ECE 597SD Project Proposal

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Optical Data Transfer Using Laser and PV Panel

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

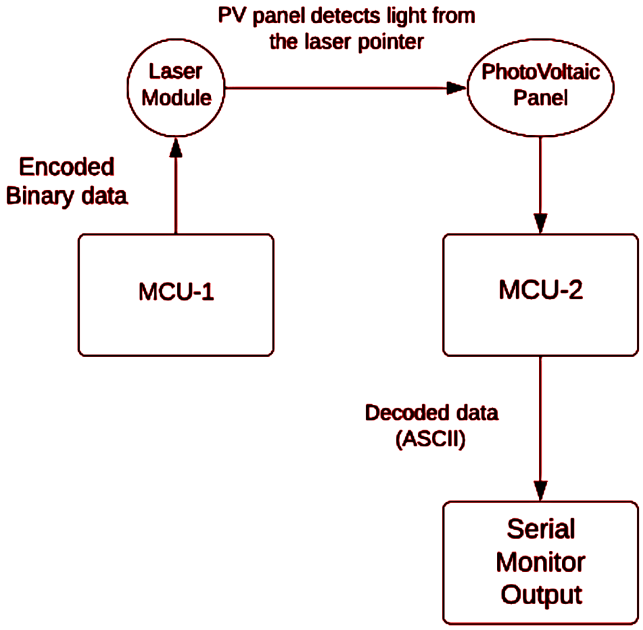
- Embed data in optical signals and optimize signal modulation and decoding at the transmitter and receiver.

Deliverables

- A modulation approach that represents data with fewer samples to cater to low sampling rates, does not require specialized tools to receive signals, is 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 and the receiver.

Hardware Diagram



HW/SW requirements

- **Hardware:** Arduino UNO, LED/Laser module, LDR, PV Panel
- **Software:** A custom algorithm to act as a communication bridge between LED/Laser and LDR/PV Panel

Team Members' Responsibilities

Rupak Poddar: Hardware design and 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 2019
- Retro-vlc: Enabling battery-free duplex visible light communication for mobile and iot applications