BEMOSS: Building Energy Management Open Source Software

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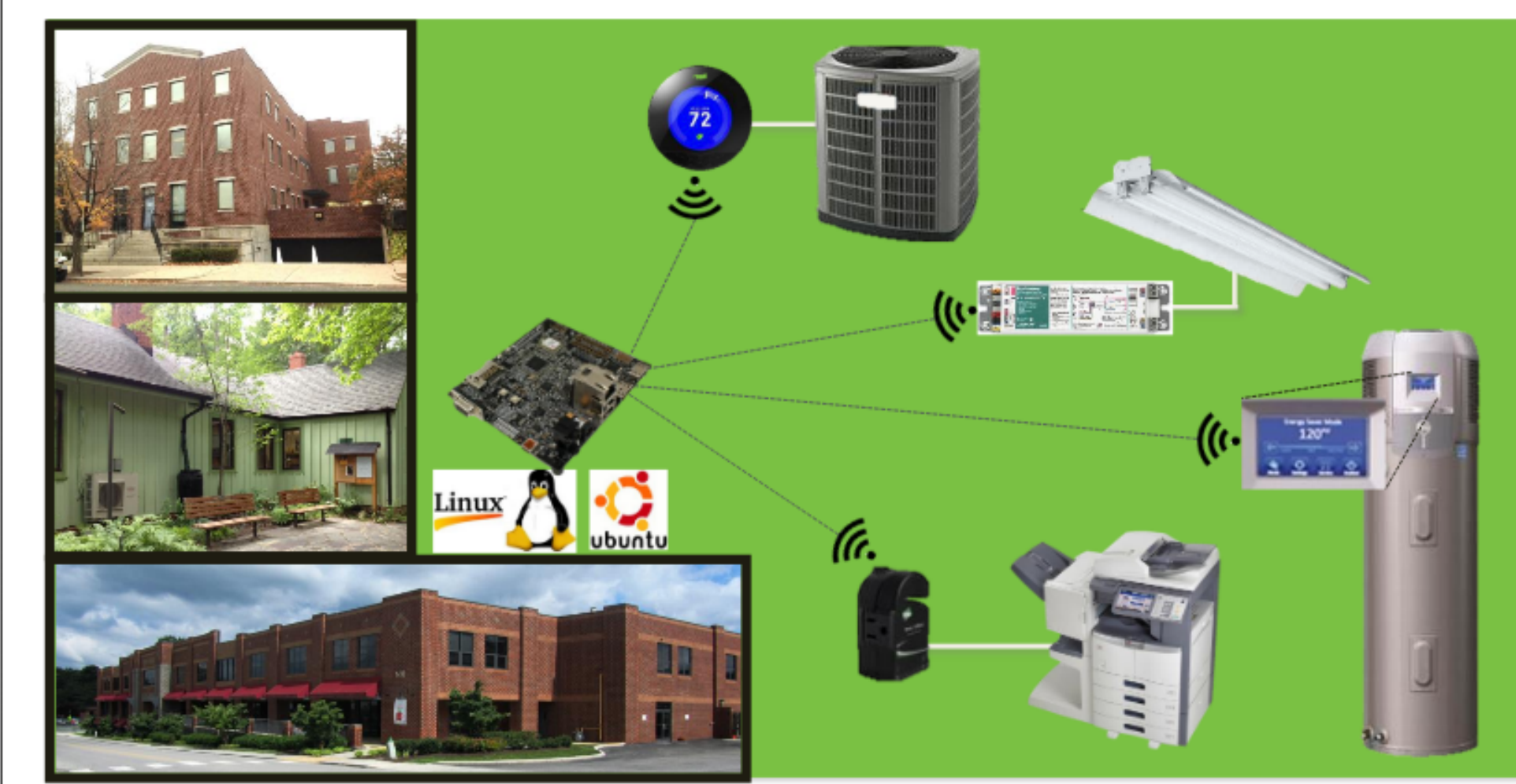
Application

Figure 1: Current BEMOSS Structure

BEMOSS Overview

- Internet of Things(IoT) control Software
- Control entire building worth of devices
- Energy friendly environment control
- Developed under the Department of Energy
- Supports HVAC, plug loads, fans, and sensors
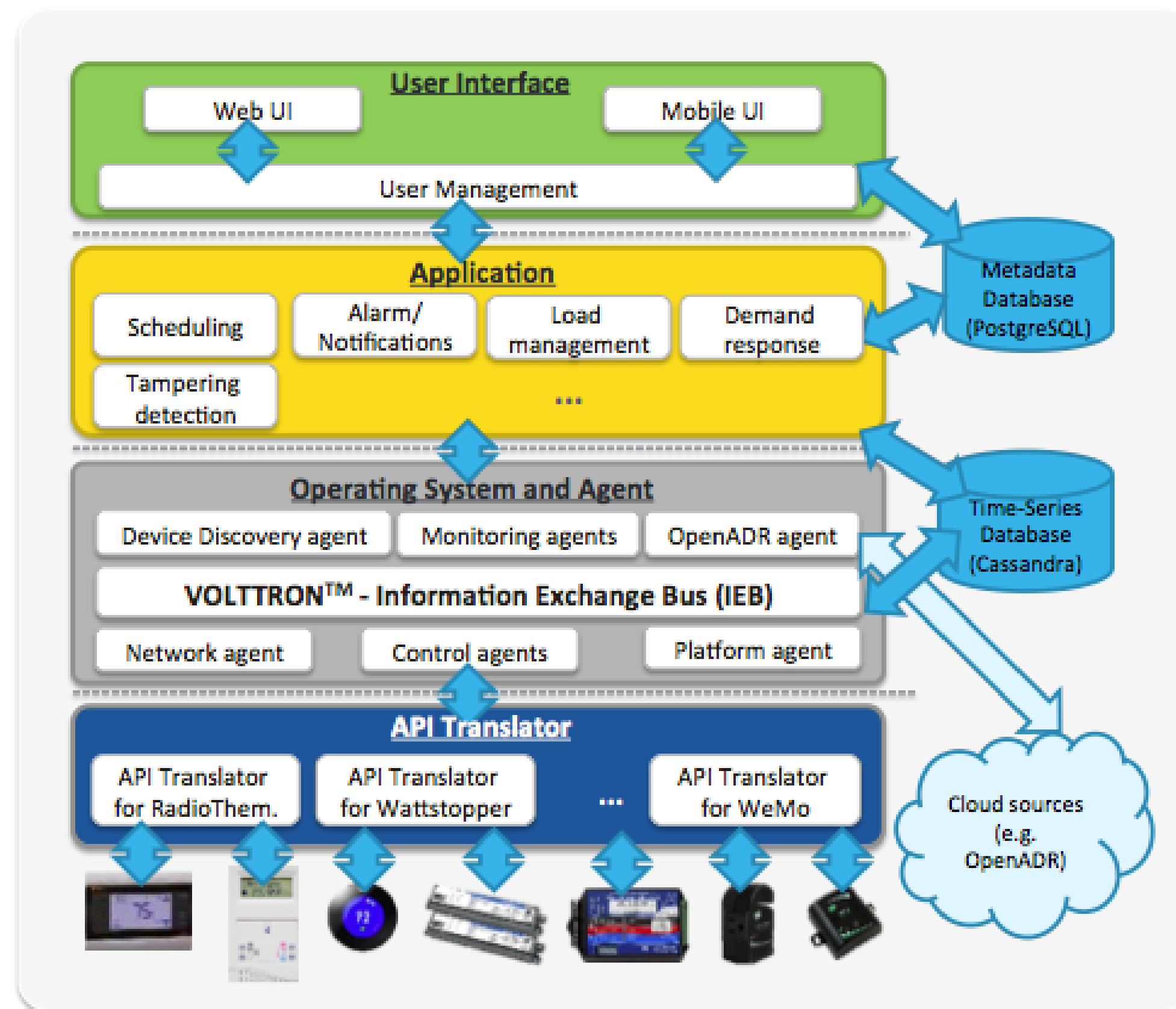- We are adding the support of a DC motor

Figure 2: BEMOSS software architecture (courtesy of Department of Energy)

Objectives

- Integrate a new device within BEMOSS
- Get BEMOSS to run on a embedded computer
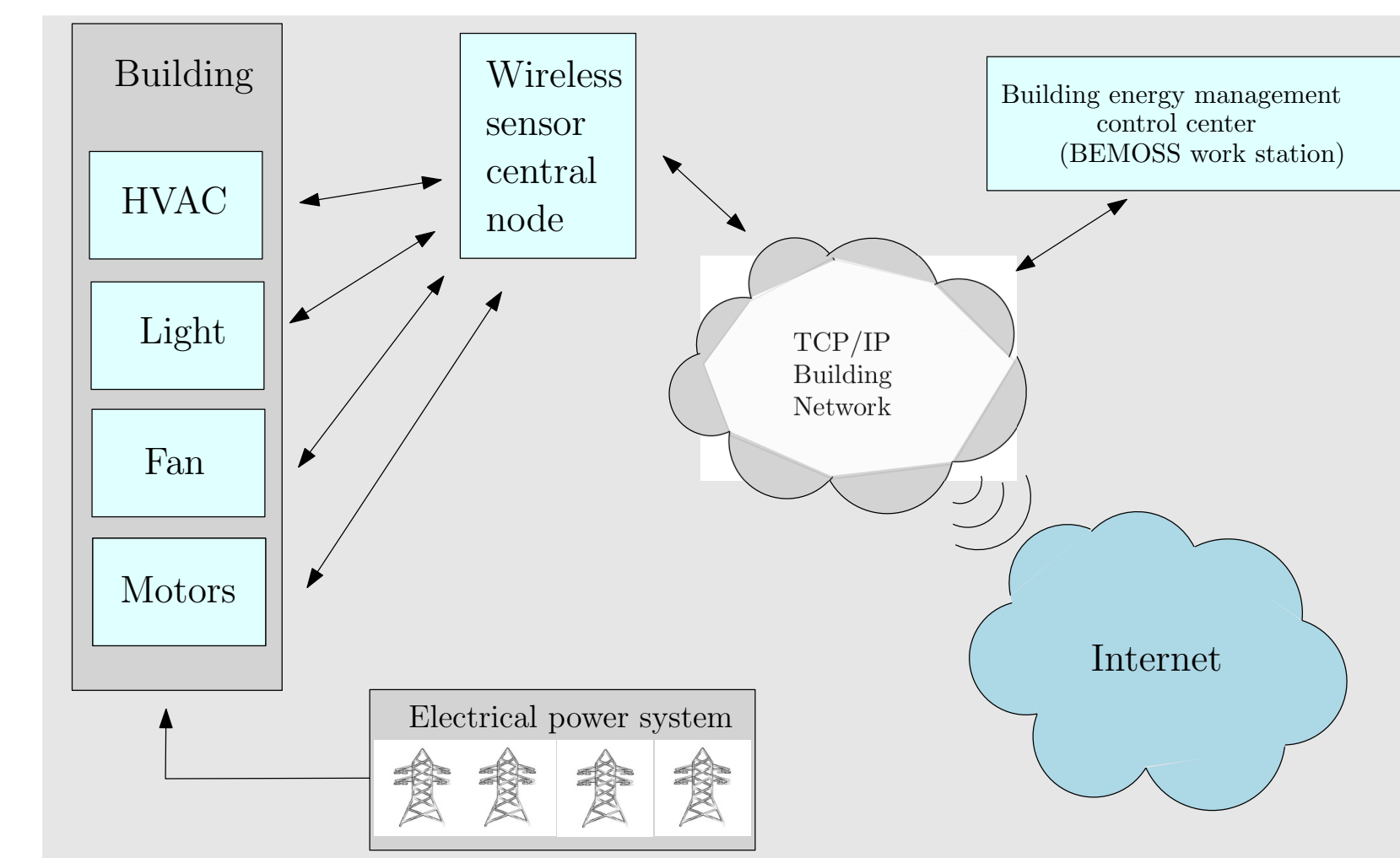- Develop and implement an energy saving algorithm to BEMOSS

Figure 3: Proposed BEMOSS structure.

New IoT Device (Motor) Configuration

- Central hub to control multiple DC motors
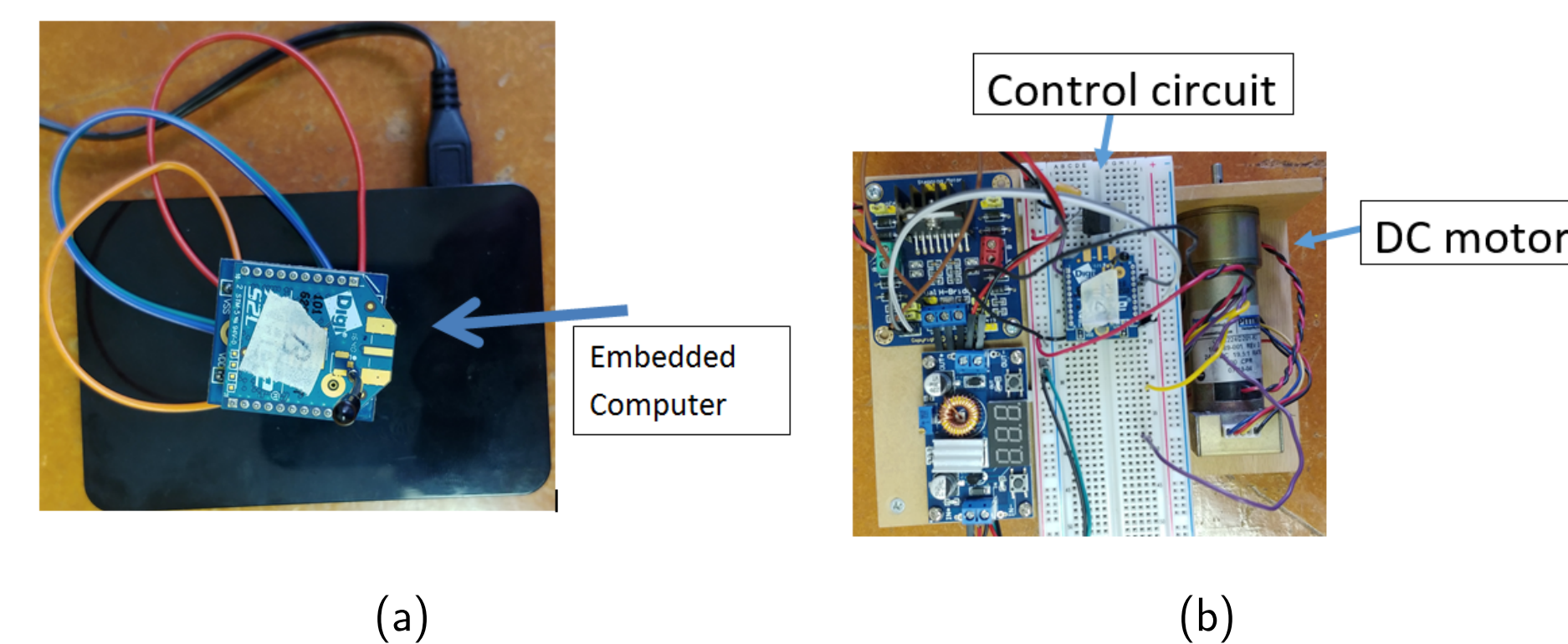- Facilitates RF communications to DC motors
- Controlled via a network

Figure 4: (a) IoT central node and (b) IoT motor.

- Automate curtains and doors
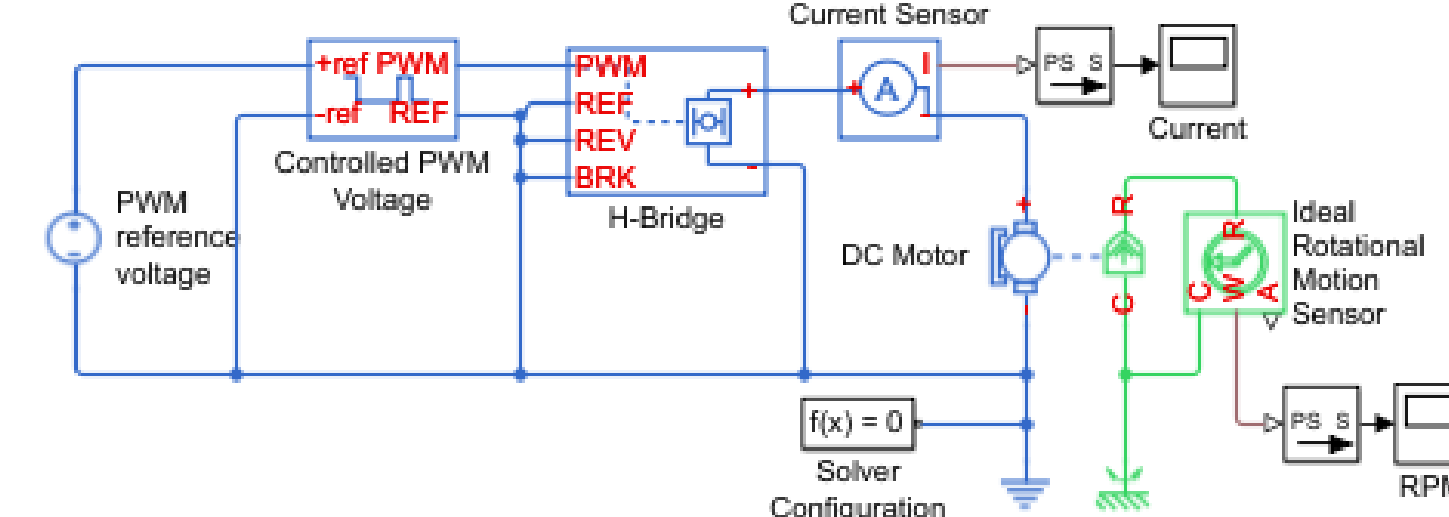- Regulate interior temperatures and privacy

Figure 5: Simscape Motor Model

Automatic Detection & Control

- Discover all devices connected to the network
- Deduce which devices we desire to control on the network
- Collect necessary control information
- Connect to desired node
- Display control interface

Figure 6: Discovery Method

Second IoT device (HVAC)

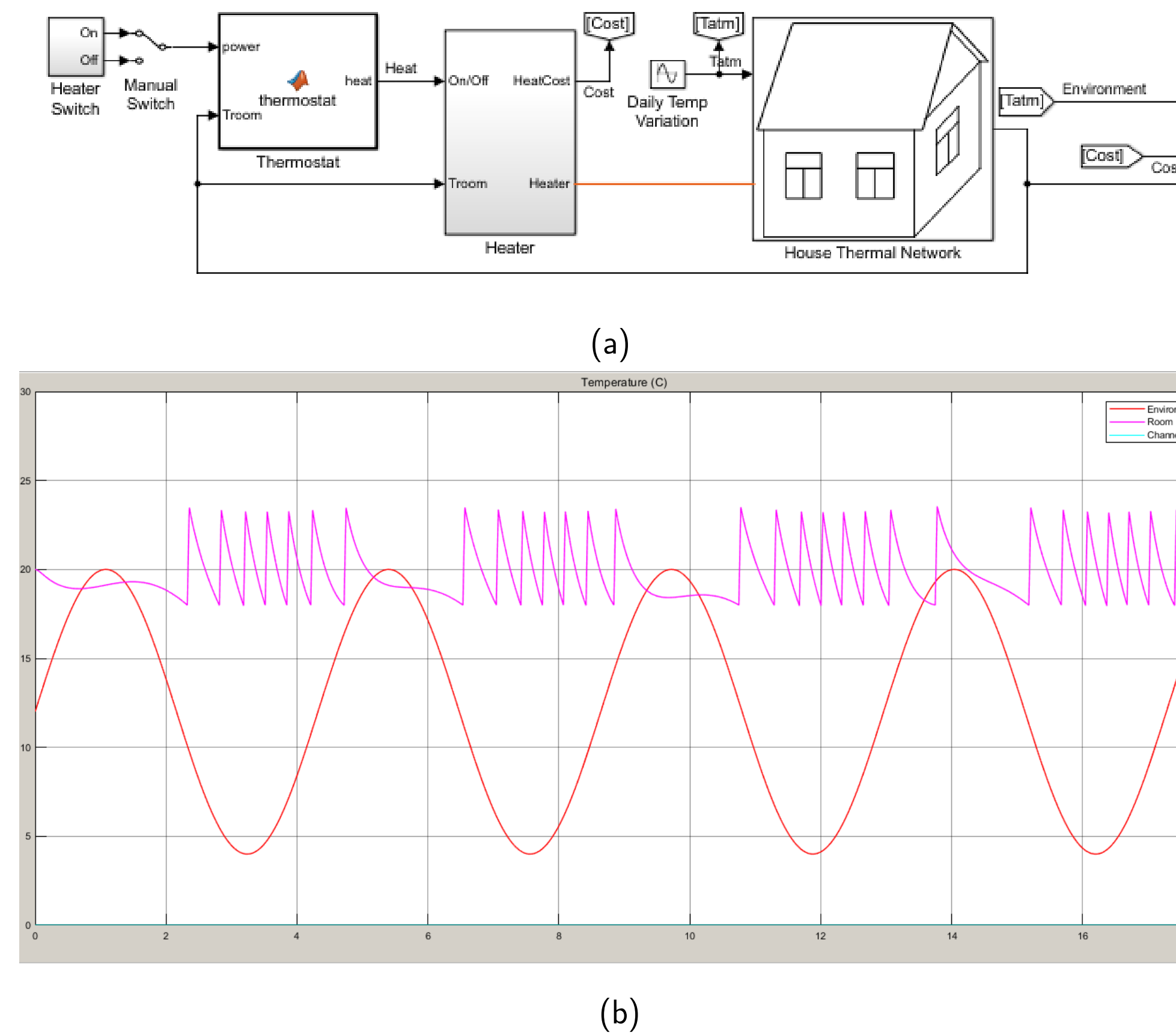- Model devices on BEMOSS
- Lower energy cost through HVAC control

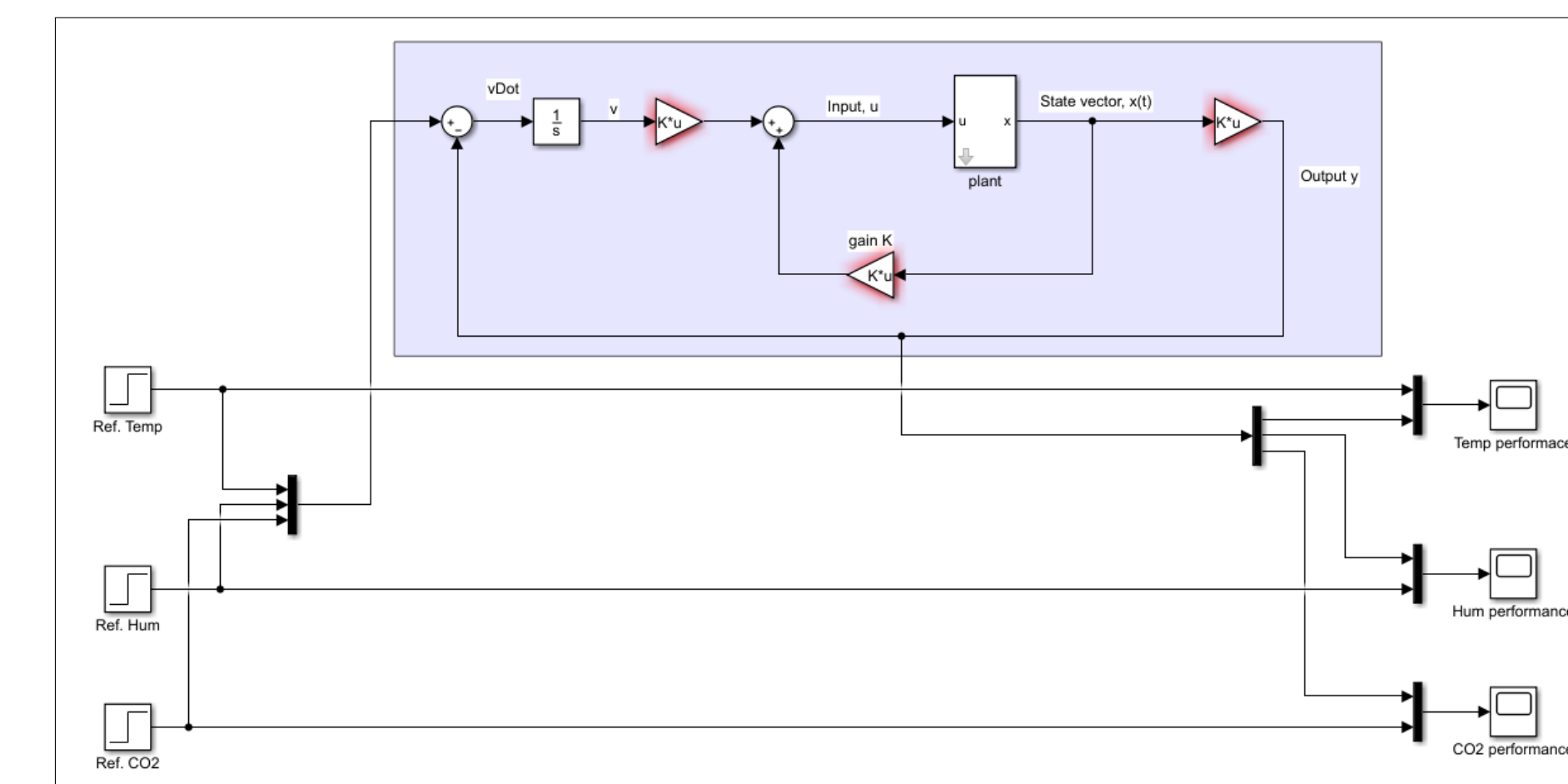**Figure 7:** (a) Simulink Model of One Room House and (b) Temperature of House

Figure 8: Block Diagram for HVAC Control

$$u(t) = -Kx(t) + K_l v(t) \qquad (1)$$
$$\dot{v}(t) = r - Cx(t) \qquad (2)$$

- Controls temperature, humidity, and CO_2
- Models a one room system
- Linear Quadratic Regulator(LQR) control design

Experimental Results

- Controlled wireless motor over the internet
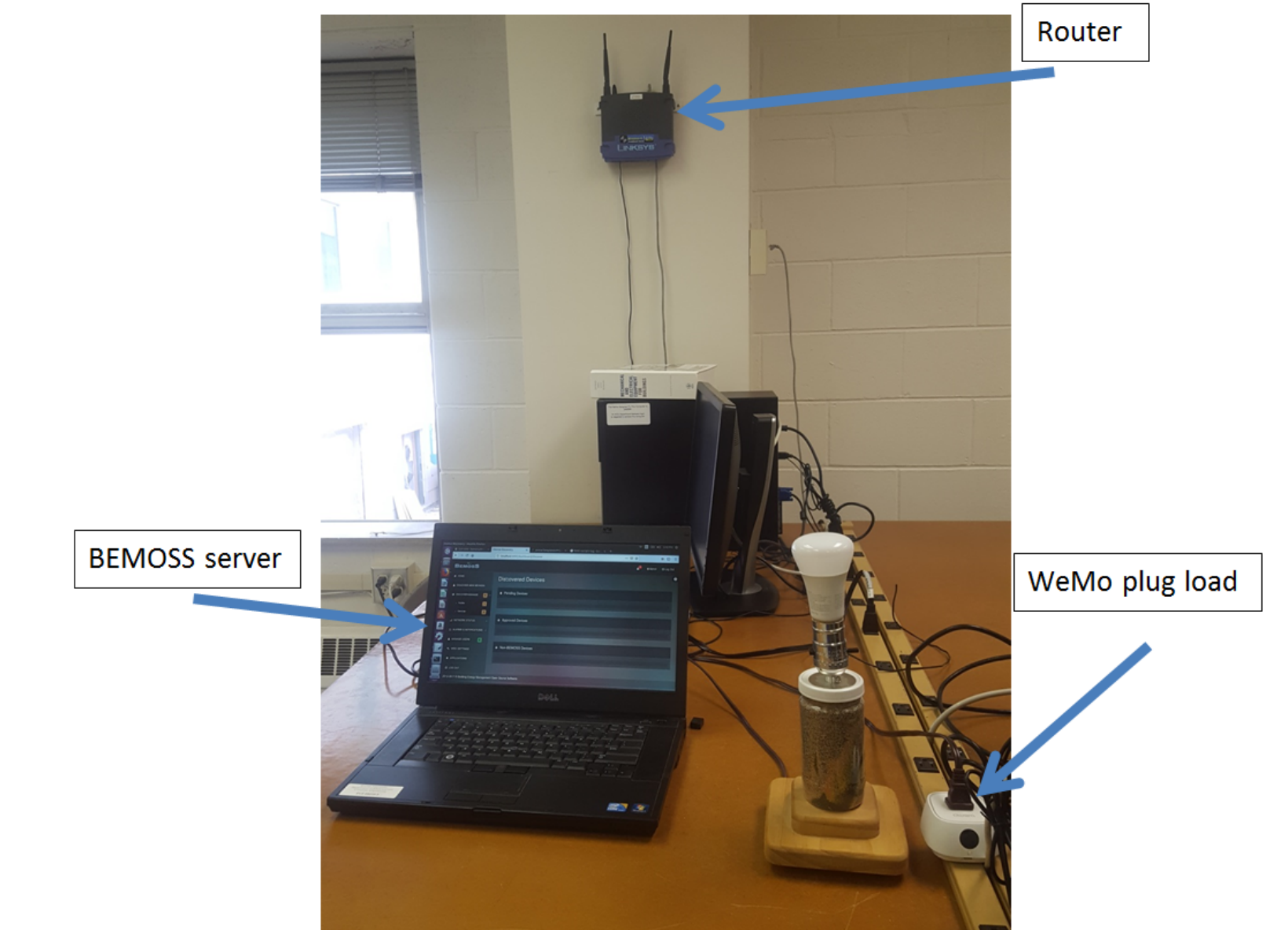- Controlled WeMo plug through BEMOSS server
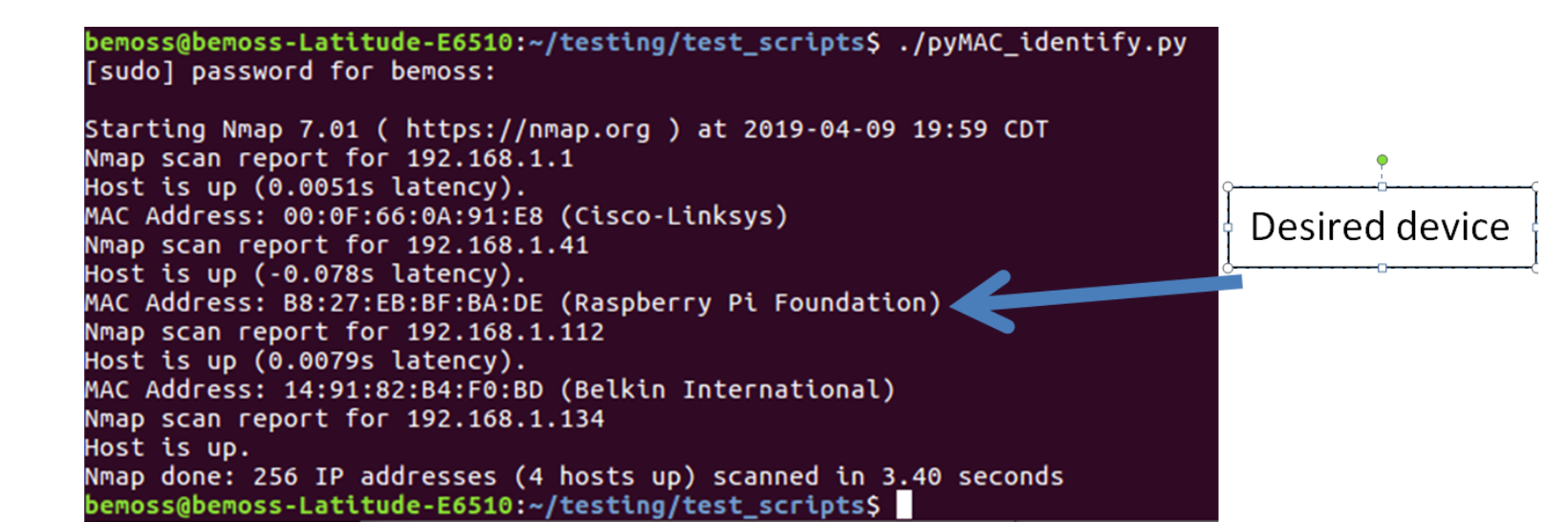- Developed energy saving algorithm

Figure 9: BEMOSS System
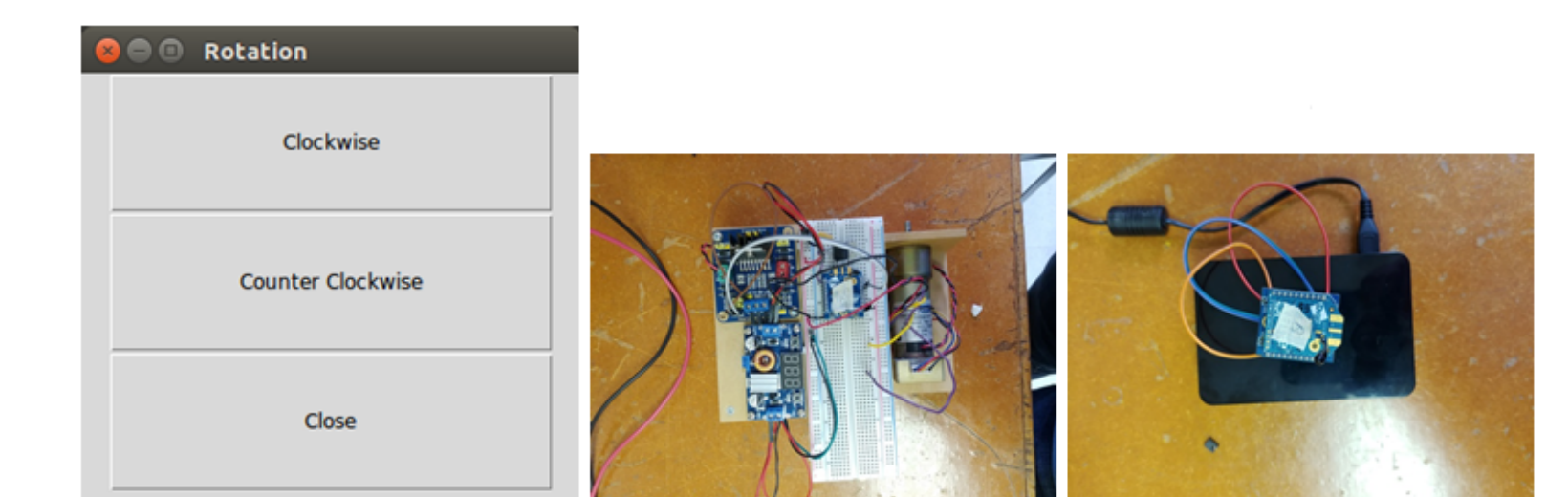

Figure 10: Discovered Devices on Network
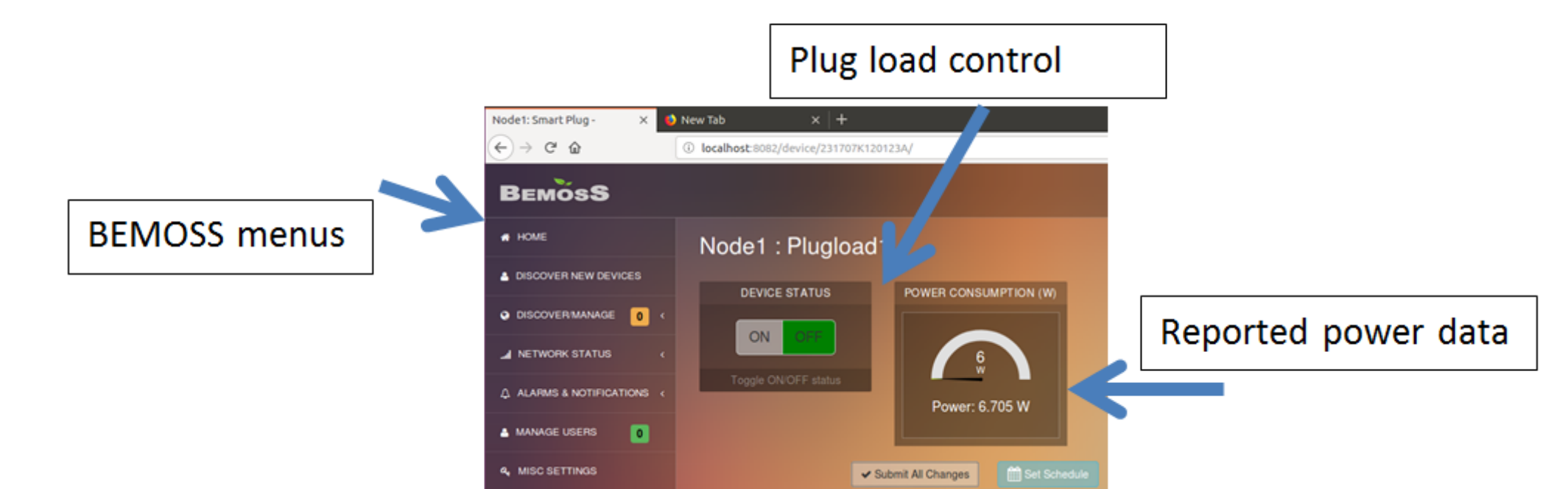

Figure 11: IoT Motor GUI

Figure 12: Data from Plug load

Summary and Future Work

- Interface a motor positional feedback system
- Integrate current energy saving algorithm with curtain toggle abilities
- Test the efficiency of our newly developed system