sdmay23-22

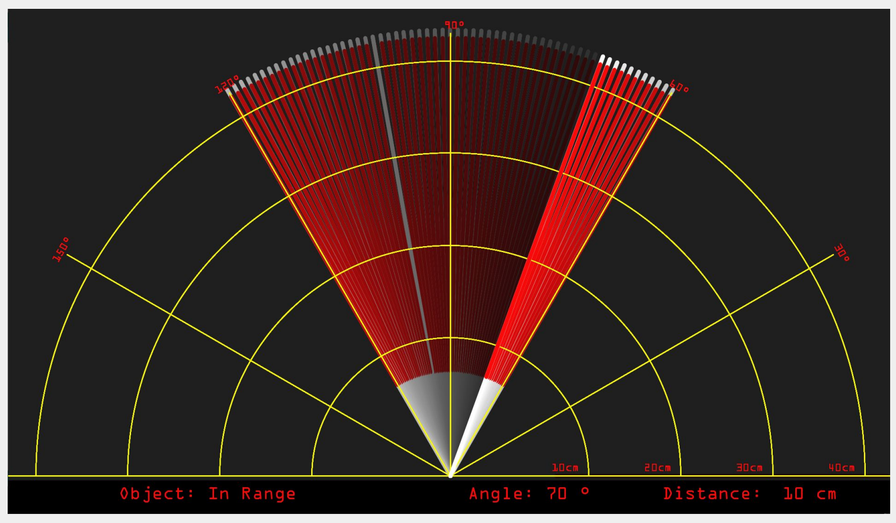
Advisor: Jiming Song

Ultrasonic Radar

Kevin Czerwinski EE || Derek Thomas CprE || Ryan Foster EE
Samuel Rosette EE || Jack Riley EE || Abubaker Abdelrahman EE

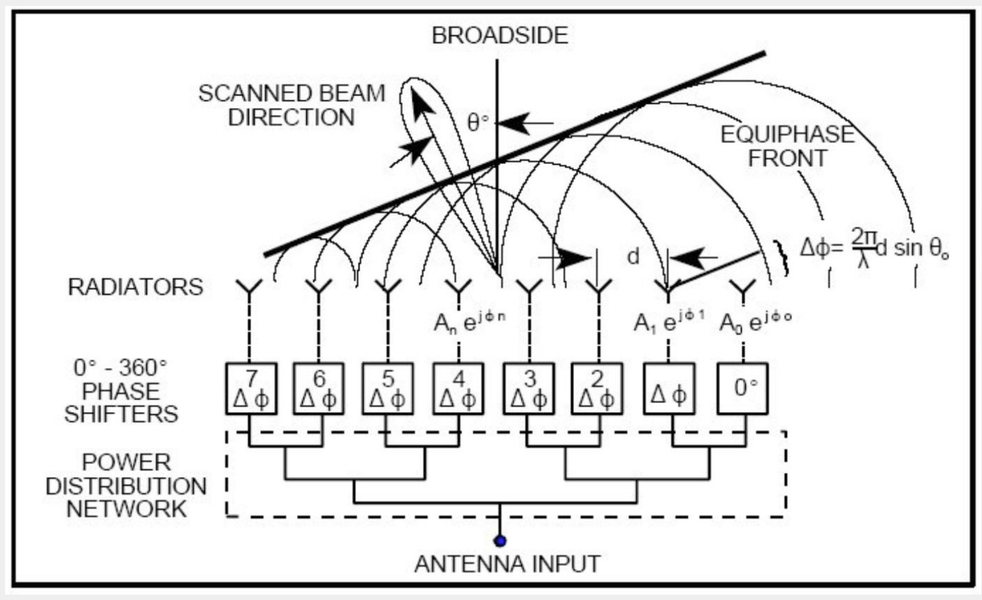
Introduction

The goal of this project is to create an ultrasonic radar that can detect objects at different angles and distances. This can be done by using a phased array of transmitters.



Overview

This device will consist of a phase array of ultrasonic transmitters to allow for scanning at different angles. By using phase shifted signals the focus point of the beams can be angled without the use of mechanical movement. The device will be able to detect distances and angles of multiple objects.



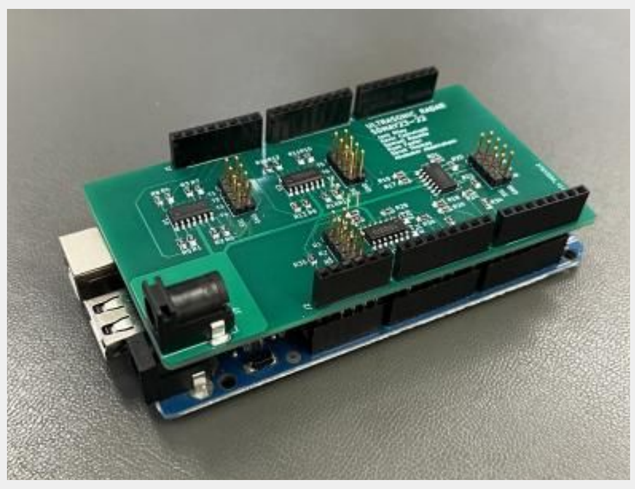
Methodology

For the circuit, the elimination of transmission amplification allowed us to strictly focus on receiving pulse clarification. This consisted of a few stages of amplifiers as well as some rectifiers to provide a clean signal between 0-5V for the arduino input. The arduino code for pulsing was simple and the distance detection only required us to record time but the phase shifting function was complex. For this we needed to delay each pulse by specific time periods in order to scan at the proper angle. The display code took in data from the Arduino serial port and displayed it conveniently on a radar.

Implementation

In the final implementation we included 10 ultrasonic transmitters optimized for 40kHz as well as a receiver optimized for the same frequency. We used Arduino for the pulse code and the phase shifting to scan different angles. The display was coded on a software program called Processing. Some of the biggest issues we had involved the voltage threshold for the input pulse which needed to be extremely fine tuned for the best accuracy. The phase shift code also proved challenging as none of us have had much experience in this

Received pulse after amplification and rectification



Results & Impact

The Ultrasonic Radar functions almost as intended. It can scan objects in front but the phase shifting does not work as well as we had hoped. With more time we would be able to further develop the code and improve the scanning. It will be a vital tool for research and education on ultrasonic sound waves.

Conclusion

Overall, this project allowed us to apply many of the skills we have learned throughout our time at ISU. It was an interesting way to take on a challenge and come up with a solution that will be used in the future. This project is important because it sets the foundation for future Senior Design groups to build off of.