EE 119/219 Project Preview

Spring 2025

ToF Camera: Secure Face Detection

- Facial recognition systems based on 2D cameras can be easily fooled by photos. Depth information can make these systems more robust to such attacks.7
- Augment a standard facial recognition algorithm (eg. KLT Algorithm) with a "real-or-fake" classifier using 3D ToF data.
- Characterize false positive and false negative rates for standard vs enhanced detection system.
- Although this system is more robust than a 2D camera, how can it still be fooled?
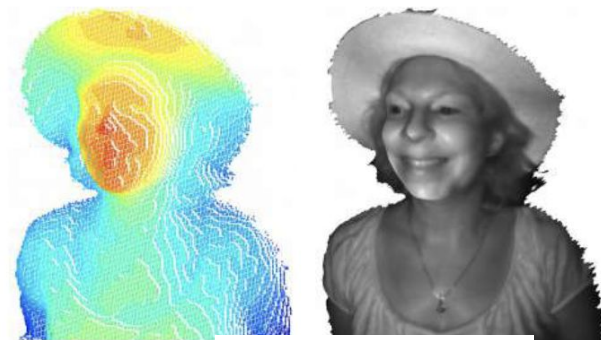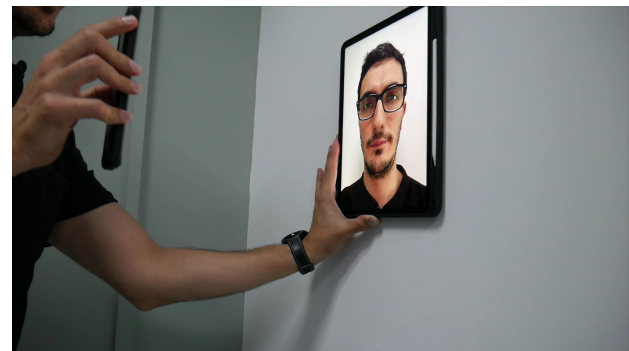

*Figure 4: Raw data poi*   *image*

Ultrasonic Sensor: Touchless Musical Instrument

- The theremin is a musical instrument that's pitch and amplitude is controlled by the distance of the player's hands from two antennas.
- Using the ultrasonic sensor, design your own musical instrument by controlling sound based on hand position in front of the player.
- Potential to add cool effects based on target amplitude, velocity, and any other cool ideas you can think of
- Requires real time streaming of ultrasound data, properly configured sensor to allow proper targeting of the hands
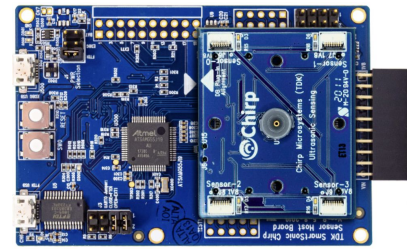
mm-Wave Radar: Through-Wall Imaging

- Unlike light, millimeter wave radar can penetrate through many materials in order to "see" through walls!
- Detect presence of a person and motion through a wall
- How are metrics such as resolution and SNR affected by wall thickness and material type?
- How can an object's shape or material be designed to avoid detection?
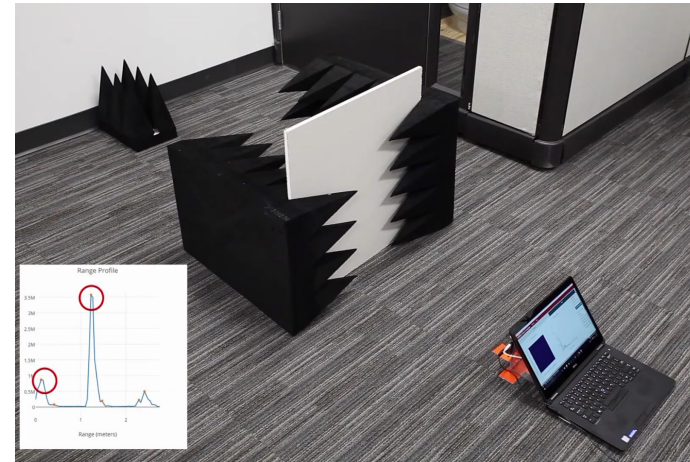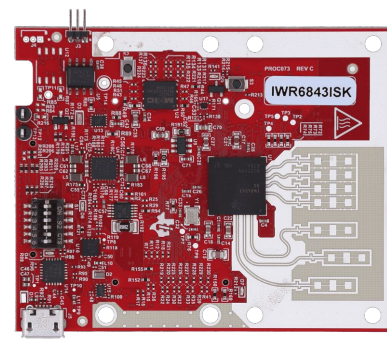
Create your own project!

Potential topics:

- Vital sign monitoring with Doppler radar
- Gesture recognition with Doppler radar
- 3D imaging with an array of ultrasonic sensors

Your project idea, milestones, and metrics must be approved by the course staff beforehand, and you will be expected to work more independently compared to the 3 predefined projects.

Important Dates

Deliverable	Due Date	Location
Project Sign up Form	11:59pm on May 16th, 2025	Gradescope
(optional) Independent Project Proposal	11:59pm on May 16th, 2025	Gradescope
Checkpoint	11:59pm on May 21st, 2025	Gradescope
10-15 Minute Demo	TBD, likely June 3rd, 2025	Packard 057
Final Report	11:59pm on June 9th, 2025	Gradescope