BRADLEY University

Laboratory Notebook

Development of an Intelligent Building Energy Management System

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Monday, September 14, 2020

1 Meeting Minutes

BL
Today, in the meeting with Dr. Miah, we kicked off the project involving development of a building enery management platform. A Github repository was created for the project which will also be paired with a corresponding Google Drive titled "seniorProject1-2020-21". On Tuesdays and Thursdays, we will have lab time from 8am to 11am and weekly meetings with the advisor from 4pm to 5pm on Mondays this semester. The lab times are devoted specifically for work rather than research or documentation. Before coming to lab, work must be cut out for both of us.

2 Homework

BL
This document was created and pushed to the Github repository for both of us to use. For better portability, one of the laptops previously used for research on this project was wiped clean and LUbuntu was installed. As of now, most of the code developed for the platform was done on a desktop PC dual-booted with Ubuntu Linux and Windows 10. To be able to move between lab and home easily, a more ideal situation is to use a dedicated laptop with Linux installed. Because the USB drive used to install Linux was previously formatted with Ubuntu 18.04, the diskpart utility was used with the following commands:

```
select disk 1
clean
create partition primary
format quick
```

The Startup Disk Creator GUI program on Linux was utilized to flash the LUbuntu 64-bit desktop iso file on to the USB-thumb drive. The commands `sudo apt-get update` and `sudo apt-get upgrade` were run on the laptop to perform necessary upgrades and updates. Lastly, `sudo apt-get install git` was used to install git. Another package installed was `textlive-full` to compile latex with all the necessary packages.

Monday, September 21, 2020

1 Meeting Minutes

BL
In the meeting with Dr. Miah, Dr. Miah pointed out that templates are available in the Google Drive for the lab notebook and other deliverables which we did not realize. In the System Level Requirements document (the first deliverable) we must replace the current block diagram with the drawing of the house connected to a microgrid. Inside, the home will be a block of the BEMS core which will connect to various IoT devices in the building. The controllable loads in the building including devices like lights, appliances (including dishwashers, washing machines), and smart plugs. Examples of uncontrollable loads include desktop PCs, laptops, thermistors, and microwaves. In a potential future research project, connectivity with a microgrid may be possible, so powerlines representing the main grid will be connecting the house to a microgrid through a PCC (Point of Common Coupling). In the current version of the diagram, the file is simply too large as it contains many images from the Internet. This will be redrawn in inkscape with custom figures to reduce the file size.

The final outcome of the project will be

- Laptop running in the IoT lab or office
- 2-3 devices in office/lab can be controlled succesfully
- System should recognize the devices immediately upon connection to the network
- Algorithm implemented to help improve energy efficiency

As a part of the first deliverable, three modes of operation will be declared including

- Device search mode
- Device operation mode
- Third mode to be determined

The sections of the deliverable will be

- Problem Statement
- System Architecture

- Block Diagram
- Modes of Operation

Another point brought up is whether an energy efficient algorithm should be included in the software. Dr. Miah said yes. This will possibly help to boost the complexity of the project and improve the usefuleness of the platform. This algorithm will have to be determined.

As of today, we should both be writing code on Tuesdays and Thursdays or possibly on our own, and we can both use code written for the research project. The split should be 50/50 so a Gantt chart will need to be made.

Tuesday, September 22, 2020

1 Lab work

BL
Elliot and I met over Zoom to work on getting a new Github repo setup for the senior project code specifically. Although Dr. Miah mentioned in the meeting that the code should be on Github, we simply will periodically upload the zipped Github project to the Drive to the implementation/ folder. I copied over the files from the research to the new Github repo cloned locally on my Linux laptop. After running the `install.sh` script, the installation failed as the Linux laptop I am using is running Python3.5 rather than Python3.6 which is required for f-string support. An example of a line that failed is shown in the figure below:

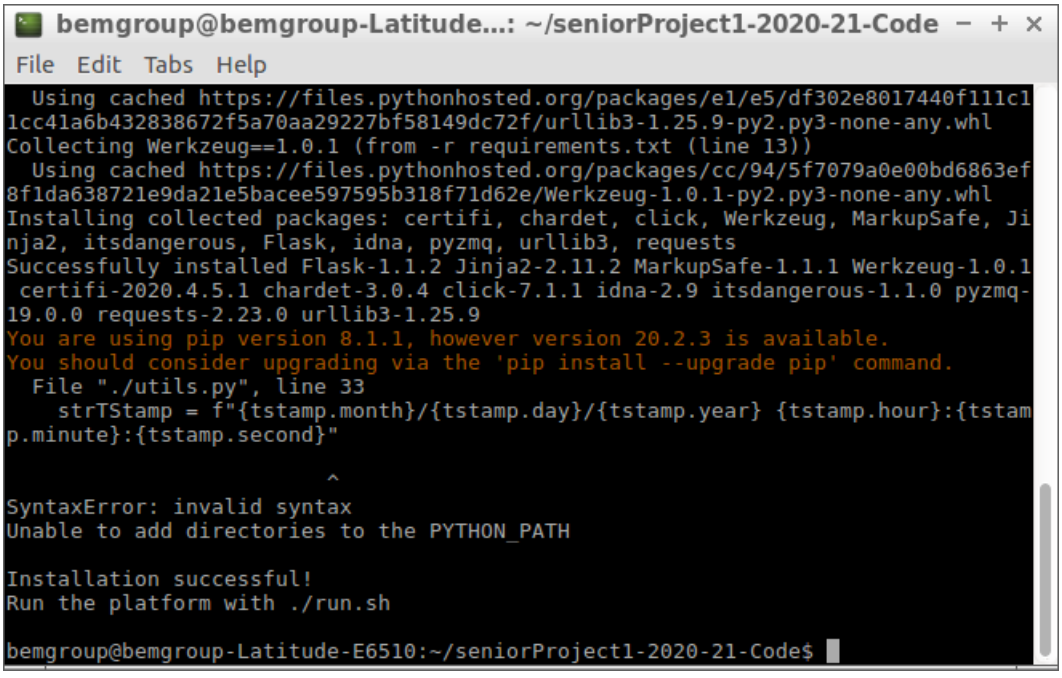

Figure 1: *f string error in* `utils.py`

A simple solution to this problem was simply using string concatenation:

```
strTStamp = str(tstamp.month) + "/" + str(tstamp.day) + "/" + str(tstamp.year) + " "
```

```
strTStamp += str(tstamp.hour) + ":" + str(tstamp.minute) + ":" + str(tstamp.second)
```

Further changes were made in the `ControlAgent.py` and `DiscoveryAgent.py` files. In particular, the line in `subscribe` to connect to the server acting as the central exchange to process publish/subscribe messages between the web server backend and agents listening for subscriptions was altered to support string concatenation. After these alterations to the source code were made, the platform was succesfully started. However, it is clear that no messages published to the server were received by both either the `ControlAgent` or `DiscoveryAgent` which will need to be debugged in the next lab or possilby before. This is evident as the terminals showing the debug output of each agent not indicating any messages received. Messages should be published via the publish function in the file `PROJECT_DIR/WebServer/pubsub.py`. All these problems must be fixed to allow the ActiveDevices page to discover and connect to devices.