Insight Power Smart Outlet

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Motivation

- Provides fully automated tracking of power usage
- Greater control over devices, allows for power saving protocols (i.e. “power down” unoccupied room
- Autonomy provides peace of mind to user.

Problem Statement

- 30-40% of energy in a home wasted on average.
- Smart devices can be difficult to manage/tedious to set up
- Difficult to track device-specific power usage
- Devices plugged in are not always the same
- Current technology only offers “semi-automation”

Usage Case: Lights in Your Home

- Other “Smart” Outlets:
  - May/May not provide ability to turn off all lights in house when leaving.
  - Cannot track when devices are moved or switched; device type tied to outlet, not power data
  - Can lead to catastrophe (i.e. fridge plugged into outlet designated as light)
- Insight Power Smart Outlet
  - Potential for any number of power saving protocols
  - Devices are classified by power data, not manual input. Constantly updating.
  - Automated safeguard against such catastrophe.

System Requirements

- Plug easily into wall outlet, remains firmly in place once plugged in.
- Connect wirelessly to app
- Measures and graphs (via app) power usage in real-time
- Turn device on and off via app
- Continuous analysis of usage data
- Classify devices based on data into different categories (lighting, heating/cooling, etc)
- User-Friendly companion app

System Specifications

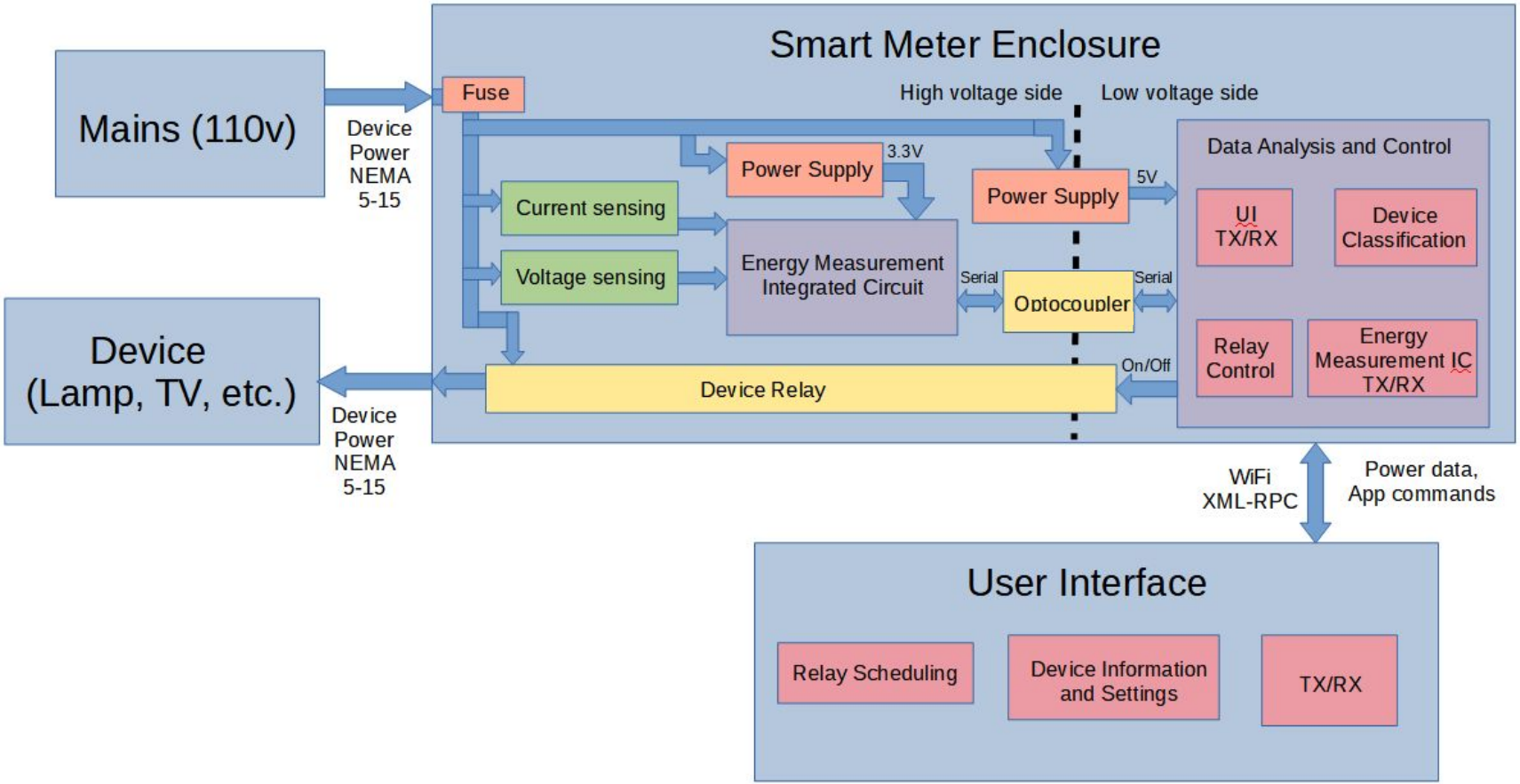
- Measures power usage at least **once per second** within **1%**
- Companion app updates **once per second**
- Communication between app and outlet takes at most **1 second**
- **Ideal Accuracy:**

True Positive 50%	True Negative 50%
False Positive 0%	False Negative 0%

Target Accuracy:

True Positive **40%**	True Negative **40%**
False Positive **<1%**	False Negative **19-20%**

Block Diagram



Proposed Deliverables

Hardware(Smart outlet):

- Outlet can send/receive data wirelessly from companion app at least once per second
- Outlet will read power data at least once per second
- Measure power usage of device within 1% of benchmark (Kill A Watt)
- Device turns on/off within 1 second of issuing command from companion app

Software(Companion app):

- Power usage data updates once per second
- Displays a graph showing data from the last minute

Achieved Deliverables

Hardware(Smart outlet):

- **Outlet can send/receive data wirelessly from companion app at least once per second**
- **Outlet will read power data at least once per second**
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Software(Companion app):

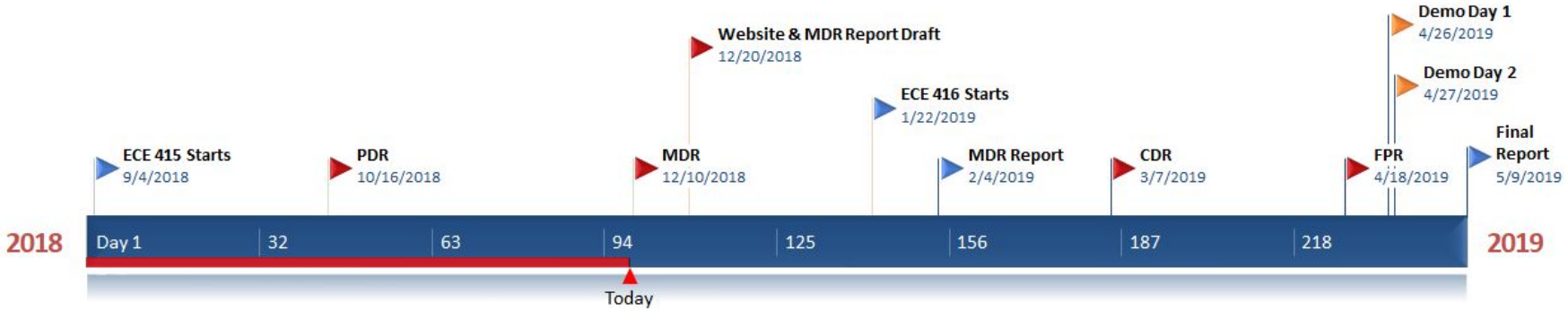
- **Power usage data updates once per second**
- **Displays a graph showing data from the last minute**

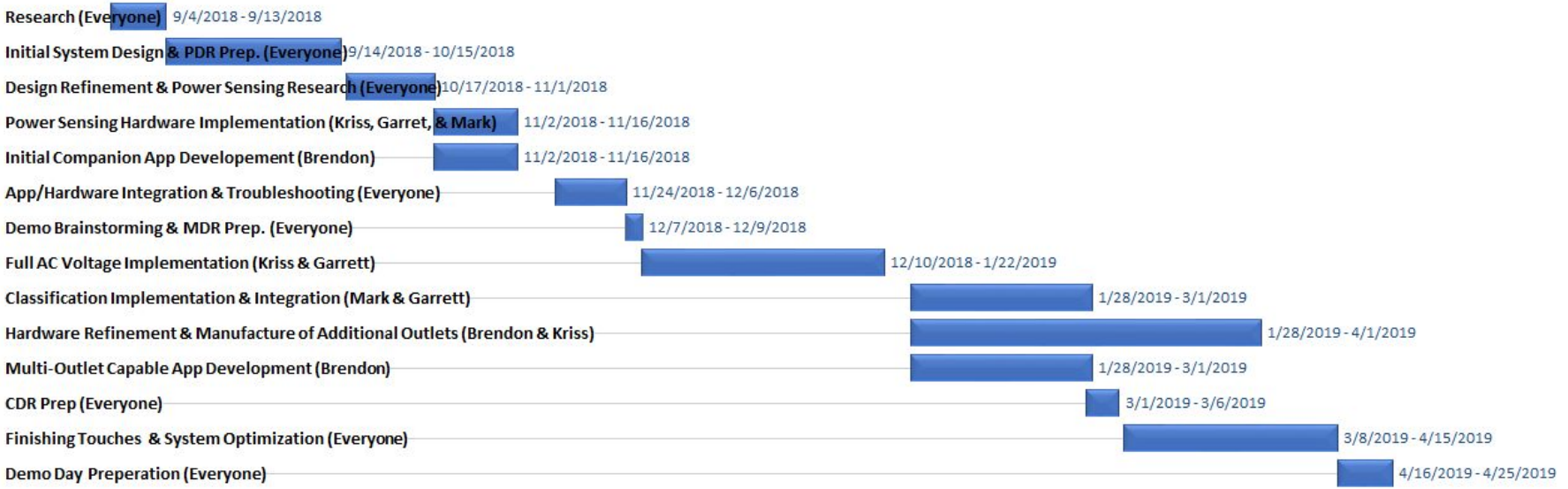
Looking Ahead

- Finish implementing & Expanding App
- Implementation & Integration of Classification Functionality
- Manufacture additional outlets
- Refine Hardware & design Case
- Move up to full AC

CDR Deliverables

- Measures power at full voltage AC within **1%**
- Simple classification algorithm (Light vs Not Light)
- Prototype PCB
- App communication with **multiple outlets** at once


Demo Day 1
4/26/2019
Website & MDR Report Draft
12/20/2018
Demo Day 2
4/27/2019
ECE 416 Starts
1/22/2019
Final Report
5/9/2019
ECE 415 Starts
9/4/2018
PDR
10/16/2018
MDR
12/10/2018
MDR Report
2/4/2019
CDR
3/7/2019
FPR
4/18/2019
2018
Day 1
32
63
94
125
156
187
218
2019
Today


Research (Everyone) 9/4/2018 - 9/13/2018
Initial System Design & PDR Prep. (Everyone) 9/14/2018 - 10/15/2018
Design Refinement & Power Sensing Research (Everyone) 10/17/2018 - 11/1/2018
Power Sensing Hardware Implementation (Kriss, Garret, & Mark) 11/2/2018 - 11/16/2018
Initial Companion App Developement (Brendon) 11/2/2018 - 11/16/2018
App/Hardware Integration & Troubleshooting (Everyone) 11/24/2018 - 12/6/2018
Demo Brainstorming & MDR Prep. (Everyone) 12/7/2018 - 12/9/2018
Full AC Voltage Implementation (Kriss & Garrett) 12/10/2018 - 1/22/2019
Classification Implementation & Integration (Mark & Garrett) 1/28/2019 - 3/1/2019
Hardware Refinement & Manufacture of Additional Outlets (Brendon & Kriss) 1/28/2019 - 4/1/2019
Multi-Outlet Capable App Development (Brendon) 1/28/2019 - 3/1/2019
CDR Prep (Everyone) 3/1/2019 - 3/6/2019
Finishing Touches & System Optimization (Everyone) 3/8/2019 - 4/15/2019
Demo Day Preperation (Everyone) 4/16/2019 - 4/25/2019

Demo