

OSU MakeOhio 2019

AEP Challenge: Enhanced Energy Bridge

Technical Information

Students are encouraged to use the information and data files as a starting point and to enhance, adapt or create their own approach.

Option 1: Arduino File “MakeOhioDataGenR0

This arduino program runs a simple simulation program. The program loops with a 1 minute increment. The loop has a “delay(500)”, this causes it to cycle once every ½ second so that things happen much faster.

Some items to note:

***Utility Usage**

Electric, Gas and Water usages are totalized each cycle and are scaled for 1 minute increments.

***Appliance Events**

Appliance usage variables are set up as Boolean. These are on or off. When “on” or “1”, these multiply against a quantity estimated to be a reasonable usage of electric, gas or water, for 1 minute.

The program has appliance flags for (Washer, Dryer, Dishwash, Stove, Refrig, Furnace, AC, Sprinkler). The simulation activates these at various times.

Additionally, there are appliance flags for (Flush, LargeLeak, SmallLeak, HairDryer and FloodLight). These are currently set up to be initiated by discrete inputs. The inputs are (8, 9, 10, 11 & 12) respectively.

***Furnace/AC Control**

The temperature inside the home “tempIn” is simulated with the following conditions. All calcs are on 1 minute intervals:

*Outside temp is a variable. Initial condition is: tempOut=90;

Note: A team may want to set this input as an analog input with a potentiometer.

*deltaT=tempIn-tempOut: This causes the inside temp to increase or decrease depending on outside temperature and simulates heat loss/gain. The rate is 0.002/min.

*Solar Intensity: This simulates heat from the sun. The rate is 0.001/min. (This may need better scaling.)

*Heating is setup as 66 to 70 degF. Rate is 0.5/min degF.

*AC is setup as 73 to 76 degF. Rate is 0.3/min degF.

*Events

*If/then/else statements are used to trigger certain events. These include lawn sprinklers running and a morning shower (water usage), Washer, Dryer and Stove (water and electric usage), etc. The Refrigerator is set up to run 5 minutes every 18 minutes.

*A group of “non-monitored events” are included. These are intended to be initiated with a discrete input. Appliance monitoring flags are not intended. This is to simulate a more realistic situation where many events use utilities but where a monitoring system does not have information as to what is actually on.

If a diagnostic program is developed, it will need to be able to adapt to known users and unknown users. Two events are included (LargeLeak and SmallLeak) to simulate a pipe break or a faucet or toilet running. Can the program distinguish between a shower and leak?

SerialMonitor: The program contains serial.print statements so that it can be viewed with the Arduino IDE Serial Monitor.

Option 2: Data Files

The data files are csv files of data output of the simulation. One is tempOut=20, the other is tempOut=90. Each line of the files is a minute of data. The first line are the column headers. Structure is:

“hour:minute, premiseID, tempOut, tempIn, kWh, kW, GasCCF, WatCCF, Solar, Washer, Dryer, Dishwash, Stove, Refrig, Furnace, AC, Sprinkler”

Option 3: Internet Data Request

An internet accessible API is available. This application will respond to a data request and provide similar data as the above options. The data is structured such that each request will include a specific “meterNumber”. This corresponds to a particular time. This application can provide responses for any request between 1 and 900. This corresponds to times from 7:00 to 21:59. The application also includes a help response and error messages.

<https://ezgateway-t.aep.com:4438/rest/makeohio/customer/meter/help>
<https://ezgateway-t.aep.com:4438/rest/makeohio/customer/meter?meterNumber={lineNumber}>

Example: Request line 200: (Time: 10:19)

<https://ezgateway-t.aep.com:4438/rest/makeohio/customer/meter?meterNumber=200>

Data Response:

```
{
  "meterData" : {
    "meterNumber" : "200",
    "premiseID" : "OH12345678",
    "time" : "10:19:00",
    "date" : "2/1/19",
    "location" : "39.964: -83.009",
    "tempOut" : "44.9",
    "tempIn" : "68.3",
    "kwh" : "20559.19",
    "kw" : "1050.441",
    "GasCCF" : "5535.3",
    "WatCCF" : "4793.3",
    "Washer" : false,
    "Dryer" : false,
    "DishWash" : false,
    "Furnace" : false,
    "AC" : false,
    "Sprinkler" : false,
    "Solar" : "0.75"
  }
}
```

Error Scenarios:

If meter number is not sent or within 1-900 range.

```
{
  "error" : {
    "code" : "METER-1000",
    "message" : "invalid meterNumber"
  }
}
```

Any other errors:

```
{
  "error" : {
    "code" : "METER-2000",
    "message" : "server error"
  }
}
```

Example: Help

<https://ezgateway-t.aep.com:4438/rest/makeohio/customer/meter/help>

Data Response:

```
{
  "meterDataAPIHelp" : {
    "URL" : "https://ezgateway-t.aep.com:4438/rest/makeohio/customer/meter",
    "inputs" : "query string parameters - meterNumber (sample append
?meterNumber=10 to the URL field)",
    "method" : "GET"
  }
}
```
