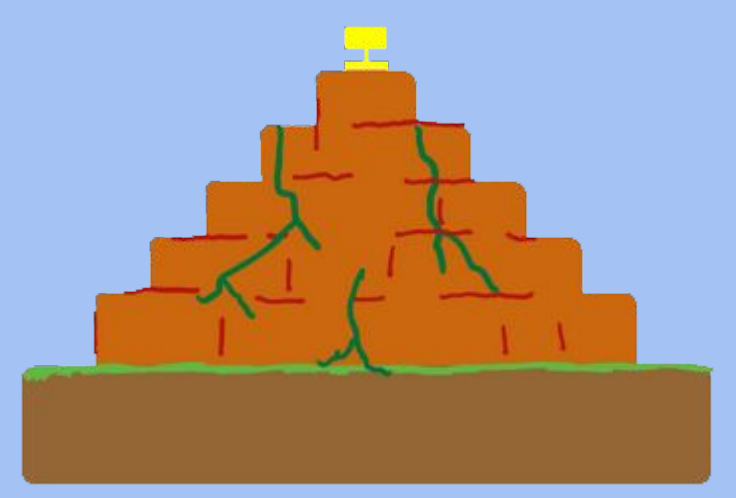




IOT MESH NETWORKING FOR ASSISTIVE TECHNOLOGY

CREATED BY: **ASTECHS**



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BACKGROUND

Most existing IoT solutions either require an invasion of privacy or cost too much, while offering too little modularity and customization in the setup process. Many users with physical and developmental disabilities have difficulties operating standard smart home technologies.

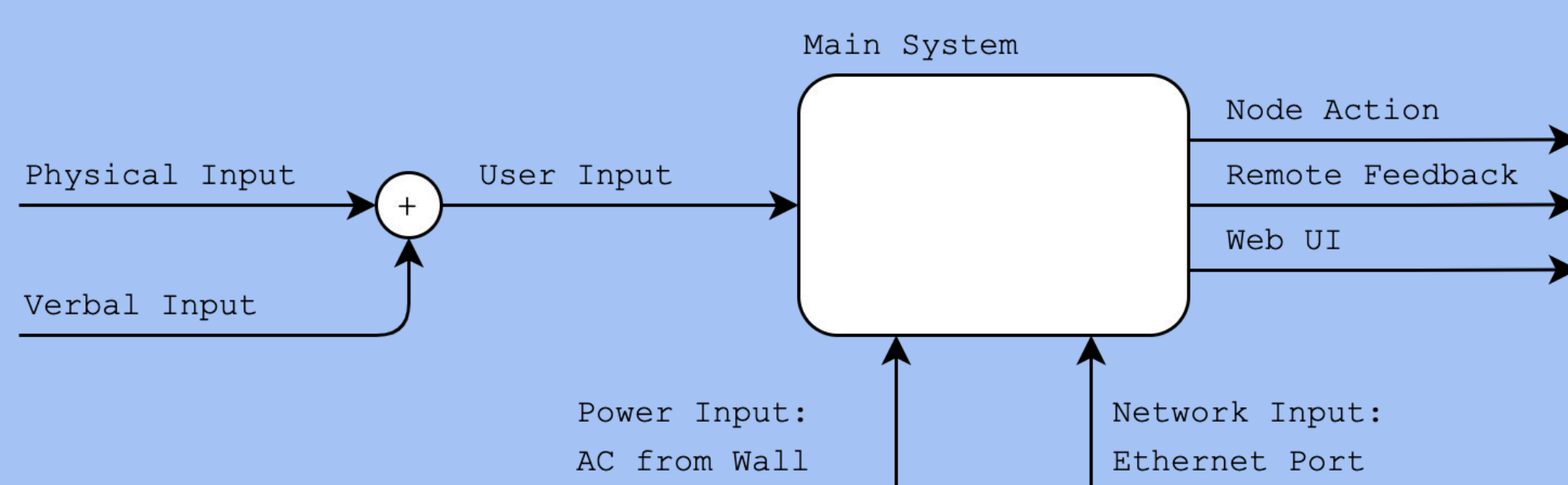
That is why we've been looking into opening this field up for a modular system that is accessible to more people.

SOLUTION

Our system consists of three main functional components:

- 1) Custom modular assistive remote with several inputs to increase accessibility.
- 2) Hub processing unit to process audio user input and connect all other devices in the Thread IoT network to the Web. (Raspberry Pi + TBS2)
- 3) Smart Outlet "Nodes" to allow users to toggle power to appliances and monitor power consumption.

System Overview



Inputs

Different input options:

- Push Buttons
- 1/8 " Monojack for custom switch
- Audio (Voice)
- Web Controls

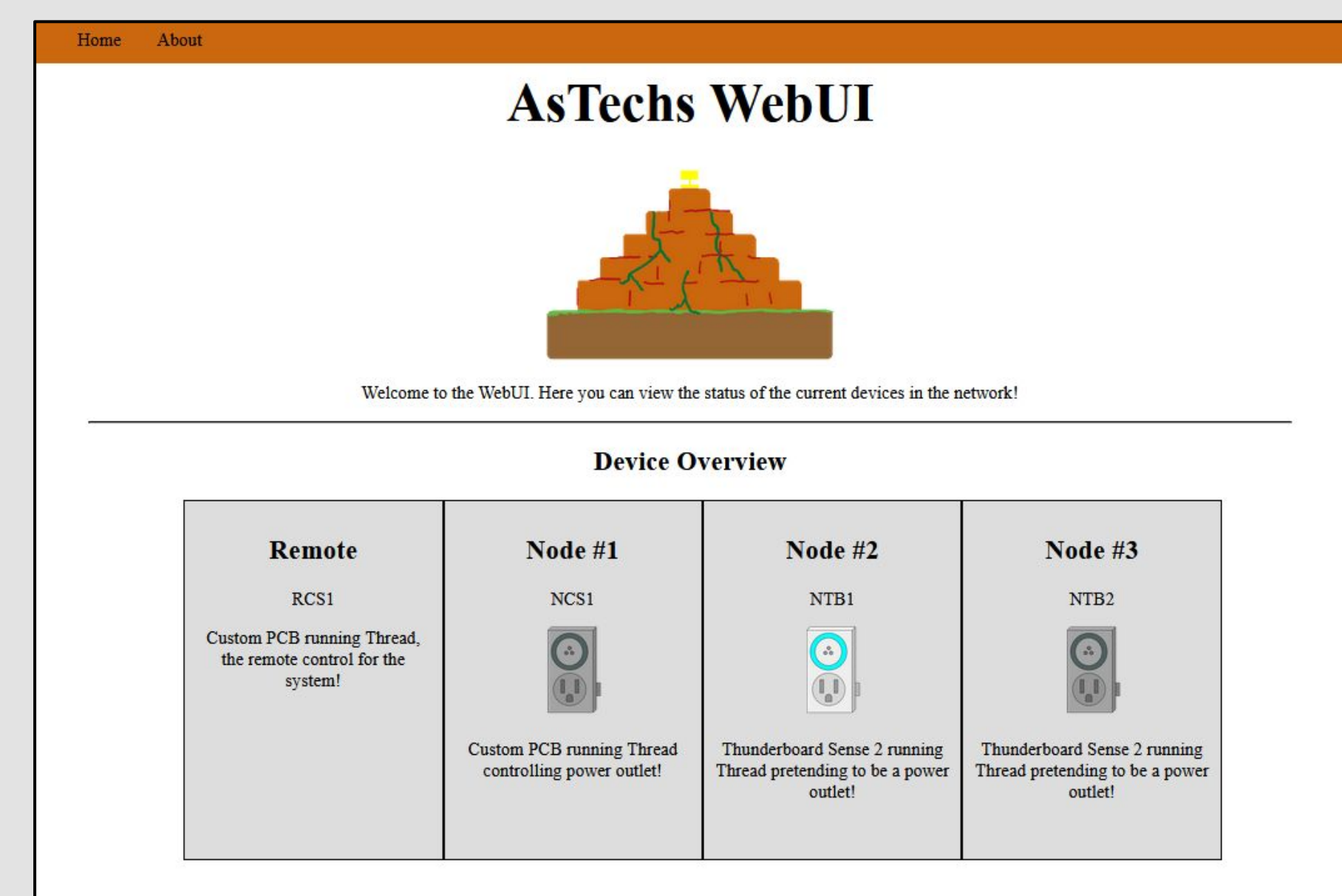
SOFTWARE

Audio

Our hub receives VOX ADPCM encoded user voice data from the remote over Thread and then processes it with trainable VOSK voice recognition.

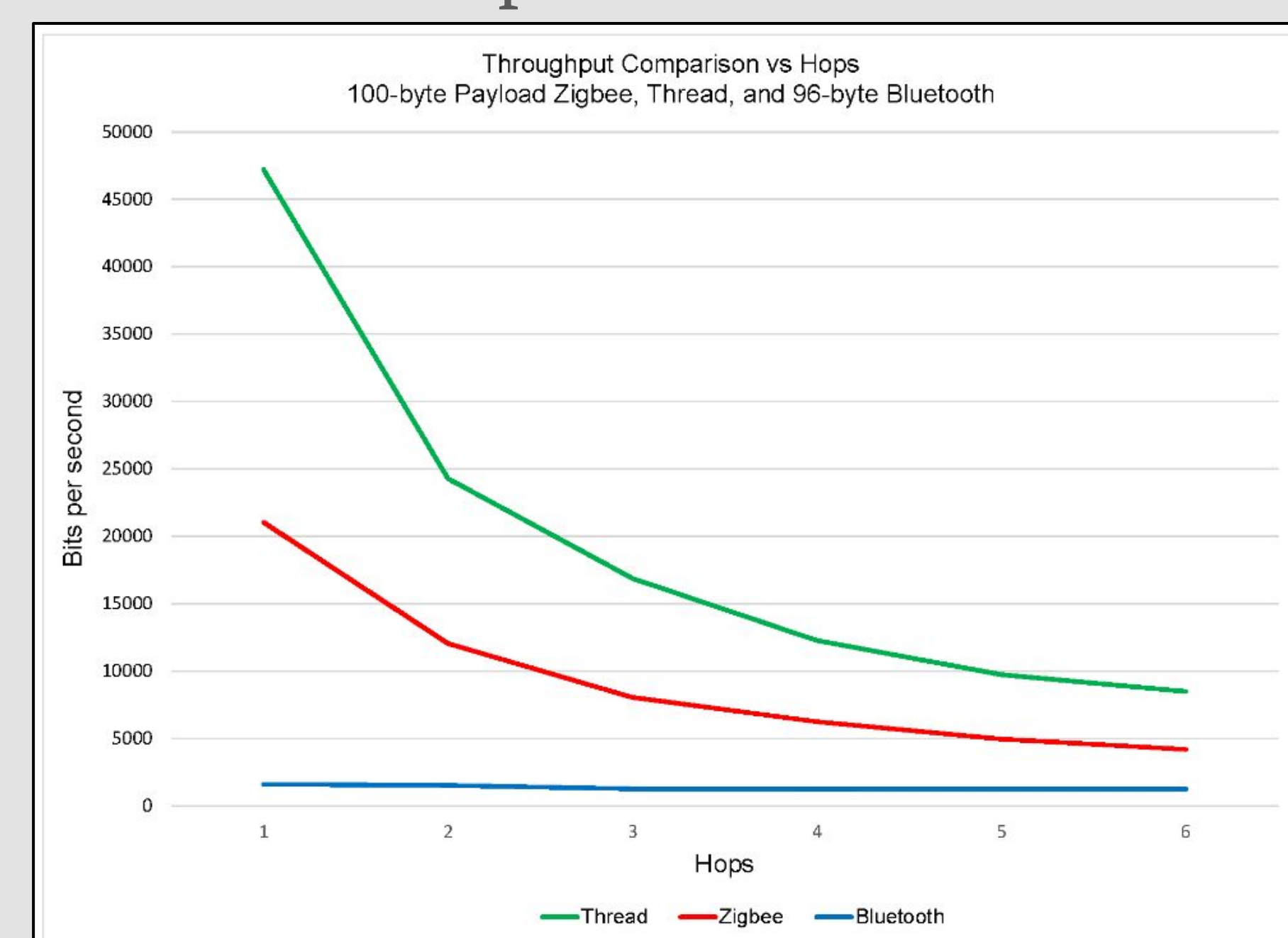
Web UI

User interface that allows users to see which outlets in the network are turned on / off and graphically monitor power consumption.



THREAD

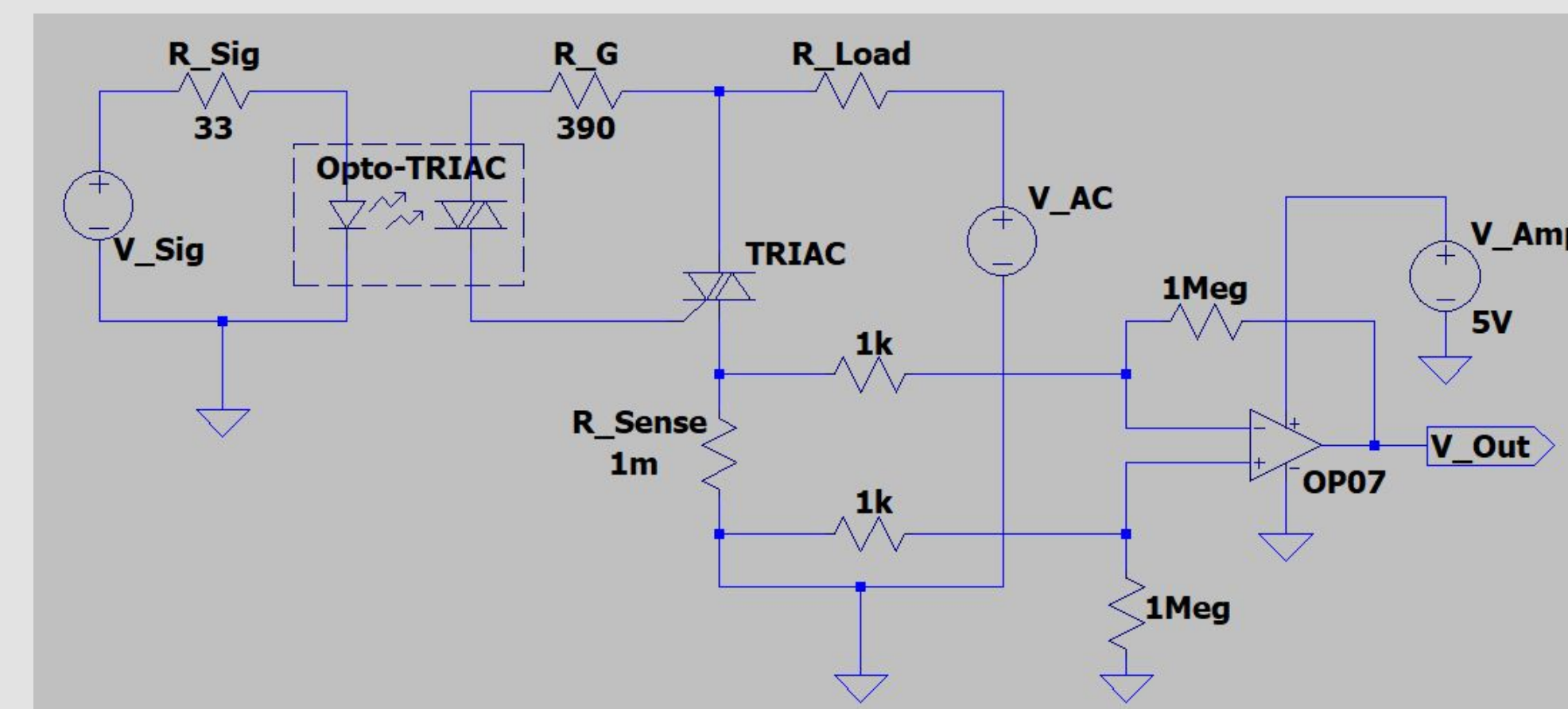
Thread is a mesh-wireless protocol based on IPv6 designed for IoT. Thread is more flexible in the application layer, offers more commissioning options, and is more future-proof.



HARDWARE

Power

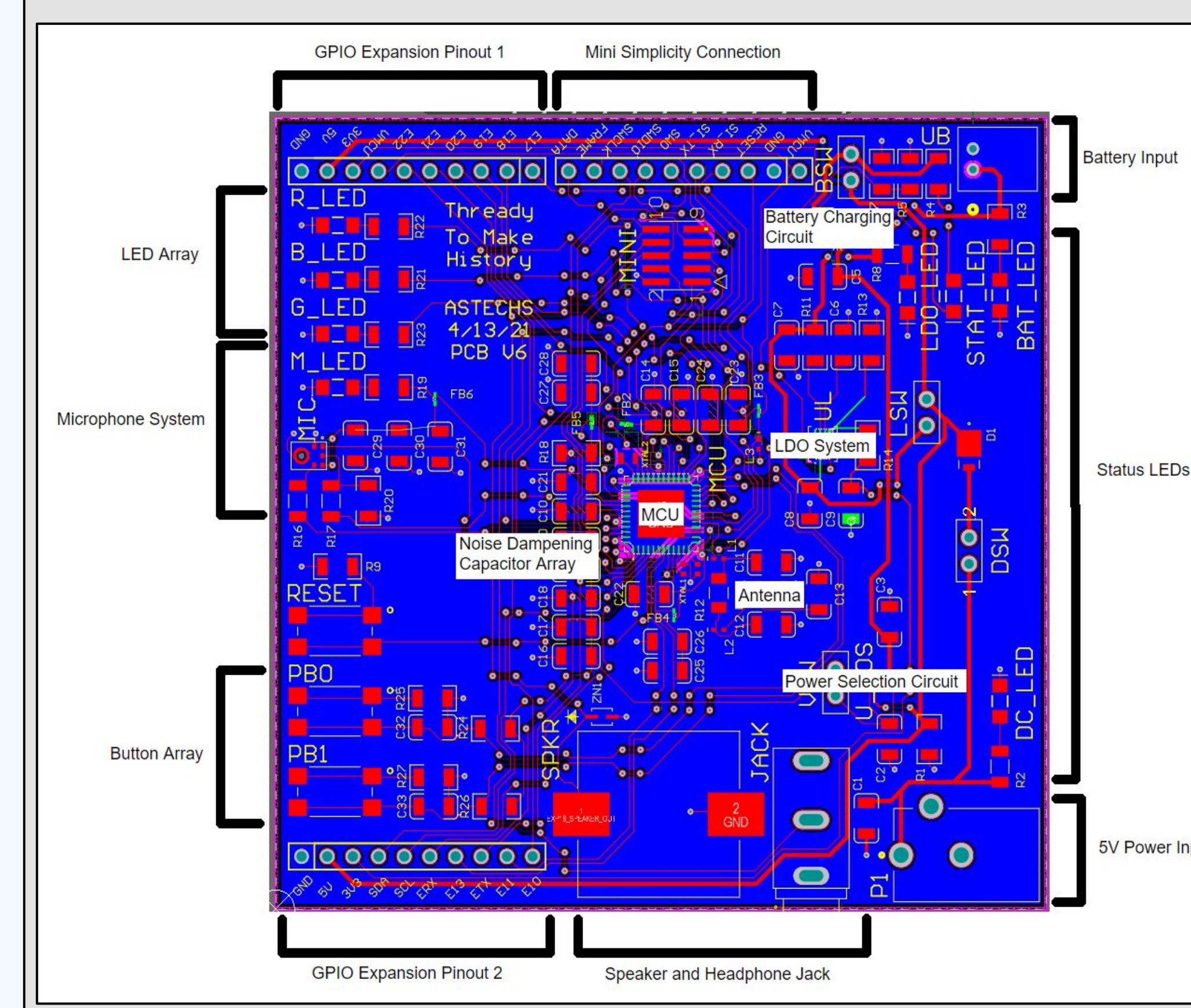
The outlet control circuitry in our Node devices doesn't use DC controlled AC relays, it's TRIAC based. Then, with a simple power sense resistor and scaling circuit, we're able to control and monitor power remotely.



PCB

Our custom PCB is based on the Silicon Lab EFR32MG12 microprocessor. The EFR32MG series is a radio-capable family built to run IoT wireless protocols.

Our custom PCBs are built to function as either the Remote or Node.



ACKNOWLEDGEMENTS

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FINAL PRODUCT

The system supports up to three custom nodes made from the custom PCB and power control Circuitry. The remote is formed by combining the custom PCB, several pushbuttons, and a 3D printed enclosure. The hub consists of a Raspberry Pi + Thunderboard Sense 2.



CONCLUSION AND FUTURE WORK

- This prototype was designed to open the door to making more accessible smart home technology with the mesh networking of the future.
- Integration of assistive remote with existing smart home technologies (Philips Hue, Amazon Alexa, Nest)
- More features built into Web UI for scalability and adding new devices.
- Build in external microphone support so that users with impaired movement can access the microphone more easily.