Sleep Cycle-Triggered Lighting Wake up

ECE 445/Group 21

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What problem does our project solve?

Background:

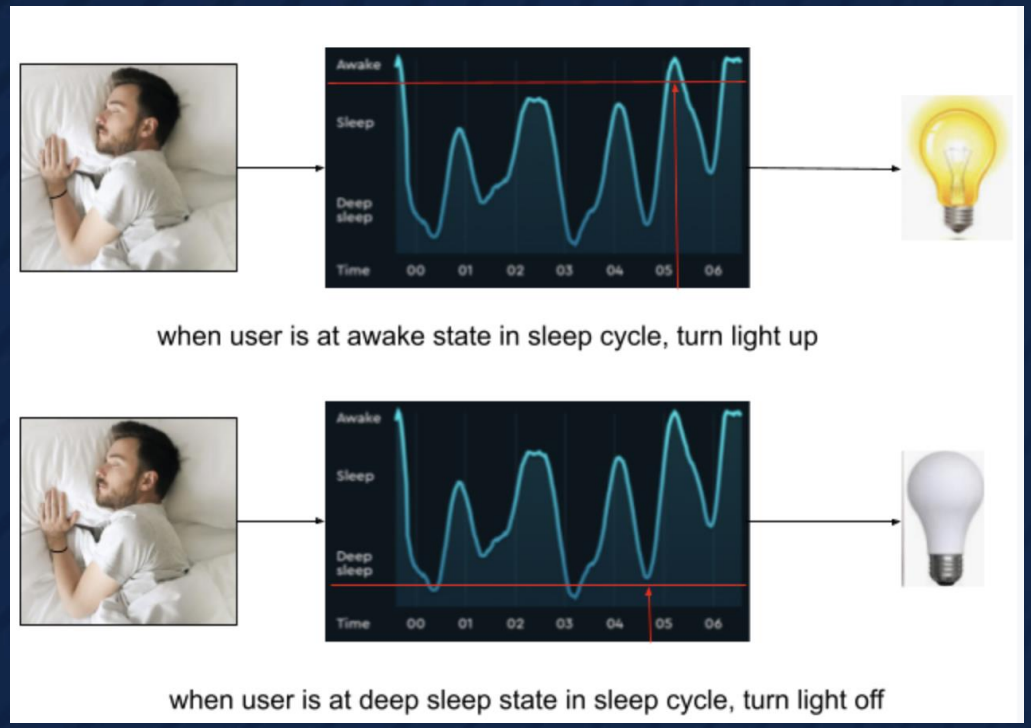
- Many people have a bad time waking up in the morning by the alarm clock
- People feel the process is painful and abrupt
- 79% of respondents from a survey admitted that bad waking up will ruin their day

Objective:

- Use light instead of noisy sound as our mean to wake the user up
- Make a device that can gather datas from the user when they are in sleep
- Make a device that is able to tell by the data that when is the right time to wake up

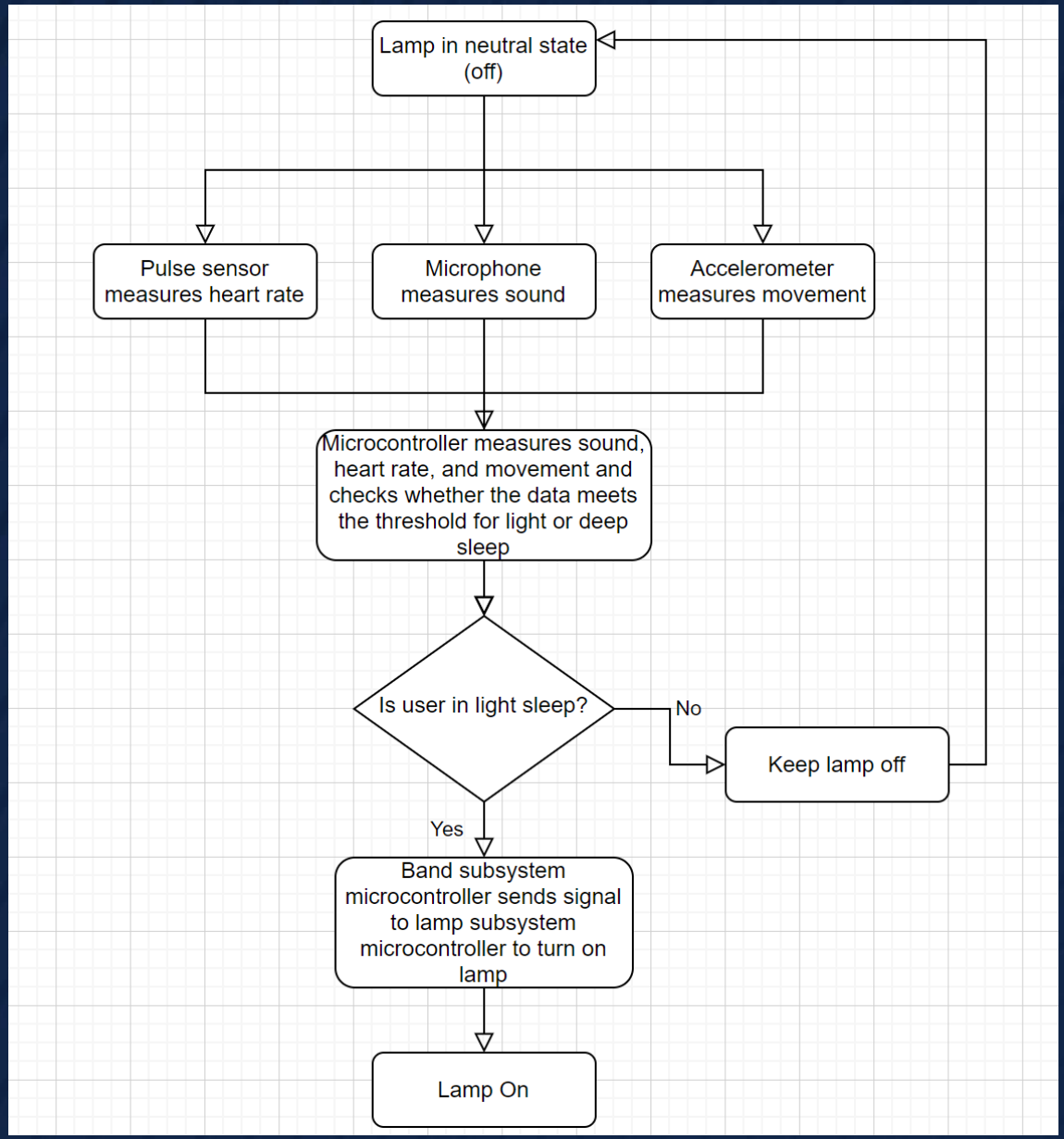
Project Brief Description

- A wristband that can detects multiple sets of datas
- Has a microcontroller that can process and analyze the data
- Determine users' sleep cycles especially the light sleep cycle
- Send signal to the light bulb when the user is in the light sleep cycle



Software workflow

- Two subsystems: band subsystem and light subsystem
- Data (Pulse, sound, and movement) will be collected by band subsystem
- Check if data meets threshold and see if the user is in light sleep
- Turns the light up when the user is in the light sleep



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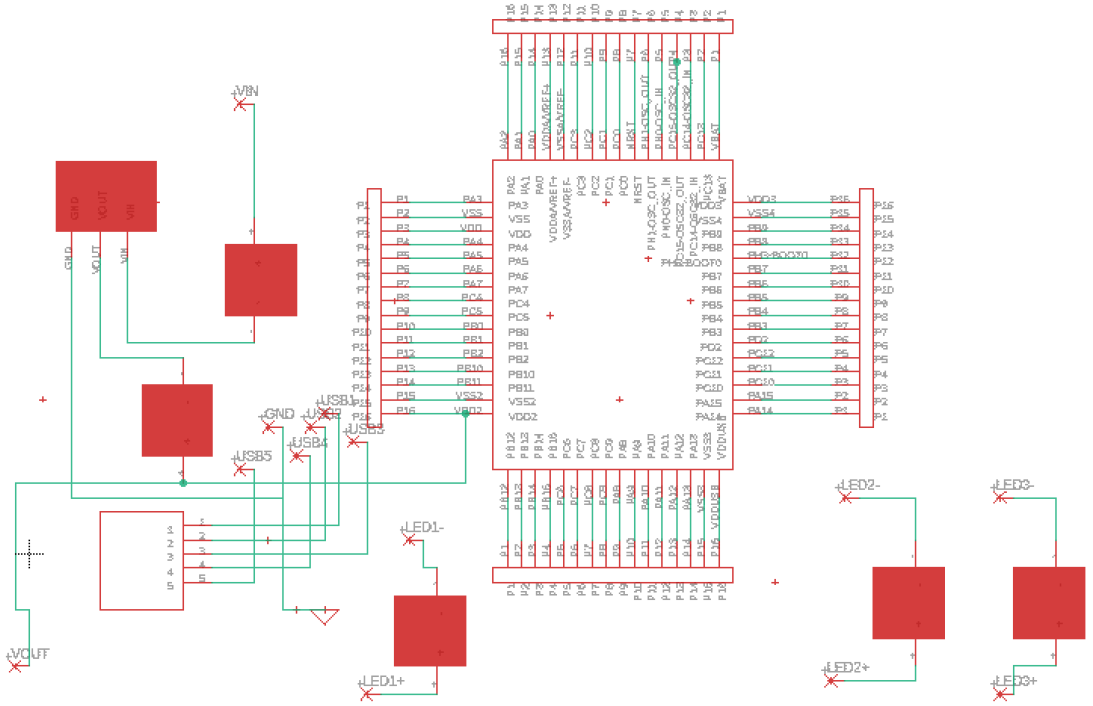
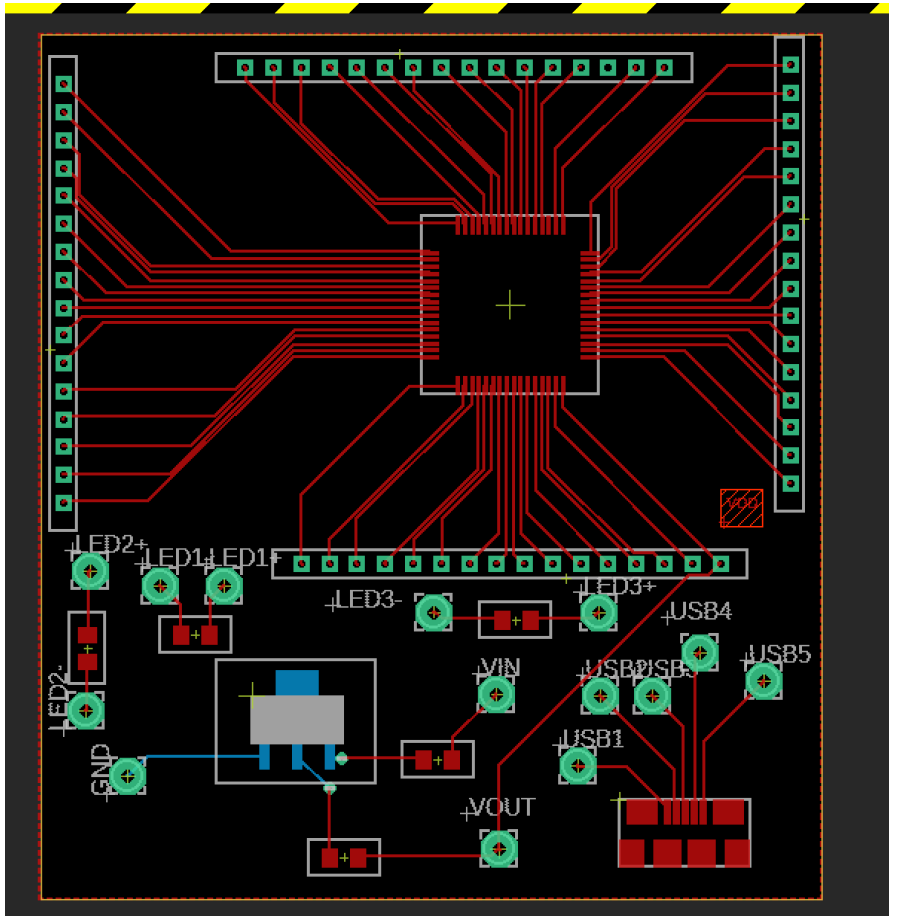
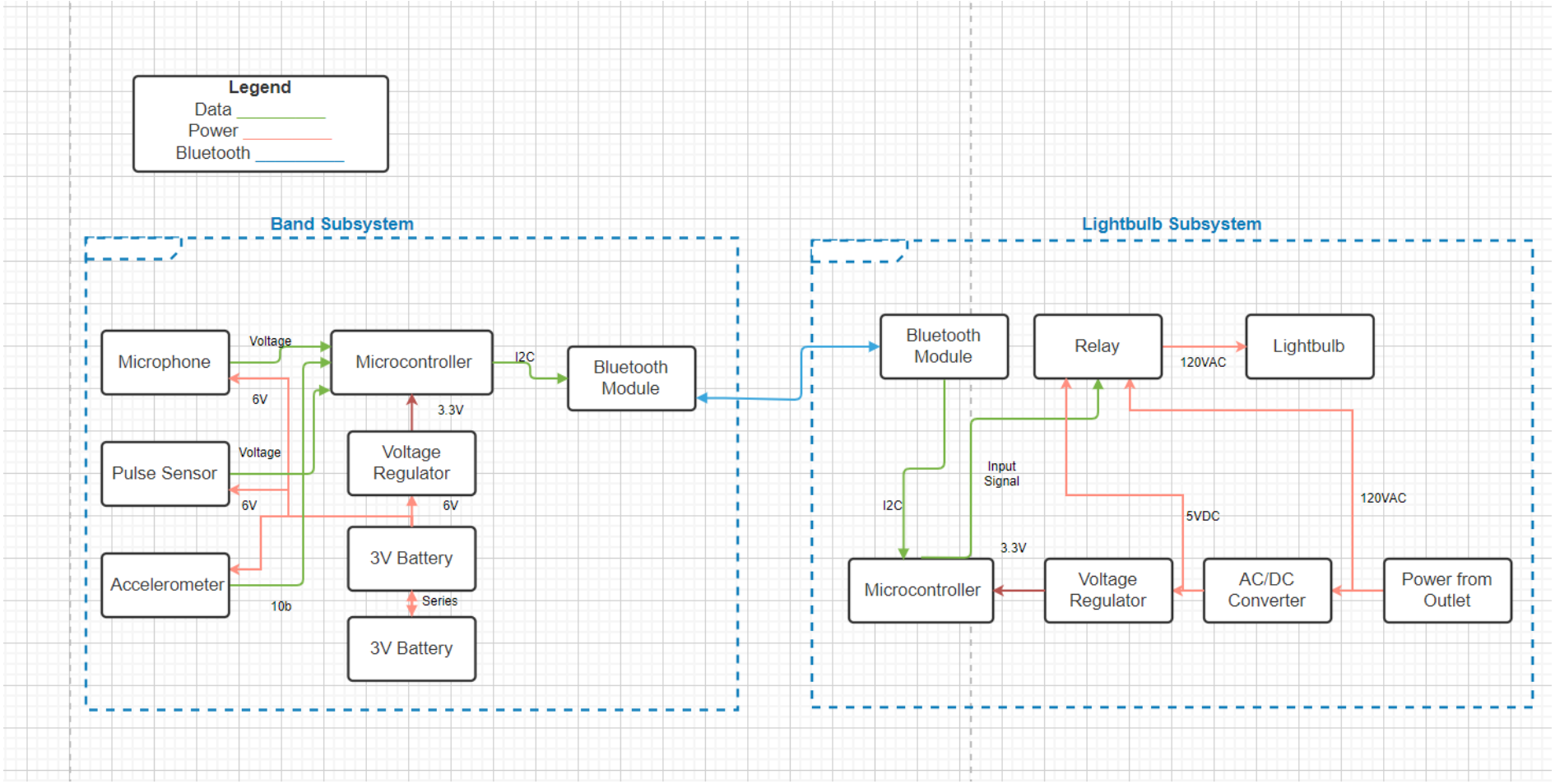
PCB designs





Block Diagram of our device

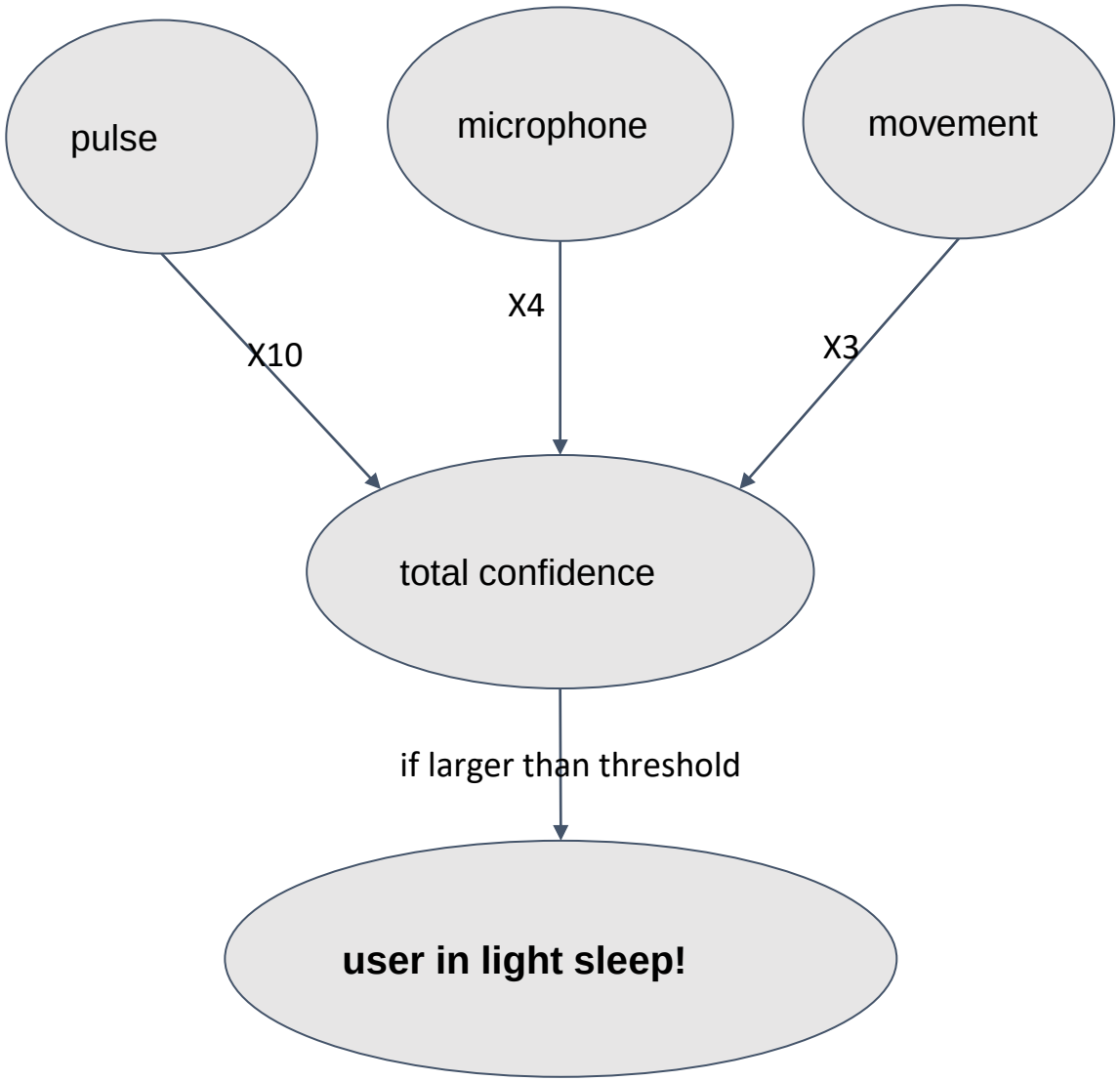


Our algorithm to detect light sleep

function *pulse_confidence*, *microphone_confidence*, *accelerometer_confidence*:
    if data point in threshold:
        confidence + 1

function *calculate_total_confidence*:
    total_confidence = confidence from pulse data * 10 + confidence from microphone * 4 + confidence from movement * 3

function *is_light_sleep*:
    if total confidence > threshold:
        user is in light sleep!



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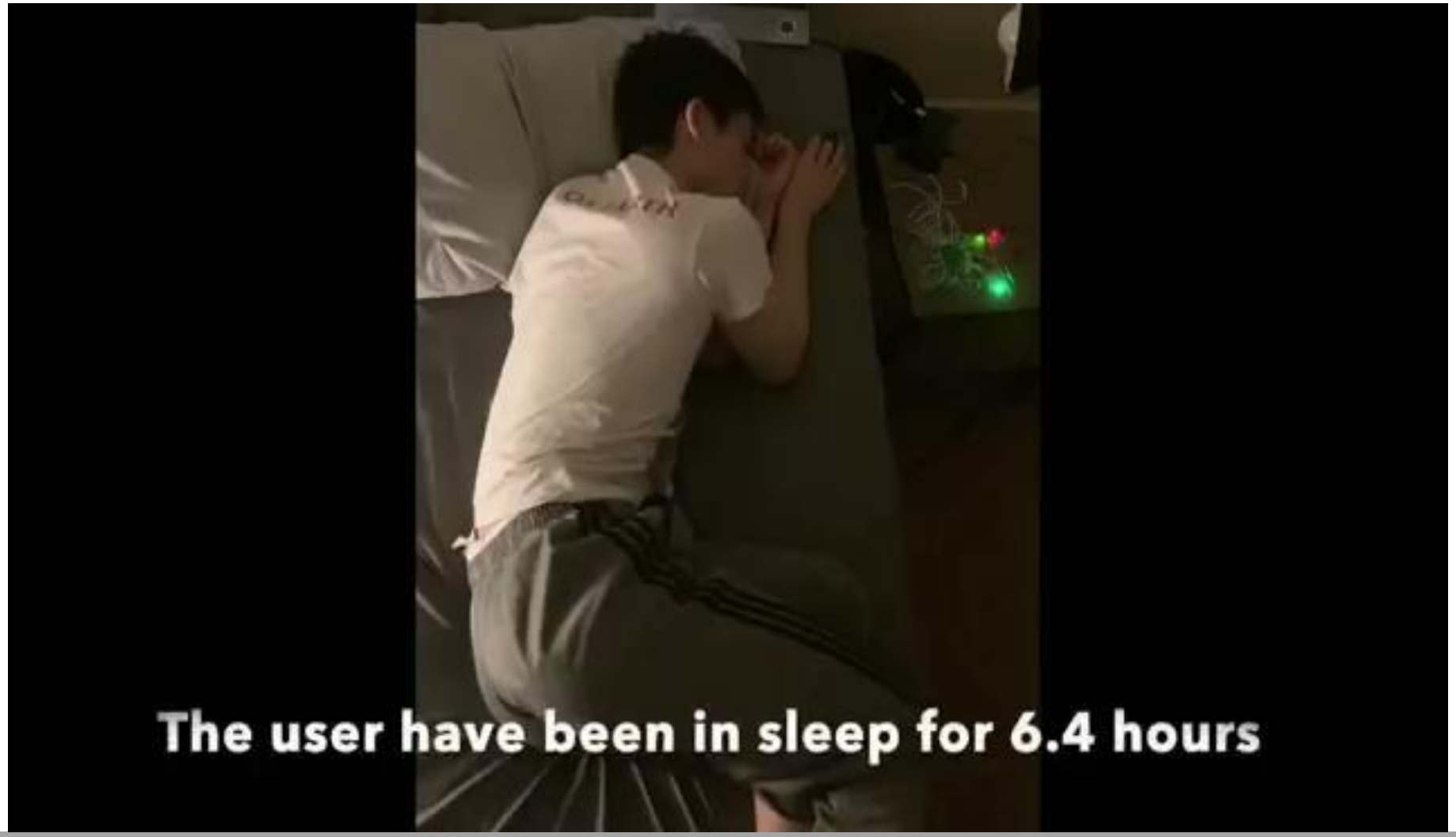
Our Testing Video



Final Results

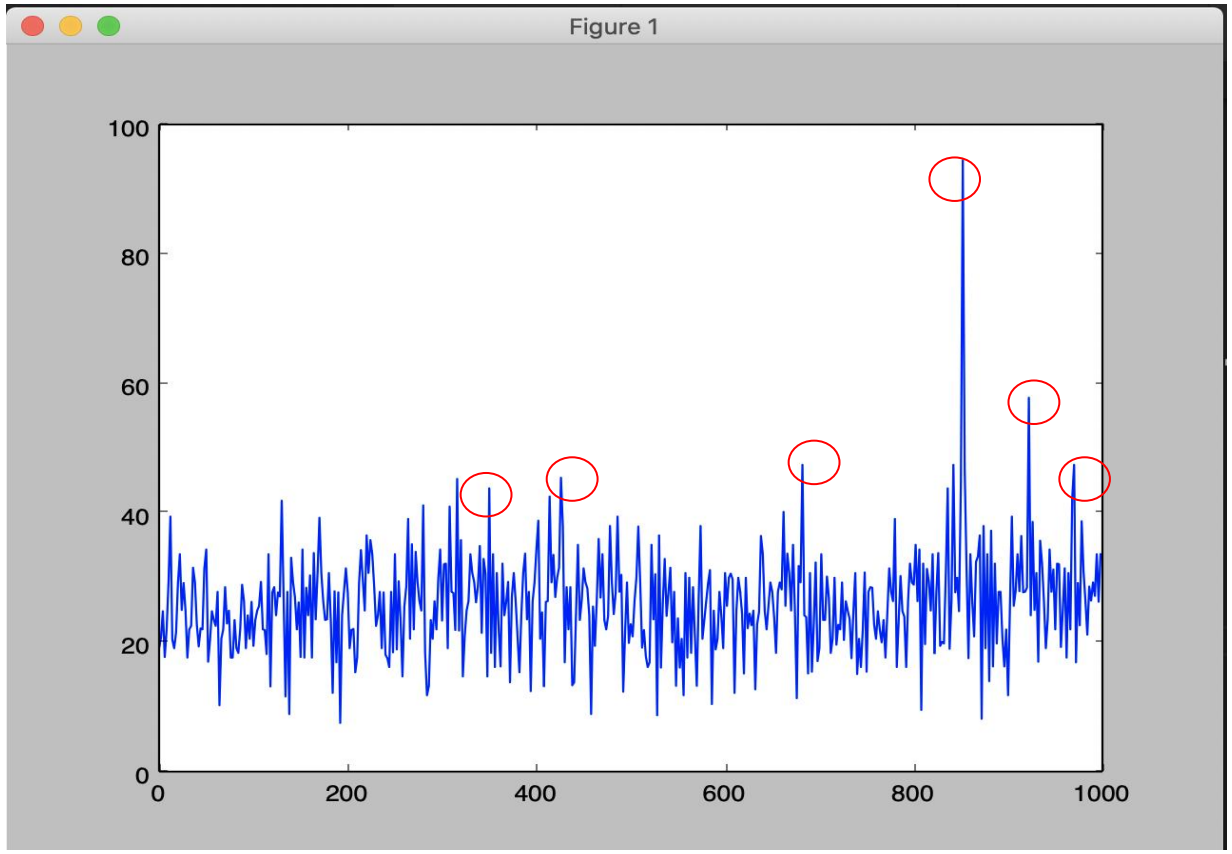


Figure 1. microphone data

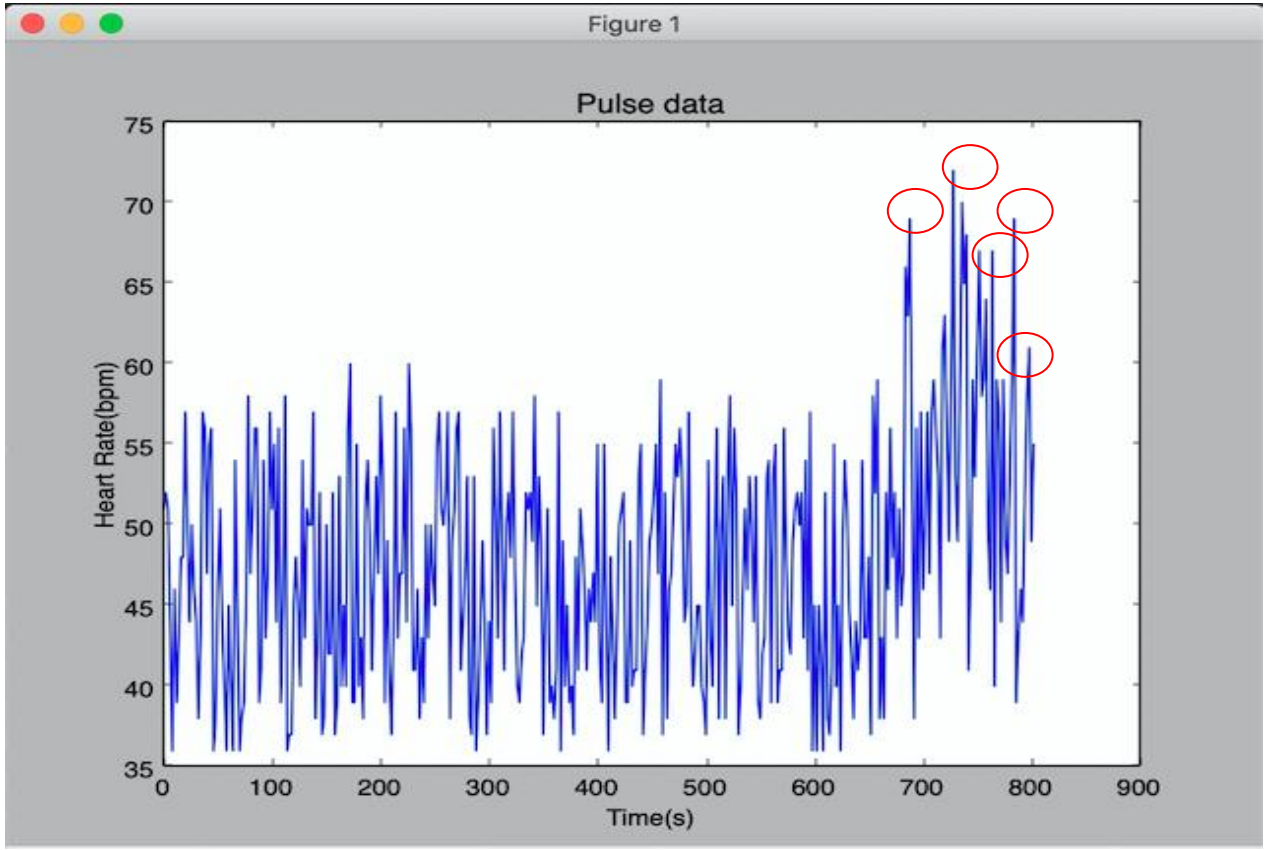


Figure 2. pulse data

Final Results

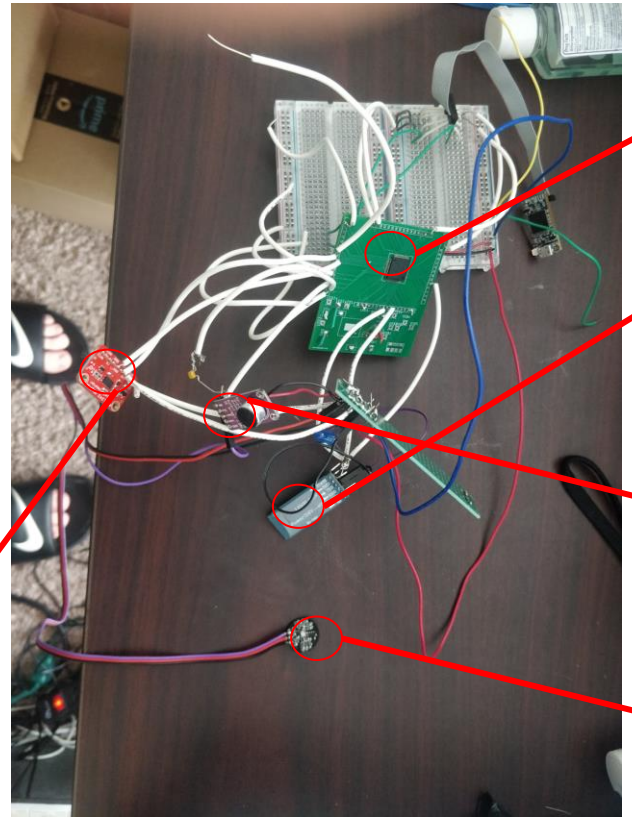


Figure 1. Band Subsystem

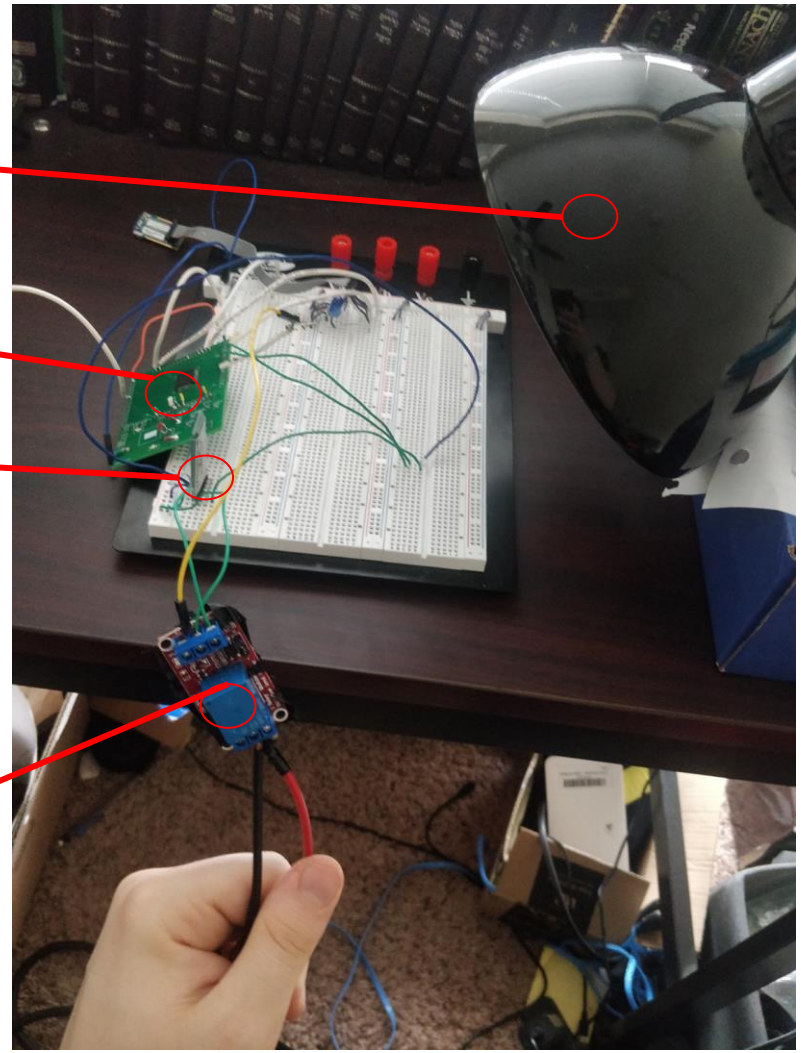


Figure 2. Light Subsystem

Final Results- Components

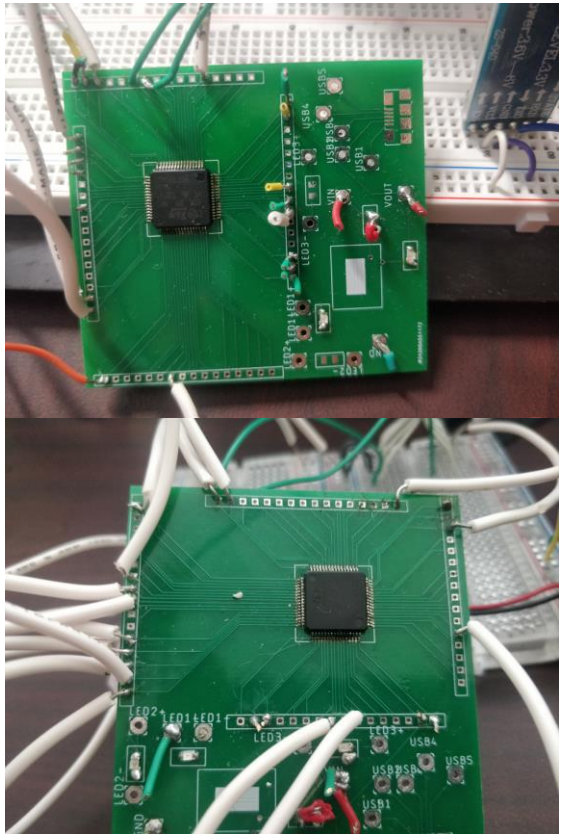


Figure 1. Microcontrollers

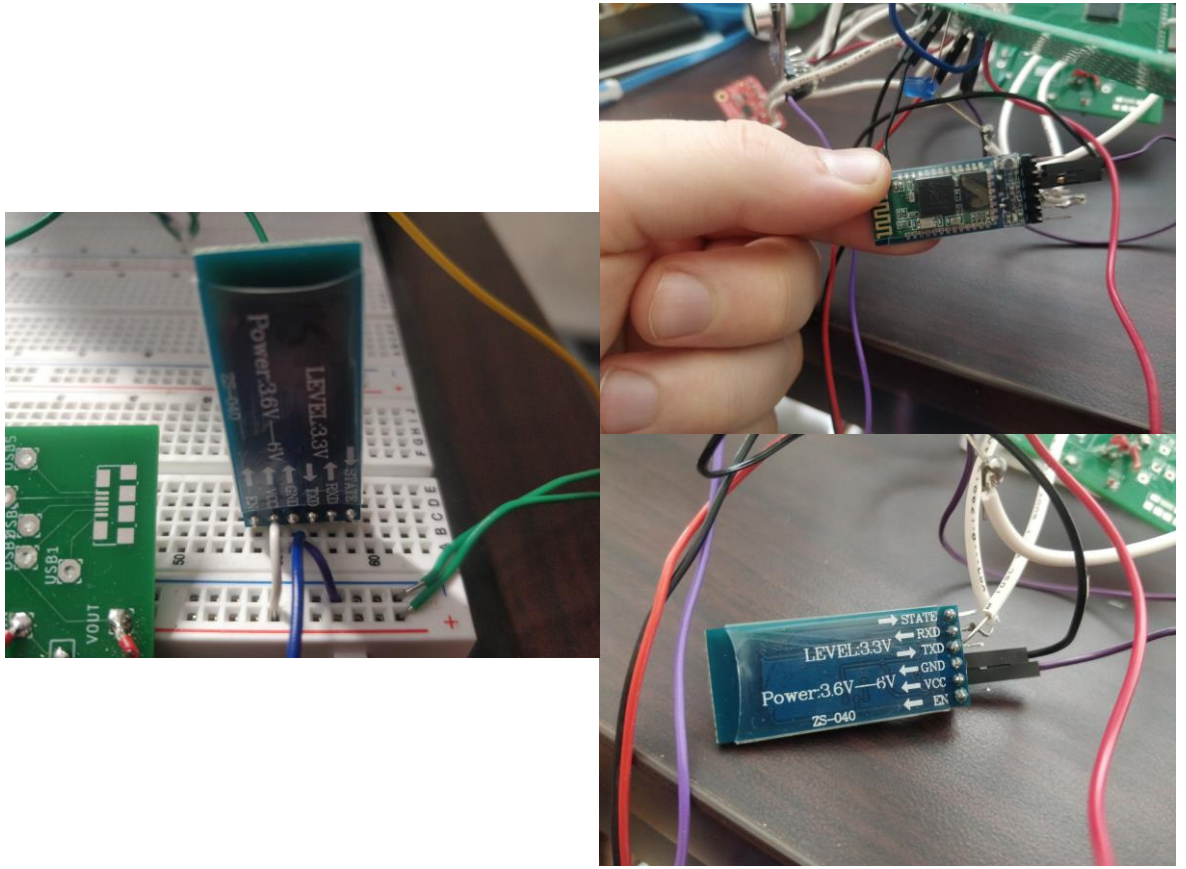


Figure 2. Bluetooth Modules

Final Results- Components

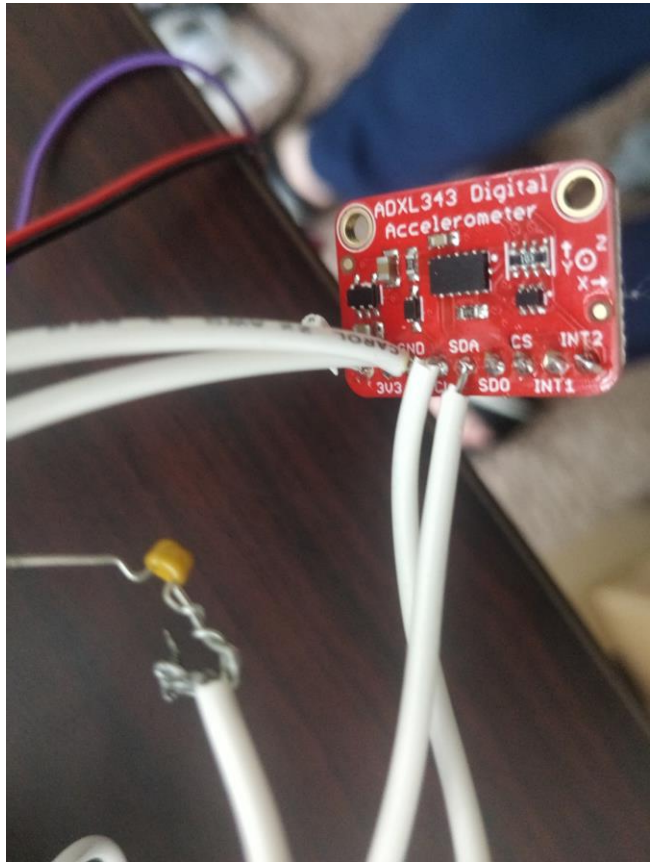


Figure 1. Accelerometer

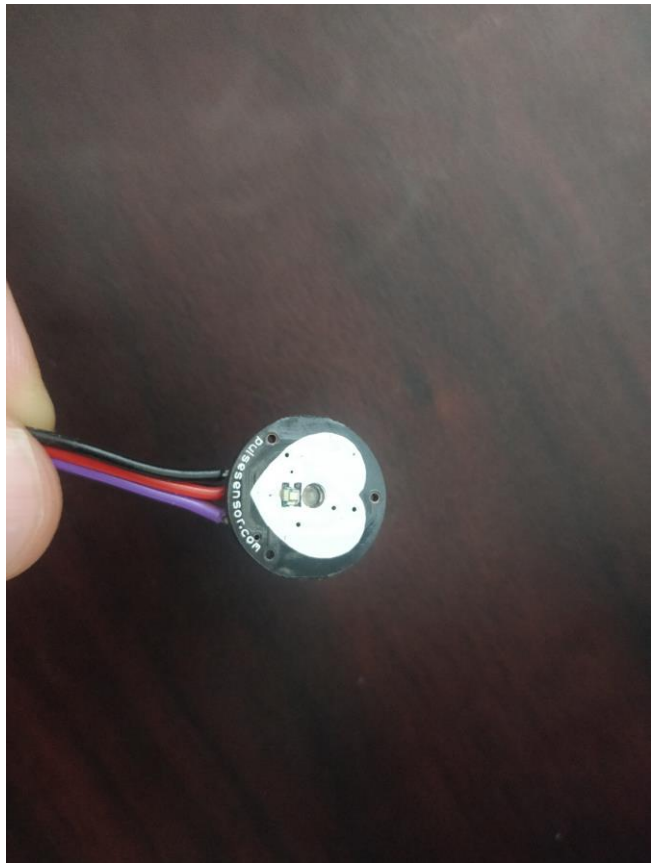


Figure 2. Pulse Sensor

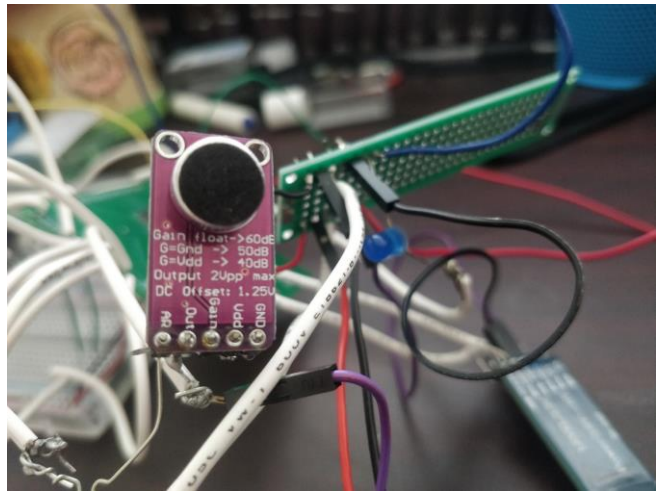


Figure 3. Microphone

Final Results- Components

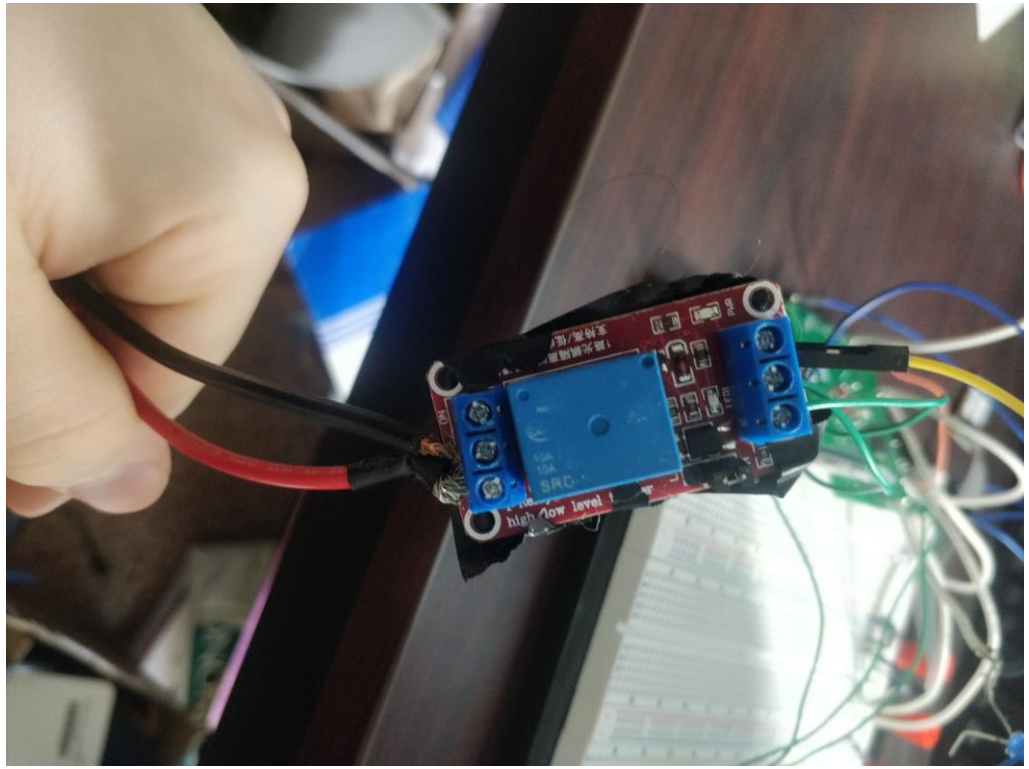


Figure 1. Relay

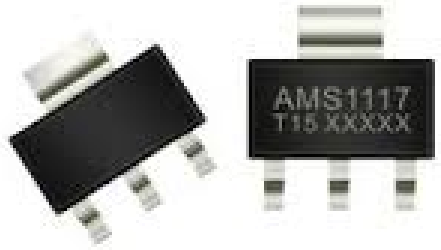


Figure 2. Voltage Regulator

What is our Project?

- We were able to read sensor data and control the lightbulb based on changes in the data
- We were able to test it for one night and it worked

Future Work:

- Solder more of the subsystems together instead of relying on the breadboard
- Make band subsystem smaller and more compact
- Incorporate band subsystem into a watch
- Get more test data and create better algorithms

Thank You!
Any Questions?

The Grainger College of Engineering

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