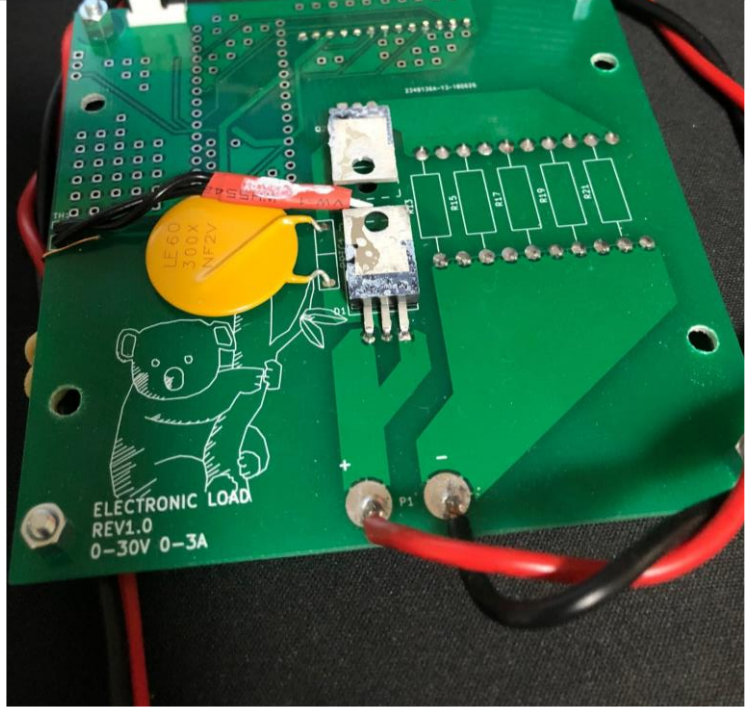
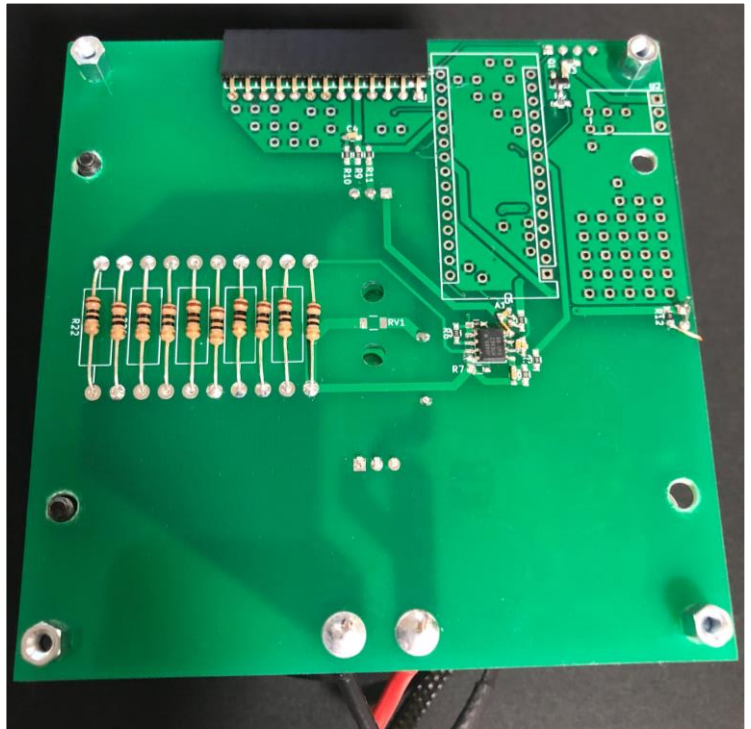
Mini Electronics Project Portfolio

By Matthew Smith





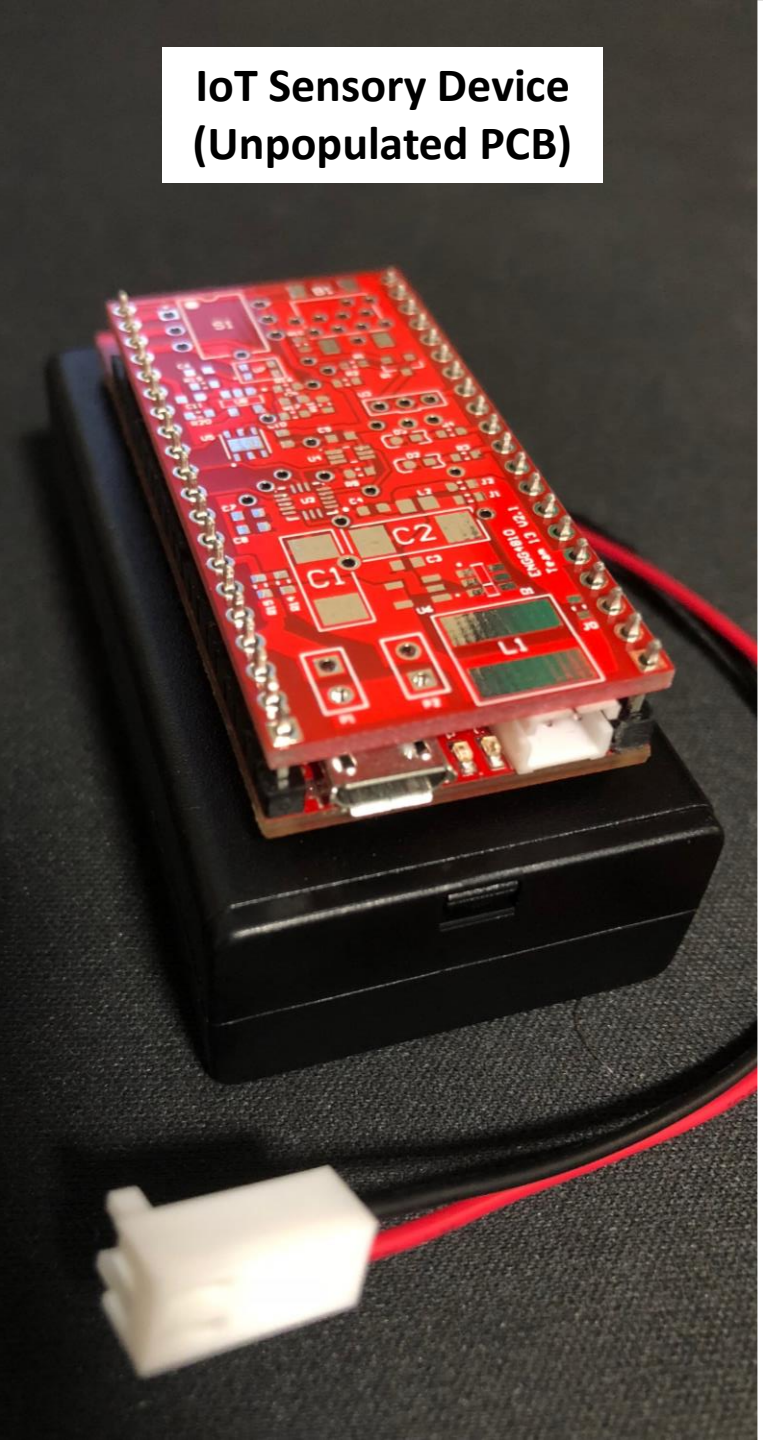
Electronic Load (Bench Test Equipment)

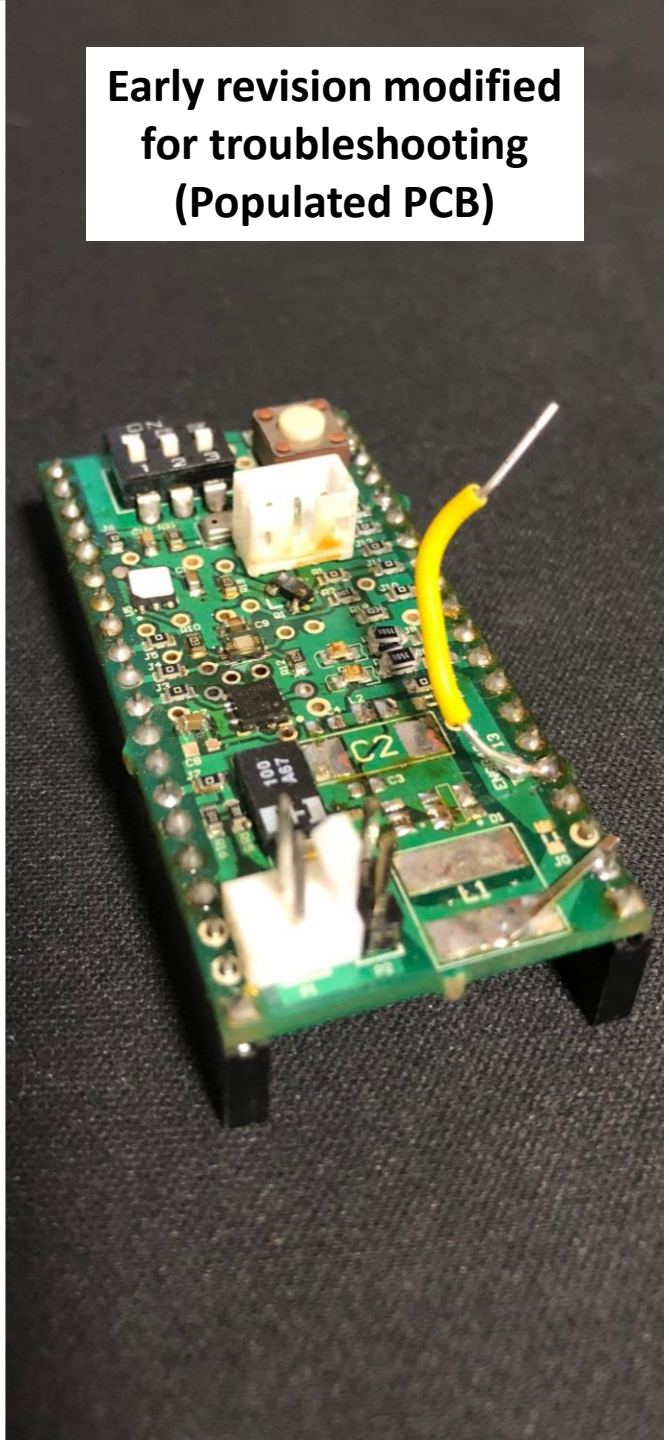
Project Type: Hobby

Knowledge and Skills:

- **Control loop design and stability analysis**
- **Thermal analysis and heat management solution design**
- **Input protection design (device protection)**
- **PCB design**
- **Electronics troubleshooting**
- **Firmware (external control of electronic load through software)**

Outcome: Reliable electronic “dummy” load (0-30 V, 0-3 A) primarily used for testing project power supplies. For thermal management, the system has been designed to use an off-the-shelf CPU fan.





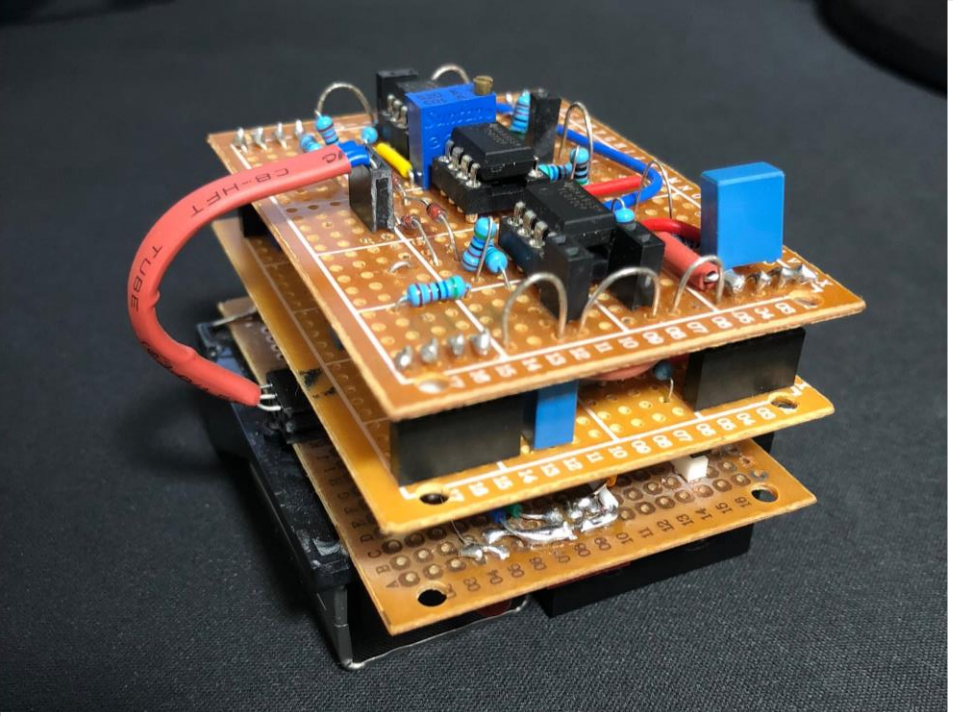
Portable IoT (Internet of things) Data Monitoring Device

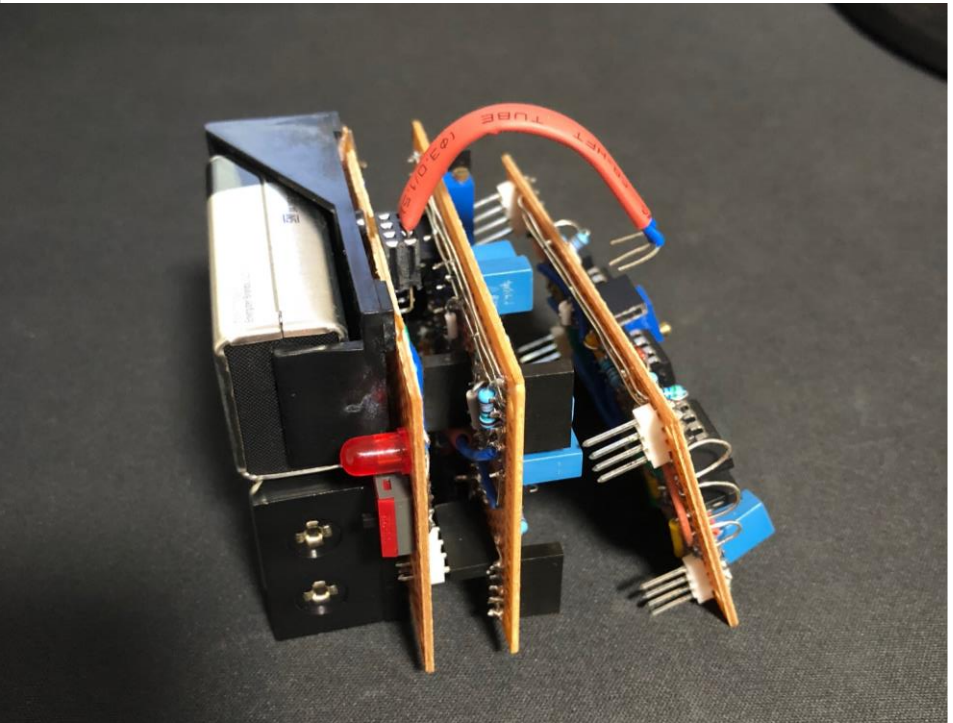
Project Type: Group Assessment

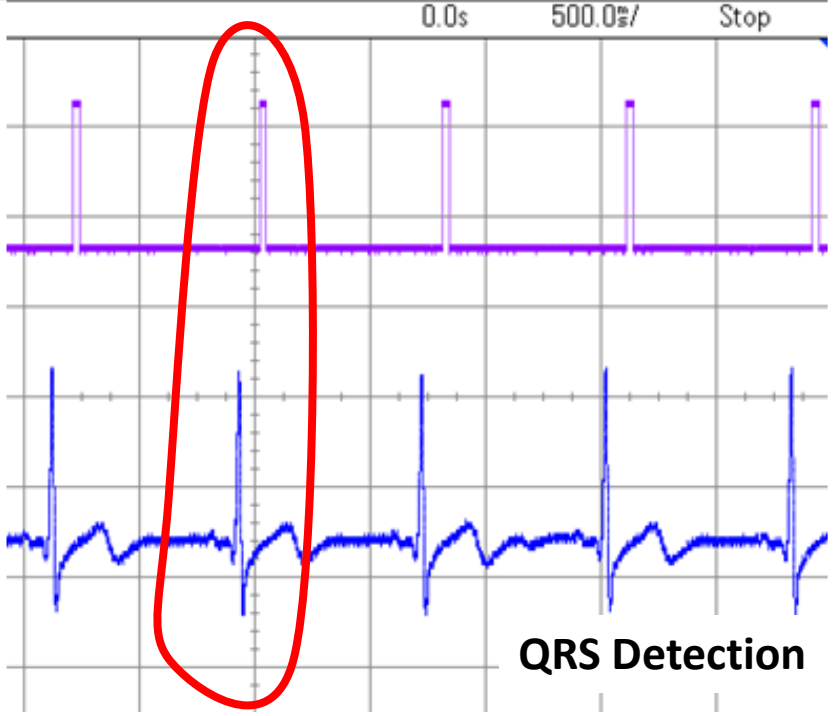
Knowledge and Skills:

- Analog circuit design
  - Component selection to meet budget (2 x devices for AUD$100) and size constraints (another cost reduction strategy)
  - Low power circuitry design
  - PCB design to act as stackable board for a Sparkfun ESP32 Thing (commercially available microcontroller board)
- Firmware
  - Periodically poll sensor data (temperature, humidity, GPS data)
  - Tone detection (listening for select frequency)
  - Send secure data packets over WiFi via MQTT
  - Adhere to strict power consumption goals (< 1.5 mW)

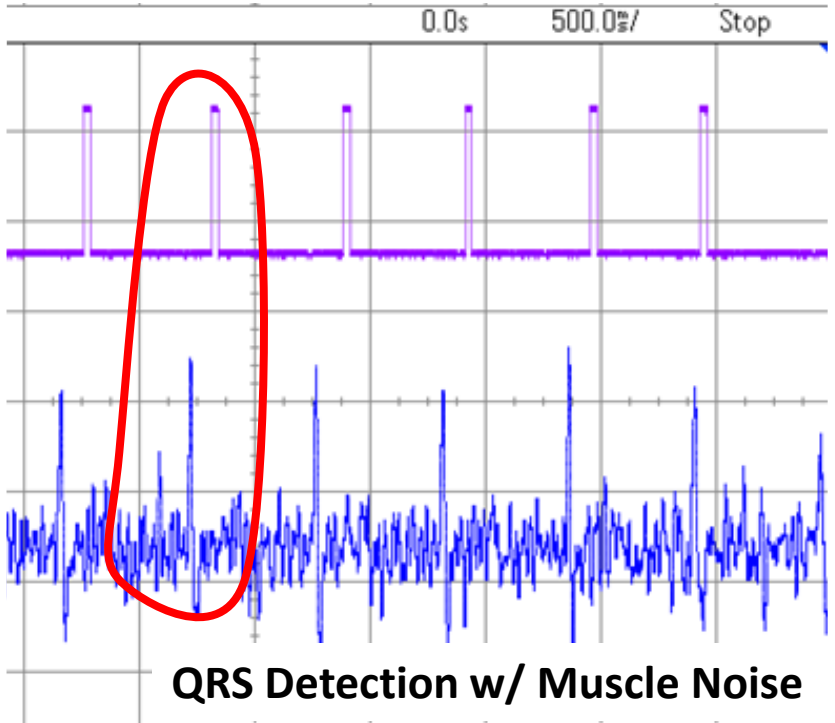
Outcome: Reliable data sensing and WiFi data logging while adhering to budget and power consumption







QRS Detection



QRS Detection w/ Muscle Noise

Portable ECG with QRS Wave (Heartbeat) Detection

Project Type: Assessment

Knowledge and Skills:

- Analog circuit design
  - Amplifier design
  - Analog signal filtering and conditioning
- Prototyping
  - Modular and compact prototype
- Electronic safety
  - Considerations for safety where a human forms part of the circuitry
- Digital signal processing on MCU
  - Digital signal filtering
  - Signal feature detection

Outcome: Reliable QRS wave detection even under noisy conditions.