LivePin

ECE Capstone Fall 2025 – **Crystal Huang**, Safiya Bainazar, Tedd Jung

Use Case

Problem

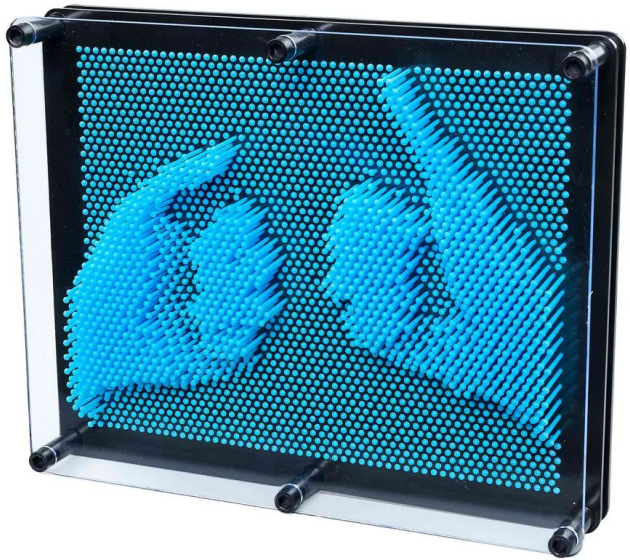
Currently museum exhibits and primarily rely on 2D screens or static objects, limiting engagement

Application

Allow users to take a picture of an object and render it into a 3D pin art recreation

ECE Areas

Software Systems, Hardware Systems, Circuits



Use Case Requirements

Size

16 x 16 (256 pins total)

Sufficient number of pins to model objects, while be cost effective

Latency

All pins should finish actuating within 2 minutes of image capture

Ample amount of time for the pins to actuate

Minimal wait time for rendering

Accuracy

95% of the target pins actuate to the correct position

Correct position defined as within 0.25 cm of intended height

Technical Challenges

Creating a realistic 3D rendering even with lower number of pins

- Adjust height map calculations

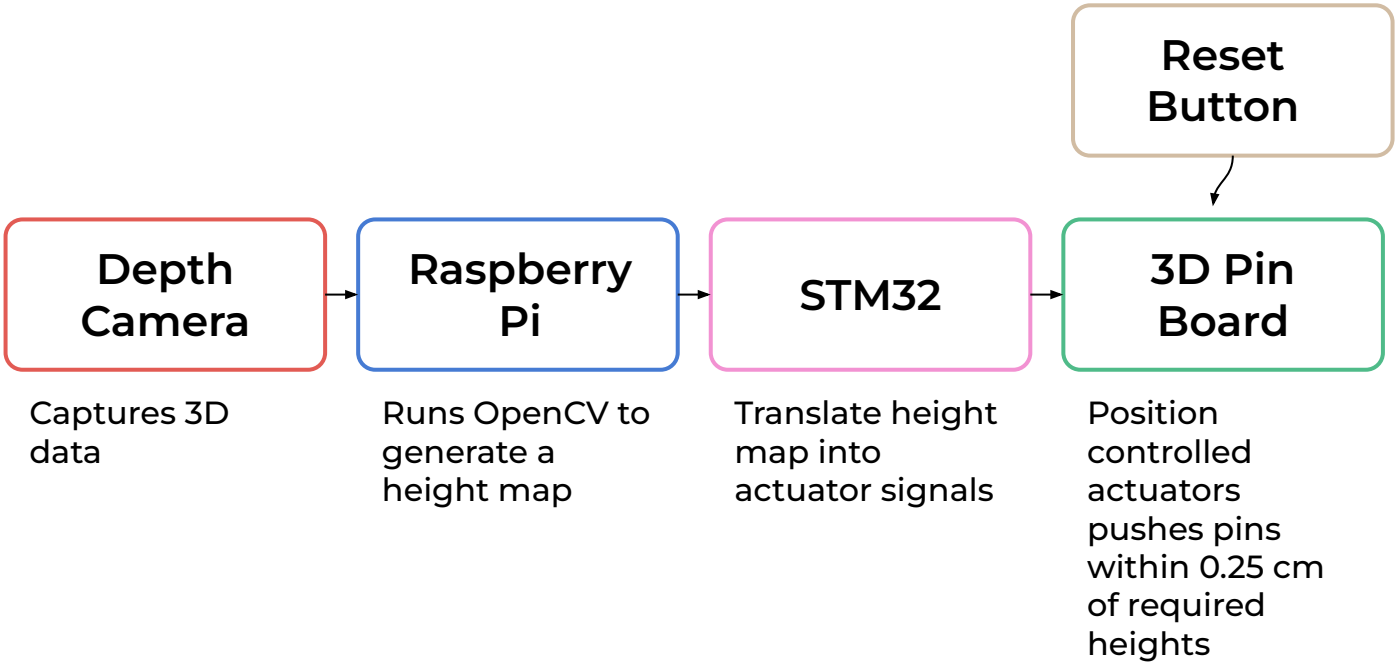
Mechanical actuation speed and precision

- Parallelize actuation
- Try different actuators

System Integration

- Modular design
- Unit testing

Solution Approach



Testing, Verification, and Metrics

Latency

Measure the amount of time between camera capture to all pins done actuating

Confirm <= 120 s

Accuracy

Construct a height map of known values

Individually measure the heights of pins based on set values

Tasks and Division of Labor

Hardware

- **Design of Prototype (CAD)** - Safiya
- **Fabrication** - Everyone
- **Assembly** - Everyone

Firmware

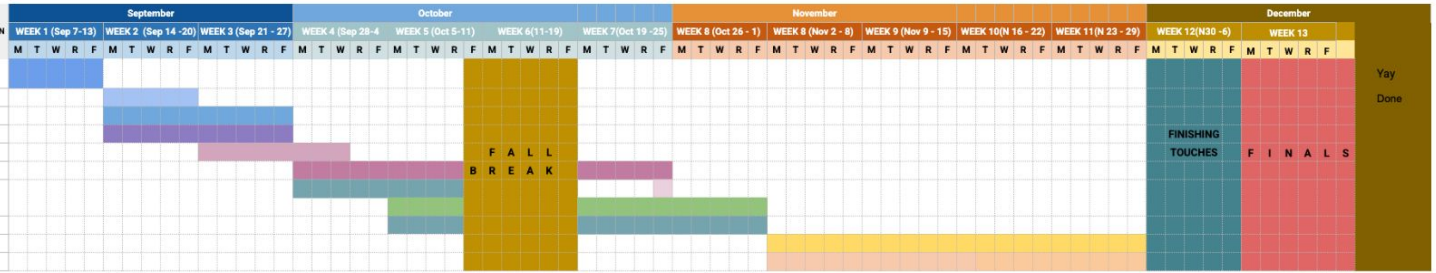
- **Actuator Driver** - Crystal
- **Gantry Driver** - Safiya
- **Reset Mechanism Driver** - Tedd
- **Communication Protocol** - Crystal

Software

- **OpenCV Development** - Tedd
- **Depth Camera** - Tedd
- **Heightmap** - Tedd

Gantt Chart

	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION
1	Project Proposal and Division of Labor	All	9/8/25	9/13/25	5
2	Drawing Of Prototype	All	9/13/25	9/19/25	6
3	Full CAD	Safiya	9/13/25	9/27/25	14
4	Design Presentation	All	9/13/25	9/27/25	14
5	Computer Vision Algorithm	Tedd	9/21/25	10/1/25	10
6	Pin Actuation Driver	Crystal	10/1/25	10/24/25	23
7	Fabrication and Assembly	All	10/1/25	10/10/25	9
8	Gantry movement	Safiya	10/5/25	10/28/25	23
9	Reset Mechanism		10/5/25	11/1/25	26
10	Integration	All	11/2/25	12/5/25	33
11	Testing	All	11/2/25	12/5/25	33



A cool new 3D visualization tool