A Generalized Open Source Platform Design for Building Energy Management

Brian Lauer
Advisor: Dr. Suruz Miah

Department of Electrical and Computer Engineering
Bradley University
1501 W. Bradley Avenue
Peoria, IL, 61625, USA

Friday, January 31, 2020

BRADLEY University

Outline

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

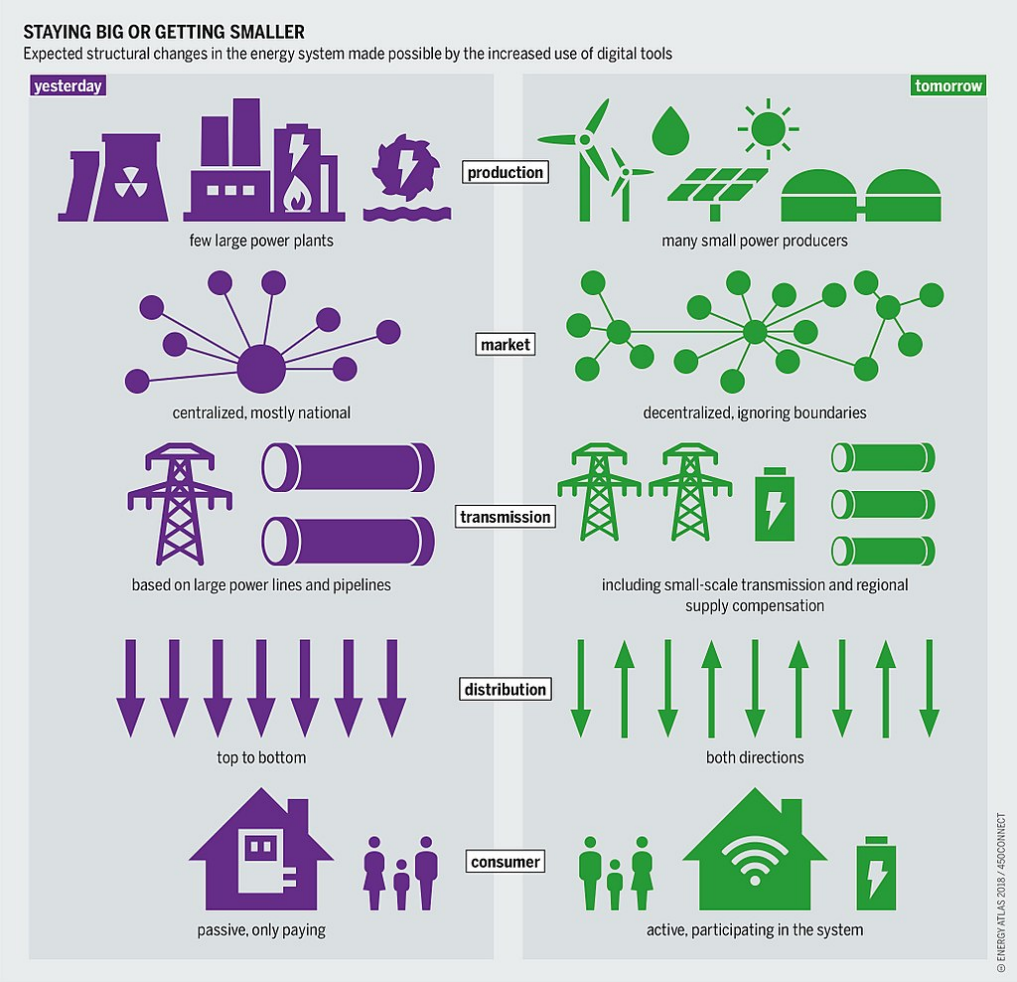

Figure: Traditional power grid characteristics (left) vs smart grid characteristics (right), courtesy of Wikipedia: `https://en.wikipedia.org/wiki/Smart_grid`

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

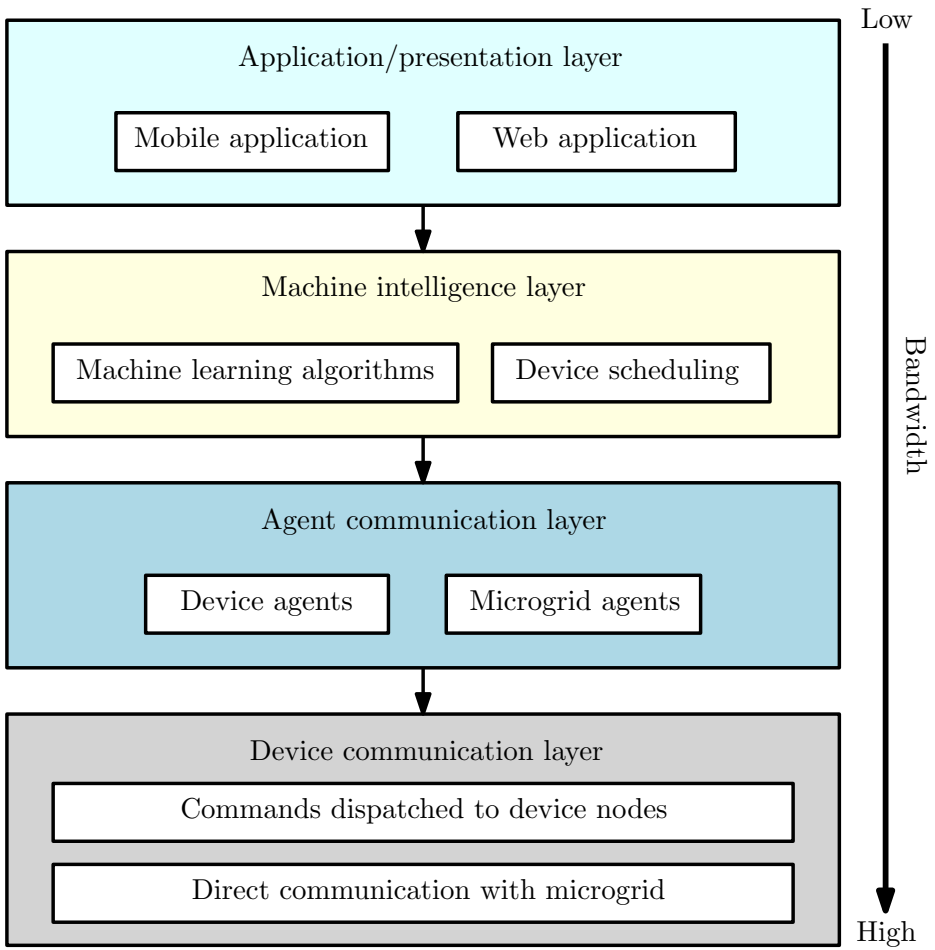

Figure: High level software architecture of BEMS

Preliminary Results

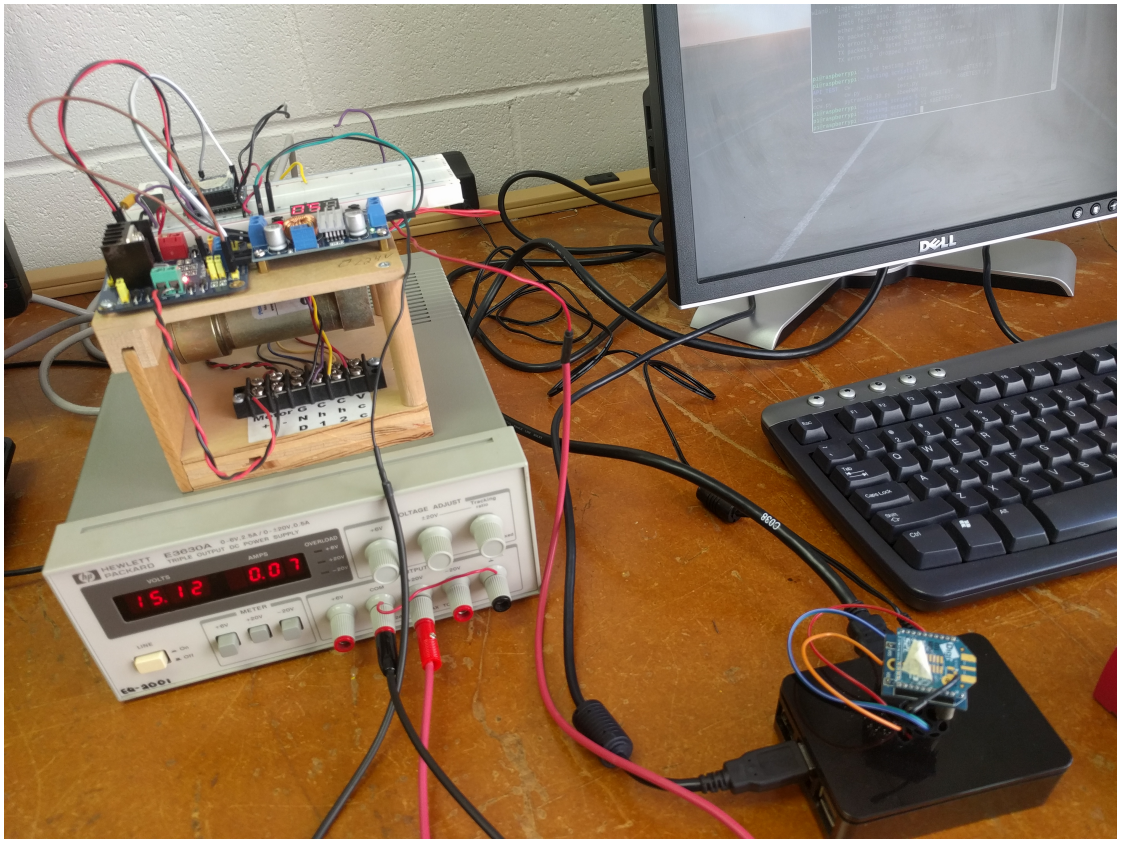

Figure: Lab setup of IoT DC motor

Preliminary Results

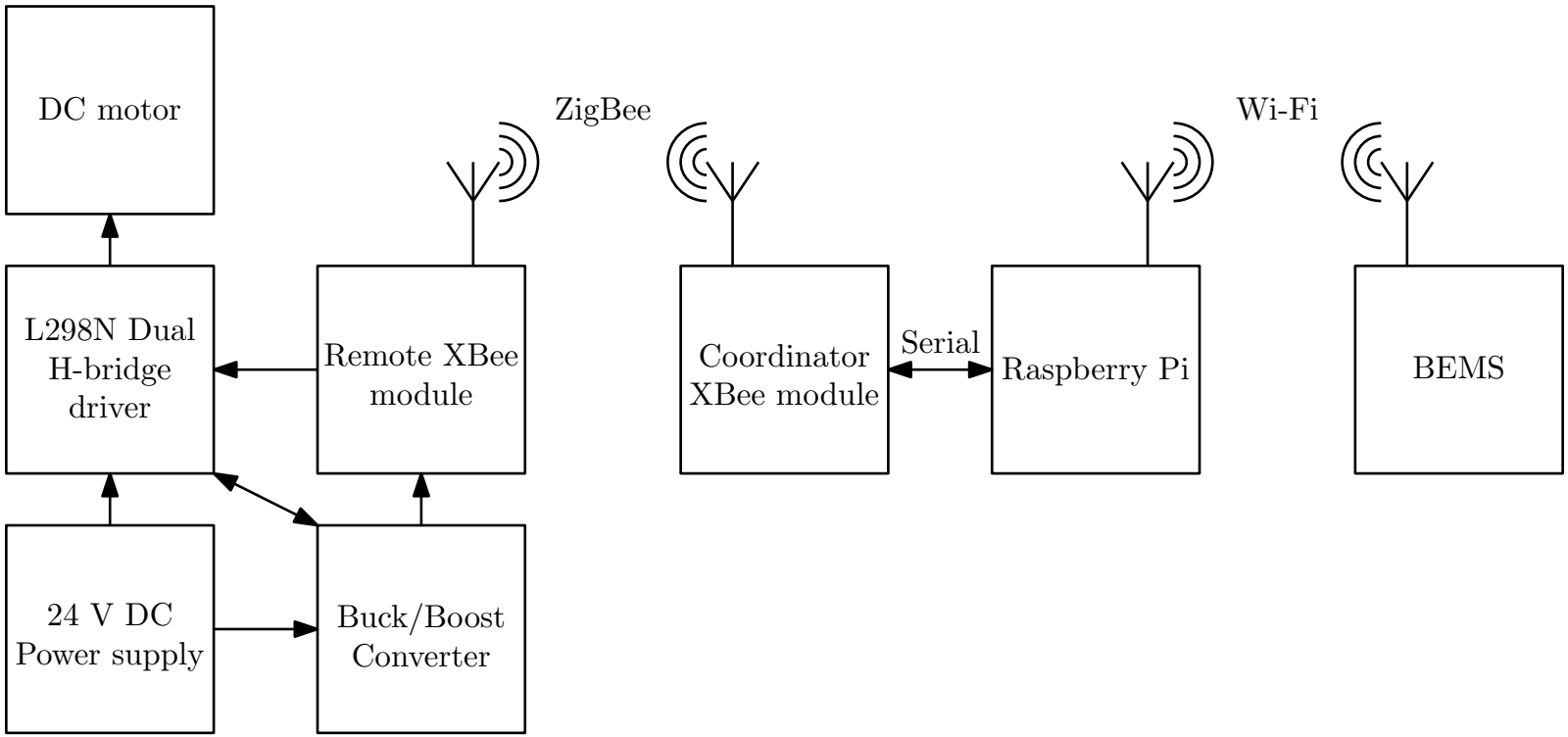

Figure: Connection of hardware modules for integrating a IoT device with BEMOSS

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