

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation

After designing a range of embedded system tools, the Implementation of the embedded system installation tools design is as follows:



Illustration 5.1: IOT Design Project

The image above is an Arduino image and a built-in sensor. Data is submitted to the Thingspeak server.

To use the Thingspeak facility, an account is required to sign in. This account works to generate API code so that others can not retrieve or corrupt data sent to the Thingspeak server. Data transmission using APIs already set up by thingspeak.

Write API Key

Key `3DCTJ764RM6X20LX`

Illustration 5.2: Write API key

The image above is the API key for writing data. The code above serves to send data to the server Thingspeak. Using the Write API key code, temperature and humidity and rain data can be sent to the server Thingspeak and Thingspeak will present the data in graphical form.

Read API Keys

Key `KB1ZWN99YY2DNGK0`

Illustration 5.3: Read API key

The image above is the API key for obtaining data. The above code serves to retrieve data from the Thingspeak server. Using the Read API key code, temperature and humidity and rain data can be retrieved.



Illustration 5.4: Field 1 Thingspeak



Illustration 5.5: Field 2 Thingspeak

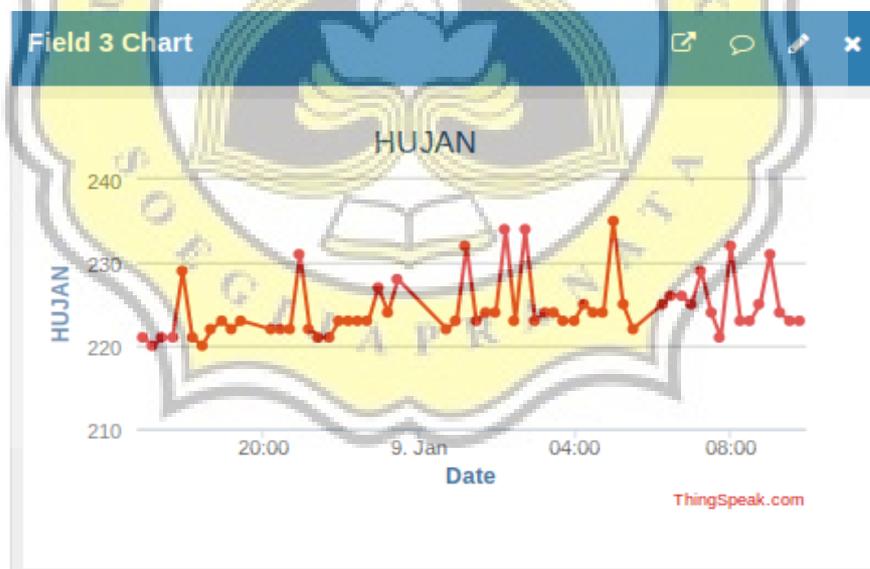


Illustration 5.6: Field 3 Thingspeak

The data is presented in graphical form, the data sent in divide into 3 fields. First field for humidity data, second field for temperature data, third field for rain data.

After the data from the server Thingspeak in can, then the program will process data with Naïve Bayes algorithm, here is a snippet of code from the Naïve Bayes algorithm program.

```
1. $data = fopen("feeds.csv","r");
2. while (($a = fgetcsv($data, ",") != FALSE ){}
```

fopen is the code to open a file, the data is stored in variable data. The "r" sign means read only. The 2nd line is the code to insert each row in a csv file into a variable a alternately separated by a comma.

```
3. $timee = strtotime(substr($a[0], 11,8)) + (60*60*7);
4. $timef = date('H:i:s',$timee);
```

The 3rd line code uses strtotime to add 7 hours to the time data, since the data is taken 7 hours apart from WIB.

```
5. $filedata = explode(';', file_get_contents("file2.txt"));
6.
7.   foreach ($filedata as $b) { //menghitung naive bayes
8.
9.     if (strpos($b, 'tidak') == true ) {
10.        $tidak = $tidak + 1 ;
11.        if (strpos($b, $a[2]) == true) {
12.            $kelembapan1 = $kelembapan1 + 1; }
13.        if (strpos($b, $a[3]) == true) {
14.            $suhu1 = $suhu1 + 1; }
15.        }elseif (strpos($b, 'hujan') == true){
16.            $hujan = $hujan + 1;
17.            if (strpos($b, $a[2]) == true) {
18.                $kelembapan2 = $kelembapan2 + 1; }
19.            if (strpos($b, $a[3]) == true) {
20.                $suhu2 = $suhu2 + 1; }
21.        }
22.        $jumlahData = $jumlahData + 1;
```

Code line 5 serves to enter the data file2.txt that has been converted into an array with a semicolon separator, into variable data files. Explode is the code to break the string into an array. Code lines 9 through 21 serve as data loops and calculate data by the Naïve Bayes method. file2.txt is a file that contains classified data. Code line 22 to calculate the amount of data found in file2.txt.

```
23.   $data_gabung = $data_gabung . substr($a[0], 0,10) .',' .
24.        $timef .',' .
25.        $a[2] .',' .
26.        $a[3] .',' .
27.        ;
```

Code line 23 through 27 is the process of merging data into variable `data_gabung`, so it can be inserted into the database txt with string data structure.

```

28.     if ($kelembapan1 == 0 || $suhu1 == 0) {
29.         $kelembapan1 = $kelembapan1 + 1;
30.         $suhu1 = $suhu1 + 1;
31.         $tidak = $tidak + 2;
32.     }if ($kelembapan2 == 0 || $suhu2 == 0) {
33.         $kelembapan2 = $kelembapan2 + 1;
34.         $suhu2 = $suhu2 + 1;
35.         $hujan = $hujan + 2;
36.     }

```

Code lines 28 through 36 are the code for laplacian correction, which omits the value 0 on the final count of probability.

```

37.     $total1 = ($tidak/$jumlahData) * ($kelembapan1/$tidak) *
($suhu1/$tidak);
38.     $total2 = ($hujan/$jumlahData) * ($kelembapan2/$hujan) *
($suhu2/$hujan);
39.
40.     if ($total1 >= $total2) { //hasil klasifikasi
        $klasifikasi = 'tidak hujan';
41.         $data_gabung = $data_gabung . $no . ',' .
$klasifikasi . ',' . $a[4] . ';';
        }elseif ($total2 > $total1) {
42.         $klasifikasi = 'hujan';
43.         $data_gabung = $data_gabung . $no . ',' .
$klasifikasi . ',' . $a[4] . ';';

```

Code lines 37 through 38 are codes for calculating the total results of each classification. Total1 is a "not rain" classification, total2 is a "rain" classification. Code lines 40 through 43 are codes for classifying and storing them in variable `data_gabung`.

```

44.     $handle = fopen("file2.txt", "w"); //save file txt
45.         fwrite($handle, $data_gabung);
46.         fclose($handle);

```

Code line 44 is a code for writing data to file2.txt. The 45th line serves to insert the contents of the `data_component` variable into file2.txt. The 46th line works to close the connection to file2.txt.

5.2 Testing

Trial of classification program using 100 training data in each experiment. The trial results in the program are as follows:

FINAL DATA

Date : 2017-12-27 - 2017-12-27	Rain	Not Rain
Temperature Average	29.10	29.27
Humidity Average	84.20	81.65
Maximum Temperature	30.70	30.60
Minimum Temperature	27.90	27.00
Maximum Humidity	91.20	90.60
Minimum Humidity	71.70	73.70

Illustration 5.7: Testing 1

The picture above is the result of temperature classification dated December 27, 2017 with 64 data.

CONCLUSION

Average temperature when rain 29.10
 Average temperature when not rain 29.27
 Temperature range when rain 27.90 - 30.70
 Temperature range when not rain 27.00 - 30.60

Average humidity when rain 84.20
 Average humidity when not rain 81.65
 Humidity range when rain 71.70 - 91.20
 Humidity range when not rain 73.70 - 90.60

FINAL DATA

Date : 2017-12-27 - 2017-12-28	Rain	Not Rain
Temperature Average	28.81	28.83
Humidity Average	83.85	82.85
Maximum Temperature	30.70	30.60
Minimum Temperature	27.20	27.00
Maximum Humidity	91.20	90.60
Minimum Humidity	71.70	73.70

Illustration 5.8: Testing 2

The image above is the result of temperature classification dated December 27, 2017 to December 28, 2017 with 116 data.

CONCLUSION

Average temperature when rain 28.81
 Average temperature when not rain 28.83
 Temperature range when rain 27.20 - 30.70
 Temperature range when not rain 27.00 - 30.60

Average humidity when rain 83.85
 Average humidity when not rain 82.85
 Humidity range when rain 71.70 - 91.20
 Humidity range when not rain 73.70 - 90.60

FINAL DATA

Date : 2017-12-27 - 2017-12-29	Rain	Not Rain
Temperature Average	29.09	29.00
Humidity Average	82.12	82.05
Maximum Temperature	31.00	30.60
Minimum Temperature	27.20	27.00
Maximum Humidity	91.20	90.60
Minimum Humidity	71.50	73.70

Illustration 5.9: Testing 3

The image above is the result of temperature classification dated December 27, 2017 to December 29, 2017 with 184 data.

CONCLUSION

Average temperature when rain 29.09
 Average temperature when not rain 29.00
 Temperature range when rain 27.20 - 31.00
 Temperature range when not rain 27.00 - 30.60

Average humidity when rain 82.12
 Average humidity when not rain 82.05
 Humidity range when rain 71.50 - 91.20
 Humidity range when not rain 73.70 - 90.60

FINAL DATA

Date : 2017-12-27 - 2017-12-30	Rain	Not Rain
Temperature Average	28.82	28.48
Humidity Average	83.58	84.69
Maximum Temperature	31.00	30.60
Minimum Temperature	26.70	26.20
Maximum Humidity	92.60	92.50
Minimum Humidity	71.50	73.70

CONCLUSION

Average temperature when rain 28.82
 Average temperature when not rain 28.48
 Temperature range when rain 26.70 - 31.00
 Temperature range when not rain 26.20 - 30.60

Average humidity when rain 83.58
 Average humidity when not rain 84.69
 Humidity range when rain 71.50 - 92.60
 Humidity range when not rain 73.70 - 92.50

Illustration 5.10: Testing 4

The image above is the result of temperature classification dated December 27, 2017 to December 30, 2017 with 248 data.

FINAL DATA

Date : 2017-12-27 - 2017-12-31	Rain	Not Rain
Temperature Average	28.39	28.27
Humidity Average	85.32	85.93
Maximum Temperature	31.00	31.00
Minimum Temperature	25.50	25.50
Maximum Humidity	93.10	93.20
Minimum Humidity	71.50	73.70

CONCLUSION

Average temperature when rain 28.39
 Average temperature when not rain 28.27
 Temperature range when rain 25.50 - 31.00
 Temperature range when not rain 25.50 - 31.00

Average humidity when rain 85.32
 Average humidity when not rain 85.93
 Humidity range when rain 71.50 - 93.10
 Humidity range when not rain 73.70 - 93.20

Illustration 5.11: Testing 5

The image above is the result of temperature classification dated December 27, 2017 to December 31, 2017 with 329 data.

Below is a table of classification data information dated December 27, 2017 through December 31, 2017:

Table 5.1: Result Table

Date	27-12-2017	27-12-2017 until 28-12-2017	27-12-2017 until 29-12-2017	27-12-2017 until 30-12-2017	27-12-2017 until 30-12-2017
Days	1	2	3	4	5
Average Temperature When Rain	29.10	28.81	29.09	28.82	28.39
Average Temperature	29.27	28.83	29.00	28.48	28.27

When Not Rain					
Average Humidity When Rain	84.20	83.85	82.12	83.58	85.32
Average Humidity When Not Rain	81.65	82.85	82.05	84.69	85.93
Temperature Range When Rain	27.90 – 30.70	27.20 – 30.70	27.20 – 31.00	26.70 – 31.00	25.50 – 31.00
Temperature Range When Not Rain	27.00 – 30.60	27.00 – 30.60	27.00 – 30.60	26.20 – 30.60	25.50 – 31.00
Humidity Range When Rain	71.70 – 91.20	71.70 – 91.20	71.50 – 91.20	71.50 – 92.60	71.50 – 93.10
Humidity Range When Not Rain	73.70 – 90.60	73.70 – 90.60	73.70 – 90.60	73.70 – 92.50	73.70 – 93.20
Jumlah Data	64	116	184	248	329
Jumlah Data Akurat	41	73	103	150	200
Akurasi	64.06%	62.93%	55.97%	60.48%	60.79%

From the data table above, the data taken sequentially from December 27, 2017 until December 31, 2017. It is recorded Average temperature when it rains 28.39 degrees Celsius and average temperature when it does not rain 28.27 degrees Celsius, the average humidity at rain 82.12 degrees centigrade and average humidity when no rain 82.05 degrees centigrade With the amount of data classified 329 produces 200 correctly classified data, so can say the accuracy of this temperature classification program is 60.79%.