

Bluemoon

Team 5

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There's got to be a better way...



The Problem

Automation controls and sensors are **inaccessible** and **expensive**.

How can we make them available for **residential** use and provide an **easy-to-use interface**?

Motivation

For Everyone:

- Portability and Mobile Device Integration
- Save money and time with staying informed

For Us:

- Opportunity to utilize new technologies
- Develop new engineering and management skills

Objective

- Achieve a modicum of success (working prototype)
- Test the limits of our abilities (SMT)
- Develop telekinesis



The Current Market

- Many networkable sensors available
- Automation systems are too costly for simple tasks
- Modern data acquisition systems tend to lack extensibility and user focus

Design Requirements

Requirements

- Easy to use
- Easily interfaced
- Battery Powered
- Motion detection
- Monitor temperature, humidity, pressure, and light
- Fast Wireless Response

Brief Project Schedule

- Project Proposal (10/11/16)
- Research and Design (10/20/16)
- Requirement/Specification (10/25/16)
- Design Schematic (11/5/16)
- Design PCB layout (11/17/16)
- Firmware* (11/24/16)
- Software Application* (11/23/16)
- Assemble Parts (11/29/16)
- Create Final Presentation (12/5/16)

* Software/firmware started Concurrently with layout design.

Our Design

Our Approach



Inputs:

- Power
- Bluetooth (Serial / UART)
- Push Button
- Sensor Array (I2C)
 - Temperature
 - Humidity
 - Pressure
- Photodiode
- PIR Motion Sensor

Outputs:

- Bluetooth Serial
- SPST Relay

Product Features

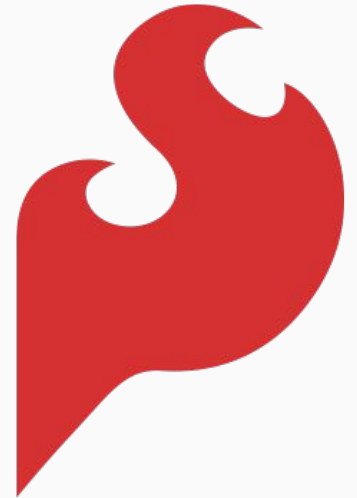
- Bluetooth connectivity
- IOS app
- Rechargeable built-in battery
- (2x) User-accessible SPST relays
- Programmable automation tasks
- Sensors:
 - Motion Sensor
 - Temperature Sensor
 - Humidity Sensor
 - Pressure Sensor
 - Light Sensor

**SHUT UP,
AND TAKE
MY MONEY!**



IP and Prior Work

- Adafruit
 - Relays
- Sparkfun
 - Power management
 - LiPo charger
 - Boost converter



Contributions

Concept Generation

Design

Schematic

Layout, Bill of materials, Parts

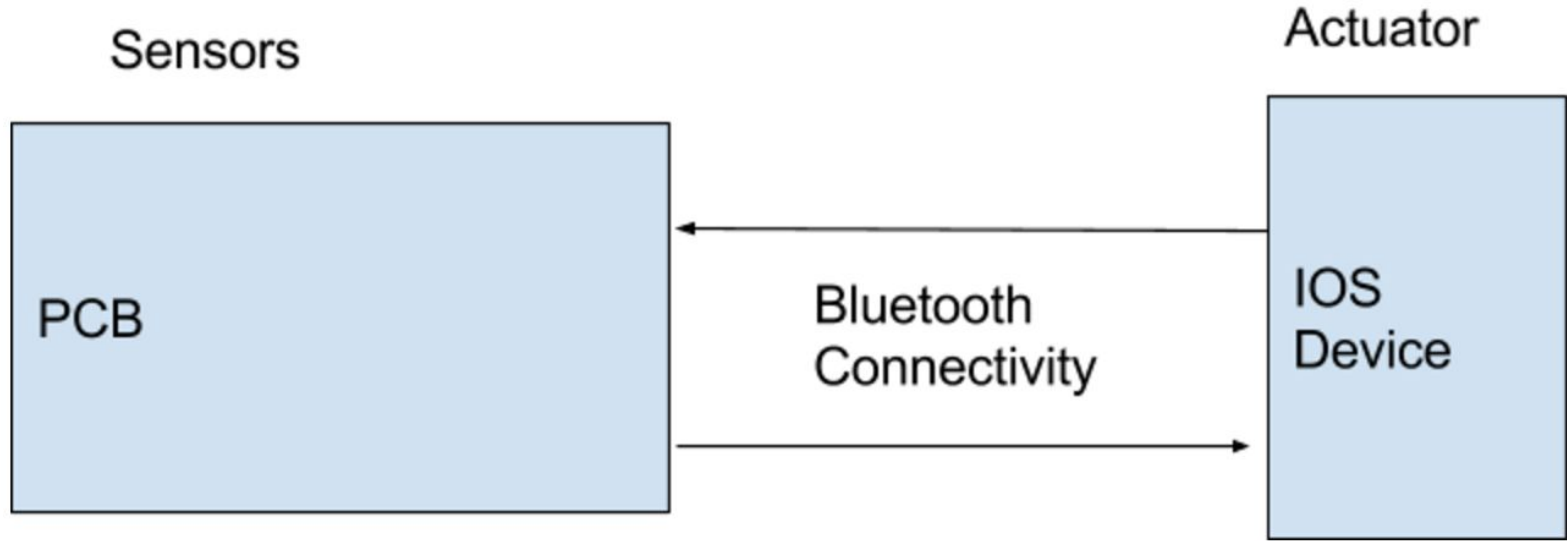
Assembly

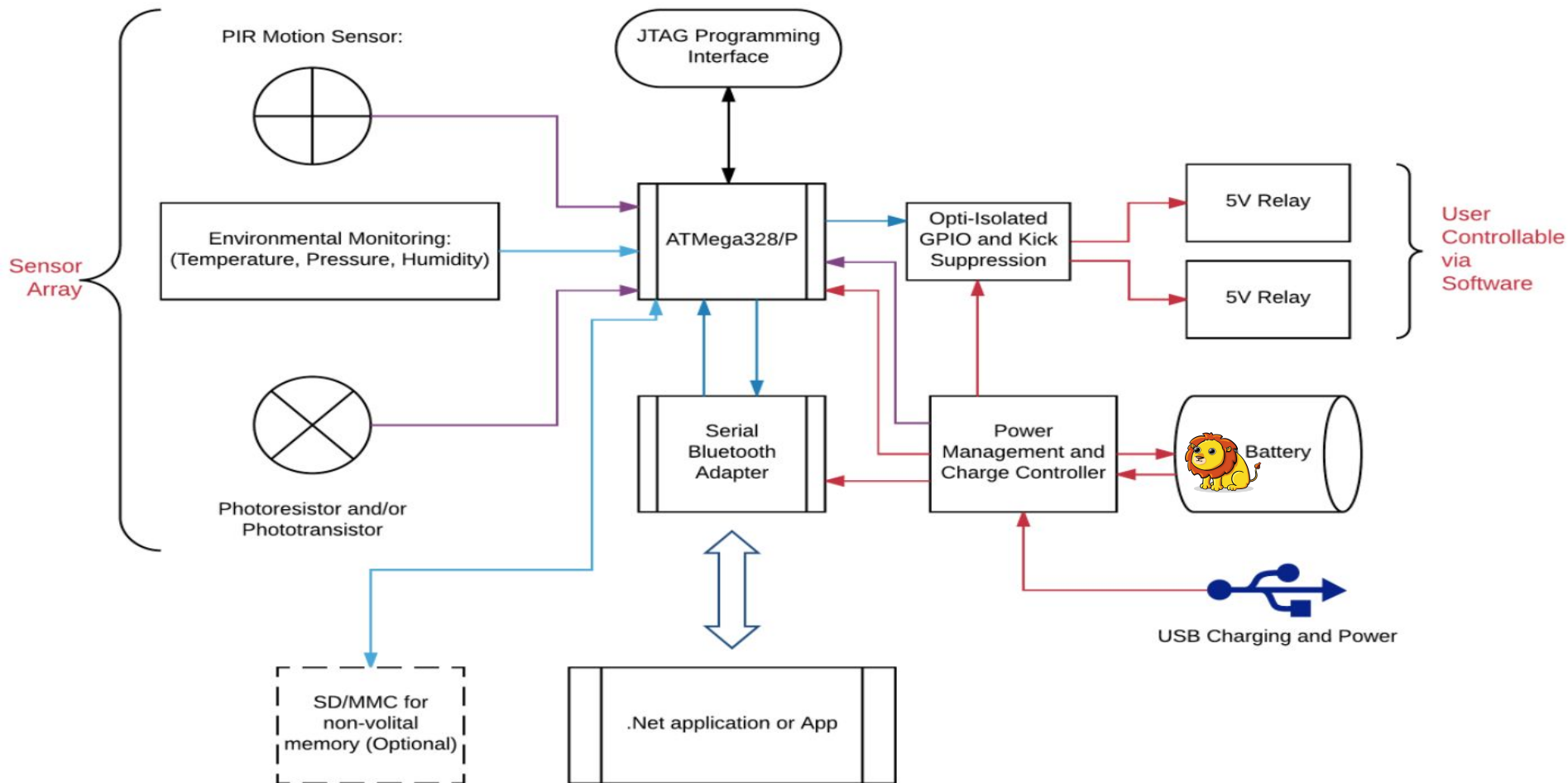
Coding



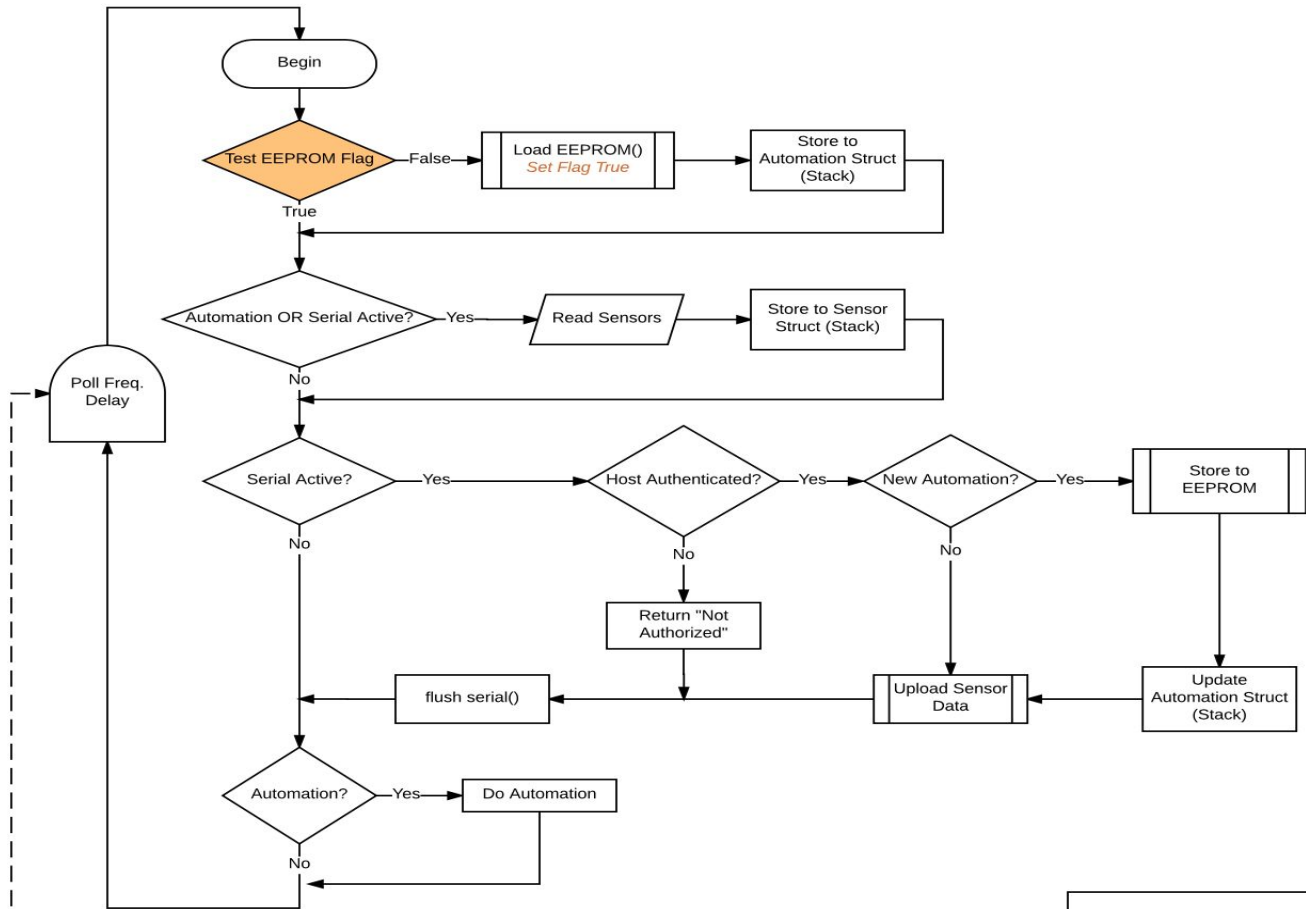
Hardware Design

Level 0 Block Design





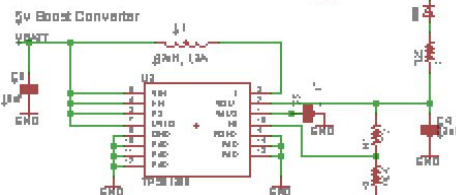
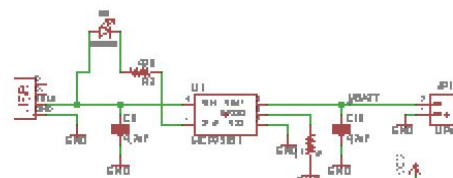
Firmware Design



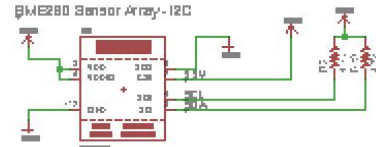
For Power Usage
Poll Freq. Could be set to 0 via ISR set to monitor STS and PIR pins.
(attach interrupt to STS and PIR)

Implementation

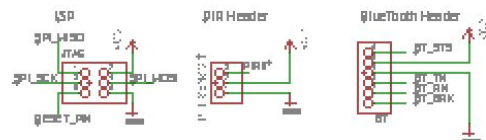
Power Management 1) Battery Charger



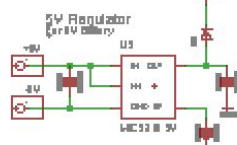
QME280 Sensor Array-12C



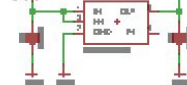
External MCU Connections



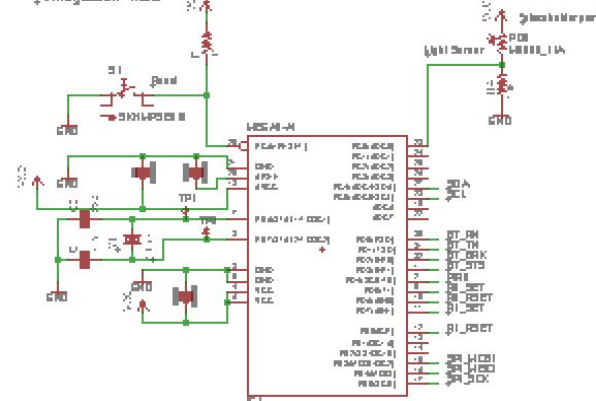
Power Source Selection



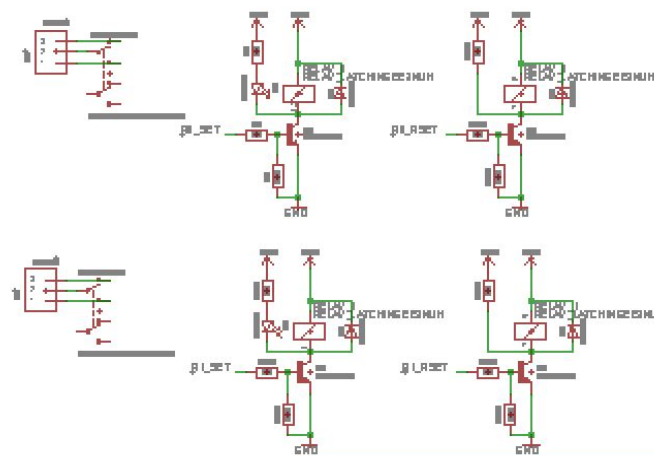
3.3V Regulator LM333 3.3V



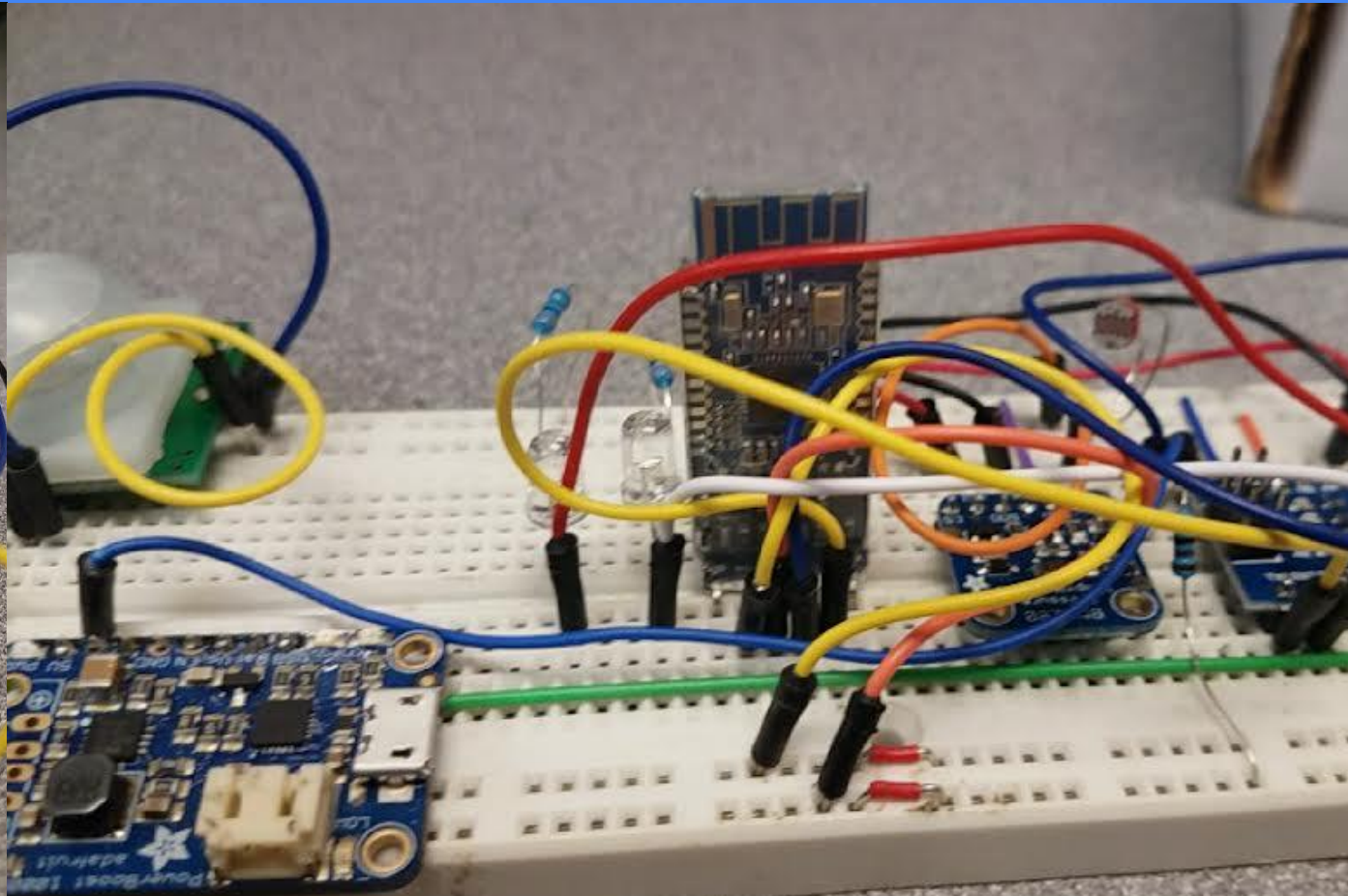
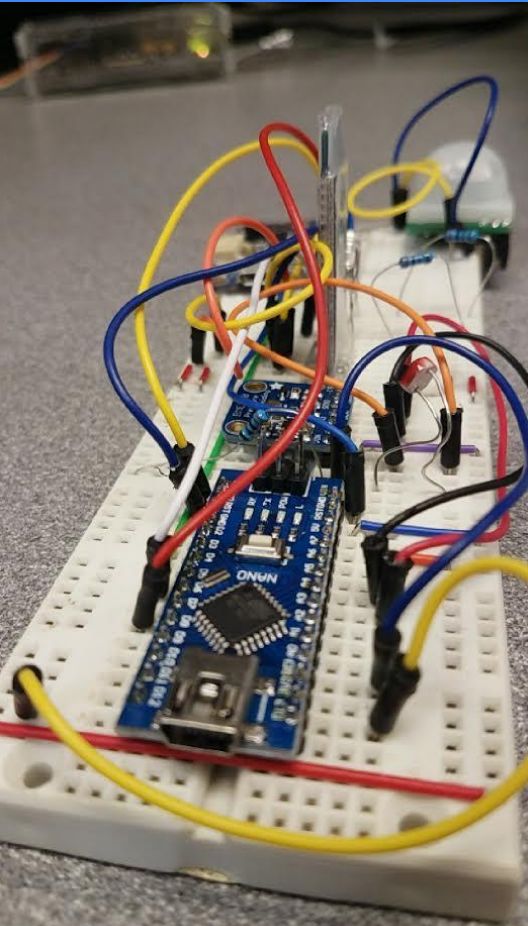
ATmega328P MCU



Relay Control



Prototyping



Layout

- Many components, very tedious
- Many schematic modifications
 - Lots of rerouting



Bill of Materials

- Total Project Cost: \$403.13
- Money Lost: \$100
- Expensive Parts: LiPo Battery, PCB Board, BME280, BLE
- Low Volume Cost: \$80.90
- Production Run Cost: \$64.72
- Time

Testing

Hardware

- Built disconnected from power supplies
- Checked power supplies before connecting to rest of board
- Test with voltage meter

Hardware Test Results

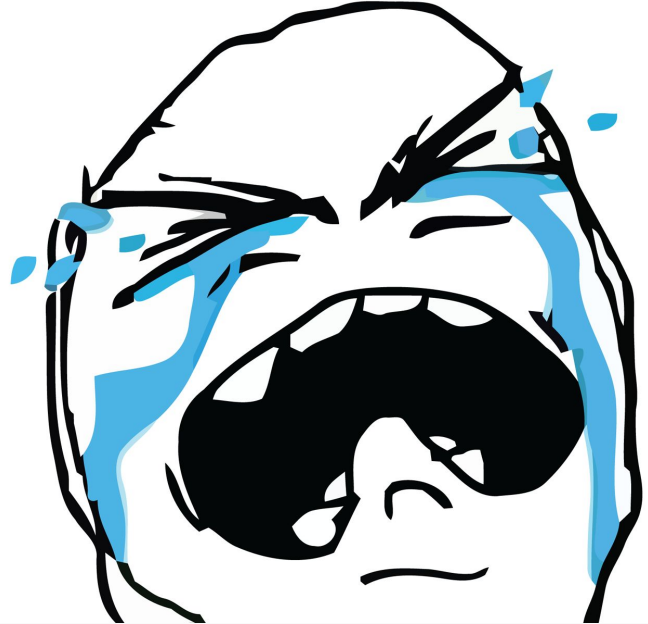
- Bad Power Supplies
- Strange grounding behavior

Firmware

- Bluetooth Connection
- Host Authentication
- Serial Communication with IOS application
- Reading sensor values
- Automation

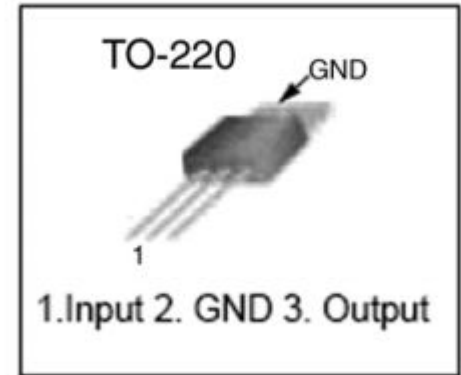
Problems

- Relays not switching on PCB. (Current problem?)
- Automation



More Problems

- Fun with datasheets!
- Strange ground behavior



Lessons Learned

- Select bigger chips (BME280, Boost Converter)
- Check parts availability before using in design
- Triple check before ordering. Twice.
- Use cheaper components (BME280)

Lessons Learned

- More test pads & in better places
- Laser Cutting
- Enhanced Soldering skills
- Github
- More vias for flooded ground