

Assignment one

Group names

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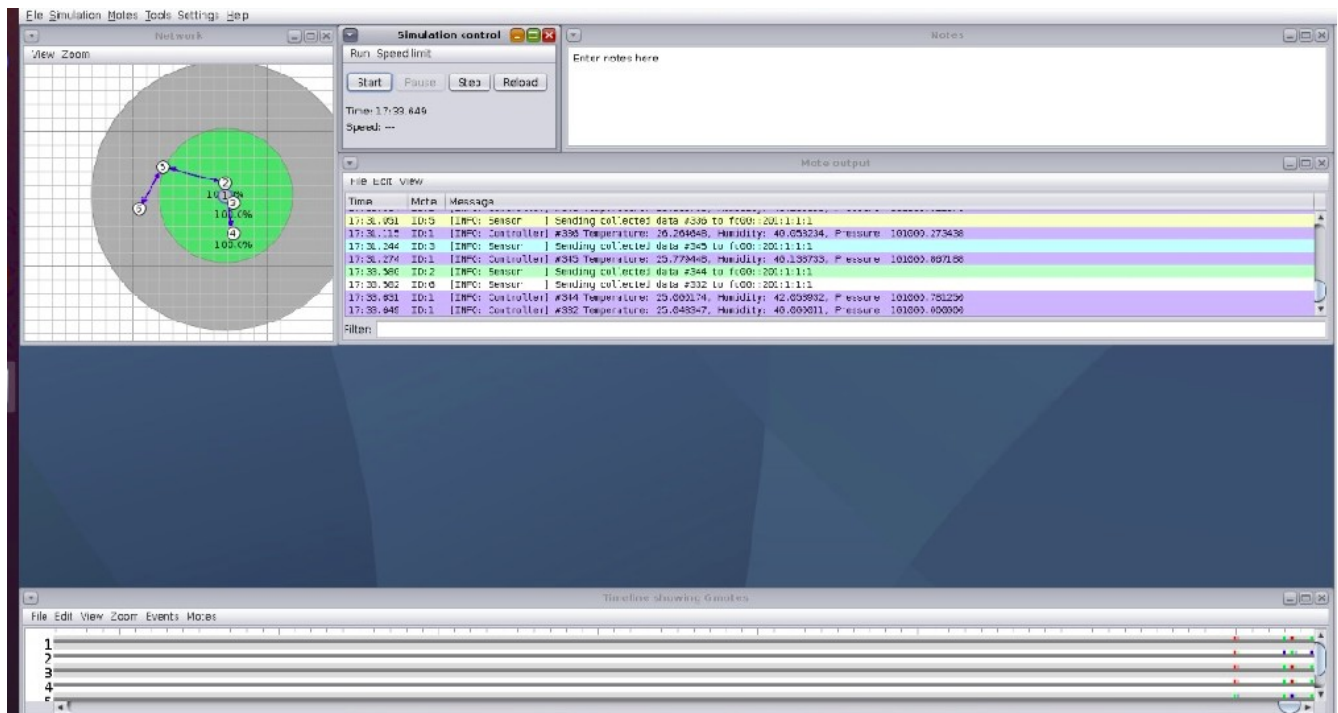
1- Network Implementation:

Scenario1:

We have assigned a 1 controller and 5 sensors in the Contiki software provided with the simulation code written in c.

After running the simulation, we have chosen a number of rounds of 30 for each sensor then we have copied the readings output as a text file.

The network in Cooja:



We have applied the python preparation code below to the data :

```
def dataPreparation(txt):  
    # https://www.computerhope.com/issues/ch001721.htm  
    df = []  
    with open (txt, 'rt') as f:  
        for i in f:  
            chars=i.split()  
            if(chars[4][0]!='#'):  
                df.append(chars)  
    df=pd.DataFrame(df)  
    Temperature=pd.DataFrame(df.iloc[:,6])  
    Temperature=Temperature.iloc[:,0].str.rstrip(',').astype('float')  
    Humidity=pd.DataFrame(df.iloc[:,8])  
    Humidity=Humidity.iloc[:,0].str.rstrip(',').astype('float')  
    Pressure=pd.DataFrame(df.iloc[:,10])  
    Pressure=Pressure.iloc[:,0].str.rstrip(',').astype('float')  
  
    return Temperature, Humidity, Pressure
```

Then we have applied a function called controller that calculates the estimated value of theta.

Controller code:

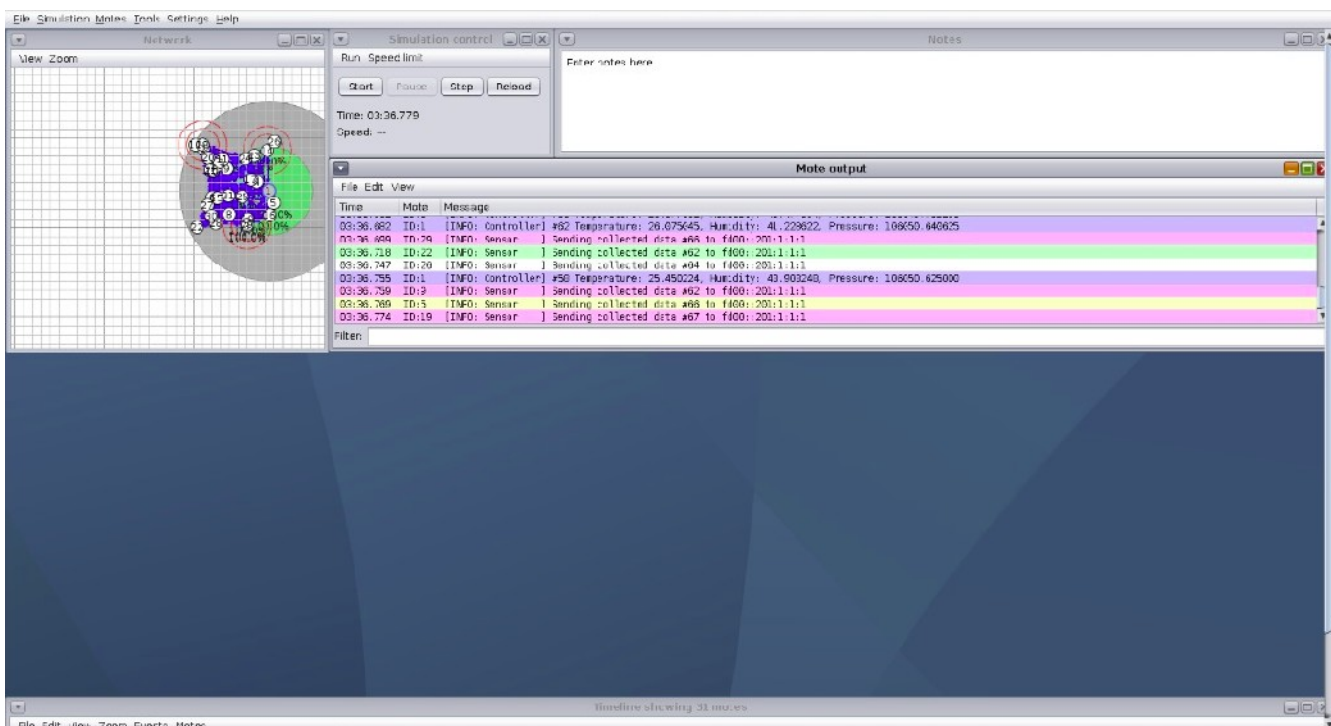
```
1 # https://stackoverflow.com/questions/47239332/take-the-sum-of-every-n-rows-in-a-pandas-series
2 def controller(df, val, L, rounds):
3
4     diff=[]
5     df=df.groupby(df.index // L).sum()
6     for i in range(rounds):
7         df[i]=(df[i]/L)+get_additive_noise()
8         diff.append(np.abs(val-df[i]))
9     return diff
```

Then we have calculated the smallest, largest and average value of the difference between the actual and the estimated value of theta for each reading.

```
Temperature:
Minimum value: 0.004442618445256841
Largest value: 4.309220434348067
Average value: 1.3452145224175454
-----
Humidity:
Minimum value: 0.17793519274191993
Largest value: 4.232703269695655
Average value: 1.8880220435825004
-----
Pressure:
Minimum value: 5048.099842111551
Largest value: 5051.420610211368
Average value: 5050.289987803424
```

Scenario 2 :

We have repeated the processes of scenario 1 but here we have chosen number of sensors of 28. The network in Cooja:



The code output:

```
Temperature:
Minimum value: 0.023898114768638123
Largest value: 3.0689463354534006
Average value: 1.432321511220015
-----
Humidity:
Minimum value: 0.6551835425184294
Largest value: 4.857565963176796
Average value: 2.02713712442189
-----
Pressure:
Minimum value: 5047.755187740564
Largest value: 5052.005877792239
Average value: 5050.253822826717
```

Scenario 1 and scenario 2 comparison:

a) Temperature:

- a.1) The temperature smallest difference value has increased slightly.
- a.2) The temperature largest difference value has decreased.
- a.3) The temperature average difference value has increased slightly.

b) Humidity:

- b.1) The humidity smallest difference value has increased.
- b.2) The humidity largest difference value has increased.
- b.3) The humidity average difference value has increased.

b) Pressure:

- b.1) The pressure smallest difference value has decreased slightly.
- b.2) The pressure largest difference value has increased slightly.
- b.3) The pressure average difference value has approx no change.

Repeating both scenarios but with 2 rounds:

Scenario 1 (5 sensors 2 rounds):

```
Temperature:
Minimum value: 2.6072288795534746
Largest value: 2.5250046331607123
Average value: 1.2439886294650577
-----
Humidity:
Minimum value: 1.4600621315800737
Largest value: 2.3557563341490066
Average value: 1.4180295590091596
-----
Pressure:
Minimum value: 5050.65916208108
Largest value: 5049.91533353024
Average value: 5049.272989007906
```

Scenario 1 (28 sensors 2 rounds):

```
Temperature:
Minimum value: 0.16932773059807005
Largest value: 3.3799247248938897
Average value: 1.4191028925084073
-----
Humidity:
Minimum value: 2.6002595963572617
Largest value: 2.39179338487304
Average value: 1.613782930479438
-----
Pressure:
Minimum value: 5048.7572971386835
Largest value: 5050.810347388935
Average value: 5050.114933504046
```

a) Temperature:

- a.1) The temperature smallest difference value has decreased significantly.
- a.2) The temperature largest difference value has increased.
- a.3) The temperature average difference value has increased slightly.

b) Humidity:

- b.1) The humidity smallest difference value has increased significantly.
- b.2) The humidity largest difference value has has decreased slightly.
- b.3) The humidity average difference value has increased slightly.

b) Pressure:

- b.1) The pressure smallest difference value has decreased.
- b.2) The pressure largest difference value has increased slightly.
- b.3) The pressure average difference value has increased slightly.

It's shown that the average error has been increased moving from 5 sensors to 28 sensors, hence increasing number of sensors may have a better simulation rather than a few number, but it also has its cons of having different readings with different error factor for each sensor.