



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

Home Appliance Energy Monitor

Electrical & Computer Engineering

Team 25

12/5/2023

Team Members

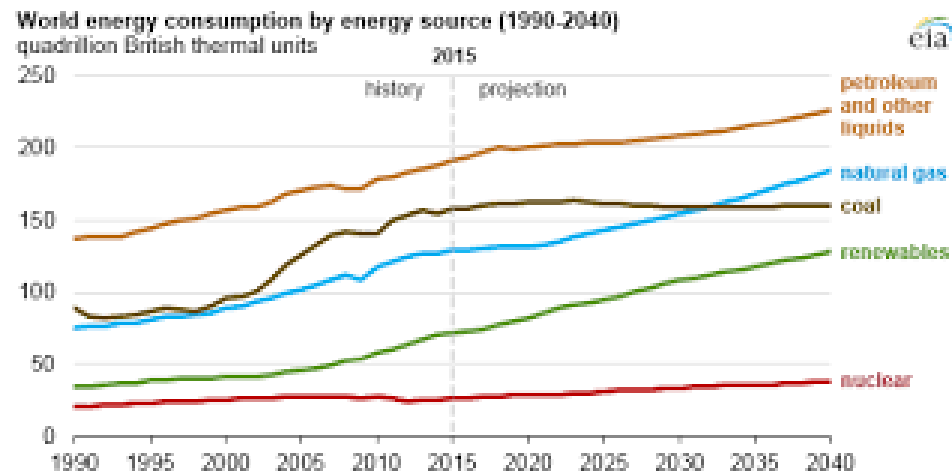
- Guneet Sachdeva: Senior in Computer Engineering
- Om Patel: Senior in Computer Engineering
- Ravi Thakkar: Senior in Computer Engineering

Photos of Team Members



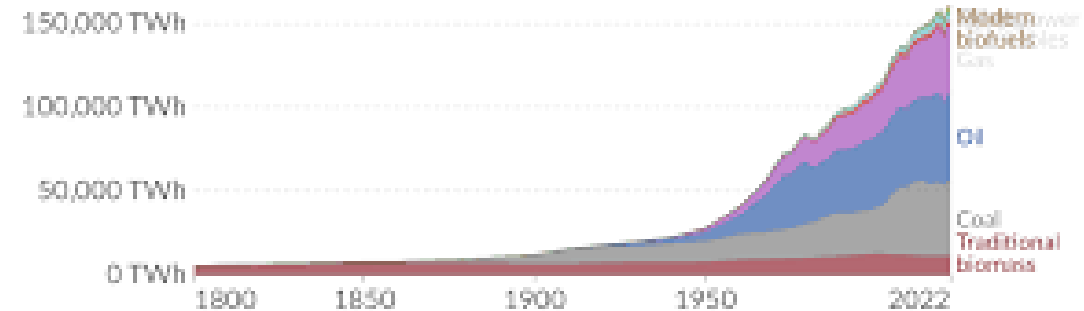
What compelled us to pick this project?

- Energy Consumptions increasing as the world becomes more technologically dependent
- Use technology in our home everyday



Global direct primary energy consumption

Direct primary energy consumption does not take account of inefficiencies in fossil fuel production.



Data source: Energy Institute Statistical Review of World Energy (2023); Vaclav Smil (2017)
OurWorldInData.org/energy | CC BY

What problems need to be solved?

- The modern lifestyle does not allow us to be mindful of electricity consumption
- Users are unaware of which appliances disproportionately contribute to the total electricity consumption
- Therefore, an average of 34% of electricity in a household is wasted



What is the solution to the problem?

- An energy metering system that relays power consumption data to a user-friendly application

Visual Aid of Solution

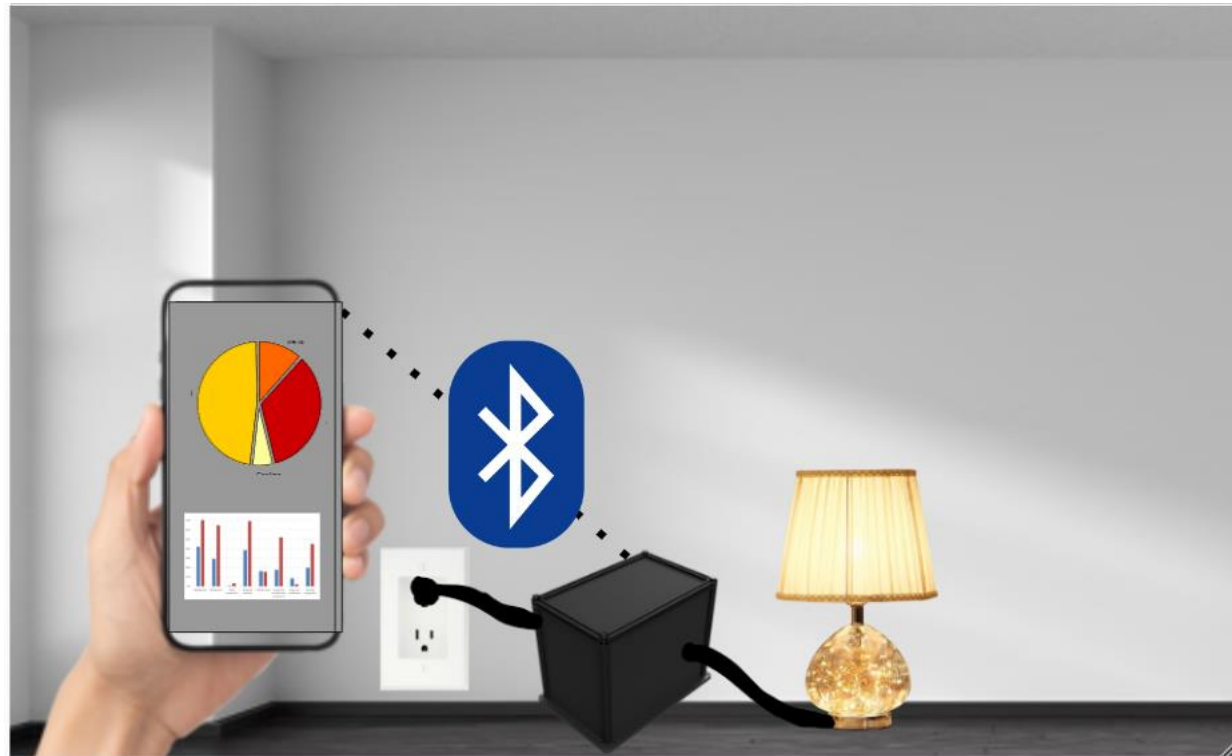


Table of Contents

• Original Block Diagram	6
• Final Block Diagram	7
• Project Build	8
• Test Results and Video	9
• Successes	10
• Challenges	11
• Looking Back	12
• Questions	13



• 4 Subsystem Model

- High Power

- Low Power

- Sensor

 - Temperature

 - Current

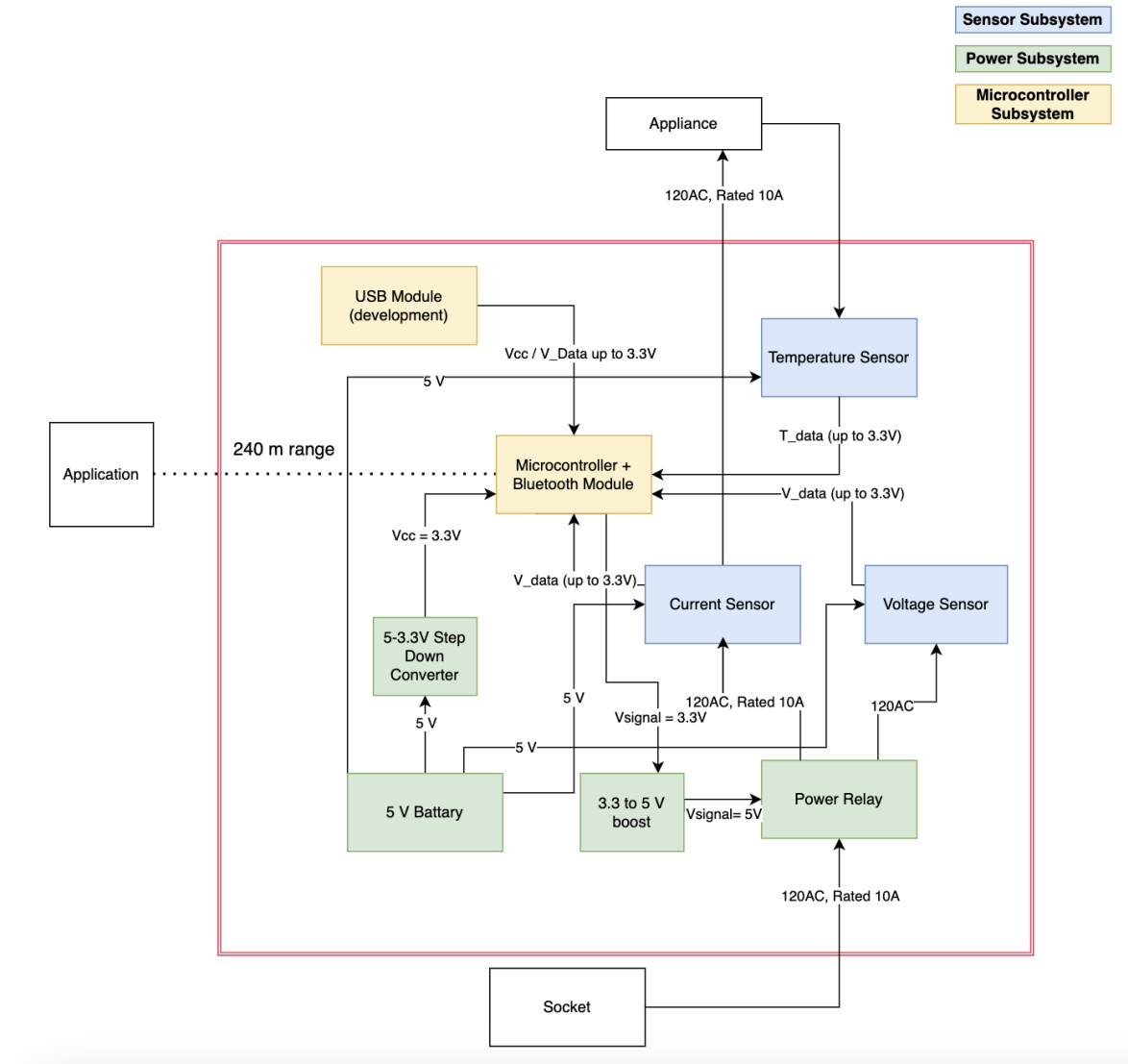
 - Voltage

- Microcontroller

 - MCU Control Firmware

 - Graphical Application

 - BLE Server/Service Setup Firmware



• 3 Subsystem Model

○ High Power

○ ~~Low Power~~

○ Sensor

■ ~~Temperature~~

■ Current

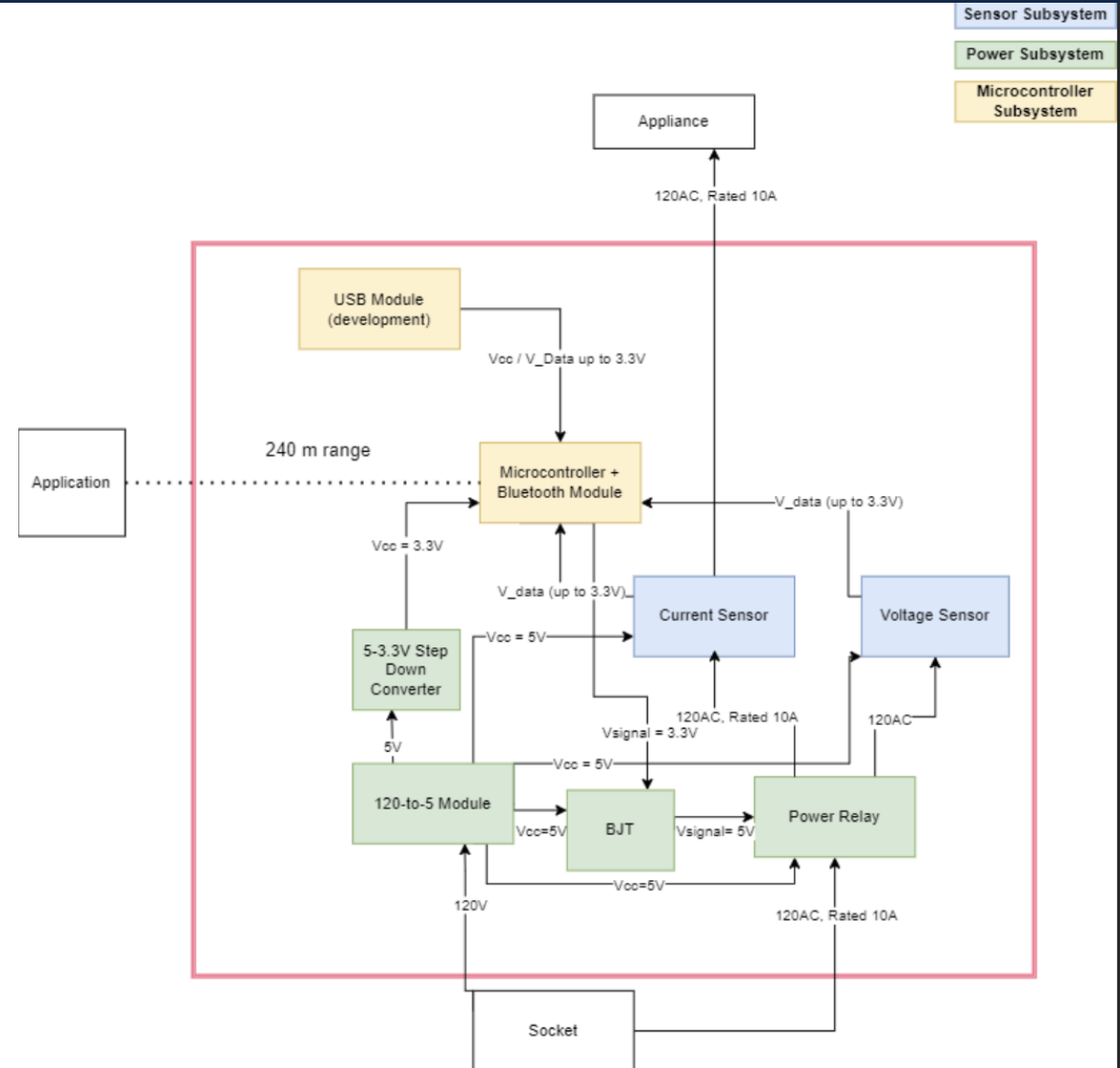
■ Voltage

○ Microcontroller

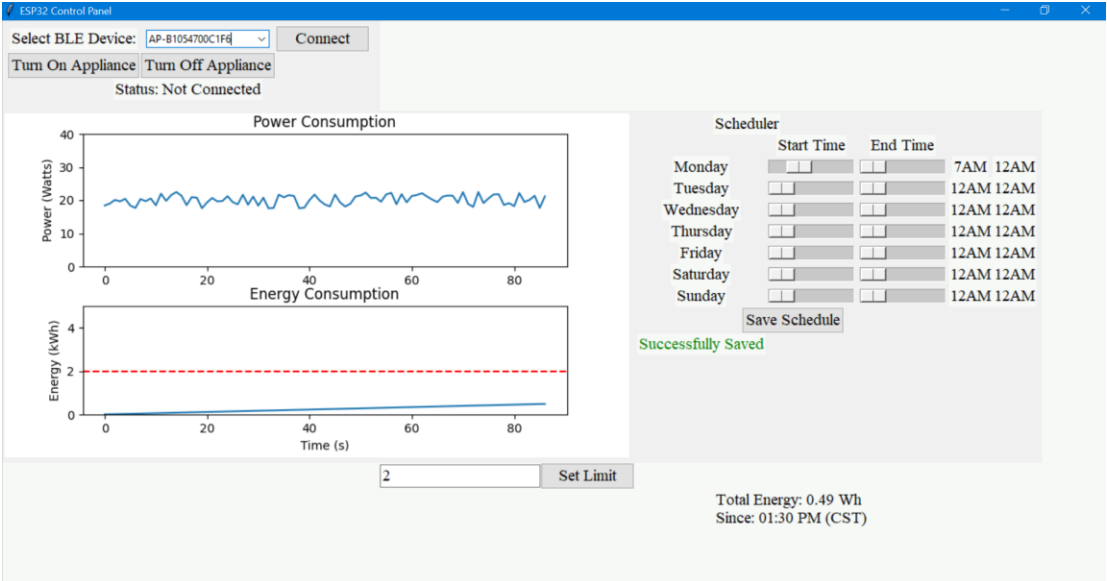
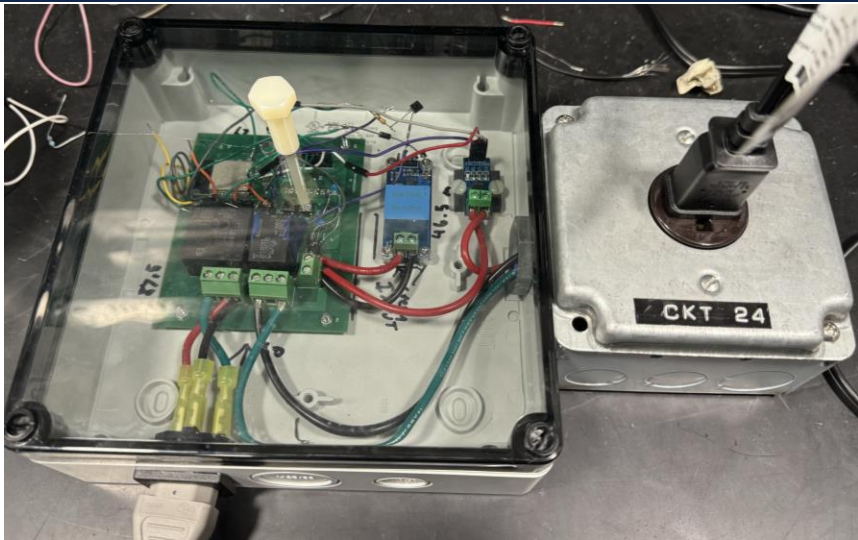
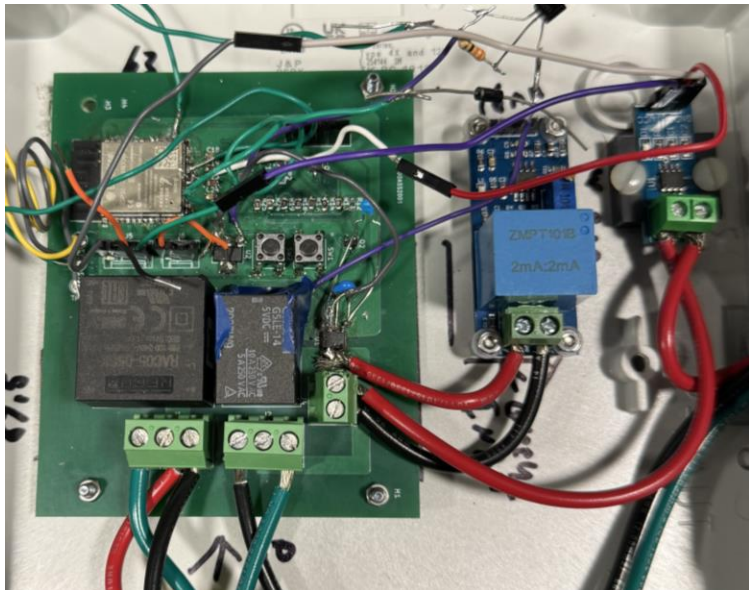
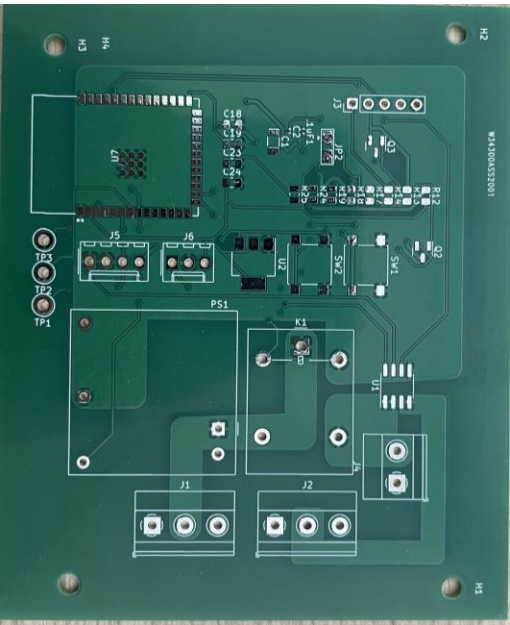
■ MCU Control Firmware

■ Graphical Application

■ BLE Server/Service Setup Firmware

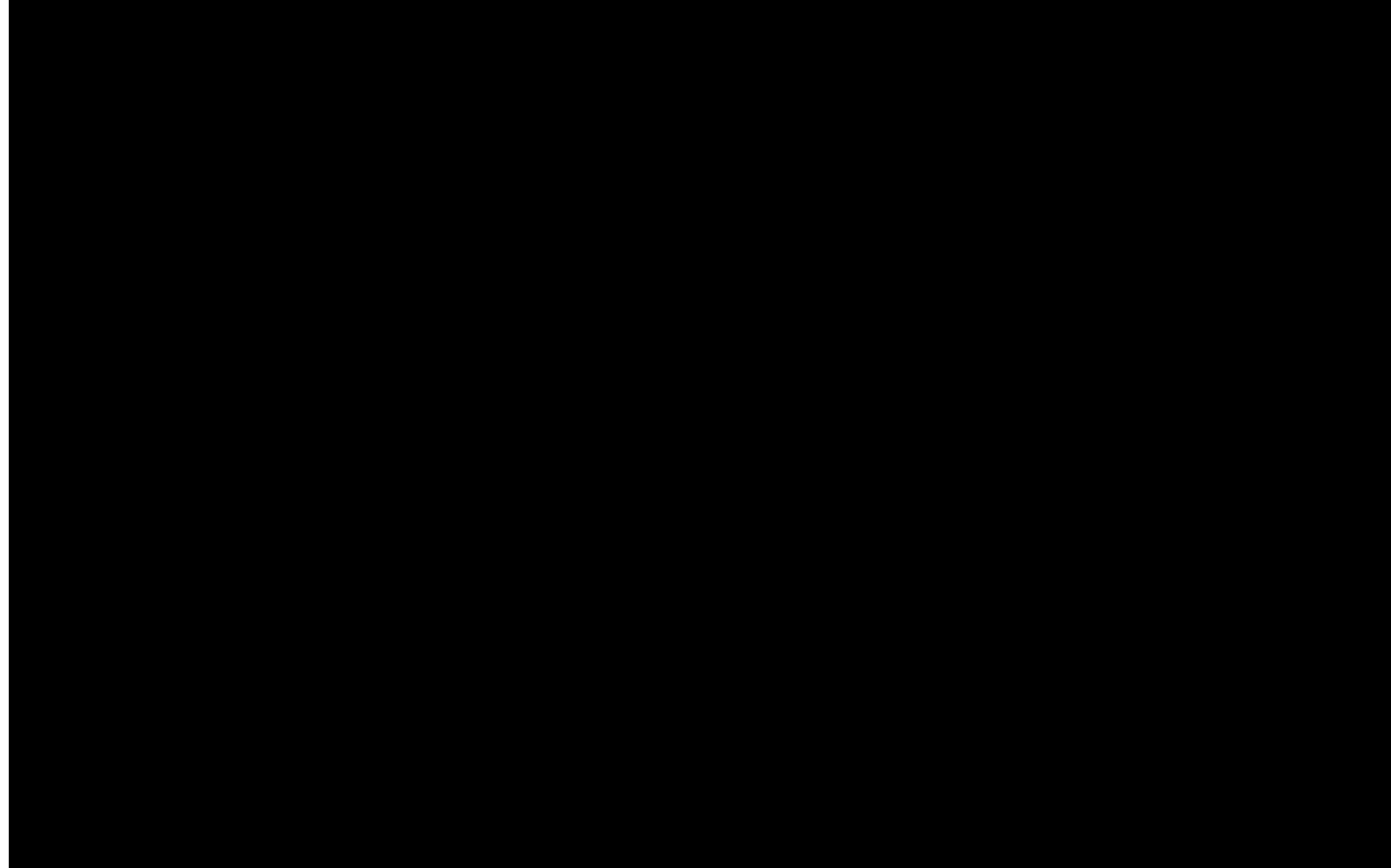


What our project looks like?



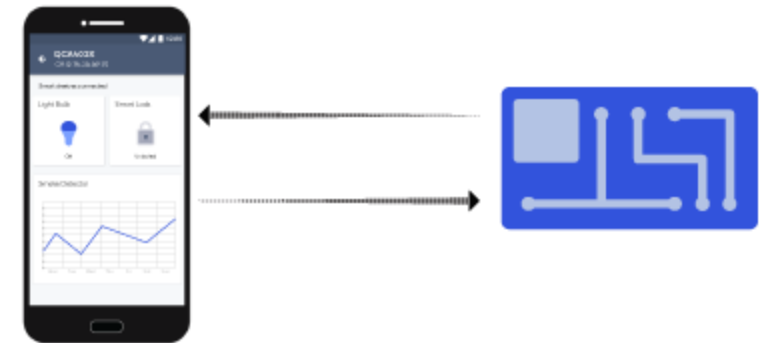
Tests and Results: Fan

- Fan off, Power Relay On
 - Voltmeter: about 120 Volts
 - Ammeter: 0 A
- Fan on level 1, Power Relay On
 - Voltmeter: about 120 Volts
 - Ammeter: 242.5 mA
- Fan on level 2, Power Relay On
 - Voltmeter: about 120 Volts
 - Ammeter: 312.5 mA
- Fan on level 1, Power Relay Off
 - Voltmeter: about 0 Volts
 - Ammeter: 0 A



Where did we succeed in our project?

- Handling high voltage and current coming out of the socket
- Controlling power supply to the connected appliance
- Relaying information to the application via Bluetooth Low Energy



- **What are some challenges we faced with our project?**

- Understanding the Microcontroller pin assignments
- Soldering the Microcontroller
- Current Sensor got Burnt during testing
- Too much power draw by Microcontroller chip
- Could not use 3.3V to 5V boost

What process and design elements would we change?

- Solder components that use the oven first
- Get extra parts early on
- Check user rating of modules that we use
- Separate PCBs for high and low voltage
- Include more access points for testing

What did we learn?

- Theoretical circuit design vs physical implementation
- Microcontroller based logic
- Industry based design procedures



The Grainger College of Engineering

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN