Automated Threat Recognition and Engagement System (ATRES)

D. Qawaqzeh, L. Nasereddin, O. Al-Ibrahim
Supervisor: Dr. Belal Sababha
Embedded Systems Final Design Project, Fall 2023-2024
King Abdullah II School of Engineering
Princess Sumaya University for Technology

Introduction

The ATRES represents a defense embedded system prototype, engineered to detect, track, and neutralize targets within a certain area through implementing the use of a microcontroller, a variation of sensors including an ultrasonic and temperature sensors as well as a different combination of motors including a stepper motor, a servo motor, and 4 regular DC motors, all of which are powered - three 3.7V lithium-ion batteries. Each of the DC motors is responsible for rotating one of our 4 wheels (4WD) enabling the ATRES to roam freely in search of targets, whilst the servo motor works on regularly rotating the upper section of the ATRES which holds the ultrasonic sensor, two spring loaded shooters and the stepper motor in between. When the ultrasonic sensor detects an object the servo and DC motors stop, and the stepper motor works on activating the spring loaded shooters to engage detected target.

Design

This embedded systems project is designed based on the use of a PIC16F877A microcontroller which operates as the core (brain) of ATRES; controlling and coordinating the work of the ultrasonic sensor, temperature sensor, and all 6 motors.

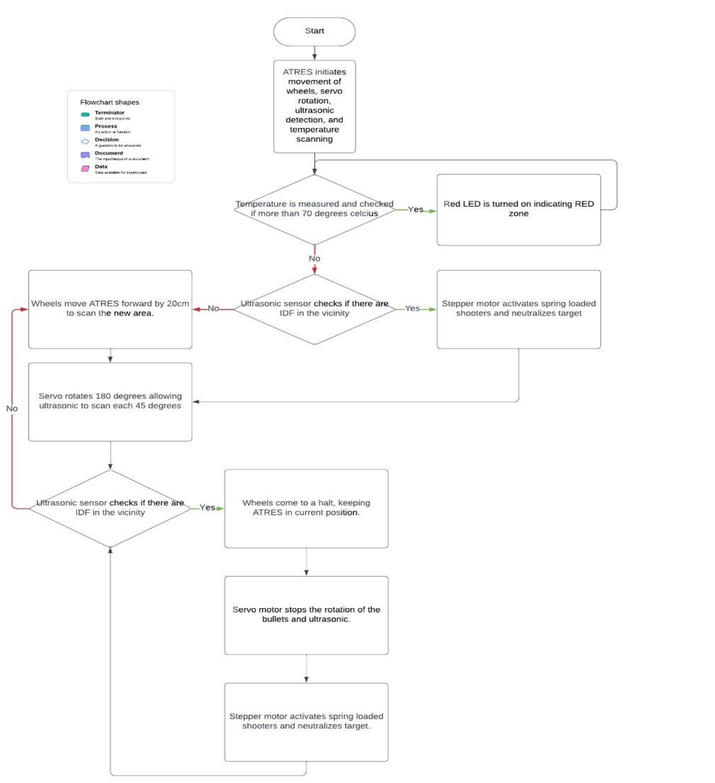

Figure 1: Flowchart

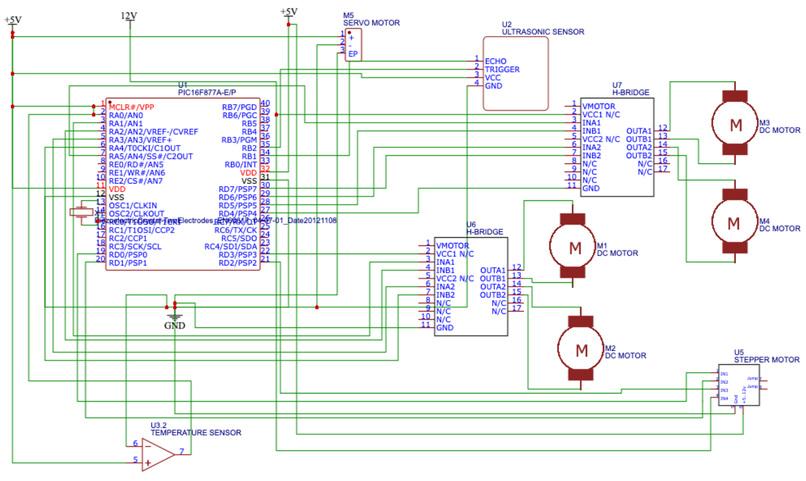

Figure 2: Hardware Design (Circuit Design)

Results

Figure 3: Front view of ATRES showing the ultrasonic sensor, stepper motor, spring loaded shooters as well as the power supply underneath

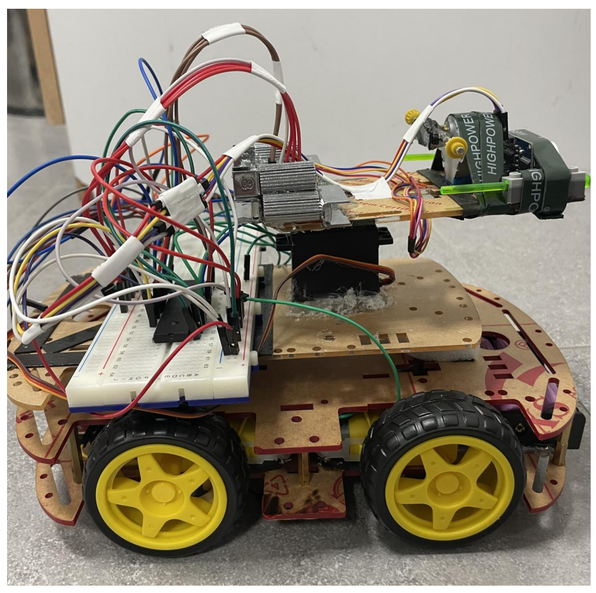

Figure 4: Side view of ATRES showing overall build

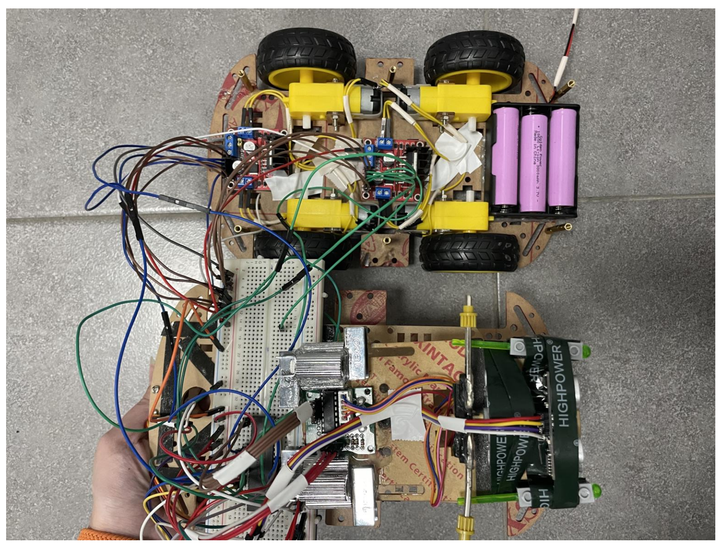

Figure 5: Internal (horizontal cross section) view of ATRES showing both the upper and lower levels and their components

Conclusion

ATRES has proven to be a very effective automated defense vehicle which has been built and designed with the goal of creating a mobile threat detection and engagement embedded system. Its durability and accuracy have been tested thoroughly to ensure its efficiency in the line of duty, and its mobility feature allows it to cover larger areas and longer distances than standard radar styled sentry guns. It has countless military applications, and can be integrated and implemented into different branches of military and law enforcement agencies.