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MICROPROCESSORS AND EMBEDDED SYSTEMS PROJECT

"PATH FINDER, SHARP SHOOTER ROBOT"

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Abstract

This project focuses on developing an advanced line-following robot using the PIC16F877A microcontroller. The robot is designed to stay on track along black lines and it automatically adjusts its wheels when it navigates white lines to stay on the right track. It has dual control modes: a manual mode operated via Bluetooth and an autonomous mode using the onboard sensors. Additionally, the robot also integrates a shooting mechanism that is capable of detecting an object at specific distances. This comprehensive report describes the project's hardware and software components in depth, outlines the difficulties faced and the solutions found, and showcases the team's technical expertise and creative problem-solving. By showcasing our skills in robotics and embedded systems, the initiative advances the field of robotic technology.

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1 INTRODUCTION

The ongoing development and enhancement of robotics and automation technologies has resulted in significant improvements in various fields, such as industrial automation, healthcare, security, education, and many more industries. Robots can help us by taking over routine work and doing it with precision and efficiency, reducing human errors. The project showcases the abilities of the PIC16F877A microcontroller to develop our project. This project's main purpose is to navigate and illustrate how control, actuation, and navigation systems can be integrated into a single robot platform.

1.1 OBJECTIVES

1. To showcase the use of embedded systems in robotics: to showcase the practical application of the PIC16F877A microcontroller.

2. **Dual-Control modes:** We should be able to control the robot in a manual mode controlled by Bluetooth and an autonomous mode using onboard sensors, switching between the two modes is accomplished by an interrupt.

3. **Shooting mechanism:** The robot must be able to shoot an object in front of it from a specific distance with the help of an IR sharp sensor, and a built-in shooting mechanism using a servo motor.

4. **line-following robot:** The robot should stay on the black line as long as it's in autonomous mode and make necessary adjustments to its movement when it encounters white lines to stay on track using two IR sensors.

2 DESIGN

In this section we will show our design from different sides (Mechanical – Electrical – Software):

2.1 MECHANICAL DESIGN

In our mechanical design, we tried our best for our robot to be cost-efficient, neat-looking, and capable of smooth movement.
We used two layers so our components could fit, 4 DC motors for the wheels, and a breadboard.

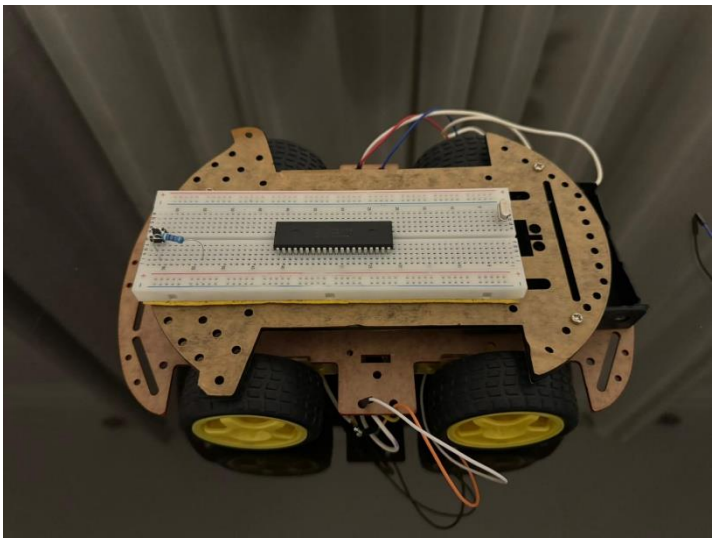

Figure 1. Mechanical Design (1)

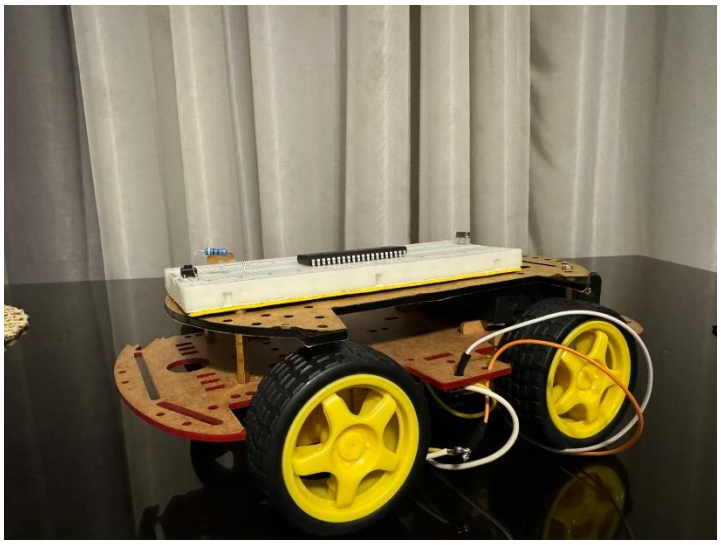

Figure 2. Mechanical Design (2)

2.2 ELECTRICAL DESIGN

In the electrical design, we used 2 IR sensors for the line following feature, for the shooting feature we used an IR sharp sensor to detect the obstacle and a servo motor to achieve the shooting mechanism, we also used an HC-06 module to interrupt the autonomous movement and enable Bluetooth connection to enter the serial controlling mode, as well as an H-Bridge to control the motors.

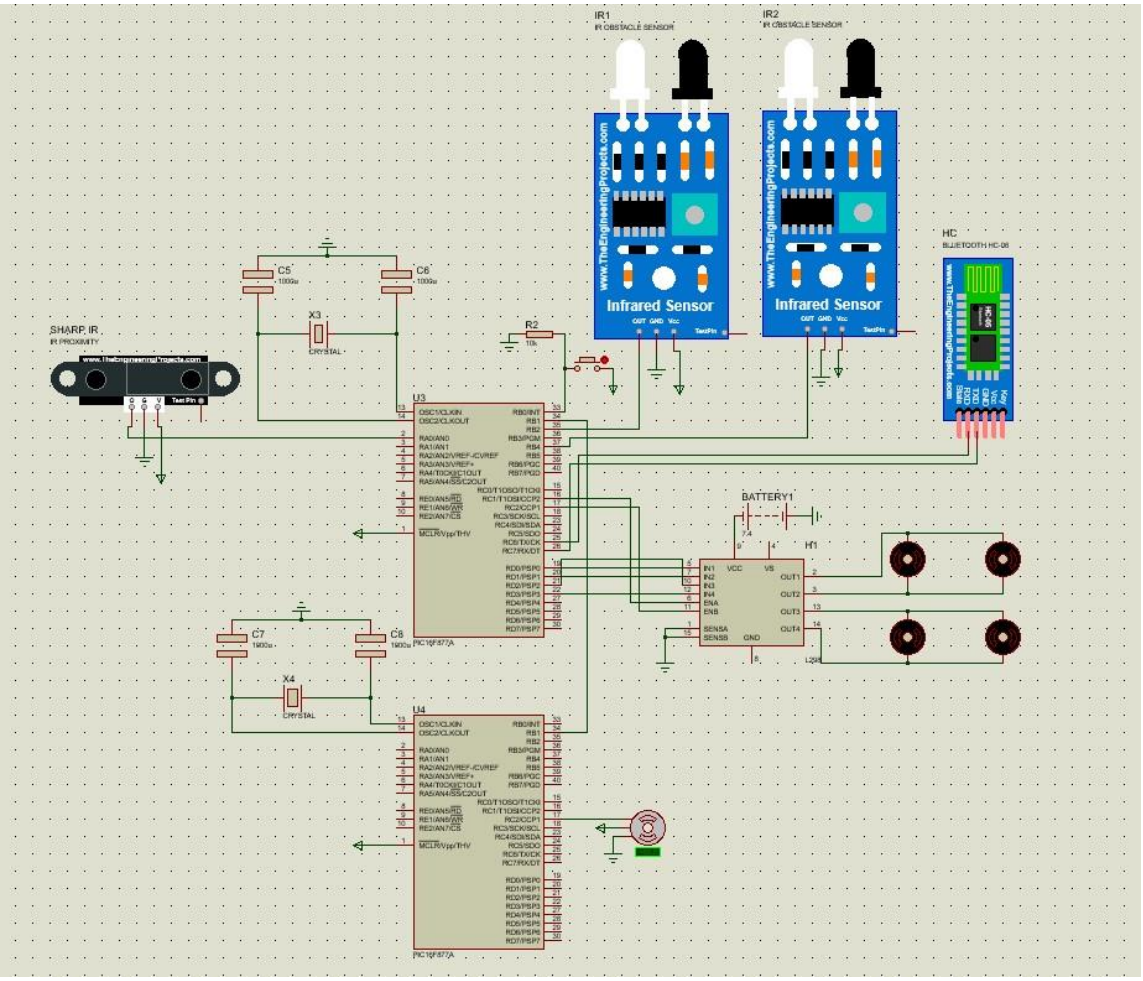

Figure 3. Electrical Design

2.3 SOFTWARE DESIGN

This flow chart explains the flow of the program we used in our project.

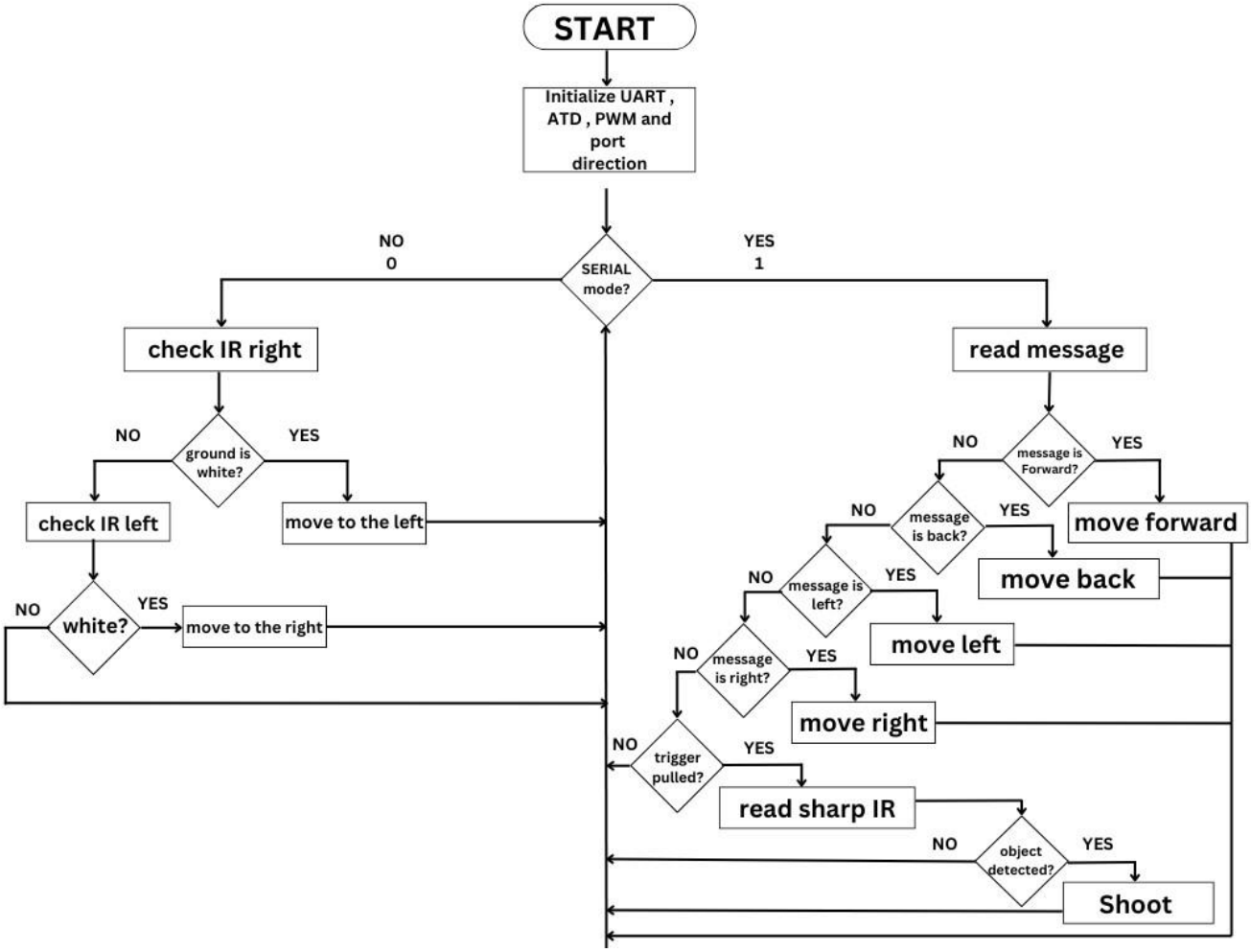

Figure 4. Software Design

3 RESULTS

We were able to achieve all of the desired functionalities within this project, and this is our last prototype:

Figure 5. Final implementation (1)

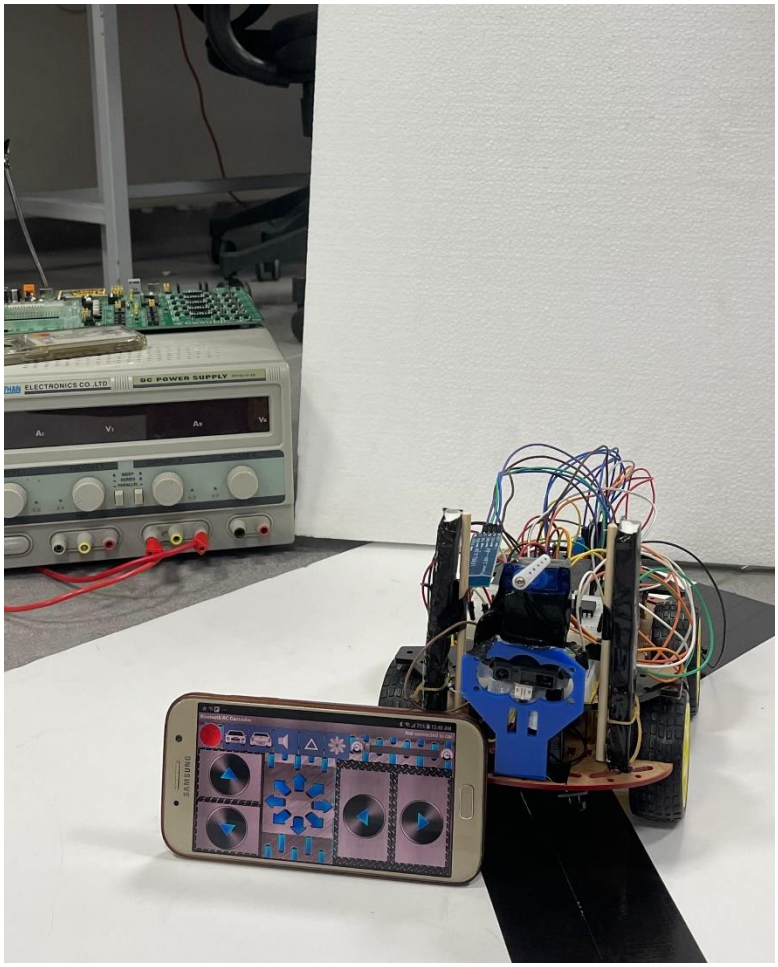

Figure 6. Final implementation (2)

GitHub Link: https://github.com/IamMariam/PathFinder-SharpShooter

Youtube Link: https://youtu.be/mEbk1Hov6x0?feature=shared

4 PROBLEMS AND RECOMMENDATIONS

In this section, we will discuss problems that we faced while implementing the project and recommendations on how to avoid dealing with these problems:

1. EasyPic was a challenge because of its many pins, we looked at the manual for the default settings then we decided to move our work and start combining everything directly on the robot.
2. We had some difficulties dealing with the servo motor because we're using both PWM signals to control the speed and directions of the motors, we managed to solve this problem by adding another PIC, sending an enable signal from the main microcontroller to enable the servo on the other PIC.
3. The shooting mechanism was also a challenge, by trying multiple ways, we ended up integrating a simple DIY.

5 CONCLUSIONS

Although building our Robot was a challenging experience, we successfully managed to achieve the desired functionalities and met the requirements of this project. Through this process, we gained a deep knowledge of microcontrollers and sensors and how to integrate both of them to build a comprehensive robotic system.

6 REFERENCES

[1] https://github.com

[2] PSUT E-Learning