Radar Guided Rescue Robot

Team Members: Armando Martinez, Lynel Ornedo
Steven Toyama, Kevin Ramos, Jacob Novoa
Faculty Advisor: Bob Dempster
Raytheon Liaison: Dr. John T. Jacobs
College of Engineering, Computer Science, and Technology
California State University, Los Angeles
Spring 2022

Project Background

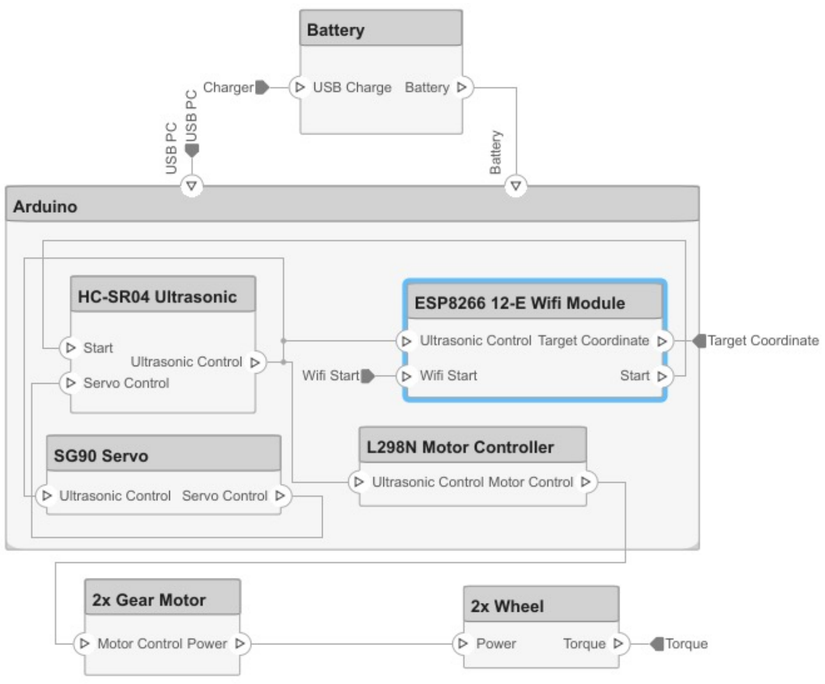
The objective of the RADAR-Guided Rescue Robot is to design and build a navigation system for a robot. The robot must search for a target based upon its given width using an ultra-sonic distance sensor. The robot shall navigate to the target autonomously. The robot shall transmit its distance from the target wirelessly to the user which is displayed.

Requirements

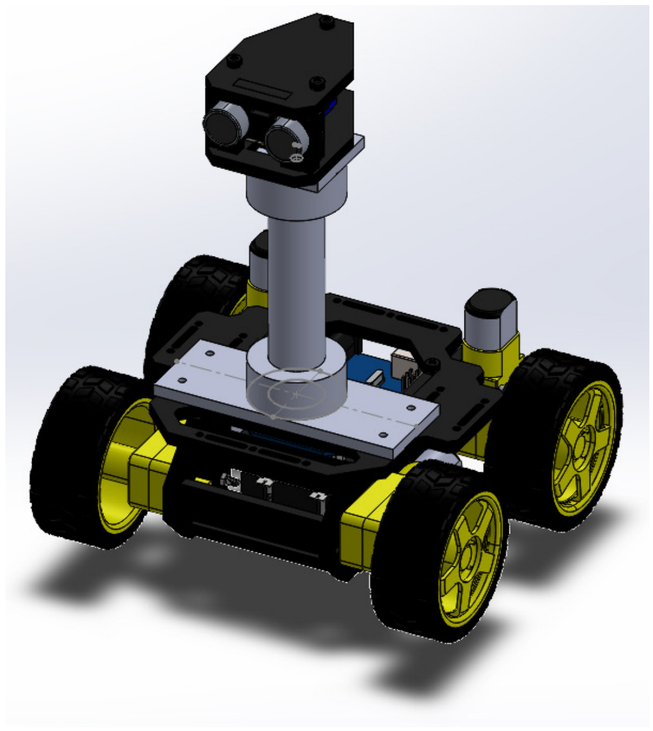
No.	Requirement	Verification
1	The contractor shall acquire and assemble the components for the robot, perform statistical tests of the components and sensors, debug, and then calibrate the system.	Observation
2	The robot must operate for at least 15 minutes on battery power and scan for a target over the range of 9 feet	Observation
3	The robot shall distinguish each object then move towards the target with the correct width	Inspection
4	The robot shall autonomously navigate to the target and stop 1 foot away from the object	Observation

Overall Design Approach

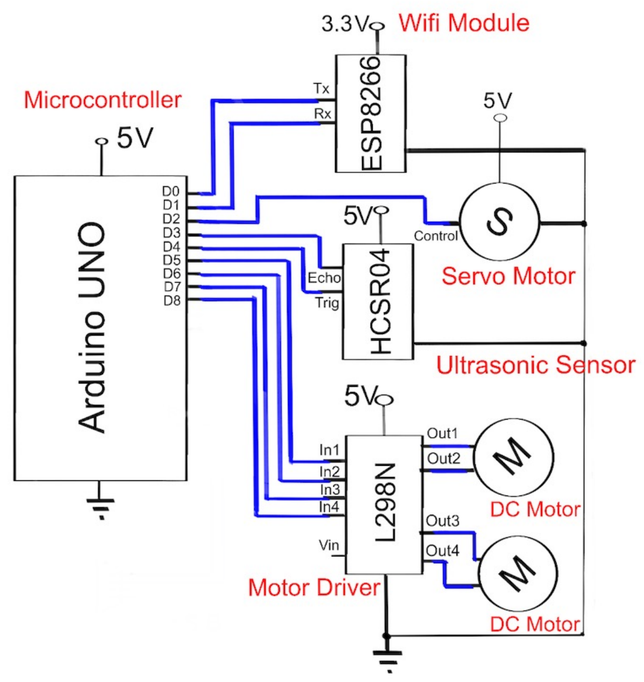
System Architecture



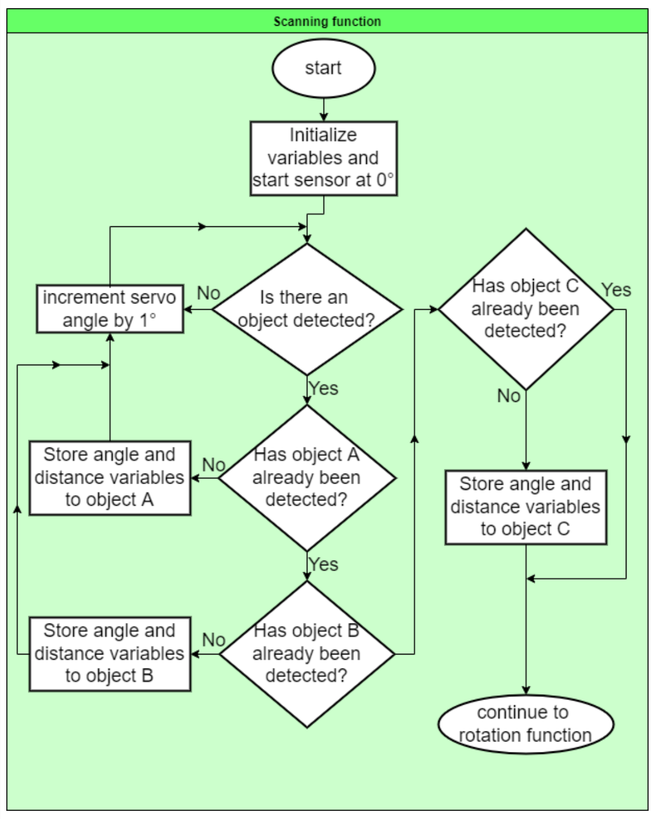
Mechanical Design



Electrical Design

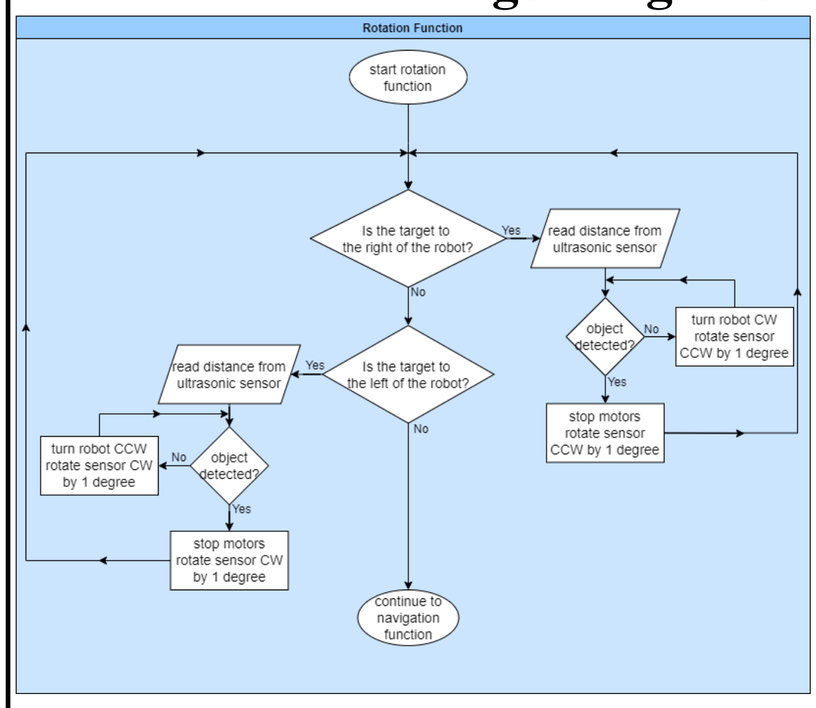


Object Detection



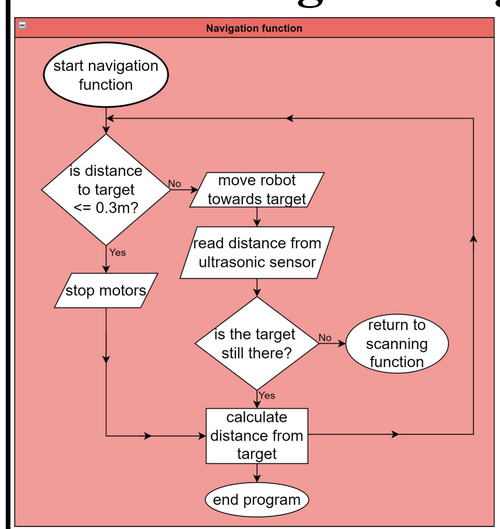
This process uses the ultrasonic sensor to detect a distance for every angle a servo motor moves. It allows to detect the edges of different objects and then calculate their width according to where the edges that were detected.
Finally, the correct target is determined after confirming the correct width.

Target Alignment



This process is a feedback loop in which the robot uses the electronic distance sensor to align itself to the center of the target object. The robot will look for the right edge of the target and align itself with the target center by using the difference in angles.

Target Navigation



This process allows the robot to move from its original position to the target. When the robot is moving, it continuously monitors the distance as it moves toward the target. Once the robot is 1 foot away from the target, it will stop.

Testing



Each electronic component was tested and verified to work with the Arduino microcontroller. Then, the components were tested as part of the detection, alignment and navigation functions. When all modules worked individually, the code was then combined into one file and uploaded to the Arduino. Final adjustments were made to the hardware as well as debugging the code for the robot to work as intended.

Results

After completing this project, we were able to understand that an ultrasonic sensor can be used to detect the width of an object in addition to its distance from the sensor. from detecting, locating, tracking, and recognizing remote targets.

