

A Generalized Open Source Platform Design for Building Energy Management

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Introduction

- Residential and commercial buildings account for around 40 % of energy consumption in US in 2018
- Microgrids which incorporate distributed renewable energy sources will be integrated with smart grids to make energy supply more reliable and decrease costs and transmission losses

Introduction

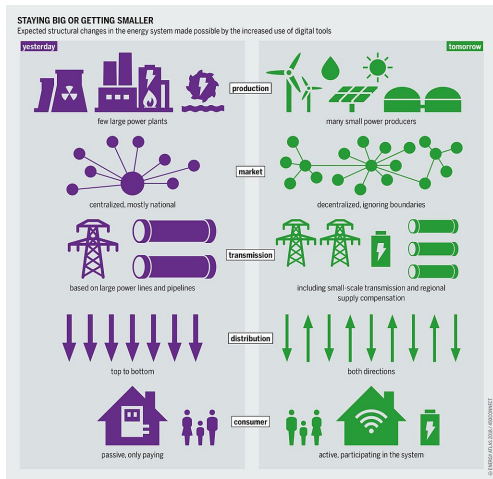


Figure: Traditional power grid characteristics (left) vs smart grid characteristics (right), courtesy of Wikipedia: https://en.wikipedia.org/wiki/Smart_grid

Objectives

- 1 BEMOSS will be fully analyzed
- 2 Prototype of the proposed BEMS will be developed
- 3 Rotational electromechanical devices will be integrated such as DC motor will be integrated in new platform
- 4 Determine research avenues - learning, control, estimation algorithms
- 5 Develop ways to mitigate security threats to reduce power outage costs in the US
- 6 Deploy the BEMS in community areas to monitor energy costs as well as demonstrate its effectiveness

Research Approach

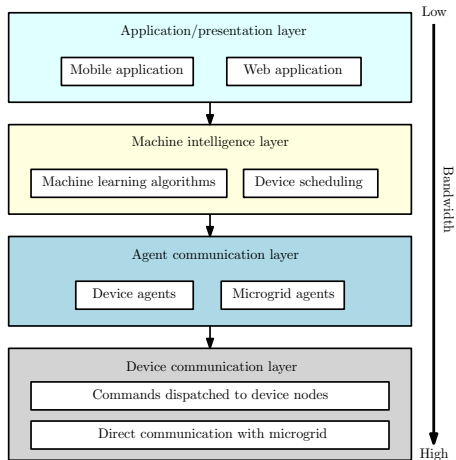


Figure: High level software architecture of BEMS

Preliminary Results

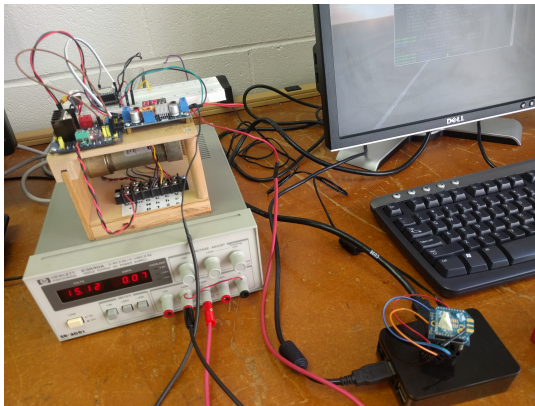


Figure: Lab setup of IoT DC motor

Preliminary Results

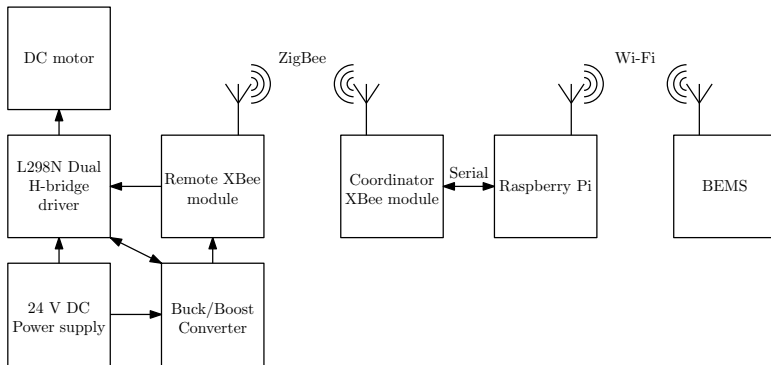


Figure: Connection of hardware modules for integrating a IoT device with BEMOSS

Learning, Control, and Estimation Strategies

- Algorithms will be implemented for solving energy optimization, monitoring, and security problems
- IoT sensors will be deployed for monitoring voltage and current of different points in the microgrid (state variables)
- Sensors are vulnerable to cyber attacks
- Kalman filter based cyber attack detection scheme will be used