Electrical Engineering Capstone Project
Optically Controlled Reconfigurable Intelligent Surface

Team 44

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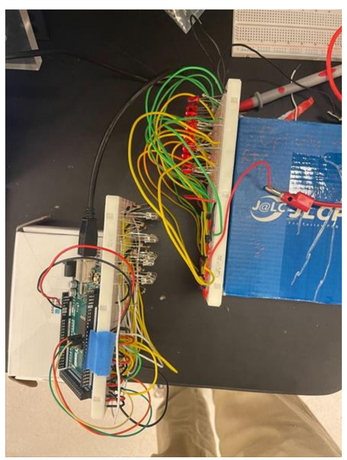
Introduction

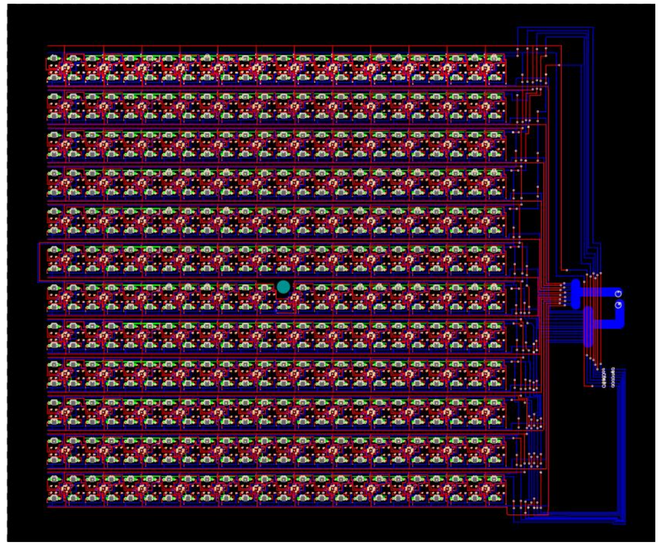
A reconfigurable intelligent surface (RIS) is an array of antennas which can be separately turned on or off in order to redirect incoming signals however desired. The current design faces an issue with signal attenuation and noise because the control wires for each antenna run through the substrate. Team 44 set out to create a control system for the RIS using LED's and phototransistors to eliminate this source of signal loss.

Initial Proof-of-concept



- 4x4 array built on breadboard
- Infrared LEDs aligned with phototransistors
- Red LEDs indicate phototransistor activation
- Arduino Microcontroller

Altium Design



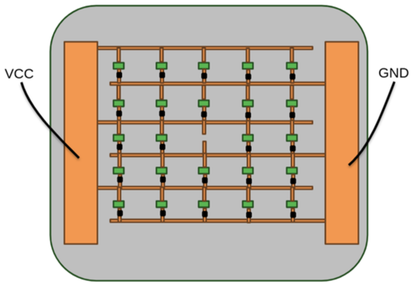
- 575 LEDs, 575 resistors, 144 shift registers
- Routing done on separate layers
- 12 shift registers shared between 2 rows to drive 4 LEDs each
- Shift registers are daisy chained, providing 12 input pins, plus 2 for clock and 2 for power and ground

Final Design

- 24x24 Array
- Fabricated on FR4
- SMD components

Testing Procedure

- 5x5 phototransistor array placed over middle of final control system design
- Each phototransistor is attached to a visible LED to show its activation



Conclusion

This LED board is a major milestone towards a fully functioning optically controlled RIS. By eliminating the source of signal loss, this project demonstrates the potential of RIS technology while providing a foundation for future improvements.

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