

Open Energy - Platform for Energy Transactions

Senior Design May 2018: Team 41

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Client: Open Energy

Motivation

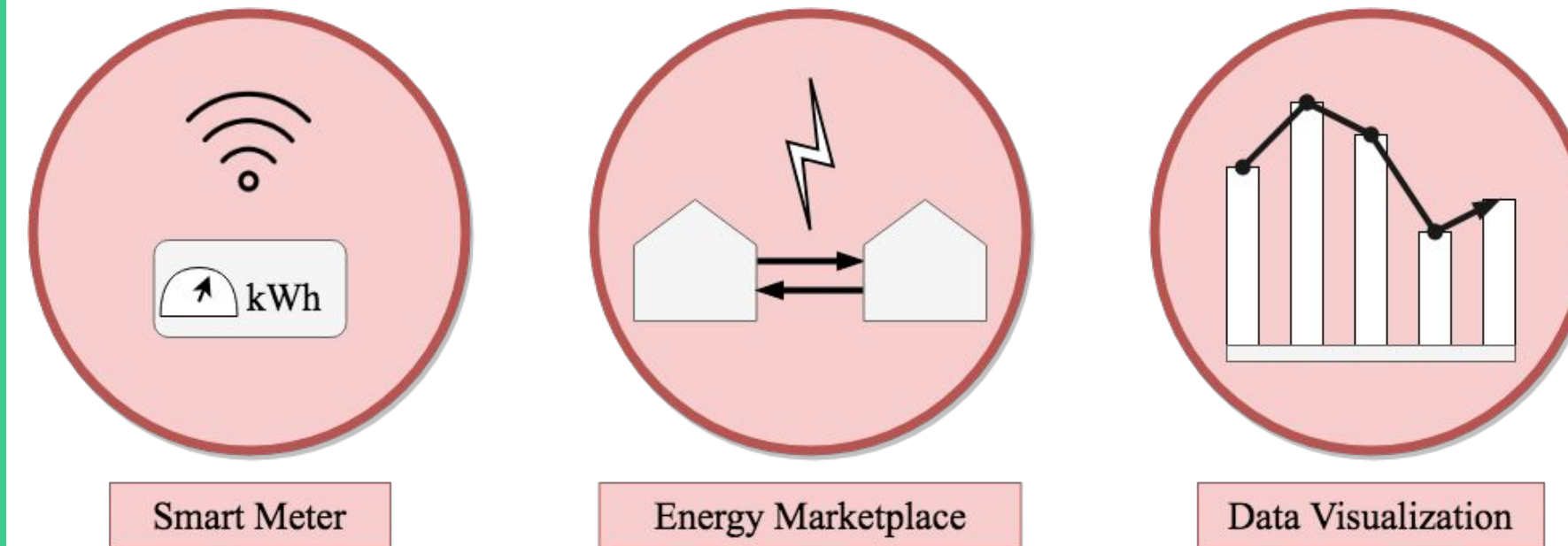
- Incentivize renewable energy generation by facilitating peer to peer trading of surplus energy.
- Aid in the decentralization of the power generation market, which will lead to:
 - Lower energy prices
 - An energy system that is capable of handling blackouts and natural disasters
 - More efficient use of available energy resources

Users

- Producers: supply excess energy, look to increase their profit relative to utility company rates
- Consumers: desire cheaper and/or renewable sources of energy

Solution

- Inexpensive and user-friendly smart power meter
- Software to facilitate peer to peer trading of surplus energy
- Data visualization tools to enable personal management of power production and consumption



Design Requirements

Functional

1. An IoT Smart Meter
2. Web and mobile apps for management of transactions
3. API for communication between the smart meter and web application
4. Backend processing block for clearing market transactions and managing user data

Non-Functional / Engineering Constraints

1. Ease of setup
2. Portability
3. Robustness
4. Scalability
5. Security

Operating Environment

- Varying economic and political climates
- Legal factors with trading (utility company's infrastructure or trading between different cities, states, countries)

Most Relevant Standards

- 1547-2003 - IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems

Design Approach

Marketplace

- Allows producers and consumers to enter and exit the market to purchase and sell energy
- Provides transactional logging to reconcile purchase and consumption history at the market price

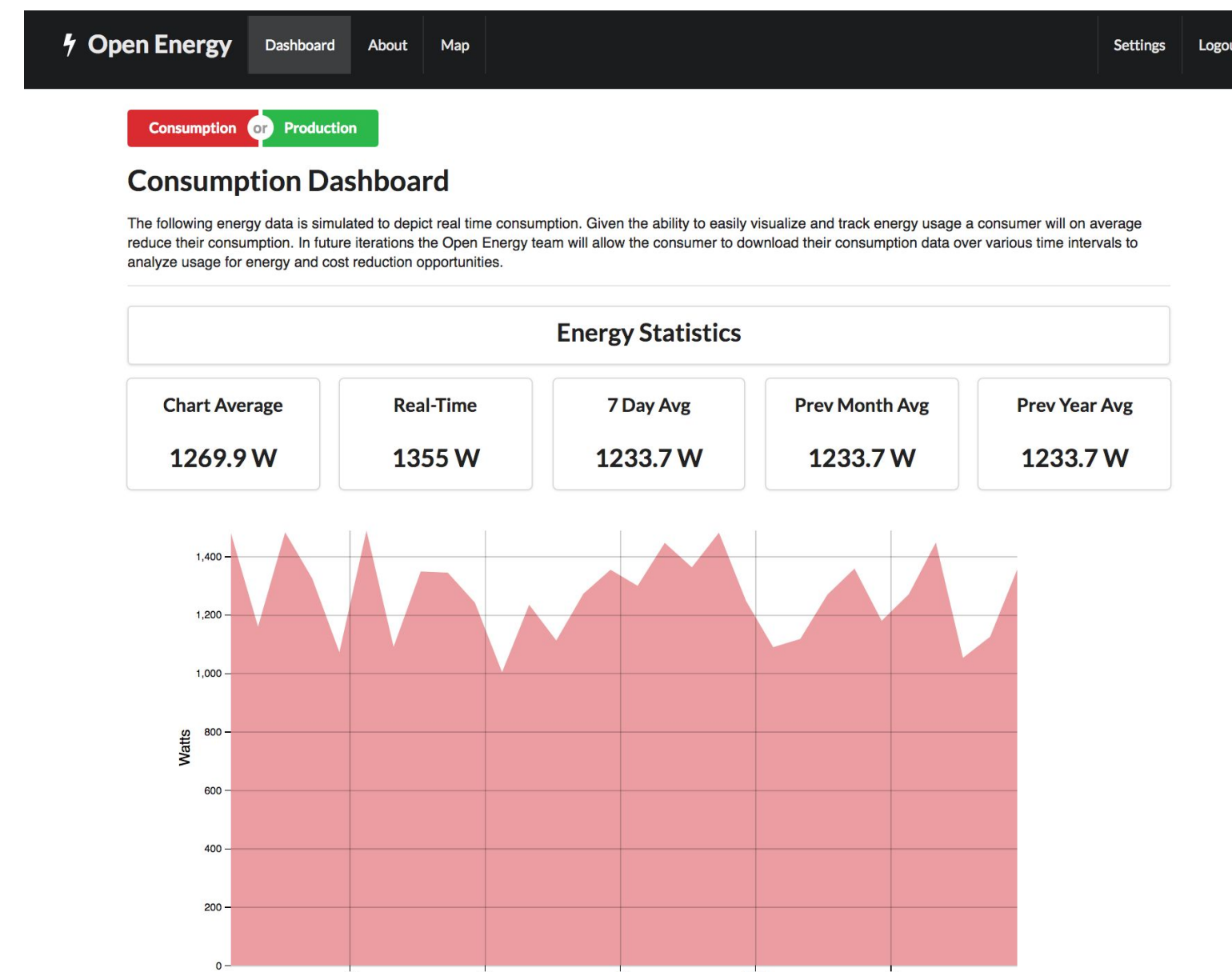
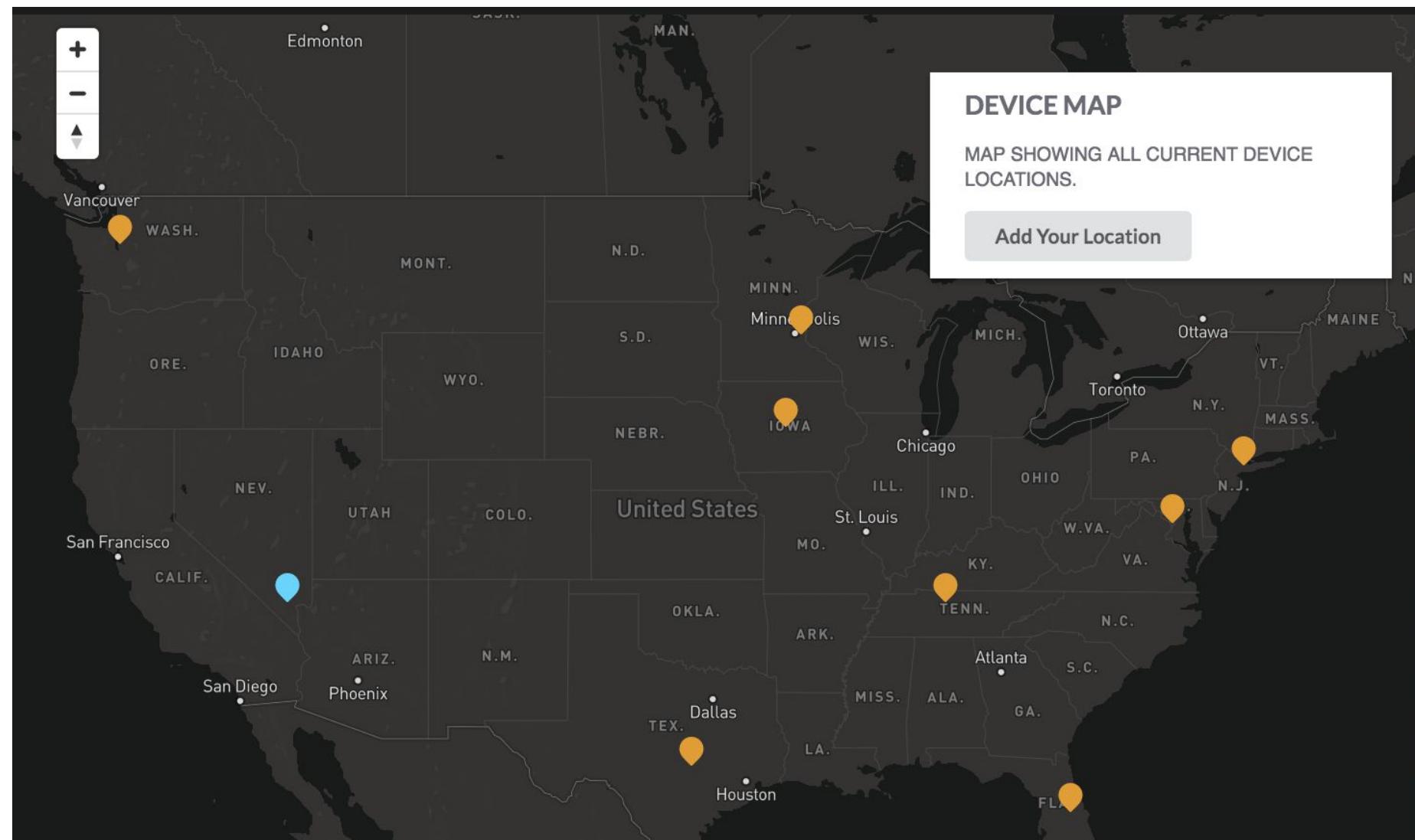
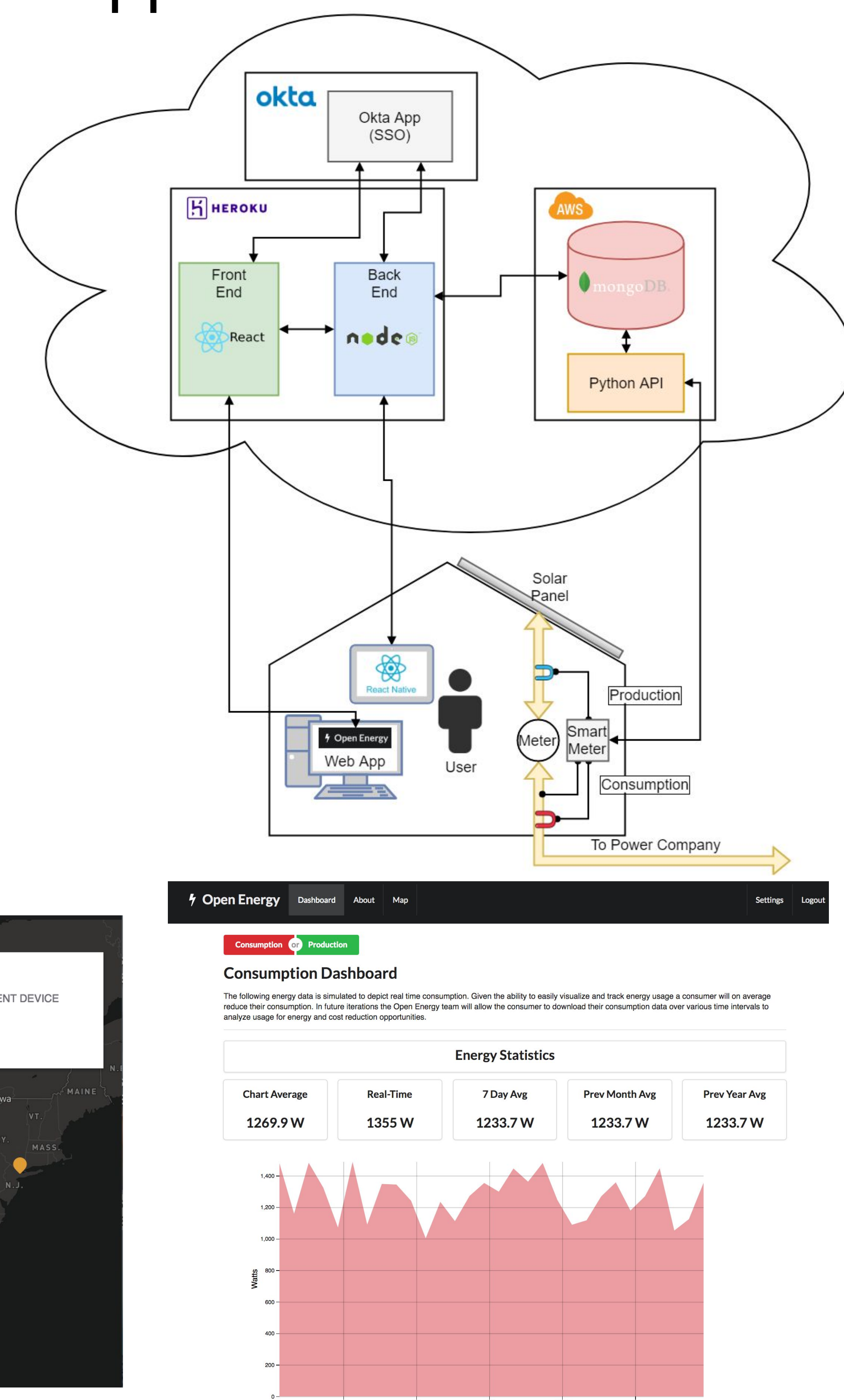
Web Application

Helps users understand real-time energy usage through:

- Real-time energy consumption and production graphs
- Downloadable data
- Marketplace configurations
- Secure login

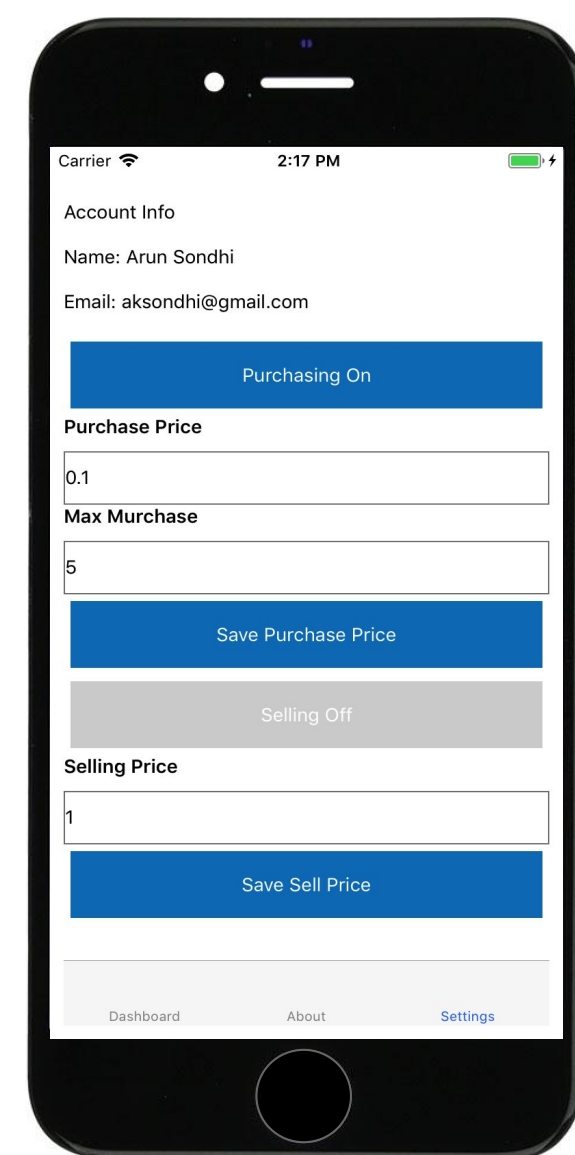
The admin portal allows Open Energy administrators the ability to:

- Visualize spatial representations of the users



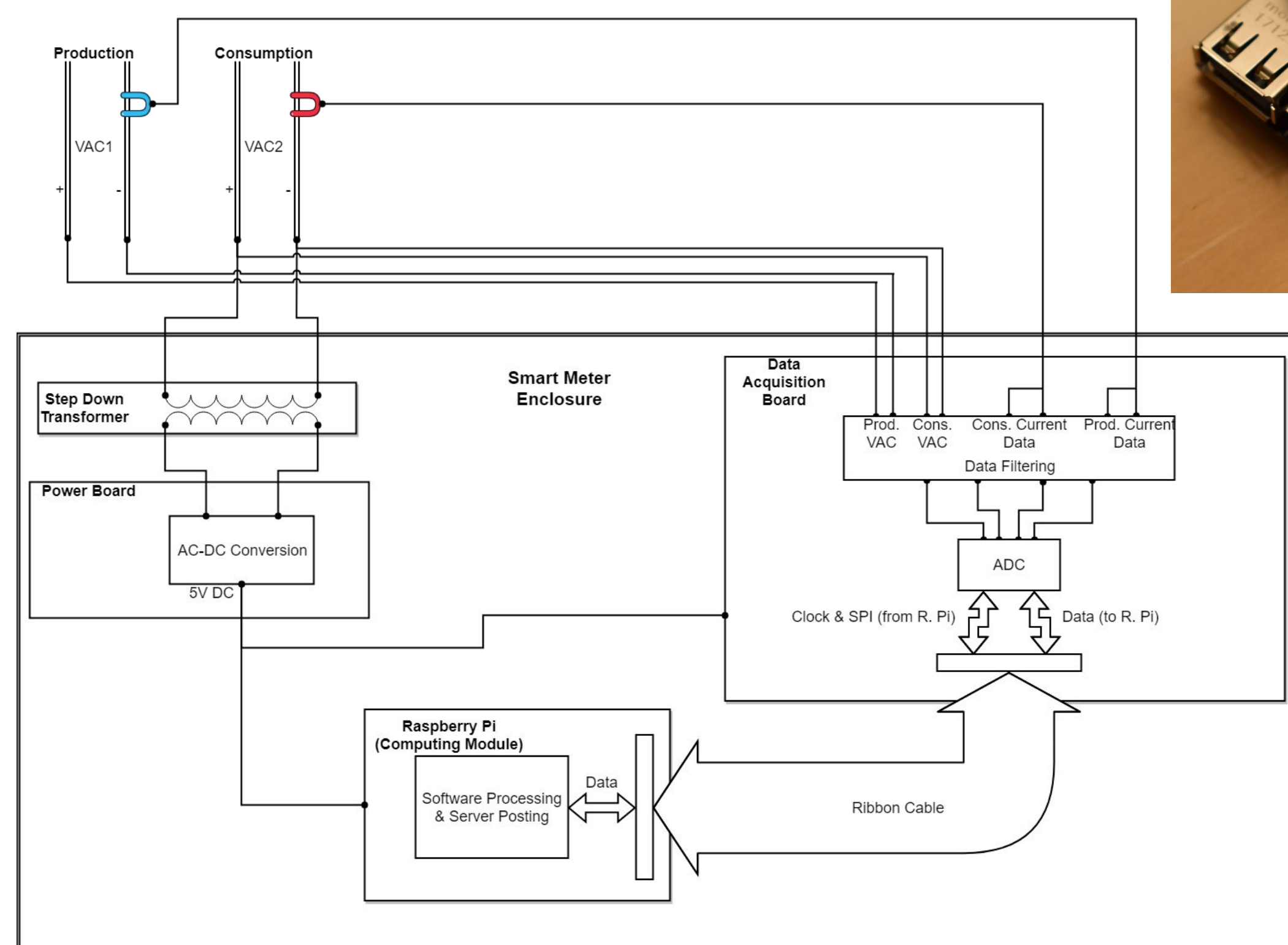
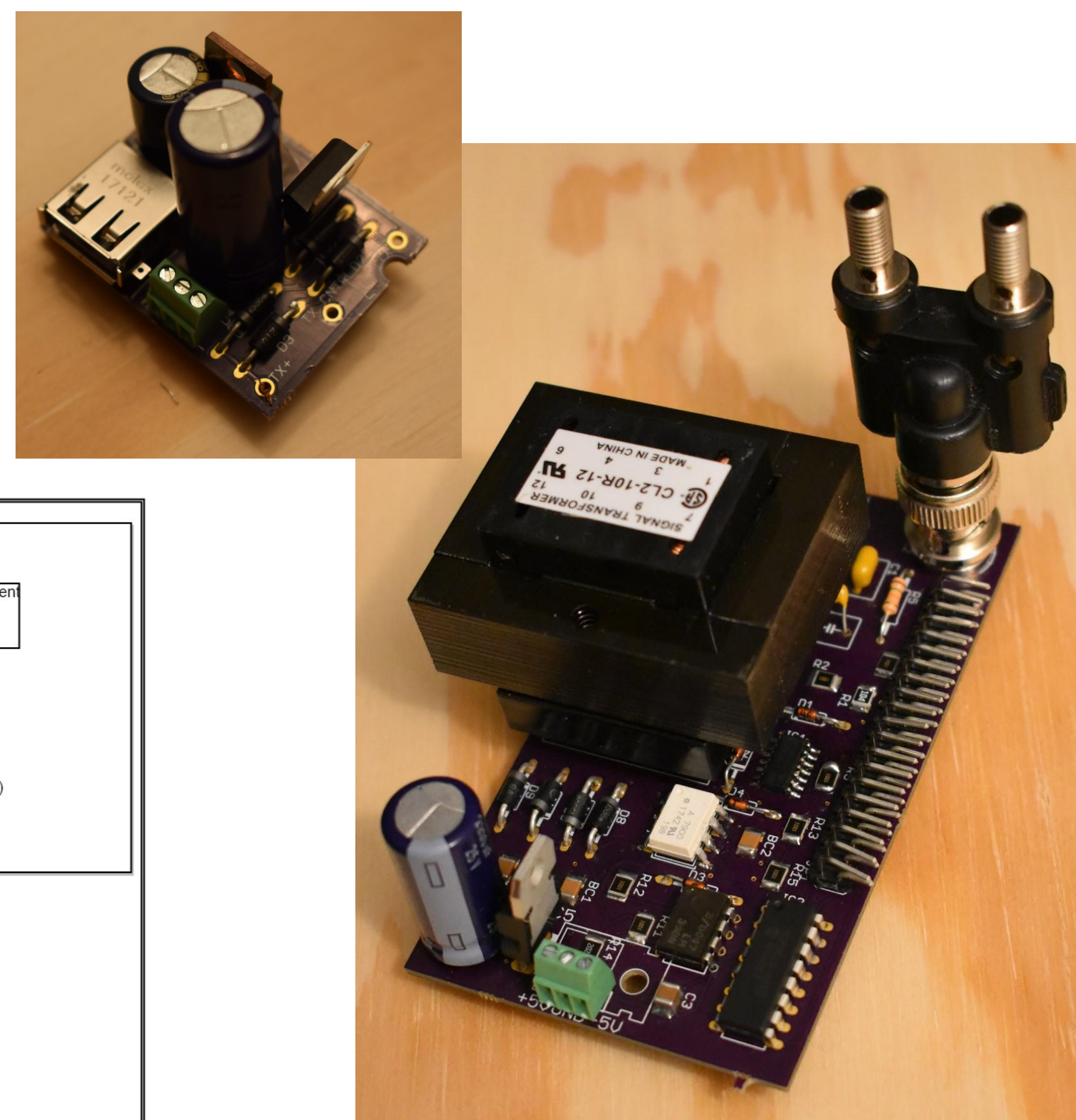
Mobile App

- Quick monitoring of consumption and production
- Configuring marketplace settings



IoT Smart Meter

- Obtains and processes power consumption and generation data
- Displays live power consumption data to the user
- Passes information to the web/mobile apps for data visualization
- Acquires power from the line to which it is connected

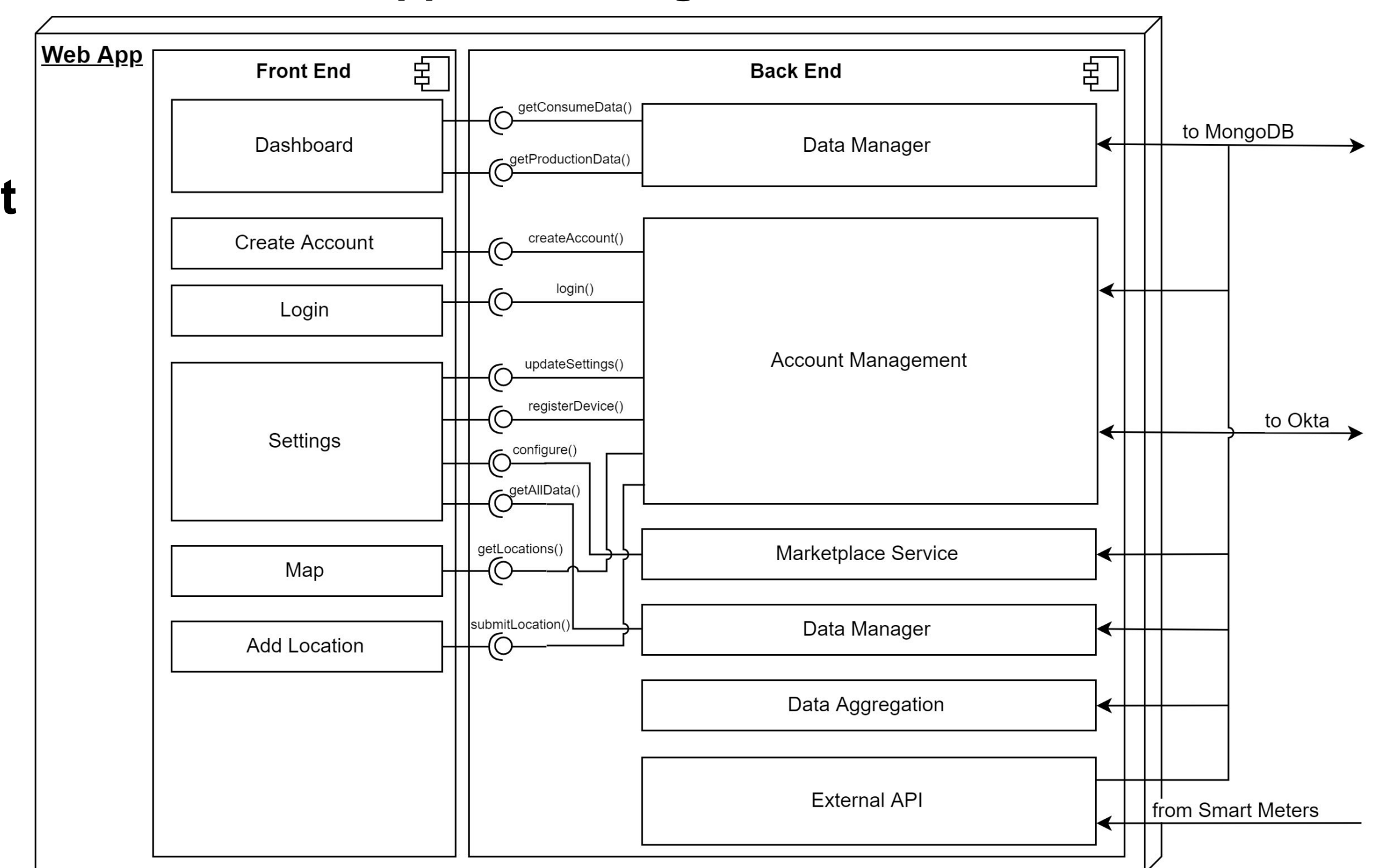


Technical Details

Technologies:



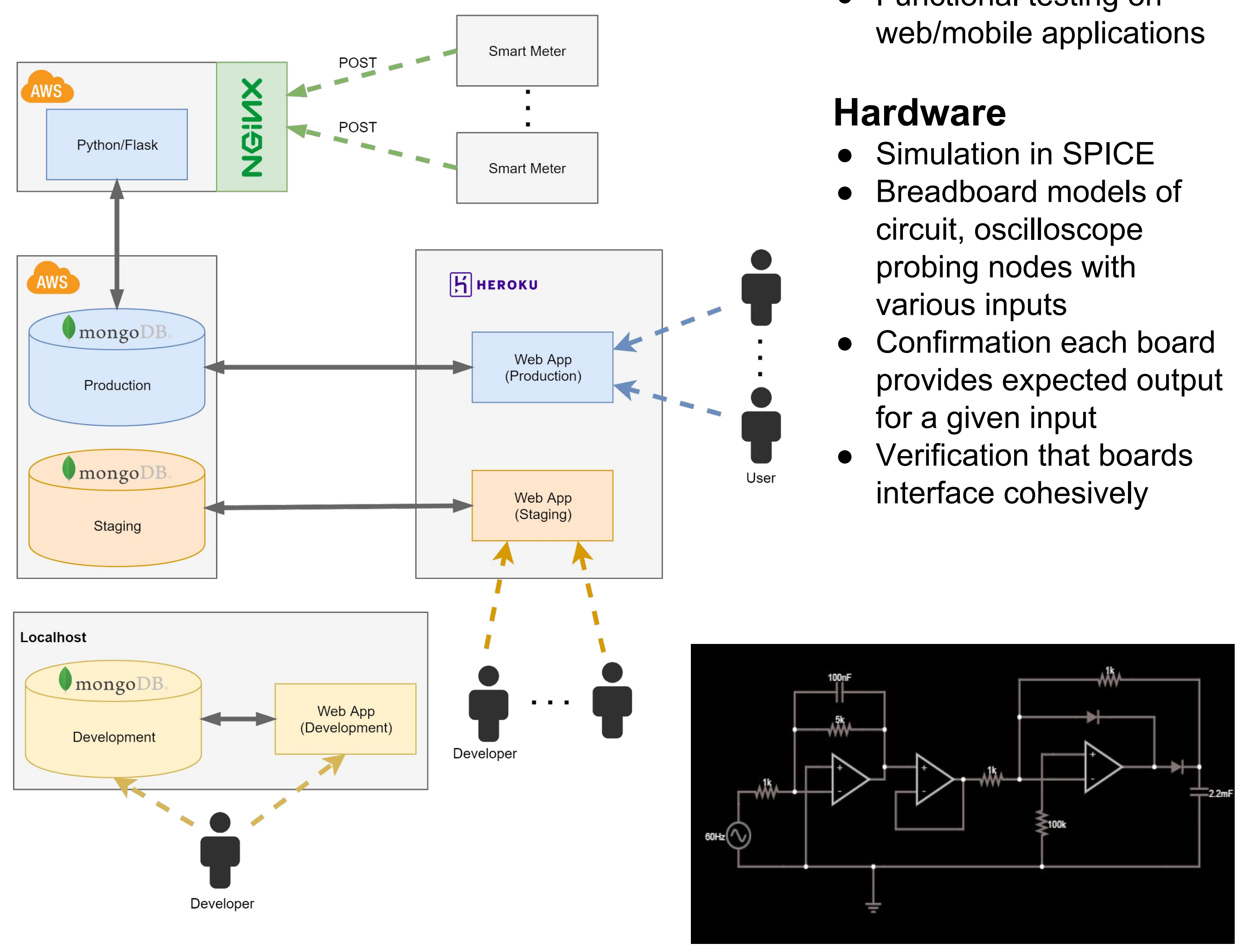
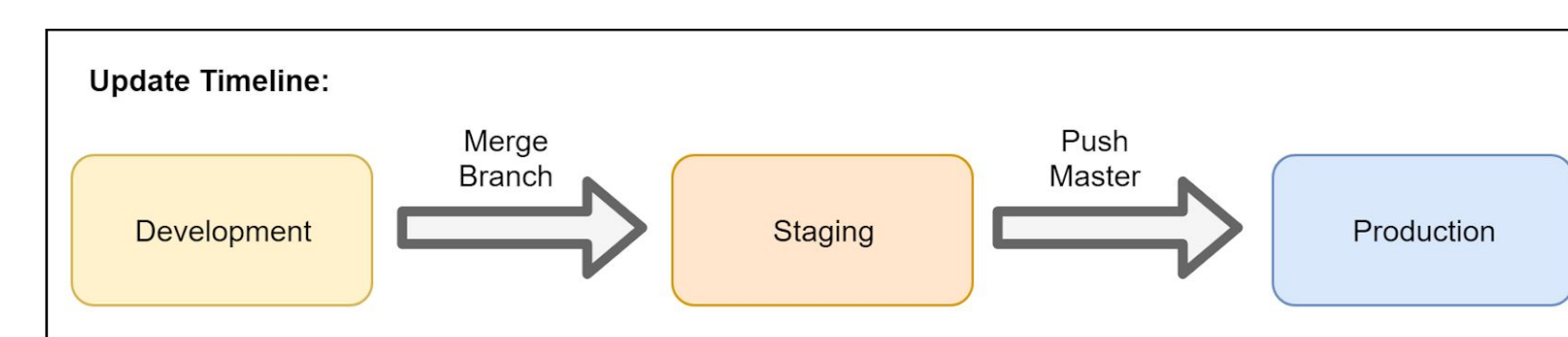
Web App Block Diagram



Development Tools

- Sublime
- Webpack
- WebStorm
- Atom
- tmux
- PyCharm
- Git/Github

Testing



Software

- Three phase deployment schedule
- Unit testing on Flask API and data aggregation
- Functional testing on web/mobile applications

Hardware

- Simulation in SPICE
- Breadboard models of circuit, oscilloscope probing nodes with various inputs
- Confirmation each board provides expected output for a given input
- Verification that boards interface cohesively

