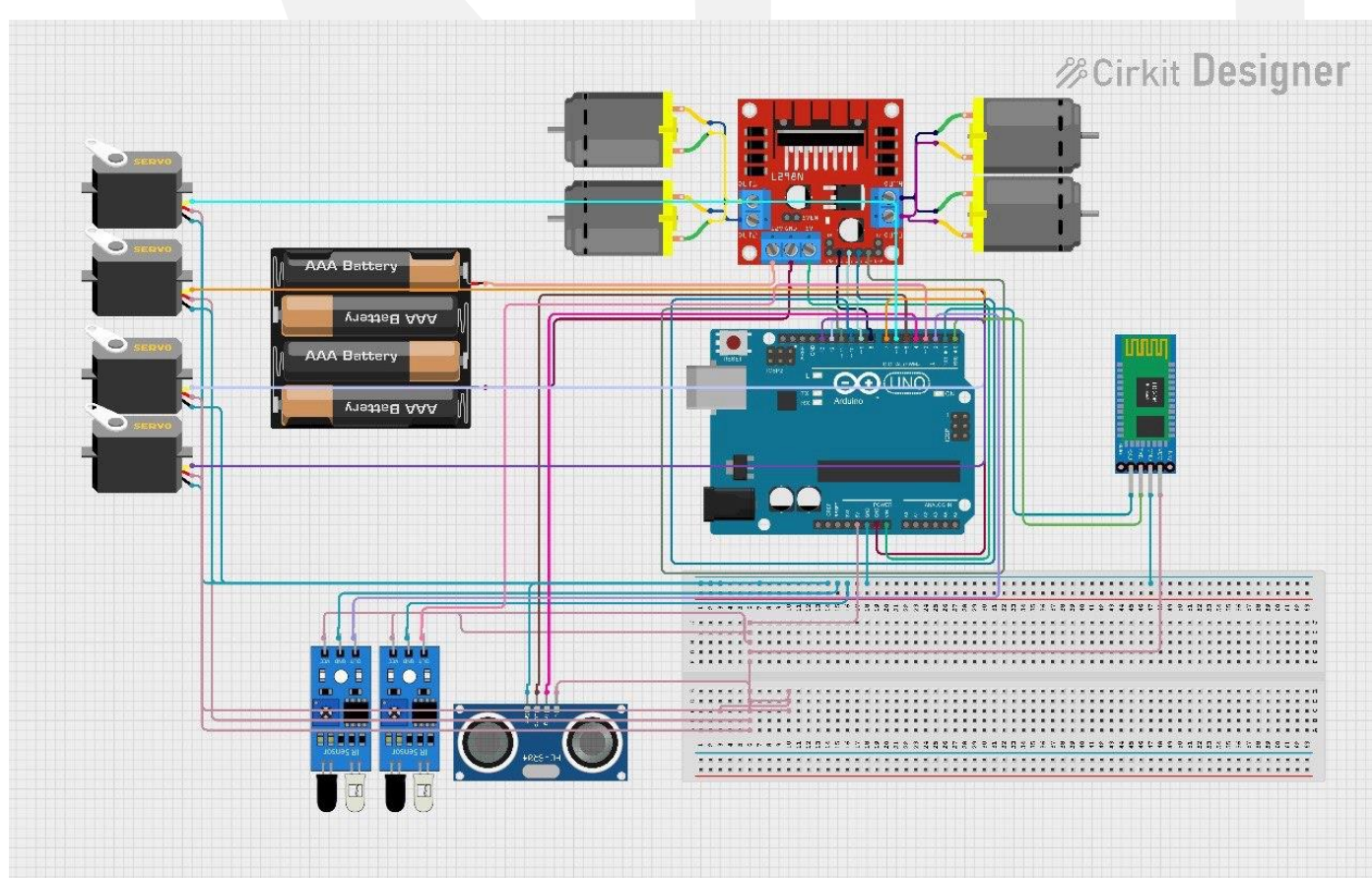


Fig (2): Circuit Diagram

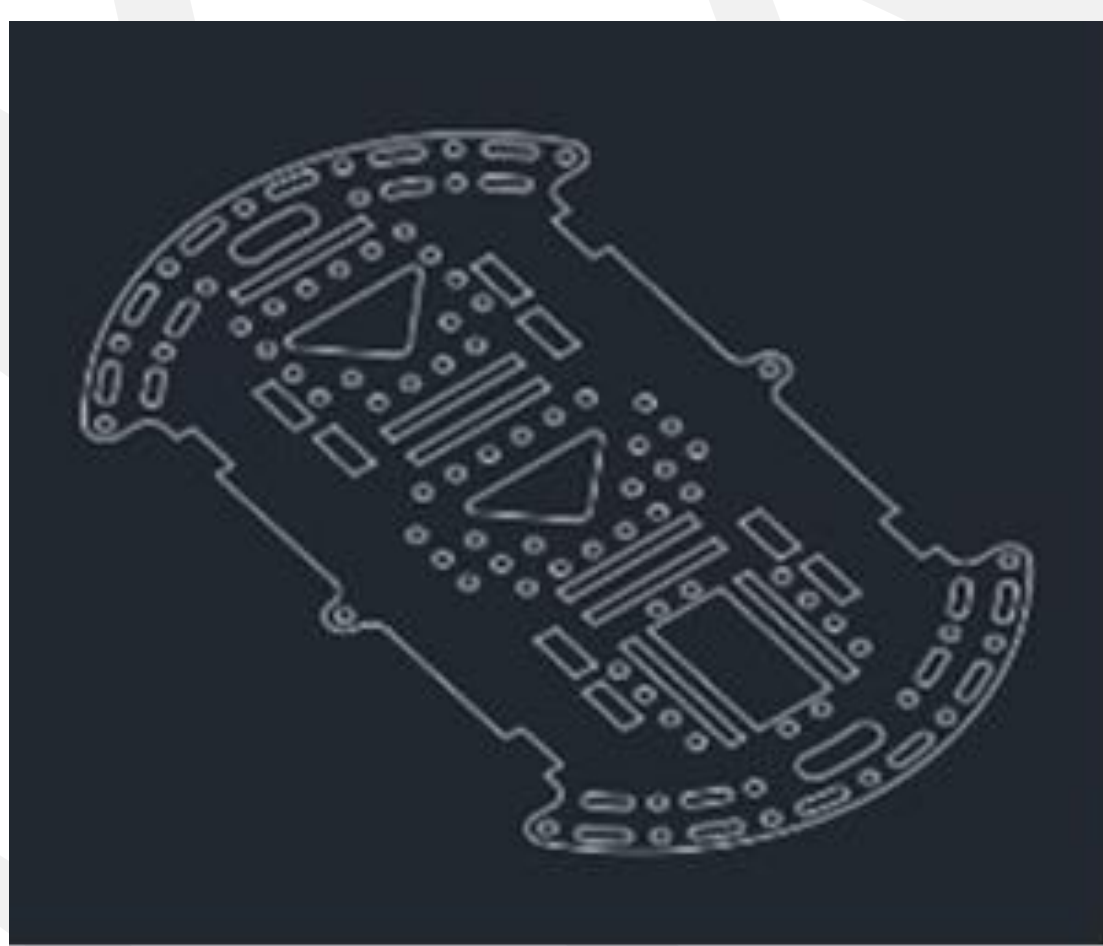


Fig (3): AutoCAD Sketch of the chassis of the body

The robot will be used for tasks like picking and placing small parts (up to 600 grams) using a group of electric motors like servo motors. The pick-and-place robot is one of the manufacturing technologies designed to perform pick-and-place operations.

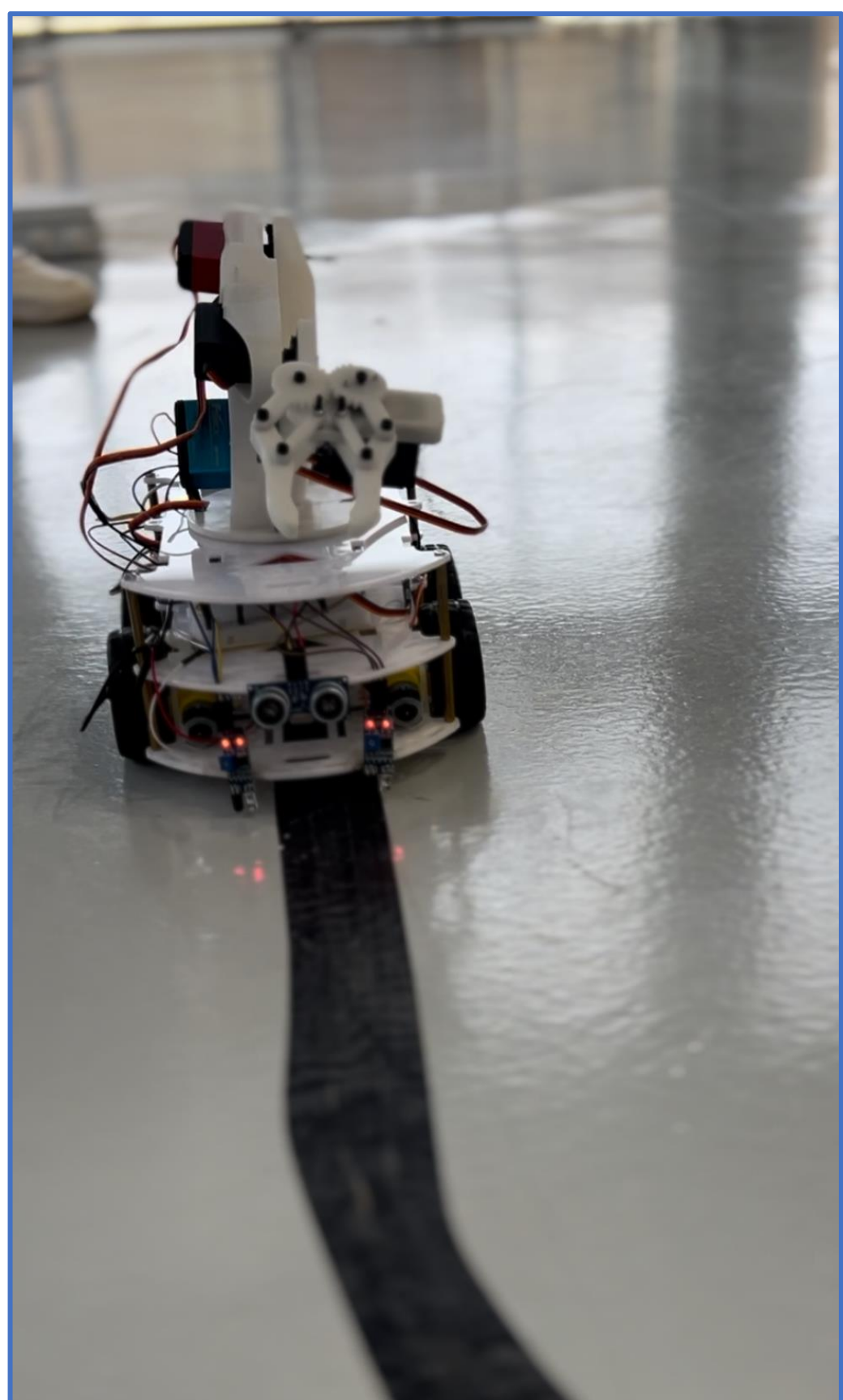


Fig (4): Prototype during testing the following line



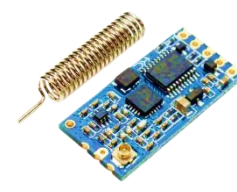
Fig (5): Prototype during testing the Picking

Further Improvements

To propel our project into a new era of automation within manufacturing environments, several improvements are proposed:

1.Expansion of Operational Range:

- Incorporation of HC-12 module to extend the operational range.



2.Enhanced Gripping Capability:

- Integration of rubber material for the gripper to augment friction, thereby enhancing gripping capabilities.



3.Motor Enhancement:

- Introduction of high-torque motors to bolster the power and efficiency of movements.

4.Increased Sensor Deployment:

- Augmentation of infrared sensor count to provide more comprehensive and accurate environmental perception.

Conclusion

Our project has demonstrated remarkable success in following designated paths and executing tasks precisely. By seamlessly navigating its environment and accomplishing tasks autonomously, our robot has showcased the transformative impact of advanced technology in industrial settings. Moving forward, the significance of this project resonates throughout the field of automation and robotics.

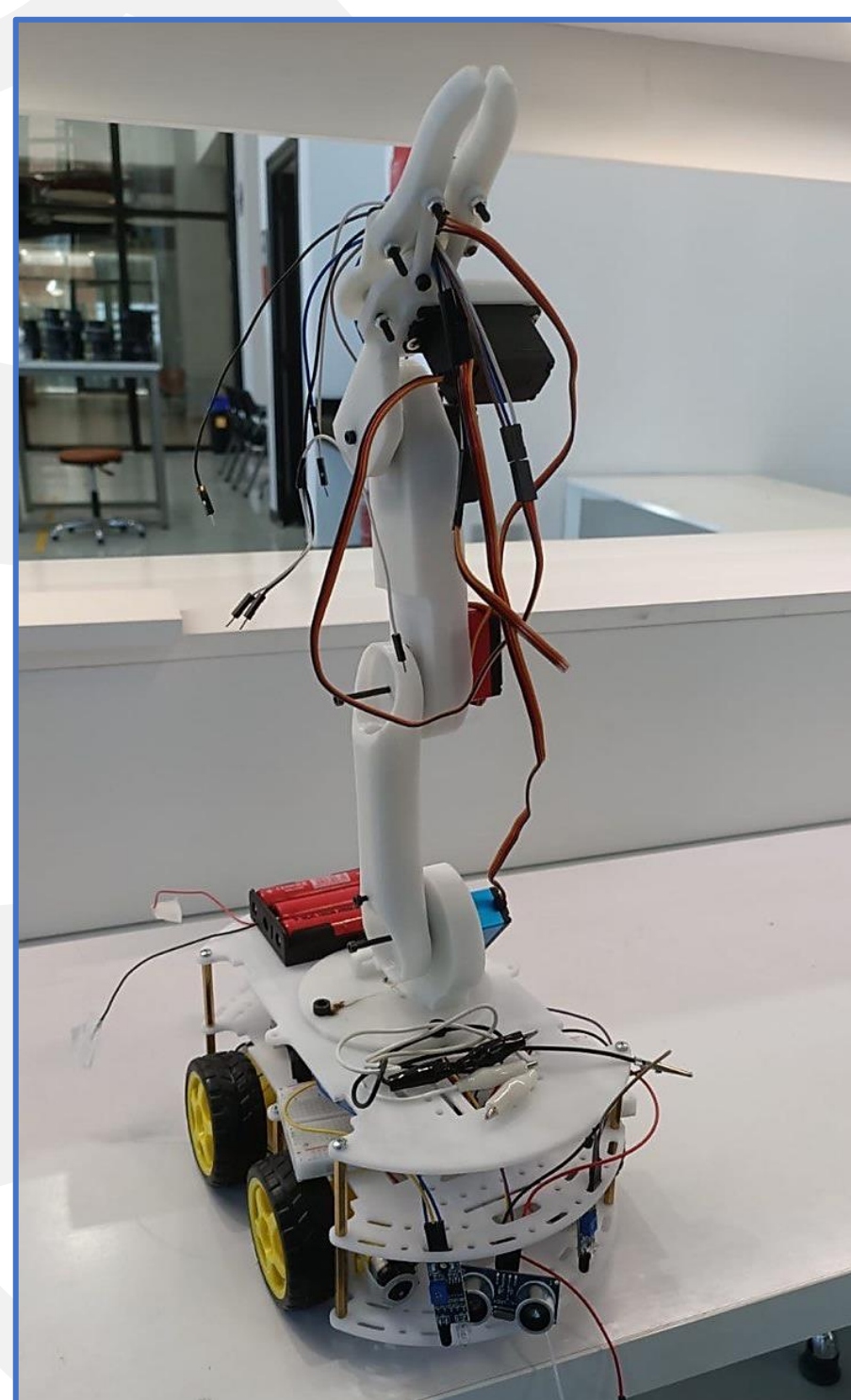


Fig (6): Final Prototype

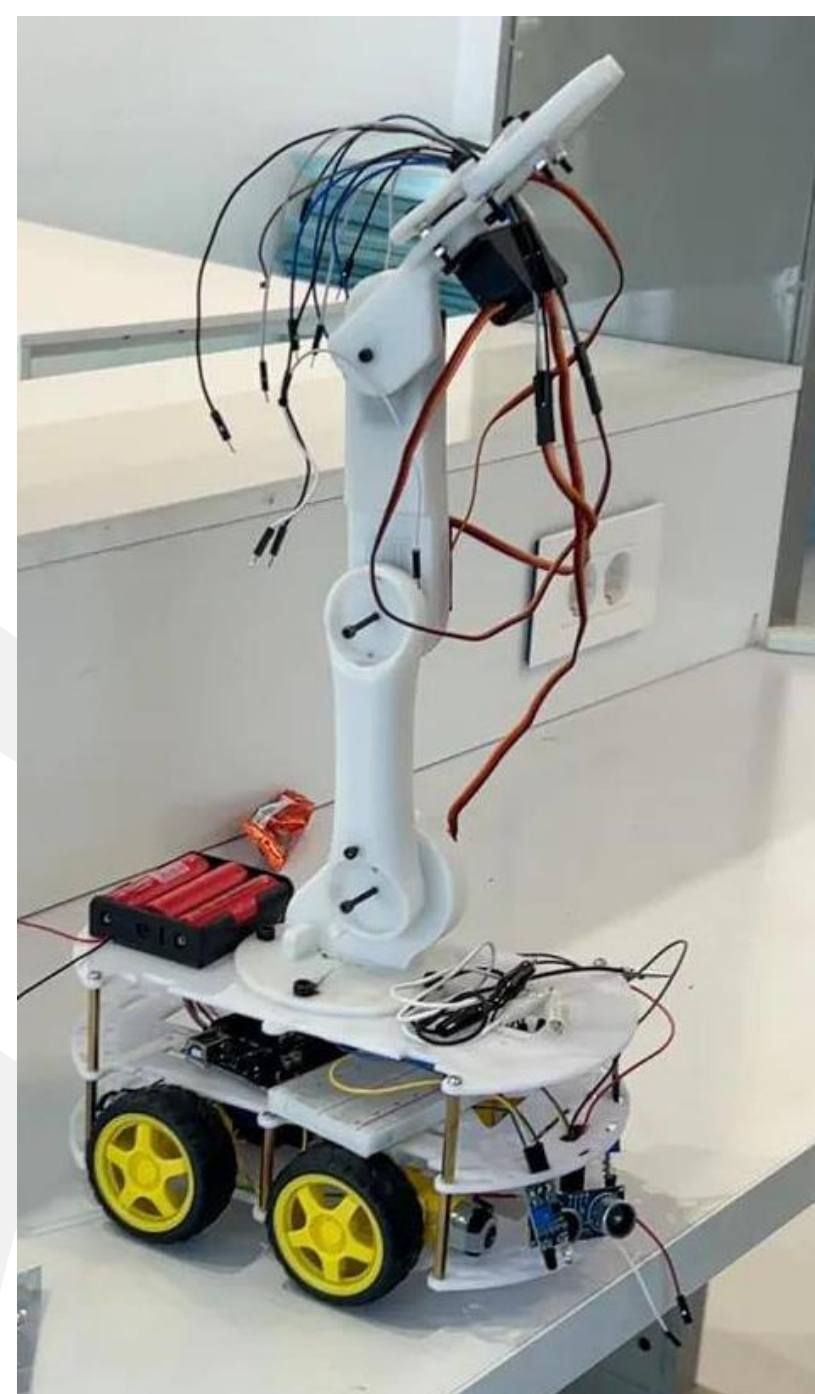


Fig (7): Final Prototype (2)

References

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- Automate.<https://www.automate.org/robotics/blogs/pick-and-place-robots-what-are-they-used-for-and-how-do-they-benefit-manufacturers> .
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