

CHAPTER 4

ANALYSIS AND DESIGN

4.1 Analysis

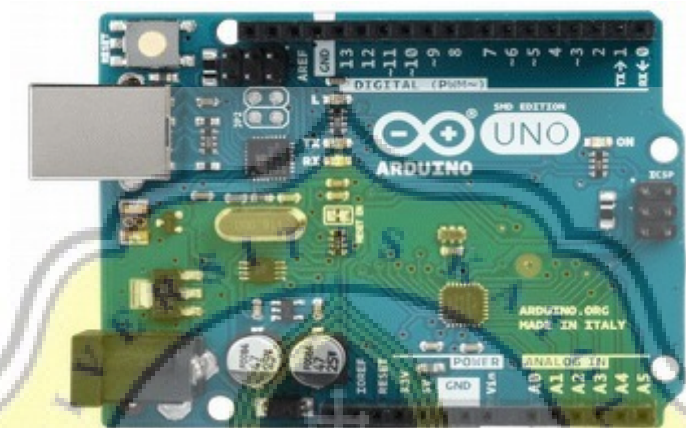


Illustration 4.1: Arduino Uno

Arduino Uno is an ATmega328 based microcontroller operated using 5.5 Volt tags and has a maximum operating frequency of 20 MHz. Power for Arduino Uno can be a USB connection, DC power supply, or both. Arduino uno has 14 digital pins, 6 analog pins with 2 pin ground, 2 pin 5 volt and 1 pin 3.3 volt.

| DHT22 pins | |
|------------|------|
| 1 | VCC |
| 2 | DATA |
| 3 | NC |
| 4 | GND |

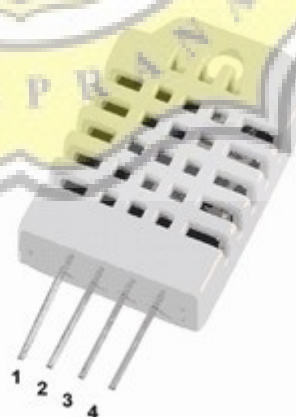


Illustration 4.2: DHT22 Sensor

DHT22 is a temperature sensor that works on a 5V voltage. The DHT22 sensor has a temperature range of -40 degrees Celsius to 80 degrees Celsius. The DHT22 sensor has a moisture range from 0% to 100% RH.

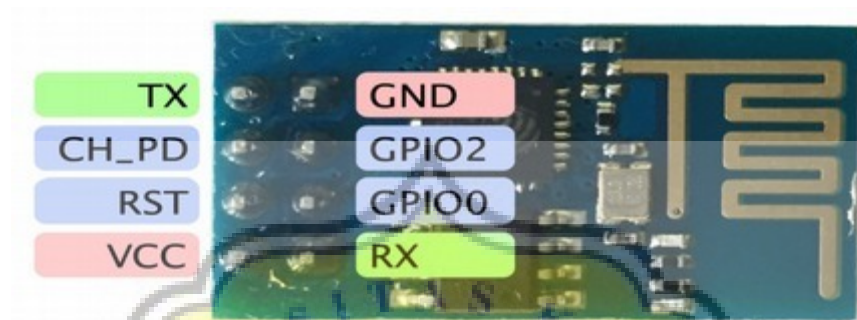


Illustration 4.3: ESP8266

ESP8266 is a 2.4GHz WiFi module that is already a SoC (System on Chip). SoC means ESP8266 can be programmed without requiring additional microcontroller. ESP8266 works at a temperature of -40 degrees Celsius to 125 degrees Celsius.

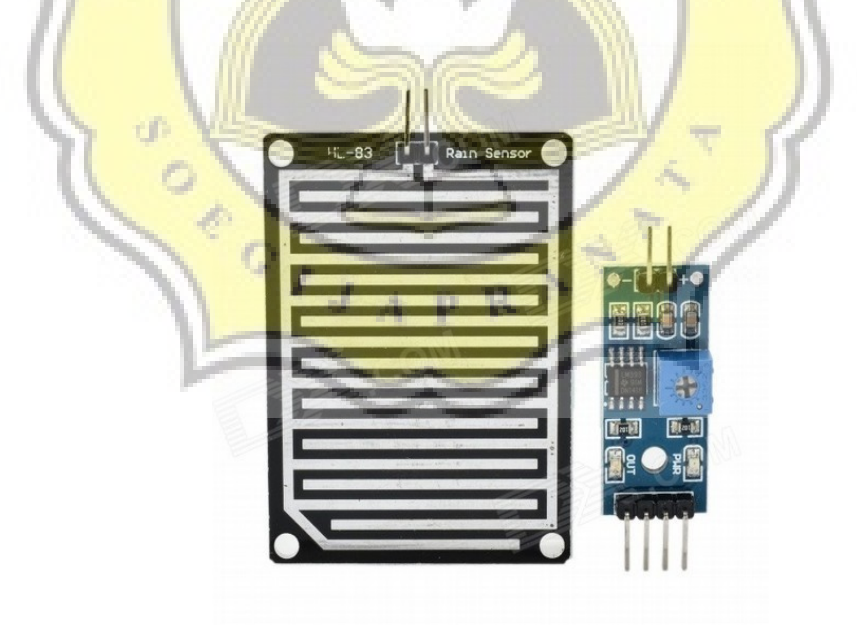


Illustration 4.4: Raindrop Sensor

Raindrop Sensor is a sensor that can detect rainfall level, using nickel base material, 5cm x 4cm sized on both sides. Raindrop Sensor works on 5V voltage.



Illustration 4.5: IOT Network with Arduino and Thingspeak

The image above is a topographic image of the IOT network using the Thingspeak server. After the Embedded system is completed in sequence, the DHT22 will send the temperature and humidity data to the Thingspeak server. So from the server Thingspeak we can see or retrieve existing data, of course it takes an internet connection.

Once the data is saved in Thingspeak, the data will be fetched by a website-based program and in process with the Naïve bayes algorithm. Naïve Bayes algorithm formula :

$$P(H|X) = P(H) P(X) / P(H \cap X)$$

where X is proof, H is a hypothesis, P(H|X) where X is the probability that hypothesis H is true for proof of X or in other words proof, H is a hypothesis, P(H|X) is a posterior probability H with condition X, P(H) is the probability that proof X is true for hypothesis H or posterior probability X with condition H, P (H) is the probability of prior hypothesis H, and P (X) is the probability of prior proof X.

In data mining X is a tuple or data object, H is the hypothesis or alleged that tuple X is class C . Specifically, in classification problems, the program will count $P(H|X)$ as the probability that hypothesis H is true for tuple X or in other words $P(H|X)$ is the probability that the tuple X is in class C . Meanwhile, $P(H)$ is the prior probability that hypothesis H is true for each tuple regardless of the value of its attribute while $P(X)$ is the prior probability of tuple X .

Examples of calculations Naïve Bayes are as follows:

| no | Date | Time | Temperature | Humidity | Classification |
|----|------------|-------|-------------|----------|--------------------|
| 1 | 11/12/2017 | 18.00 | 26 | 88 | <u>hujan</u> |
| 2 | 11/12/2017 | 19.00 | 25 | 90 | <u>hujan</u> |
| 3 | 11/12/2017 | 20.00 | 25 | 93 | <u>hujan</u> |
| 4 | 11/12/2017 | 14.00 | 28 | 79 | <u>hujan</u> |
| 5 | 11/12/2017 | 15.00 | 27 | 81 | <u>hujan</u> |
| 6 | 11/13/2017 | 14.00 | 27 | 84 | <u>hujan</u> |
| 7 | 11/13/2017 | 15.00 | 27 | 83 | <u>hujan</u> |
| 8 | 11/13/2017 | 18.00 | 25 | 88 | <u>hujan</u> |
| 9 | 11/13/2017 | 19.00 | 25 | 89 | <u>hujan</u> |
| 10 | 11/13/2017 | 20.00 | 24 | 90 | <u>hujan</u> |
| 11 | 11/12/2017 | 12.00 | 28 | 71 | <u>tidak hujan</u> |
| 12 | 11/12/2017 | 13.00 | 28 | 75 | <u>tidak hujan</u> |
| 13 | 11/12/2017 | 14.00 | 27 | 79 | <u>tidak hujan</u> |
| 14 | 11/12/2017 | 15.00 | 27 | 80 | <u>tidak hujan</u> |
| 15 | 11/12/2017 | 16.00 | 27 | 83 | <u>tidak hujan</u> |
| 16 | 11/12/2017 | 17.00 | 26 | 86 | <u>tidak hujan</u> |
| 17 | 11/12/2017 | 21.00 | 24 | 94 | <u>tidak hujan</u> |
| 18 | 11/12/2017 | 22.00 | 24 | 95 | <u>tidak hujan</u> |
| 19 | 11/12/2017 | 23.00 | 24 | 95 | <u>tidak hujan</u> |
| 20 | 11/12/2017 | 00.00 | 24 | 96 | <u>tidak hujan</u> |
| x | 11/14/2017 | 13.00 | 27 | 80 | ? |

Illustration 4.6: Training Data

The table above is 20 training data. There is new data that has date = 11/14/2017, humidity = 80, temperature = 27 which will be in search of its classification.

The first step is to find the number of classifications divided by the total data. Rain = 10, not Rain = 10, therefore the probability of rain becomes 10/20, probability of not rain becomes 10/20.

The second step is to find the number of Humidity(80) with each classification. $80|_{\text{rain}} = 0/10$, $80|_{\text{not rain}} = 1/10$.

The third step is to find the amount of temperature(27) with each classification. $27|_{\text{rain}} = 3/10$, $27|_{\text{not rain}} = 3/10$.

The fourth step multiply the probability of rain with $80|_{\text{rain}}$ dan $27|_{\text{rain}}$. Likewise with the classification is not rain. For the rain classification we get the probability $10/20 \times 0/10 \times 3/10$ because there is data with a value of 0, $80|_{\text{rain}}$ then with laplacian corrector method, add additional data that contains $80|_{\text{rain}}$ and $27|_{\text{rain}}$ so the probability of rain becomes $10/20 \times 1/12 \times 4/12$, this is done because there is data with value 0. so we get the probability $40/2880(0.0138)$, the probability not rain $10/20 \times 1/10 \times 3/10 = 30/2000(0.015)$.

The fifth step determines its classification. From the result of probability multiplication, the highest is the probability of no rain, with the result $30/2000$ and it can be concluded that the date = 11/14/2017, time = 13.00, humidity = 80, temperature = 27 has a classification "not rain".

4.2 Design

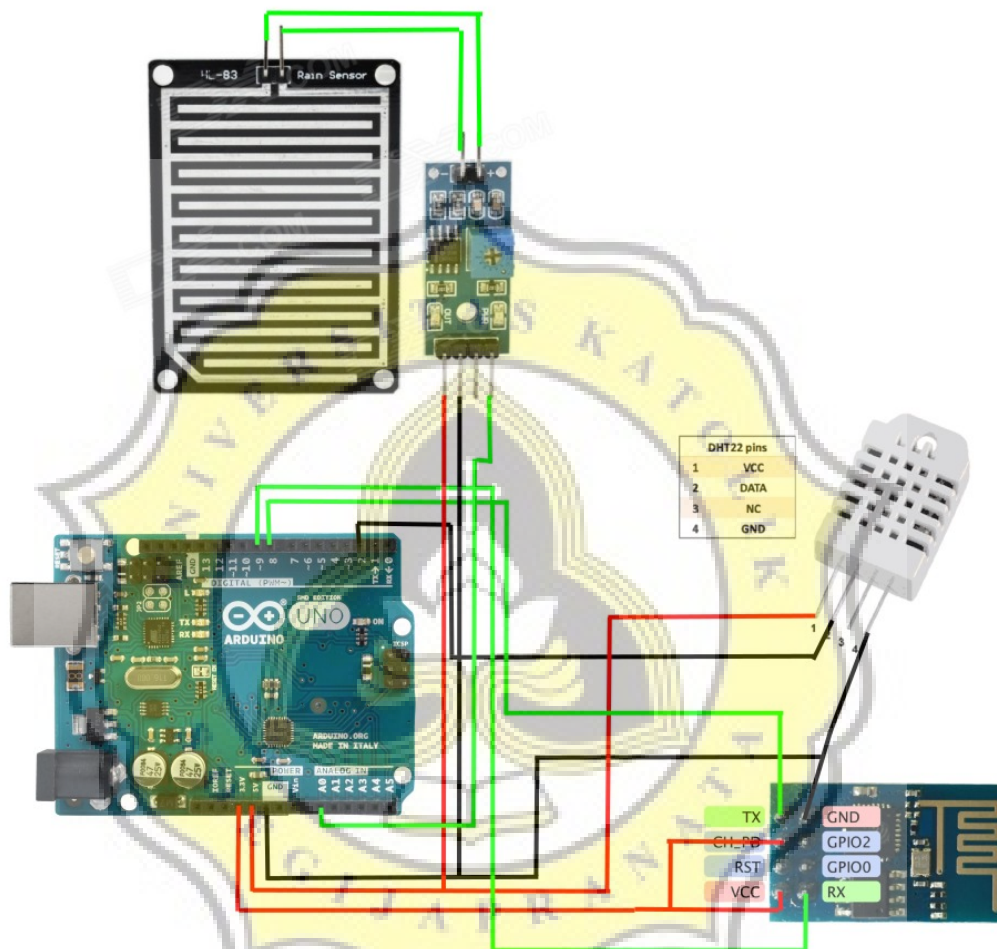


Illustration 4.7: IOT Design

This project uses arduino uno and several sensors that are coupled with a particular design, the image below is the design of the arduino and several sensors.

DHT22 sensor uses 5V voltage while ESP8266 uses 3.5V voltage. Only important parts are used, not all features are connected to Arduino Uno. There are 3 pins used by DHT22 sensors, pins 1, 2 and 4. For pin 1 connect VCC to arduino with 5 volt voltage. For pin 2 connect on digital pin 2 on arduino. For pin 4 connect GND to arduino.

There are 5 pins used by ESP8266 Module, pins 1, 3, 4, 5 and 8. For pin 1 connect to digital pin 9 on arduino. For pins 3 and 4 connect the arduino with a voltage of 3.3 volts. For pin 5 connect GND to arduino. For pin 8 connect on digital pin 8 on arduino.

Raindrop Sensor uses 3 pins connected to Arduino, pins 1, 2, 4. Pin 1 for 5V power, pin 2 for GND, and pin 4 for output (A0) Raindrop sensor runs at 5V voltage.

