Physical Games in K-12 despite COVID-19

Yifeng Cao, Ashutosh Dhekne, Mostafa Ammar
Georgia Institute of Technology

Motivation

- Physical games are important to children
- Enabling physical games in COVID-19 raises safety concern

It is difficult for children to be aware of keeping safe distance all the time during a game.
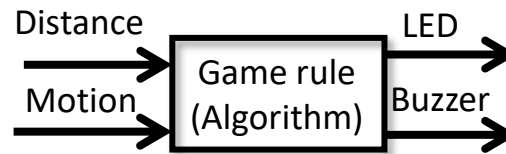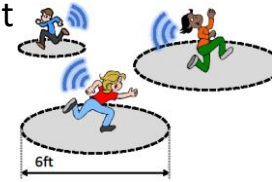
Opportunity

Our recent wearable device 6Fit-a-Part can provide accurate distance in real-time.

Buzzer
UWB chip
LED
Accelerometer
SD card
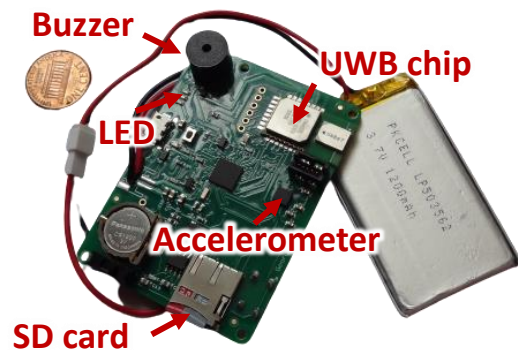
Problem Statement

Requirements

- Accurate distance measurement
- Real-time all-to-all ranging
- Occlusion detection in special cases
- Lightweight

6ft

Distance → | Game rule (Algorithm) | → LED
Motion → | | → Buzzer

Design Overview

Increasing accuracy:

- Two way ranging with UWB

Reducing delay:

- Efficient all-to-all TWR protocol
- Motion prediction
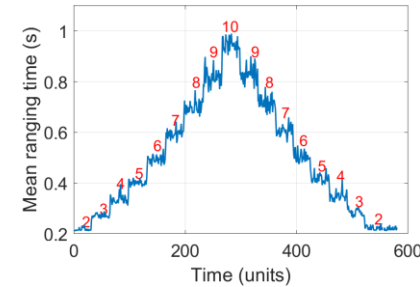- Node filtering

Detecting occlusion

- Discriminate wall-blockage, human blockage and no blockage
- Compensate for error caused by blockage
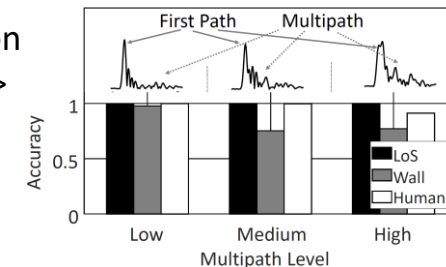
Evaluation

Prior performance

(i) Ranging accuracy: ~10cm

(ii) 10 nodes perform a complete all-to-all ranging in 1s.

(iii) General occlusion detection accuracy > 85%.

Planned new experiments

- Employing mobile robots
- Emulating real physical games by path planning
- Evaluate delay and occlusion detection in a real game
- Evaluate the game failure probability