

Coat Hanger Light Switch Controller

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Introduction

- Automate an easily forgettable task
- Simplify morning routine
- Reduce electricity costs



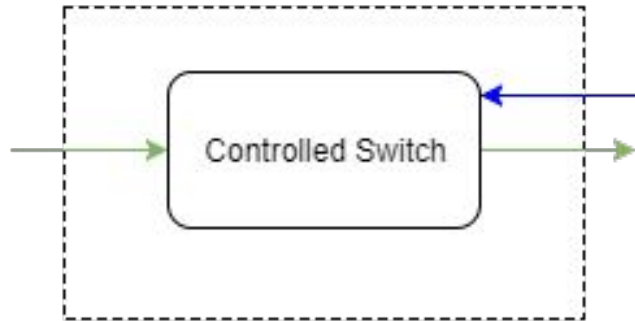
Objectives

- Effective control of light
- Wireless, subtle home integration
- Delay
- Allow normal control of light independent of hanger status

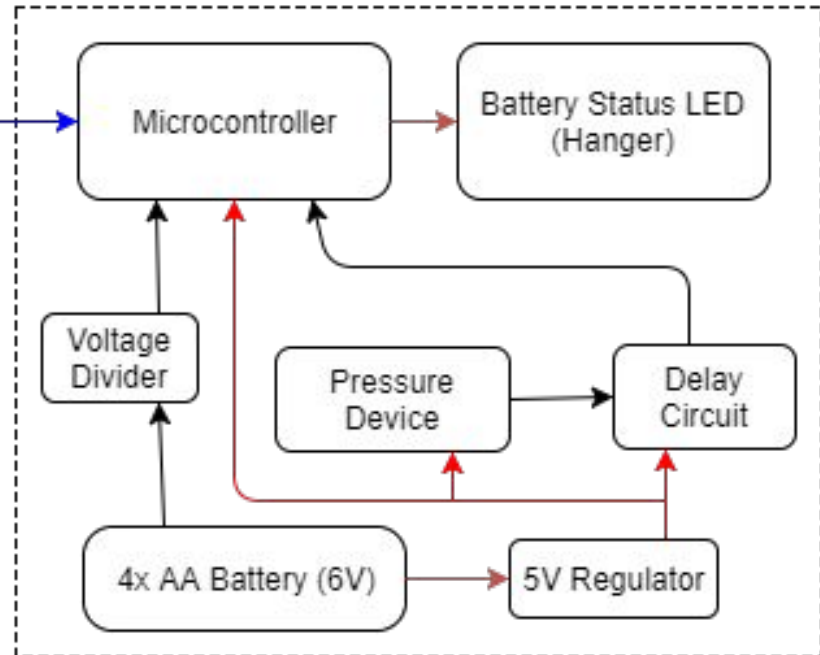


Block Diagram

Control Unit - Light Switch



Control Unit - Hanger

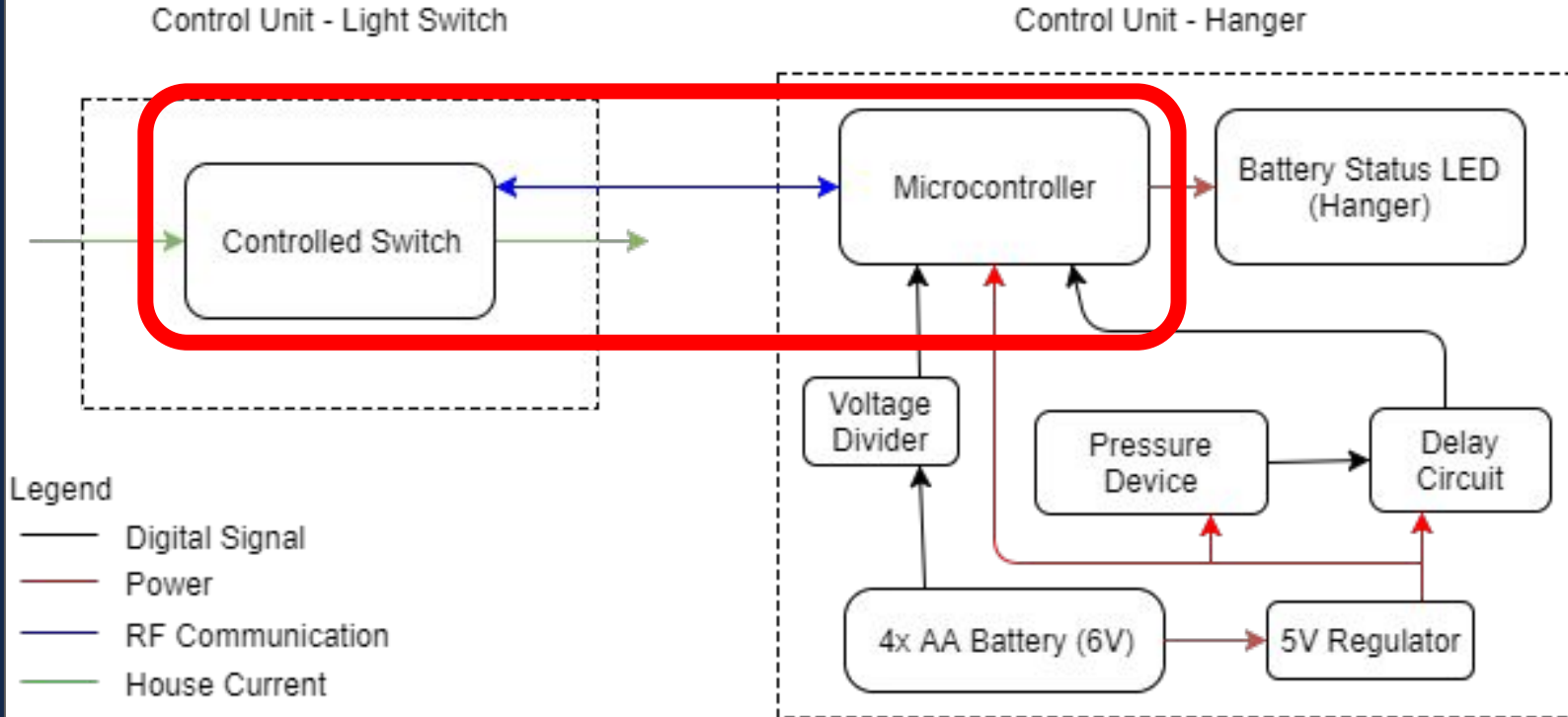


Legend

- Digital Signal
- Power
- RF Communication
- House Current

Physical Layout





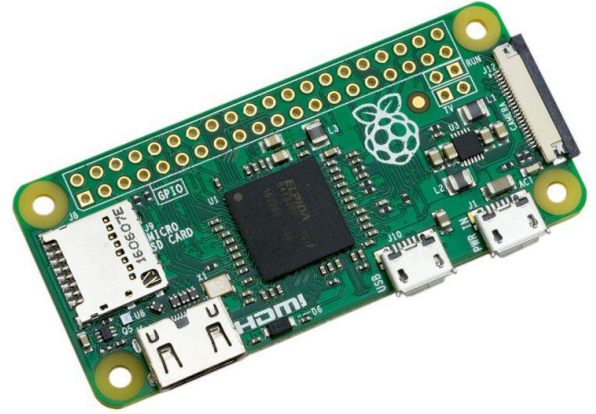
Z-Wave Communication

- Z-Wave is a radio frequency (RF) control protocol
- Based on a mesh network topology
- Wi-Fi consumes a lot of power, Bluetooth has limited range
- Use Home Assistant to create Z-Wave Hub
- Open-source home automation platform
- Communicates with and coordinates all the smart devices in network

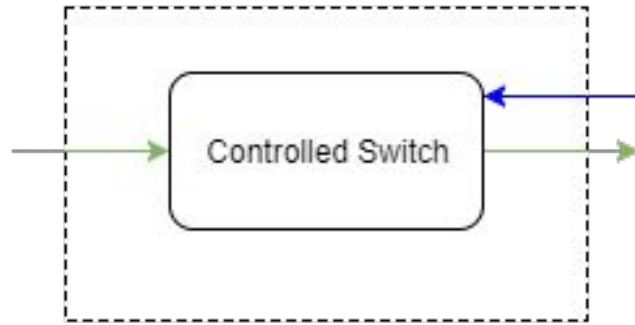


Microcontroller

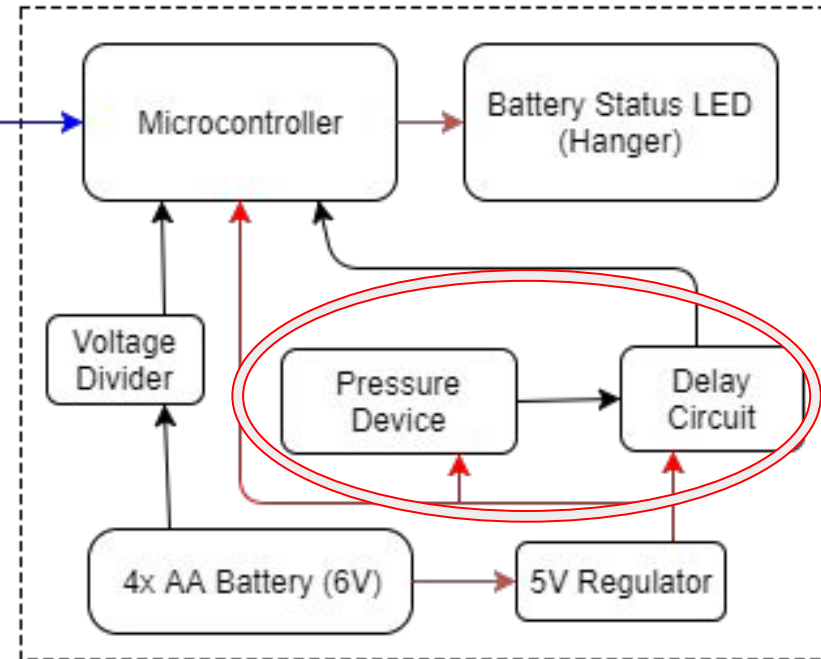
- Used a Raspberry Pi Zero and a Z-Stick to create a Z-Wave hub
- Most cost effective option
- Customizable
- Direct hardware connection
- Inputs from Delay Circuit
- Verify with power source from 0V-1.3V



Control Unit - Light Switch



Control Unit - Hanger

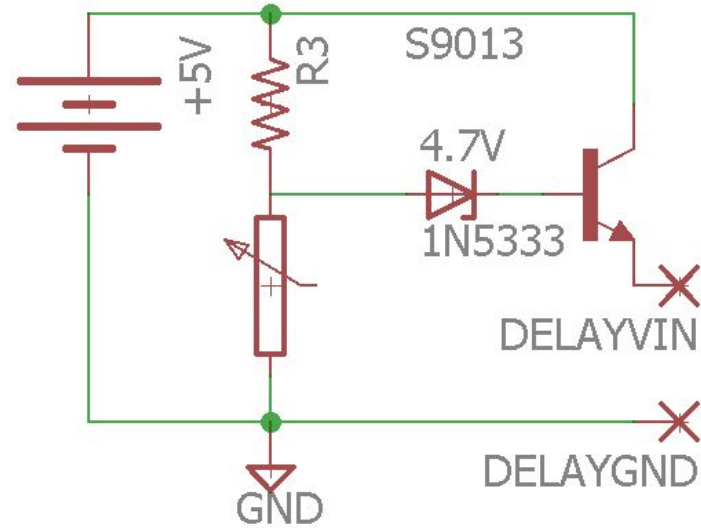


Legend

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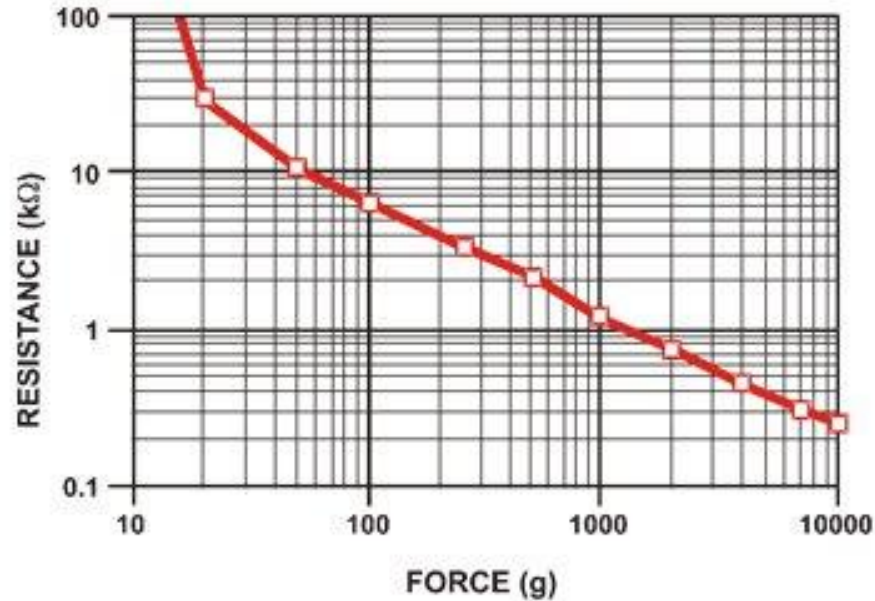
Pressure Device

Resistor balances
pressure sensor for
specificity



Pressure Device

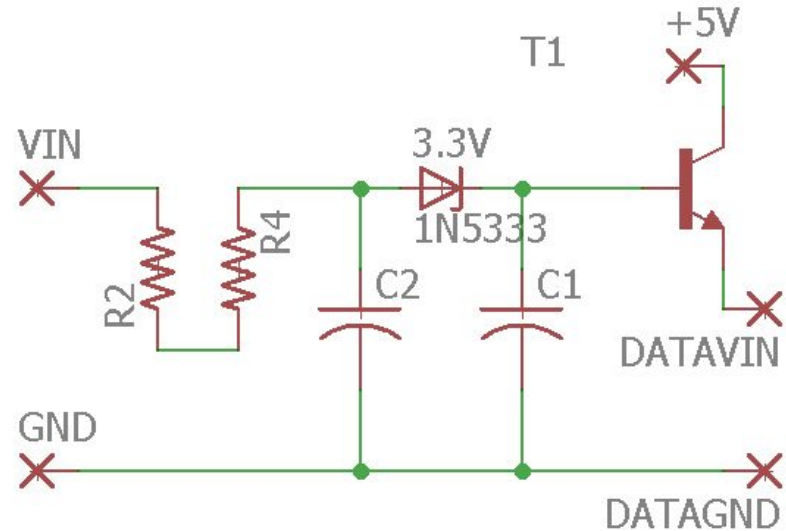
Sensor Characterization



Delay Circuit

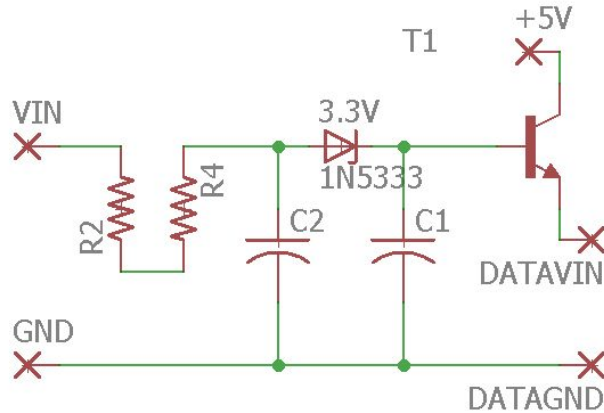
Crosses 1.3V threshold
after a 60 second delay

Series resistors for time
specificity



Delay Circuit

Evaluation



$$V_{C_2} = IR + \frac{Q}{C}$$

$$Q = CV_{C_2} \left[1 - e^{-\frac{t}{RC}} \right]$$

$$V_{in} = 5V$$

$$V_{C_2} = .632V_{in} @ t = RC$$

$$.632V_{in} = 3.16V$$

$$ZD = 3.3V$$

$$C_2 = 1000\mu F$$

$$RC = 60$$

$$R = 60k\Omega$$

Results

<https://youtu.be/OTnMTFW1L5w>

Design Challenges and Future Solutions

- Circuit Discharge
- Power Management

Future Work

- Implement Battery LED
- Separate Z-Wave Hub
- Integration with multiple targets

Thank You

