Sonic Object Localization For Reconstruction In Virtual Reality

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Objective
Hardware system that tracks real-time position of sonic objects and transmits this data to a remote server for reconstruction in virtual reality.

Introduction
- Localization is a technique for identifying the position of an object in an environment.
- Real-time localization has many use cases; from tracking a pet in a house to an inventory in a warehouse.
- GPS, Wi-Fi or Bluetooth have either accuracy issues or cannot localize in real-time.

Motivation
- On | Off is an audience collaboration project from Eastman School of Music.
- Motivates participants to create harmonious music using home-made synthesizers (sound-boxes).
- This project aims to capture the audience participation by tracking the movement of the sound-boxes and reconstruct them in virtual reality in real-time.

Hardware
- Raspberry Pi v 3.0
- Decawave DWM1001-Dev

Software
- Decawave android application is used for initializing the network.
- Serial communication with the hardware is done through C-API or PySerial.
- Coordinates are transferred to a remote server using UDP and reconstructed in Unity Engine.

Trilateration Algorithm
\[
(x - x_1)^2 + (y - y_1)^2 = d_1 \quad (x - x_2)^2 + (y - y_2)^2 = d_2 \quad (x - x_3)^2 + (y - y_3)^2 = d_3
\]

Motivation
- Home-made synthesizer
- Audience Collaboration

Results
- Real-time tracking of objects with 10-20 cm accuracy was achieved.
- Real-time positions were reconstructed in 3D space.

Future Work
- Show the audience participation in Virtual Reality.
- Reduce the tag footprint by using Arduino.
- Transmit sound along with location.

References