

Optical Tomography

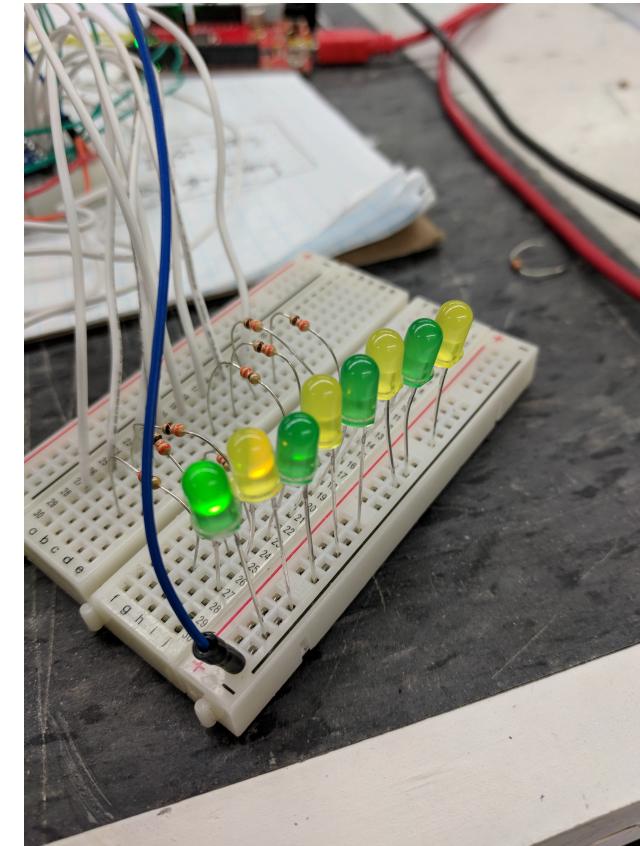
AN EXPERIMENTAL PROTOTYPING EXPERIENCE

BEN VENCILL AND OSVALDO ARMAS

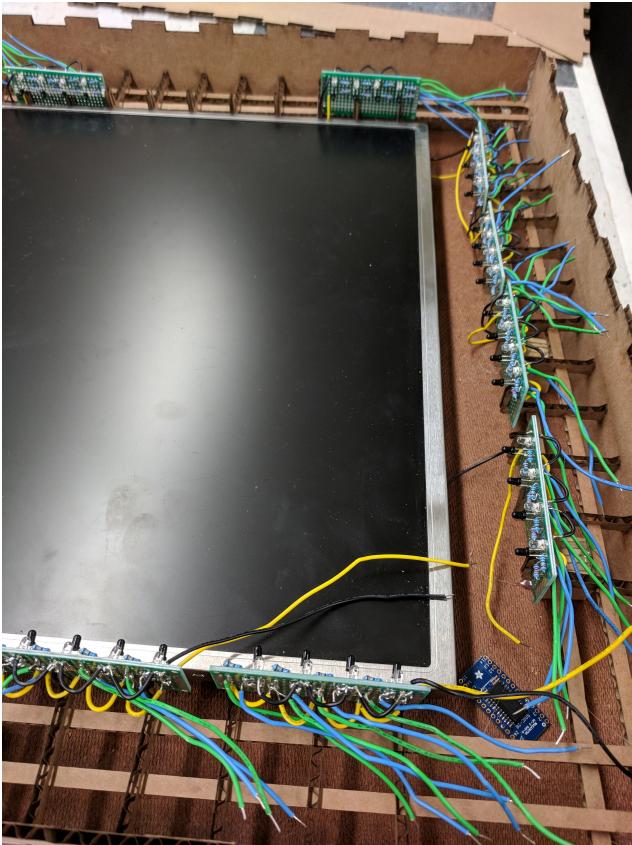
What is Optical Tomography

Use optics to map objects in 2-D or 3-D space

For this project, we use infrared light
transmitters and receivers



Introducing Our Project



Our goal is to use Optical Tomography in 2-D space to map a game of chess

Provide feedback and hints to teach new players

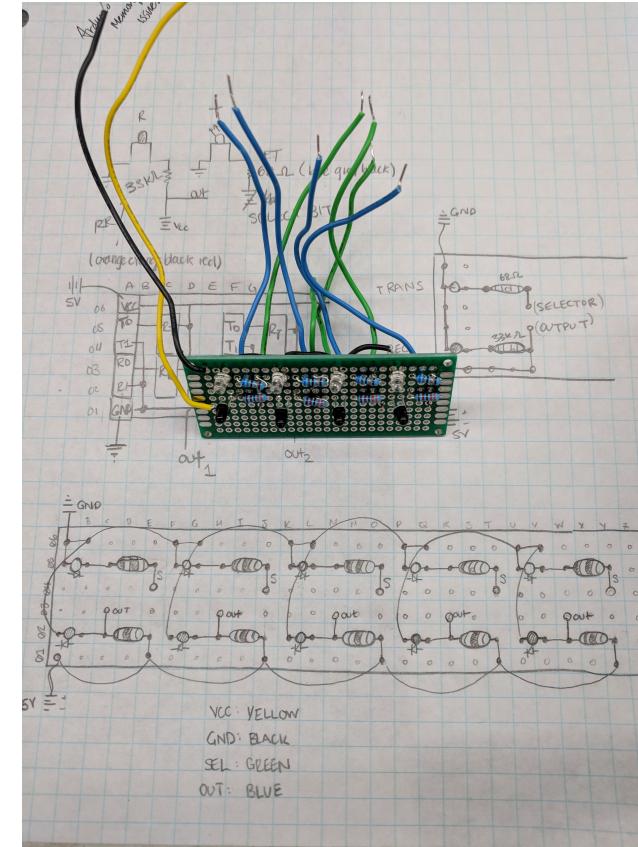
We attempt to use an LCD screen outfitted with IR sensors to accomplish this task

The Transmitter Board

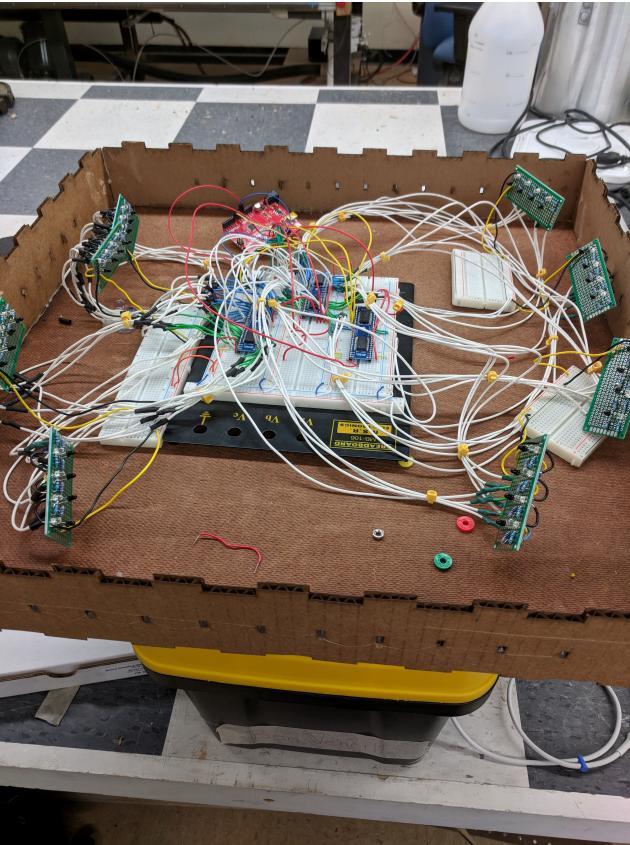
Comprised of pairs of infrared LEDs and receivers

Many of these boards make up the sensor bank that surrounds the chess board

Receiver values are read through analog input



Our Prototyping Adventure



Successfully fabricated enough functional sensor boards to sense a $16 \times 16 \times 16 \times 16$ area around our square

Difficulty combining and reading from such a large mess of sensors

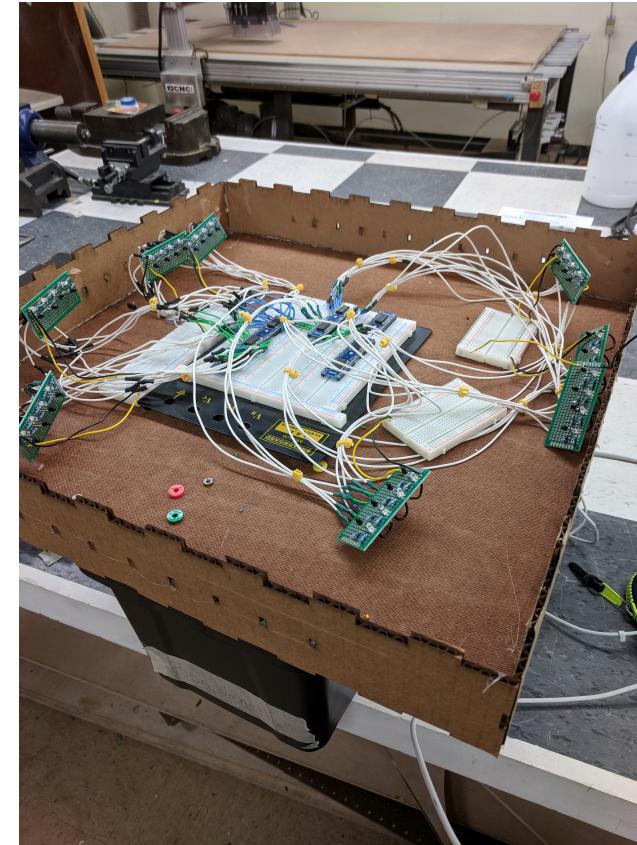
Alignment of cross-board sensors proved difficult

A Productive Flop

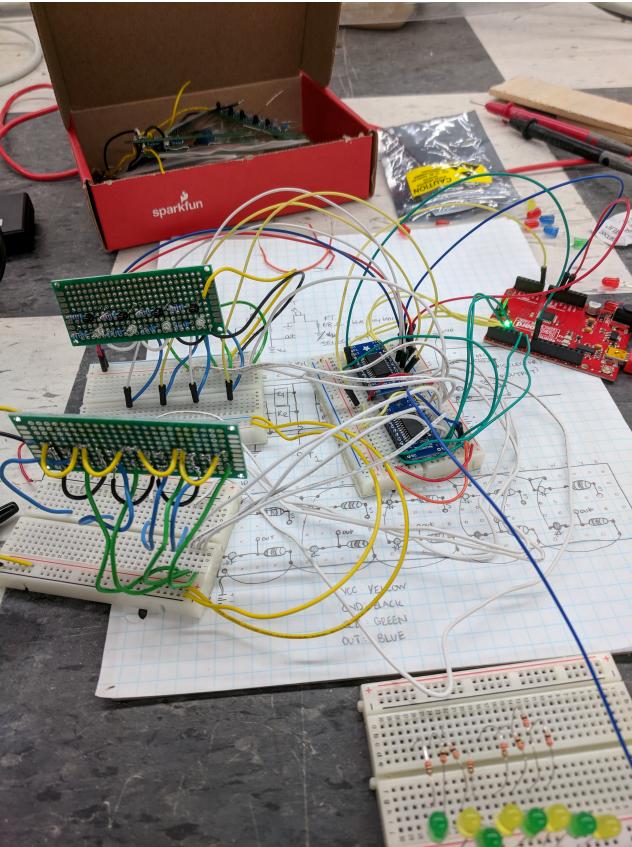
Project failed due to scope, challenge, and time limitations.

Scope: Too many complex components to tackle all at once

Challenging fabrication, assembly, and debugging of complex components



What We Accomplished



1. Functional IR transmitter receiver pairs that are modular and can be added to easily
2. Working control of LCD screen via Arduino
3. Basic detection of objects

Lessons Learned

Project Related:

Fail fast

Iterate quickly

Re-plan and refocus

Scoping project appropriately

Hardware Related:

Soldering masters

Controlling large number of sensors

Designing and debugging large, complex circuits

Controlling LCD screens in Arduino

Computational limits of Arduino

Future Work

We're both very excited about this project, and have a lot of ideas for where we want to take it from here

1. Finish the chess game
2. Create higher resolution IR sensing
3. Increase compute power
4. Incorporate machine learning with sensor data
5. Fourier Transforms for simultaneous sensing