CHAPTER IV

ANALYSIS AND DESIGN

4.1 Analysis

This project aims to determine the effectiveness of the use of water pump. One way is use the HC-SR04 ultrasonic sensor and microcontroller NodeMCU, distance of water from sensors can be detected and monitored at any time by the broker.

The workings of ultrasonic sensors HC-SR04 and NodeMCU is:

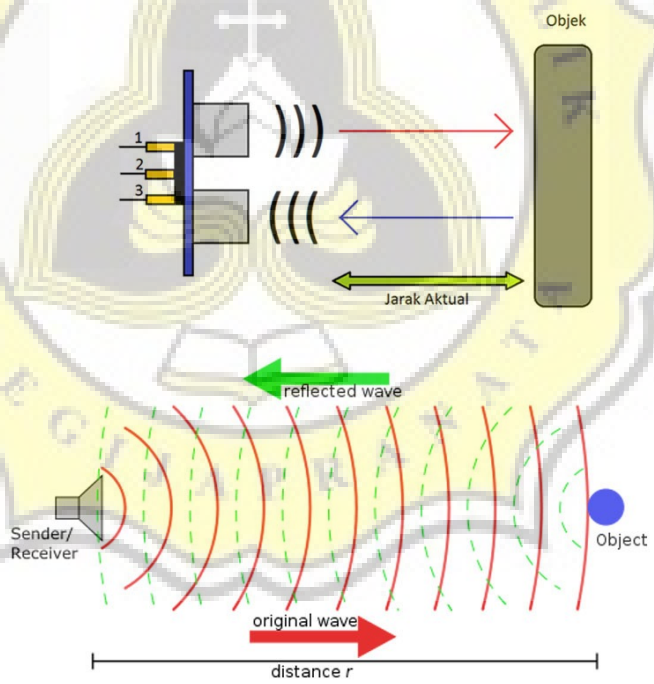


Figure4.1. Work System of HC-SR04[2]

2Hari Santoso,"Cara Kerja Sensor Ultrasonik, Rangkaian, & Aplikasinya", accessed from http://www.elangsakti.com/2015/05/sensor-ultrasonik.html, on 16 November 2016.

- The signal emitted by the ultrasonic transmitter to a specific frequency and with specific time duration. The signal frequency above 20 kHz. To measure the distance of objects, commonly used frequency is 40 kHz.

- The signals are emitted as sound waves will propagate at the speed of about 340 m / s. When light strikes an object, then the signal is reflected by the object.

- After a wave reflection to the receiving device, then the signal is processed to calculate the distance of the object. The object distance is calculated based on the formula: S = 340.t/2. Where S is the distance between the ultrasonic sensor with an object (field reflection), and t is the time difference between the transmitting wave by the transmitter and the time when the reflected wave received by the receiver.

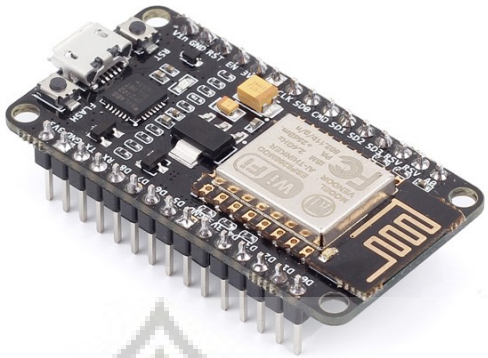
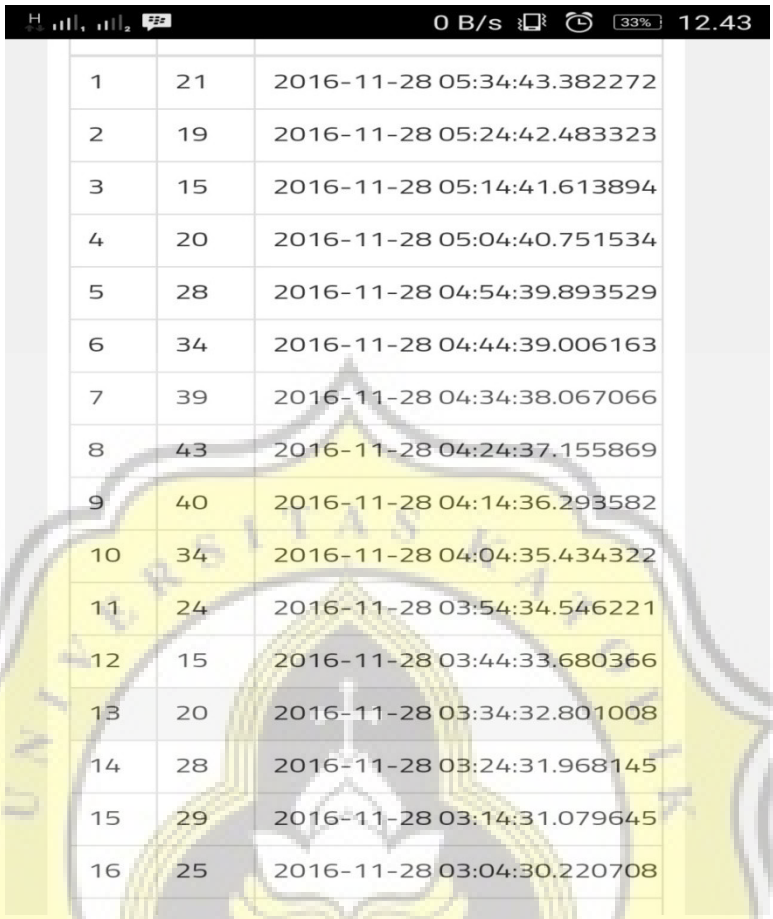


Figure4.2. Microcontroller NodeMCU[3]

- Microcontroller function to receive input program.
- Program inputted by using the C++ language, library <ESP8266WiFiMulti.h> and <ESP8266HTTPClient.h> through arduino IDE application.
- After the program is uploaded it will automatically connect to the wifi network that has been defined in the program and the data can be uploaded to the broker via the internet.

3Google,"NodeMCU", accessed from https://www.google.co.id/search?q=nodemcu&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiSm4WDxK3QAhVIu48KHUGdBMgQ_AUICCgB&biw=1366&bih=696#imgrc=t5suRVkbSTKI9M%3A, on 16 November 2016.



1	21	2016-11-28 05:34:43.382272
2	19	2016-11-28 05:24:42.483323
3	15	2016-11-28 05:14:41.613894
4	20	2016-11-28 05:04:40.751534
5	28	2016-11-28 04:54:39.893529
6	34	2016-11-28 04:44:39.006163
7	39	2016-11-28 04:34:38.067066
8	43	2016-11-28 04:24:37.155869
9	40	2016-11-28 04:14:36.293582
10	34	2016-11-28 04:04:35.434322
11	24	2016-11-28 03:54:34.546221
12	15	2016-11-28 03:44:33.680366
13	20	2016-11-28 03:34:32.801008
14	28	2016-11-28 03:24:31.968145
15	29	2016-11-28 03:14:31.079645
16	25	2016-11-28 03:04:30.220708

Figure4.3. Data From HC-SR04 in Broker

The table above shown the data obtained from HC-SR04 ultrasonic sensor that contains:

- The first column is ID of each data.
- The second column is distance the water from the HC-SR04 ultrasonic sensor.
- The third column is date and time while data recording.

4.2 Design

4.2.1 Design Installation

Figure4.4. Design Installation

Sensor HC-SR04 is placed on top of the water tank then used to detect the water level. Sensor systems work here detects the water level and then the data is sent to the broker via the Internet.

4.2.2. Design Flowchart Diagram

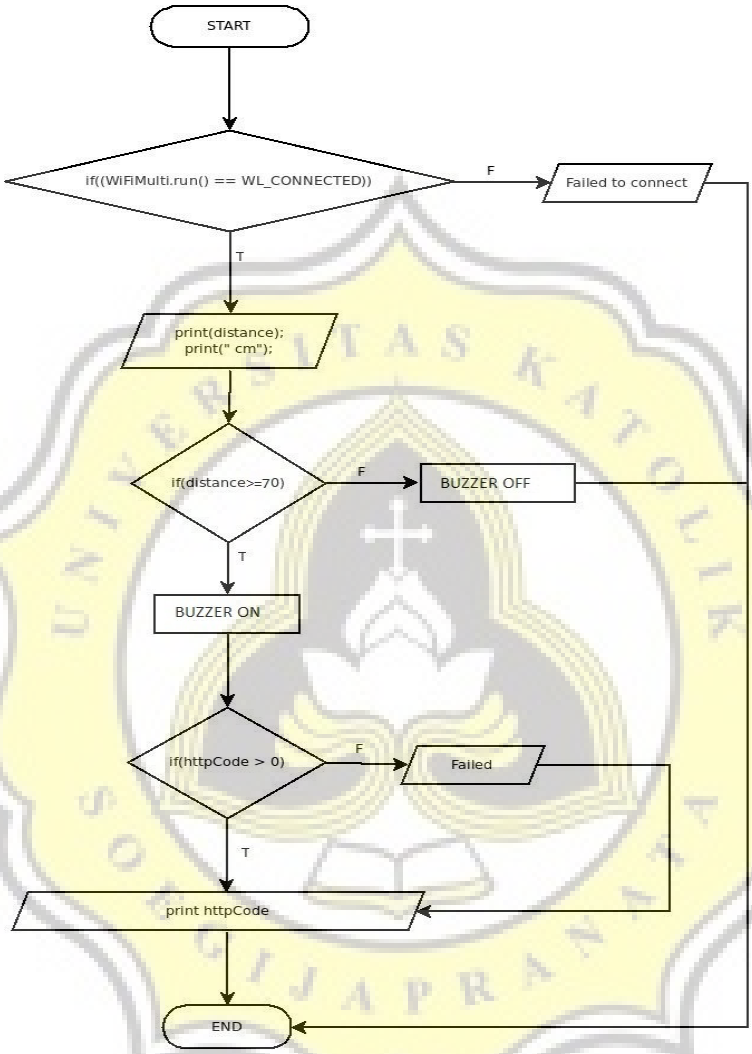


Figure4.5. Flowchart Program Sensor

The program begins from NodeMCU microcontroller connection with the MiFi. After that, if the microcontroller is connected to the MiFi, then read the HC-SR04 ultrasonic sensor and print distance, when distance >= 70 then the Buzzer will be ON to determine warning. Next, send http Code, if the code sent is 200, the data from the ultrasonic sensor

has been successfully submitted to the broker's server via the API address obtained from a broker.

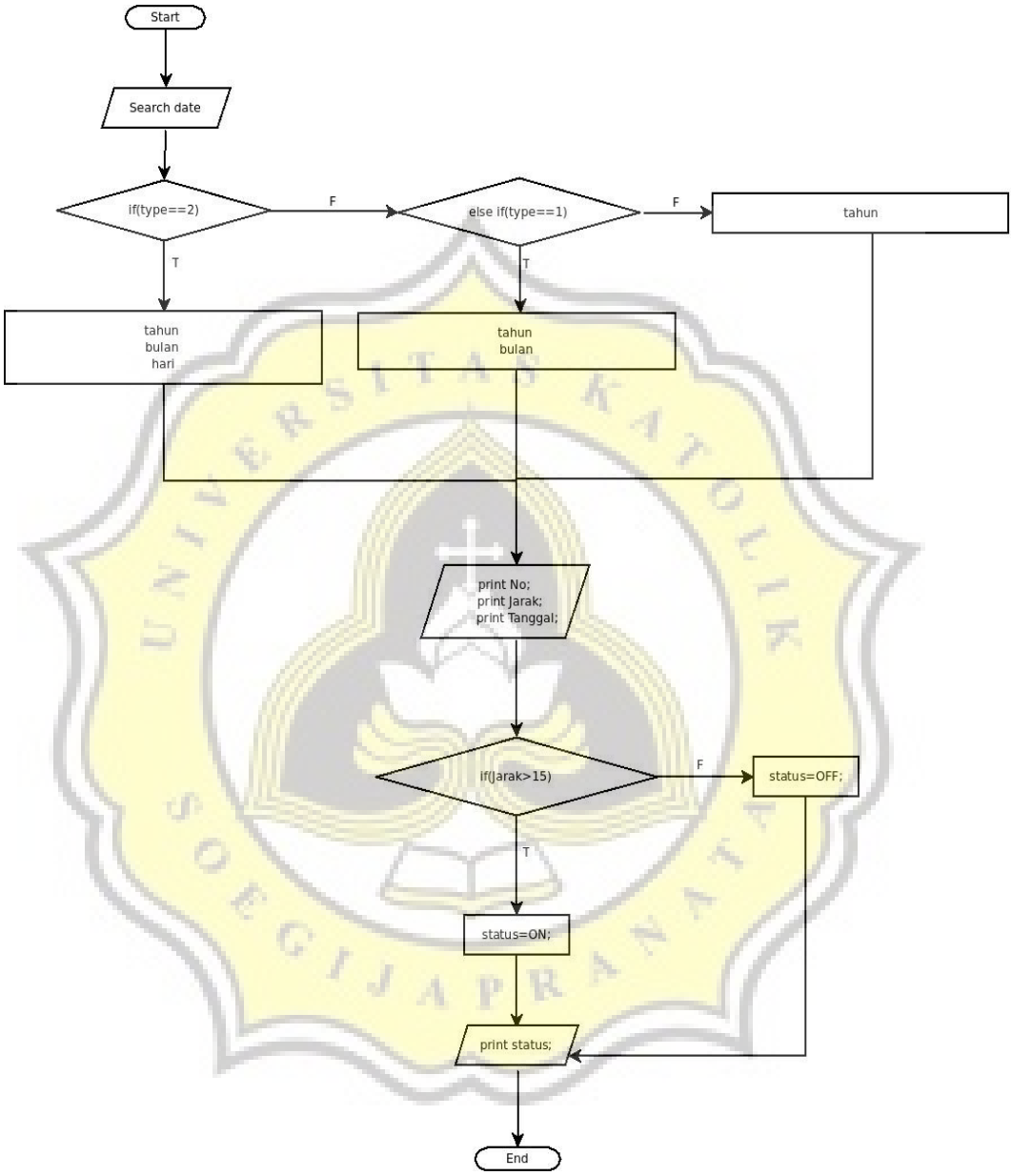


Figure4.6. Flowchart Program Table

System data search by date of recording in file txt. It works divided into three types of input: 1.DD-MM-YYYY (day-month-year), 2.MM-YYYY (month-year), 3.YYYY (year). After the data meet and then displayed plus one column to determine the status of the water pump by using the

distance data from the ultrasonic sensor, if the data distance> 15 then the water pump ON and if the distance <15 then the water pump OFF.

4.2.3. Design Schematic

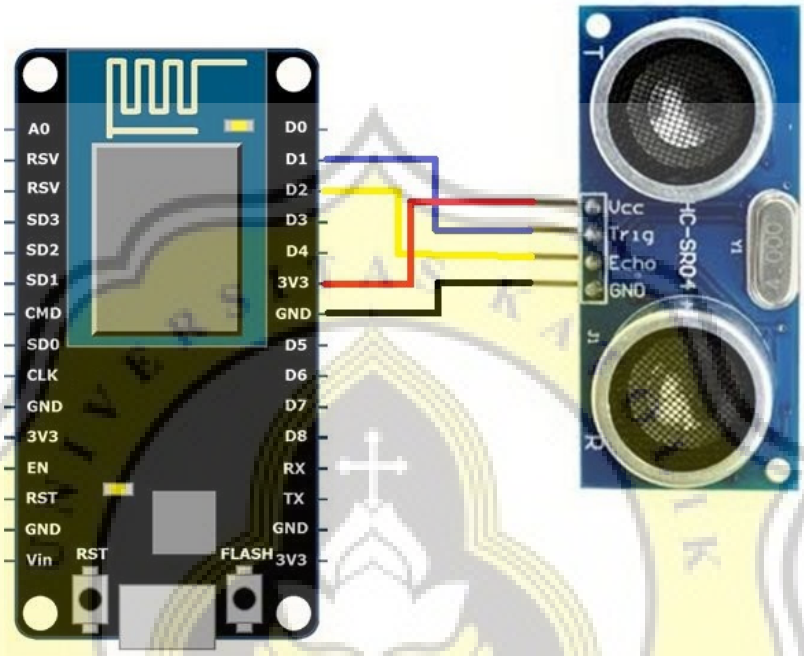


Figure4.7. Design Schematic

The pictures above are microcontroller NodeMCU left and right is a sensor HC-SR04. Here is the sequence of mounting pins:

Pin D1 on NodeMCU connected to TrigPin on HC-SR04,

Pin D2 on NodeMCU connected to EchoPin on HC-SR04,

Pin 3v3 on NodeMCU connected to Vcc on HC-SR04,

Pin GND on NodeMCU connected to GND on HC-SR04