597SD Project (6) Proposal
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Motivation:

- Our team is interested in a hardware-oriented project combining algorithm design and communication elements using unorthodox methods. We have all previously utilized encoding and decoding methods in previous coursework and are interested in practicing these techniques in this project. Catering to the different constraints such as data rate, information transfer accuracy, and decoding error make this project an interesting challenge when trying to minimize cost and power consumption compared to custom devices.

Design Goal:

- Embed data in optical signals and optimized signal demodulation and decoding at the receiver.

Deliverables:

- A modulation approach that represents data with less samples to cater to low sampling rates, does not require specialized tools to receive signals, resilient to distance-based variations, and is robust to sensor-specific environmental interference such as fluorescent light for optical channels
- Reduction of demodulation errors under low sampling rates, and minimize decoding error in the absence of symbol frame synchronization between the sender (server) and the receiver (IoT device)

System blocks:

Hardware Diagram:
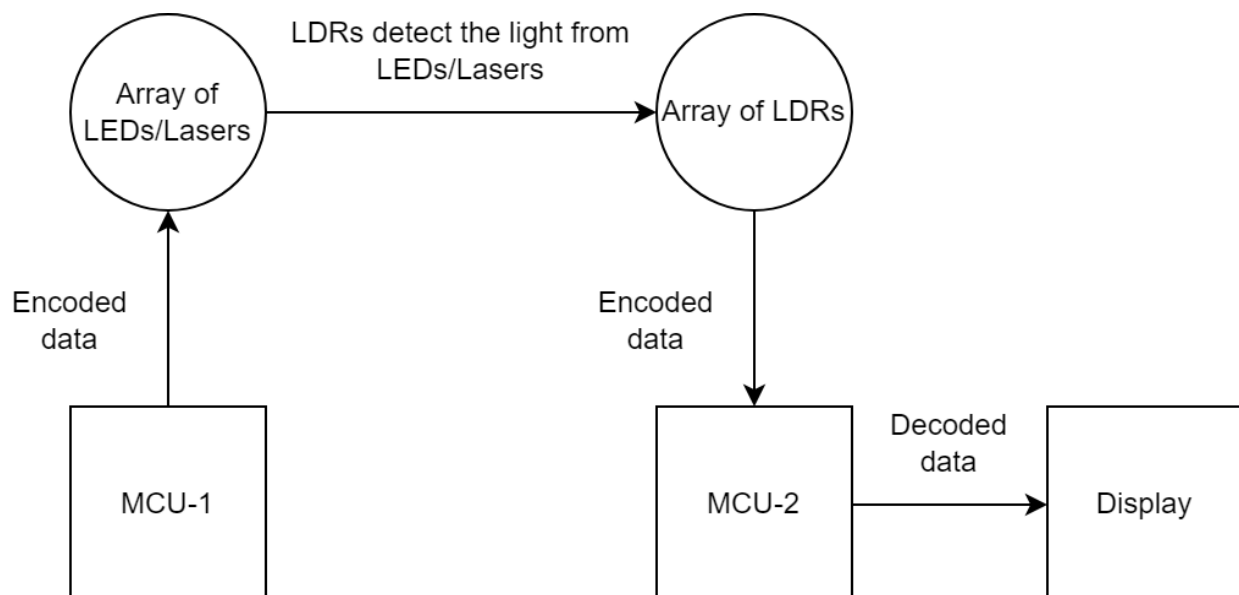
HW/SW requirements:
- **Hardware:** Arduino Uno, LED/Laser, LDRs,
- **Software:** A custom algorithm to act as a communication bridge between LED/Lasers and LDRs

Team Members' Responsibilities:

Rupak Poddar- Hardware design/setup
Kyle Taubert- Research + Writing
Liam Glockner- Algorithm design
Sach Jankharia- Software

Project Timeline:
Prior to midterm
- Background research (component selection, research papers, analyze previous approaches)

Post Midterm (mid to late October):
- Collect different hardware components needed
- Create the preliminary design of the transmitter and receiver
- Test the transmitter and receiver effectiveness

November:
- Develop the algorithm for communication and demodulation
- Test the system with respect to different distance requirements and sampling rates.
- Re-factor the system and reduce the decoding/demodulation error

December:
- Construct the final project design
- Create final report and presentation
- Documentation of results and findings
- Retrospective for future advancements for this project

References:
- Universal Timestamping with Ambient Sensing, SECON 2022
- Luxlink: Creating a wireless link from ambient light. In SenSys '19
- Retro-vlc: Enabling battery-free duplex visible light communication for mobile and iot applications