Problem and Requirements

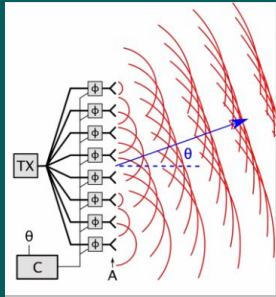Ultrasonic Object Detector
sdmay25-36

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Project Overview

- Design an ultrasonic radar

- Array of transducers

- Rely on reflected sound waves to determine object distance

- Use of time-delay (phase) to control scanning direction and location

Problem Statement

- Design an Ultrasonic Radar System which can detect small objects

- Accurately detect two side-by-side objects

- Effectively convey an image through the use of an intuitive display

User Needs

Client Persona
Professor Song

- Ultrasonic radar system to detect objects

- Improve on past Implementations of the project

Designers Persona
Our Group

- Design an ultrasonic radar

- Learn how sound waves are used to detect objects

- Learn what software and hardware are involved

Purchaser
Theoretical

- Understand what the display needs

- Detailed instructions on use

Requirements

Functional

- Detect objects up to 1 meter away

- Display sweep for detected objects

- Using a phase array with phase delay to determine direction

- Use time delay to determine object distance

- Use 40KHZ ultrasonic pulses

Resource

- Server/Raspberry Pi for wireless data transmission

- External power source for powering the radar

- MA40S4S/R (10S, 1R)

Physical

- 10 transmitter/sender transducers in linear layout

- 1 transducer as receiver

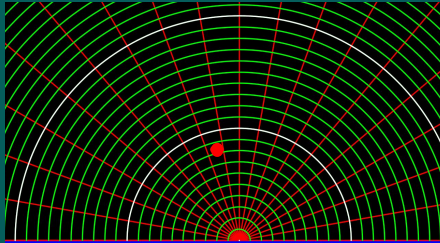- Transmitters are approximately 10mm in diameter

Requirements

Experimental

- Circuit simulator
  - Falstad/LTSpice

- Schematic Designs
  - Plan out Layout of product

- Oscilloscope
  - Test frequency range, components, etc.

Aesthetic

- Clear and readable display

- Clear object groupings

Environmental

- 40k Hz
  - Outside Human hearing range

Engineering Standards

IPC 2221

- This standard establishes design requirements for PCBs.

- This standard applies to the construction of the radar hardware, since it will be using a PCB board as its foundation.

IEEE 1471-2000

- This standard deals with creating, analyzing, and maintaining software architecture

- Applies due to changing nature of radar display

IEEE 802.11

- This standard is about transmitting data to a computer wirelessly

- Will be using Raspberry Pi to communicate wirelessly

Questions?