Boston University
Electrical & Computer Engineering
EC463 Capstone Senior Design Project

Final Prototype Testing Plan

by

Team #18
Team Greener Living
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Required Material

Hardware:

- DHT22 Temperature and Humidity Sensor
    - Measures temperature and humidity in real time
- Etekcity Energy Monitoring Plug
    - Measures the connected device's power usage in real time
- IoTaWatt
    - Measures the circuit breaker panel usage (voltage, current, etc) in real time
    - Using one current transformer for 120Vs and below
- AC Line Splitter (this is only for testing purposes to show that the current transformers work)
    - Allows for the IoTaWatt current transformer to be able to read current readings from any plug outlet
- Raspberry Pi Zero W

Software:

- Python scripts
    - The first stores temperature and humidity data in an InfluxDB database in the Raspberry Pi. The second does the same but with the energy monitoring plug.
- Raspberry Pi Zero W
    - Show that a local instance of InfluxDB is working and is able to receive data between energy monitor and itself
    - Show that a local instance of grafana is also working and able to connect to the database
        - Display data onto dashboard
        - Customize time-scale
- Web Application
    - Implement Grafana dashboards
    - HTML and CSS website implementation

Setup

The set up consists of two parts: the hardware, specifically the Raspberry Pi Zero W, the DHT22 sensor, the ESW15 plug, the IoTaWatt. The software is composed of two main parts; backend and frontend. The backend is composed of python scripts, InfluxDB, and Grafana that were downloaded onto the Raspberry Pi and start on boot up. The DHT22 sensor is directly connected to the Raspberry Pi, while the plug will be connected to a mobile or laptop charger at a power outlet. It is important to note that the WiFi security is vital to making our project work and function. Since the Raspberry Pi W Zero is vital for the seamless data transfer, it is important to note that it can only accept very specific WiFi security settings. Using 802.1x that is offered on Boston University's campus will not suffice and the Raspberry Pi will not connect; other security types such as WPA, WPA2, WEP, etc. will generally work. The Raspberry Pi will run 2 scripts: the first will collect the data from the DHT22 sensor and store it into an influx database, and the second does the same with the plug but in a different database. Those two databases are connected to a local instance of grafana which will graph the data in a dashboard with a custom timescale. The frontend is our custom made web application, where we consolidate all the data from our InfluxDB instance and display it for the customer to see through the creation of Grafana dashboards. Grafana offers a lot of functionality and customization options, which allows us to offer different visualizations for our client.

Pre-testing Setup Procedure:

1. Connect the Raspberry Pi to WiFi
2. Enable the local instance of influxDB on Raspberry Pi
    a. Influxdb in one window (which shows the logging) on port 8086
    b. Influx in second window to show access to influxCLI for database
3. Enable the local instance of Grafana on Raspberry Pi
    a. The login tab will be in port 3000 as default, or change port to 8080 or similar to avoid extra Windows permissions
    b. The url will be http://raspberrypiip:3000
4. Plug in Etekcity Energy Monitoring Plug
    a. That it is on and measuring an appliance laptop charger
5. Plug in DHT22 Sensor
    a. That it is on and measuring temperature and humidity
6. Plug in IoTaWatt
    a. Plug in the 120V current transformer into IoTaWatt

Testing Procedure:

1. Show that the measurement is going into InfluxDB on the Raspberry Pi
    a. Run a quick query on the database to show data is truly going through
2. Show that the energy, temperature and humidity are being collected is updating in real time
    a. Show that the Etekcity energy monitoring plug is plugged in and on, and measuring something

    b. Show that the DHT22 Sensor is also on and is measuring temperature and humidity
    c. Show that the IoTaWatt current transformer is measuring a wire and displaying the current on iotawatt.local or even in the Grafana
3. Show website implementation
    a. Show content on the webpage
    b. Show ability to switch between timeframes
    c. Show ability to retrieve and show values from InfluxDB
4. Show that the setup runs immediately upon startup of the Raspberry Pi.

Measurable Criteria

- Grafana is able to integrate with InfluxDB
- Grafana is able to create dashboard or panels that satisfies customer's needs
- The energy monitoring plug is working as intended and displaying energy in real time.
- The energy monitoring plug can connect to the Raspberry Pi, and store the data in an influx database.
- The temperature and humidity sensor is working as intended, storing the data in an influx database in real time, and displaying the data in real-time.
- IoTaWatt is able to use the current transformer and show real-time current data, and data is stored in an influx database in real time.
- Website is set up with graphs and time options, and needs general design edits