Raspberry Pi-based Face-Traceable Fever Detection System

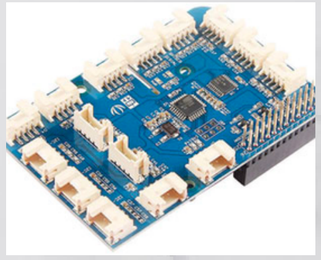
Presenters:

Jiacheng Wei
Zeal Liang
Wenqian Zhang
Minxin Shi

Group: kurukuru~

H A R D W A R E

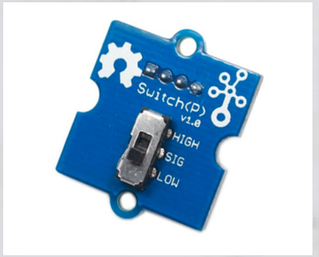
Raspberry Pi 4 Model B 4GB



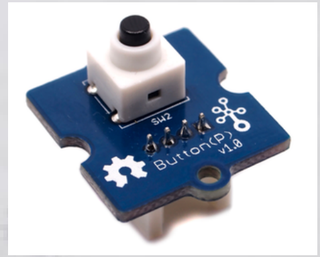
GrovePi+

RealSens Depth Camera D435

Grove - Rotary Angle Sensor



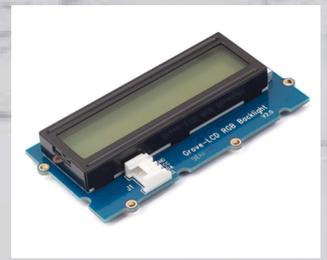
Grove - Switch(P)



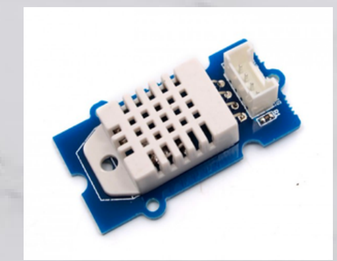
Grove - Button(P)

Grove - PIR Motion Sensor

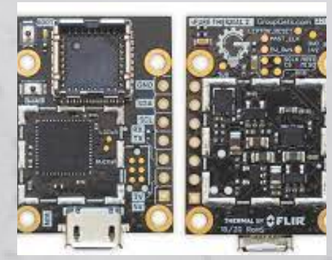
SM-S2309S ; Micro Analog Servo Motor



Grove - LCD RGB Backlight



Grove - Temperature & Humidity Sensor

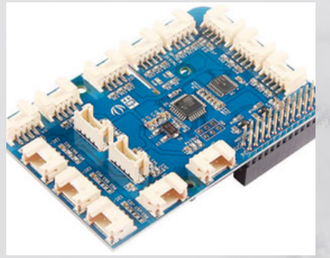


PureThermal 2

FLIR Lepton 2.5

H A R D W A R E

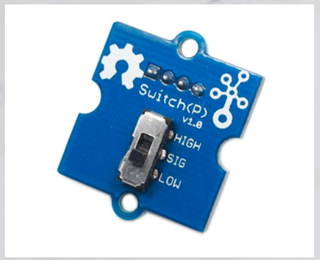
Raspberry Pi 4 Model B 4GB



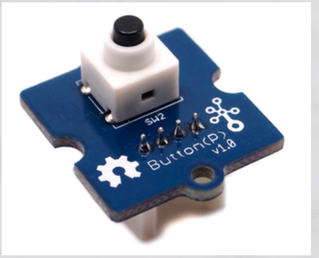
GrovePi+

RealSens Depth Camera D435

Grove - Rotary Angle Sensor



Grove - Switch(P)

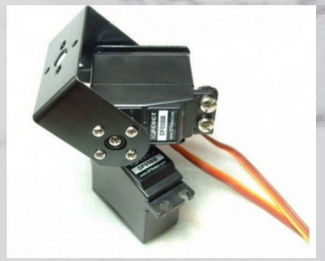


Grove - Button(P)

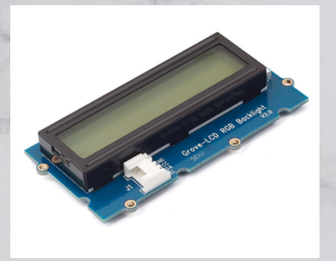
Grove - PIR Motion Sensor

Grove - Buzzer

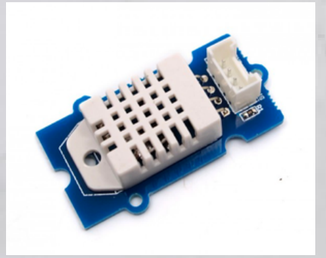
SSD1315 0.96" OLED Display



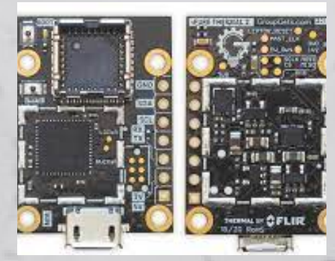
DSS-P05; 5kg Servo Motor Set



Grove - LCD RGB Backlight



Grove - Temperature & Humidity Sensor



PureThermal 2

FLIR Lepton 2.5

Progress in Software

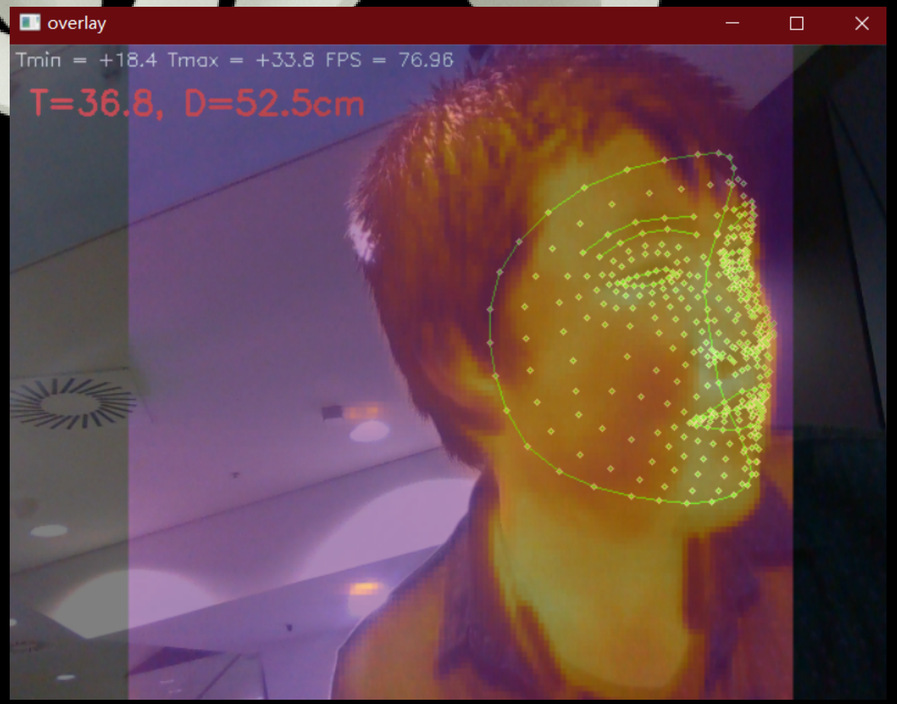
Challenges

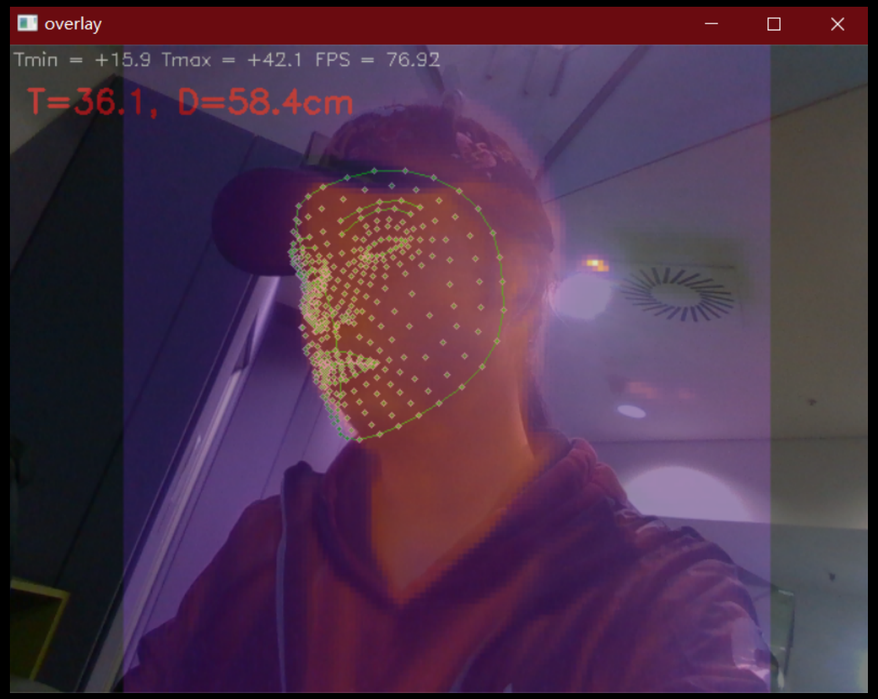
1. Thermal Tuning & Face Detection

2. Aligning thermal and rgb images

3. Temperature Offset

Thermal camera tuning



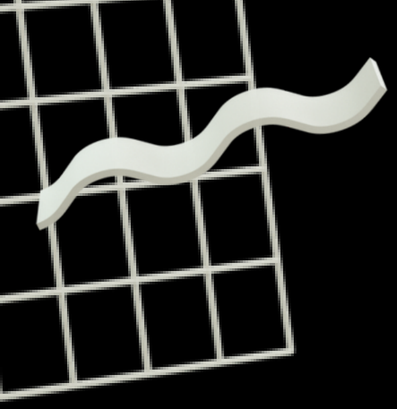


- Detect Edge and Remove Invalid Landmark Points
- Take the average of 5 highest points
- Capture from multiple frames and then average

Aligning thermal and rgb images

First attempt

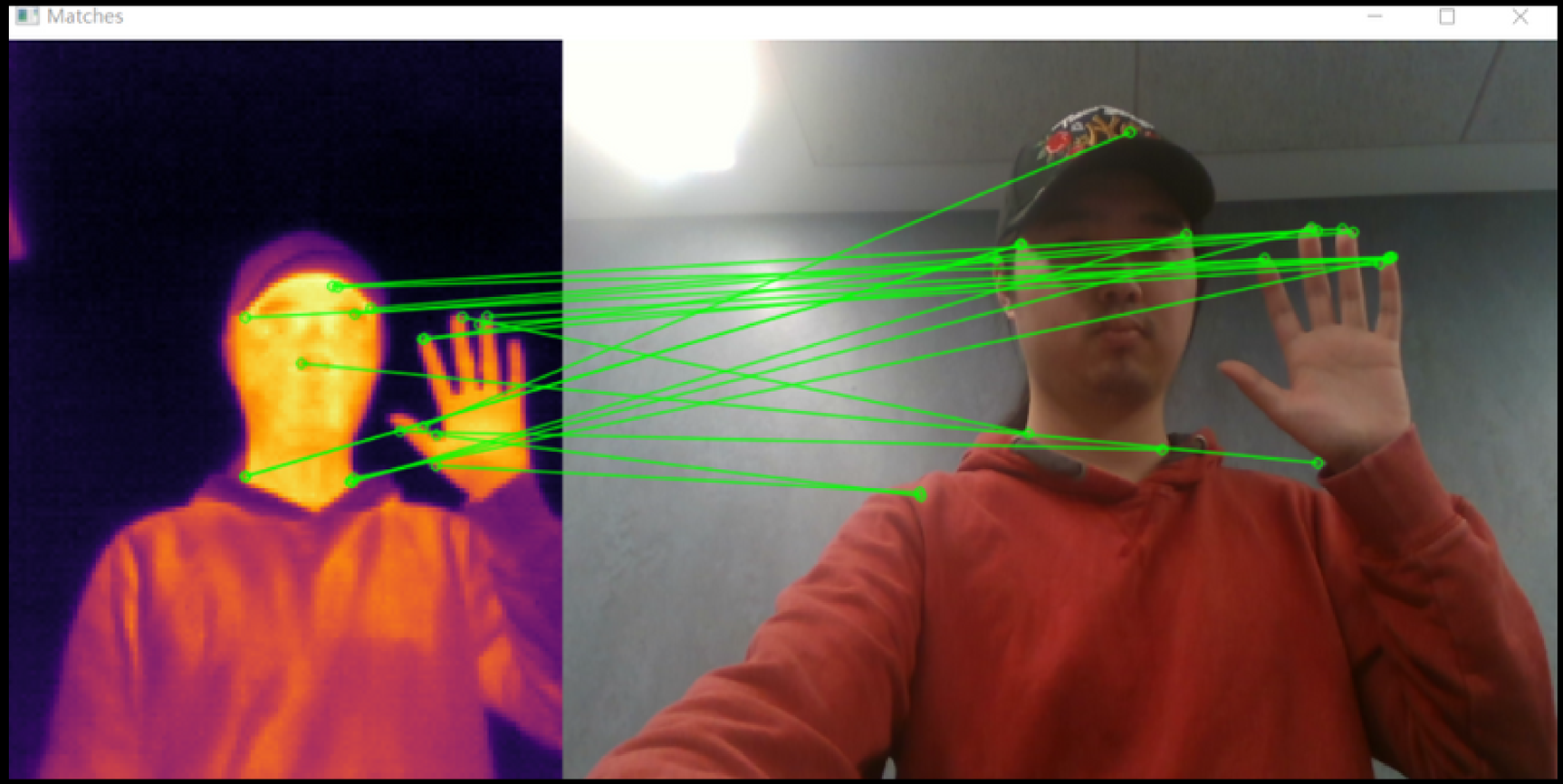
1. rgb: 480*640
2. thermal: 480x360
3. Cut to 480*160



Aligning thermal and rgb images

Second attempt

1. FAST and Rotated BRIEF (ORB) algorithm
2. cv2.BFMatcher



Aligning thermal and rgb images

Third attempt

Perspective transformation matrix

Correct temperature offset based on face distance

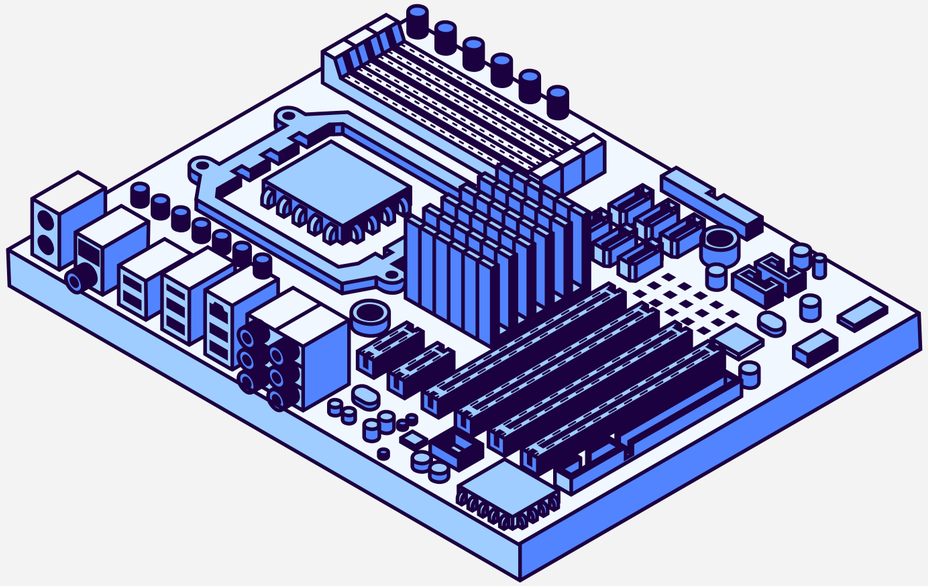
First attempt

- Width of the face relative to the width of the image
- 50cm to 100cm

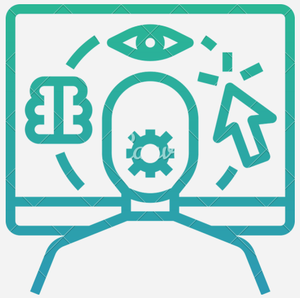
Second attempt

- Use Image depth data
- 20cm to 200cm

Progress in Hardware



2-Axis Gimbal



Human-Computer Interaction

Physical Alarm

2-Axis Gimbal

x-axis range:

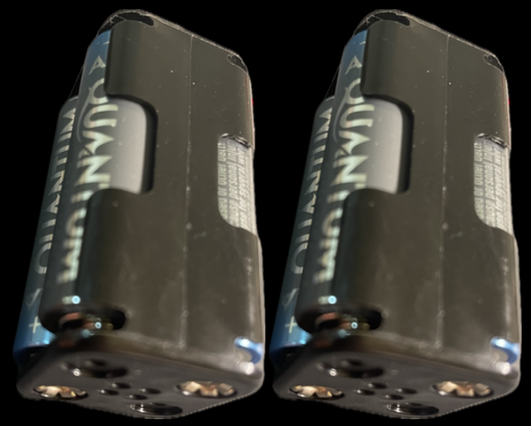
0˚-180˚ degrees

y-axis range:

50˚~120˚ degrees

Challenge

- Insufficient Power

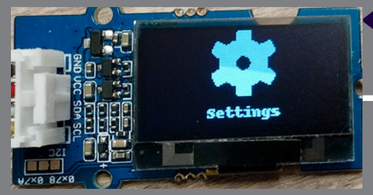


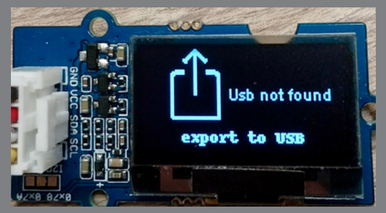
Human-Computer Interaction

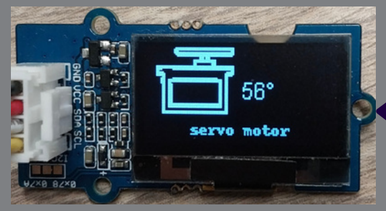
On-screen display, Rotary Position Sensor and Button for interaction

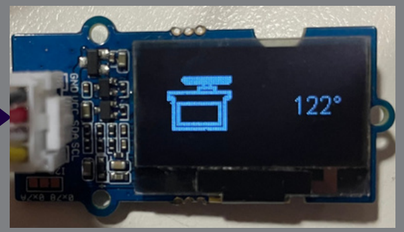
Home Menu

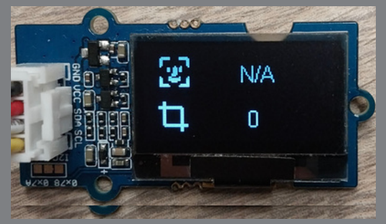
Setting Menu

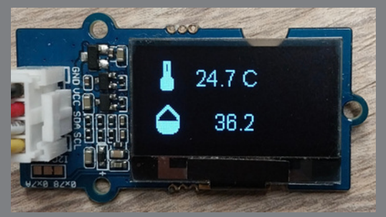


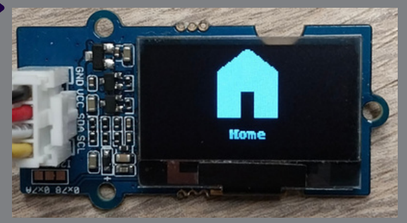


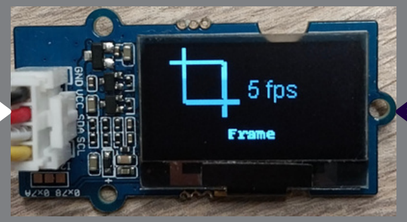


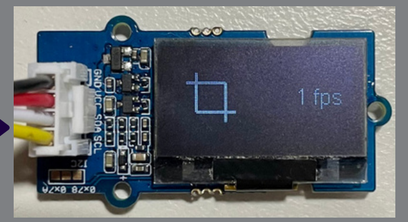


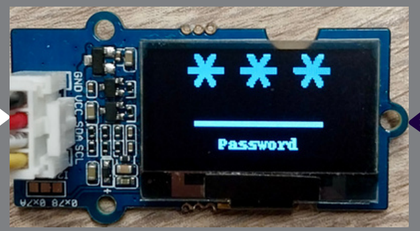


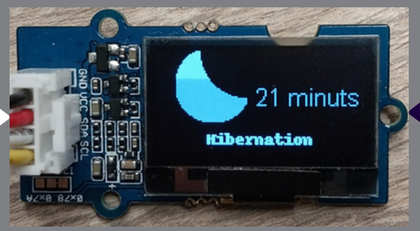










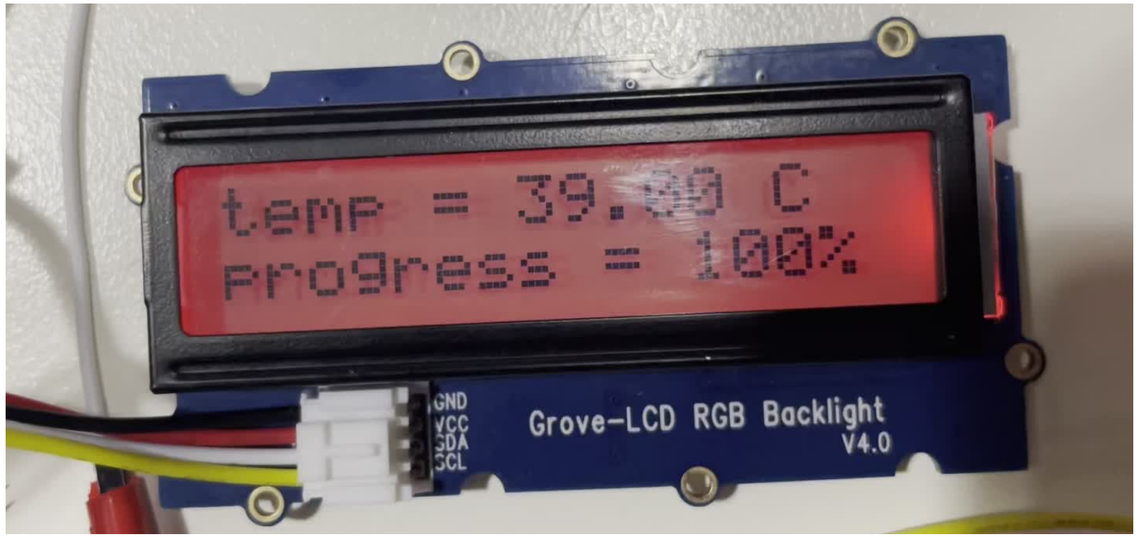


Challenge

- Software design
- Screen refresh rate

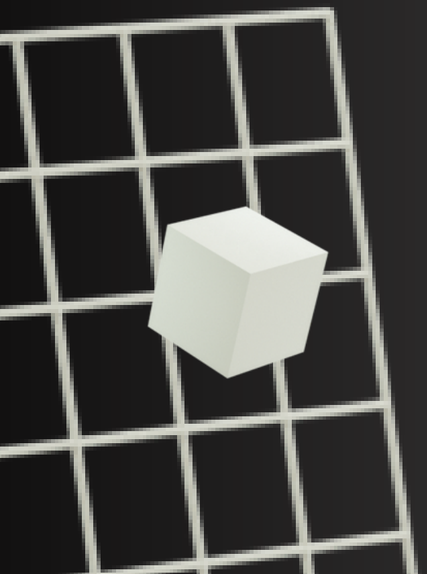
Physical Alarm

Buzzer and screen flickering



Advantages:

- High reusability: Can be easily extended.
- Well-styled code: The code has a clear and organized structure.
- Strong productivity: Easy to replicate and produce.



Pending Tasks:

Alarm Email

If the temperature is higher than normal people, the camera will take an RGB photo and send with the temperature to the administrator's email.

The Future of IoT

Where to next?

Challenging Project Expansion

- Tracking
- Shell

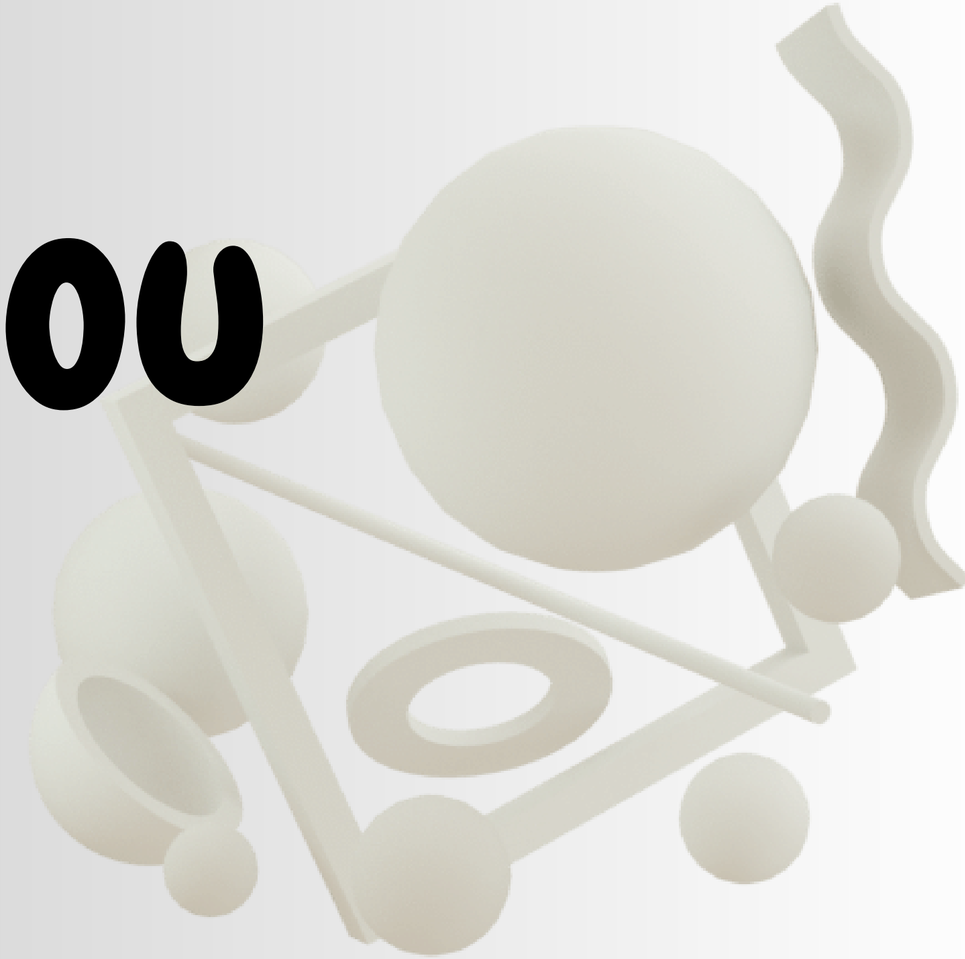
Testing and Calibration

- Testing: Use a temporal gun.
- Calibration: Minimize distance impact.

Testing

- Thermal camera affected by distance.
- Further temperature adjustments based on infrared thermometer and depth camera readings.

Thank you



Q&A