Low Fidelity SONAR

ECE 110 Lab

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Introduction and Problem Statement

Sometimes when studying in Grainger library (or any other cozy public place), one can feel insecure studying alone. This insecurity can ultimately inhibit any student from focusing on his or her work. This is why a Low Fidelity SONAR can help put any learner's insecurity at ease. The Low Fidelity Sonar detects when any suspicious object or person is too close and sets off an alarm, thus alerting the user to when a possible threat may be apparent.

Design Concept

The Low Fidelity Sonar will use a rangefinder (1.0 meter range) that consists of two ultrasonic sensors attached back to back on a servo. This servo will then rotate ~160 degrees, giving approximately 320 degree coverage. The sensors will feed back into the Redboard, which will convert the output of the rangefinder into a distance. After determining the bearing and range of the closest object, the Redboard will rotate the indicator, consisting of a servo with a pointing device, to point at said object. In addition, if the distance is within 0.3 meters (and further than 0.2 meters to avoid detecting yourself), the Redboard will also tell the speaker to emit an alarm.

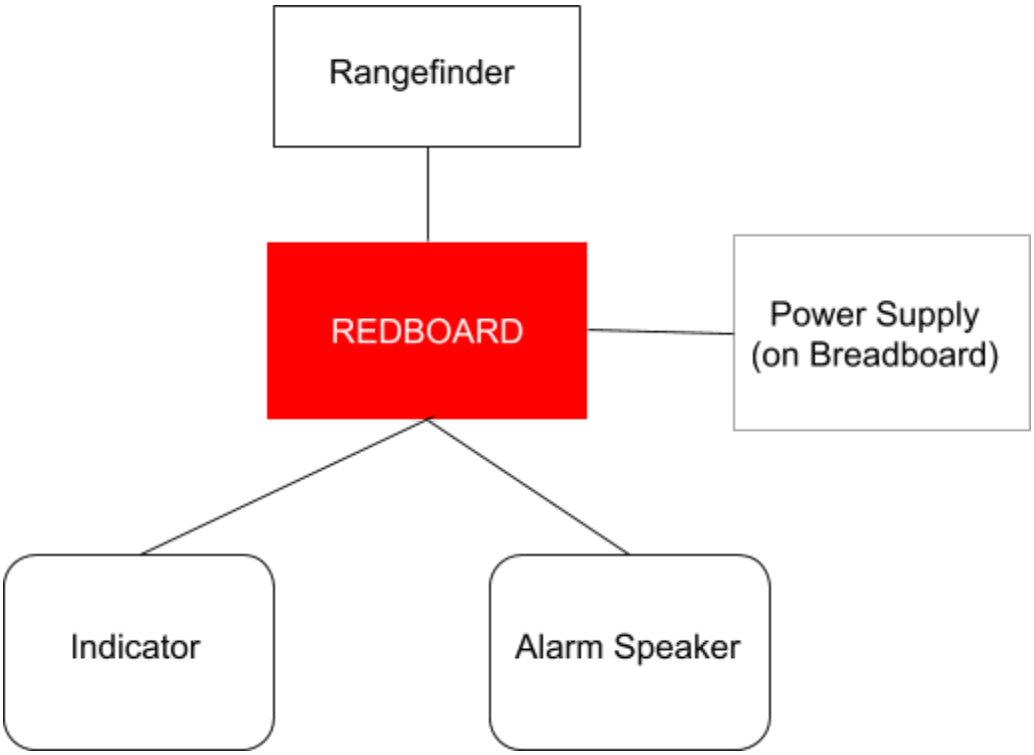
Analysis of Components

The device uses two ultrasonic distance module SC-SR04 sensors programmed to send data to the Arduino Redboard (for configuration see Design Description). In this case, the data specifically measured was simply the distance of objects found from the ultrasonic sensor which was simply viewed by the user in decimal values (in meters) from the serial monitor.

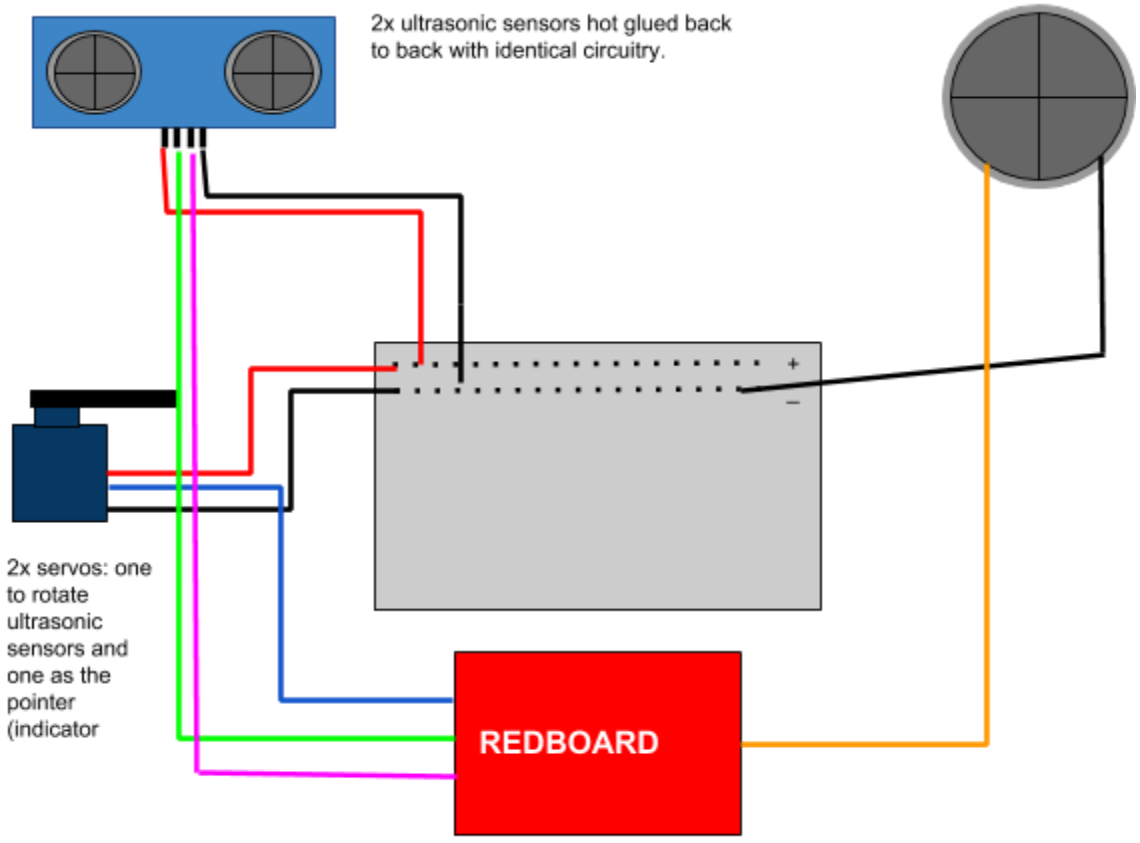
Two servos were used: one as the rotating medium for the sensors and the second as the rotating medium of the indicator. The former was programmed with the Arduino Redboard to repeatedly move in a cycle (~160 degrees) while receiving data from the sensors. Meanwhile, the second servo was again programmed with the Arduino Redboard this time to move to the direction at which the closest object in range was sensed.

One PCB mount speaker was used as the alarm for the sonar. Due to its small input pins, additional wires were soldered on in order to allow the device to more easily be connected to the Arduino Redboard. This speaker was able to send off an alarm whenever the range read by the ultrasonic sensor was within the acceptable parameters (greater than 0.2 meters and less than 0.3 meters).

Design Description



Circuit Diagram



Arduino IDE Code: Please see sonar.c

Conclusion

The ultrasonic sensors on the sonar occasionally return a very small number due to interference or a fault in the measurement. This error tended to occur on the first reading of the second sweep. To solve this, we reconfigured the design to only sweep once from 0 to 180, then resetting to 0 degrees.

Another problem that occured was that the indicator servo was only able to move 180 degrees, so even though the sonar could detect objects in near 360 degrees, the indicator would only be able to point in its 180 degree range. This could be resolved by adding an led indicating which side of the arm is pointing to the object