The Use of the Internet of Things in the Design and Construction of a Monitoring System for Hydrogenic Plants and Fish Ponds Using Thingspeak And Esp-01

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Abstract

Design a monitoring system on hydroganic plants and fish ponds based on Thingspeak using Arduino Mega and Uno with ESP-01 is a system that utilizes 4.0 technology in its monitoring process to make it easier for users who every day have busy working but want to remain productive with their hobby to plant. Thingspeak is one of the media that helps in the process of remote monitoring or IOT (Internet Of Things). The tools used in the process of making this monitoring system are electric drills, screwdrivers, solders, hole saws, and saws. The materials used are Arduino Mega, Arduino Uno, ESP-01, ultrasonic sensors, soil moisture sensors, DHT 11 sensors, servo motors, plastic crates as water reservoirs, mini water pumps and panel boxes. The method used in the creation of this thesis is the trial and study of literature from previous research. The purpose of making this tool is to help in monitoring the process from the beginning of the planting period to the harvest so as to save the maintenance time. Monitoring is assisted with Thingspeak's media server making remote monitoring easier. This design can be accessed by smartphone or PC that while connected to the internet can be used to monitor hydroganic plants and fish ponds because it is connected to Thingspeak server. So that it can be monitored in real time on your smartphone or PC by looking at the display that has been set up on the Thingspeak server. For the delivery time from the monitoring equipment to the server Thingspeak is 15 seconds so that within 60 minutes there is 240 data that can be obtained and from the server Thingspeak can be retrieved the data in the form of excel. From this data can make it easier for users to monitor their plants and fish ponds at any given time.

1. INTRODUCTION

Hydrogenic comes from the words "Hydro" and "Organic" which is defined as an organic cultivation system by combining a hydro system and an organic system. The main source of this hydrogenic nutrient is obtained from solid and liquid organic fertilizers and pond water which is treated as plant nutrition. There are 3 important components in hydrogenic applications, namely: 1) Pond; 2) organic fertilizer (as a planting medium); and 3) a series of wick systems (Yeniarta, 2017).

One of the things that young people are considering at this time to study agriculture is the problem of mud which is often described as something that is not good. Another problem is that there is not enough land for agriculture. And no less important is whether it can be monitored using current technology.

An equipment was designed entitled "Designing a Monitoring System for Thingspeak-Based Hydrogenic Plants and Fish Ponds Using Arduino Mega and Uno with ESP-01". Where smartphones or PCs can be used to monitor hydrogenic plants and fish ponds because they are connected to the Thingspeak server. So that it can be monitored in real time on a smartphone or PC by looking at the display that has been set on the Thingspeak server.

2. METHODOLOGY

Tools and materials

In carrying out this final project, the author in carrying out its manufacture uses various kinds of tools and also the main and supporting components in its manufacture. The following are tools and materials that are a reference in making the final project.

Table 1 Tool List

No	Tool List
1	Electric Drill
2	Hacksaw
3	Hole Saw
4	Electric Solder
5	screwdriver +
6	miser
7	Pliers for cutting
8	*Cutter*
9	Pliers for cutting

Table 2 List of Ingredients/Components

No	List of Ingredients/Components	Information
1	Arduino Mega 2560	1 Pcs
2	Arduino Uno	1 Pcs
3	Module ESP-01	1 Pcs
4	Sensor Ultrasonic HC-SR04	2 Pcs
5	Sensor Capacitive Soil Moisture v1.2	1 Pcs
6	Sensor Temperature and Humadity Type DHT11	1 Pcs
7	Jumper Cable 20 cm	Enough
8	Motor Servo Type SG-90	1 Pcs
9	Aquarium Pump	1 Pcs
10	LCD 16 x 2 with I2C	2 Pcs
11	Buzzer 5 VDC	1 Pcs
12	Moduel RTC (*Real Time Clock*) DS3231	1 Pcs
13	Power Suply 220 VAC to 5 VDC	1 Pcs
14	Cooling Fan 5 VDC	1 Pcs
15	PVC Pipe Size 4 Inch	Enough
16	PVC Pipe Cover	3 Pcs
17	Plastic Cup Size 16 OZ	Enough
18	Container Box Size CB 45 Liter	1 Pcs
19	Plastic Food Box Size 27 x 20 x 8	1 Pcs
20	Tie Mount	Enough
21	Cable Tie	Enough
22	6 port Power Terminal	1 Set
23	USB Cable For Arduino	2 Pcs
24	Cable Gland	2 Pcs
25	Sprite Drink Bottle Size 1 Liter	1 Pcs
26	Wood	Enough
27	Plywood Cut	Enough
28	2 port socket outlet	1 Pcs
29	Stop Contact	1 Pcs
30	Cable Size 3 x 1.5	Enough
31	Screws and Bolts + Nuts	Enough
32	L elbow	Enough

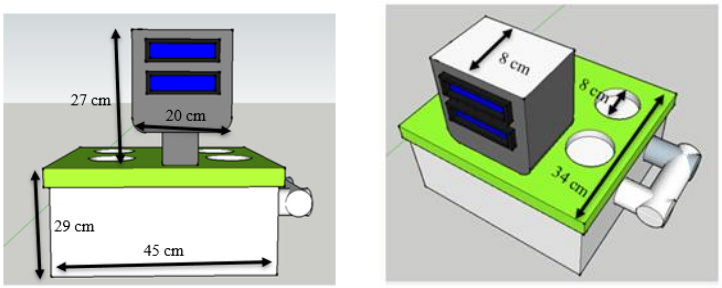

Figure 1 Hardware Design

Software Design

The software design for Arduino is divided into 2, namely the first for Arduino Mega 2560 which is in charge of sending data to Thingspeak and reading sensors that have been installed in the final project tool and there is a display for sensor measurements on the I2C LCD. The second is software for Arduino Uno whose job is to display the real time of the tool and also to set the timing of feeding the fish that drives the servo motor

Figure 2 Software Design

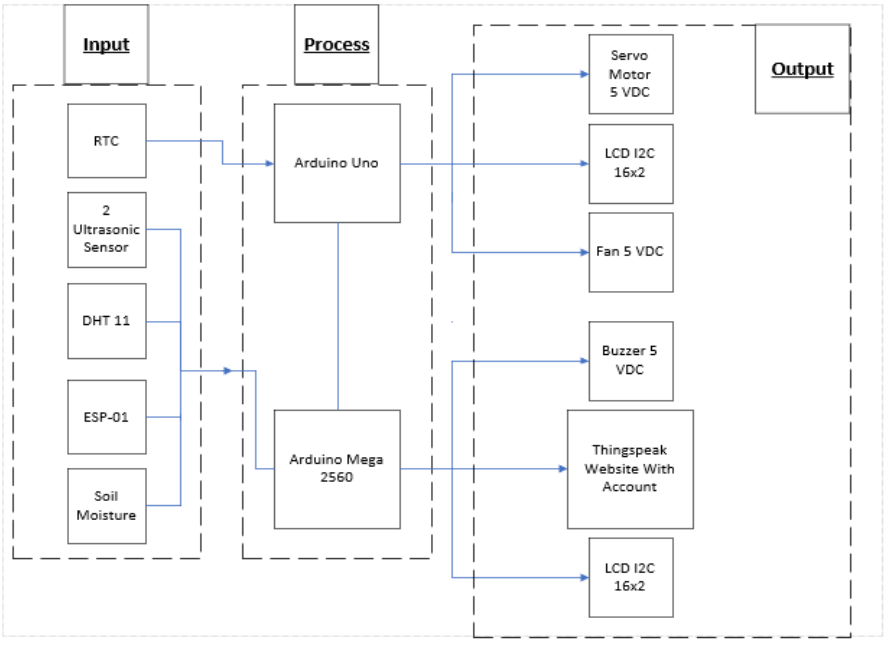

Figure 3 Block Diagram

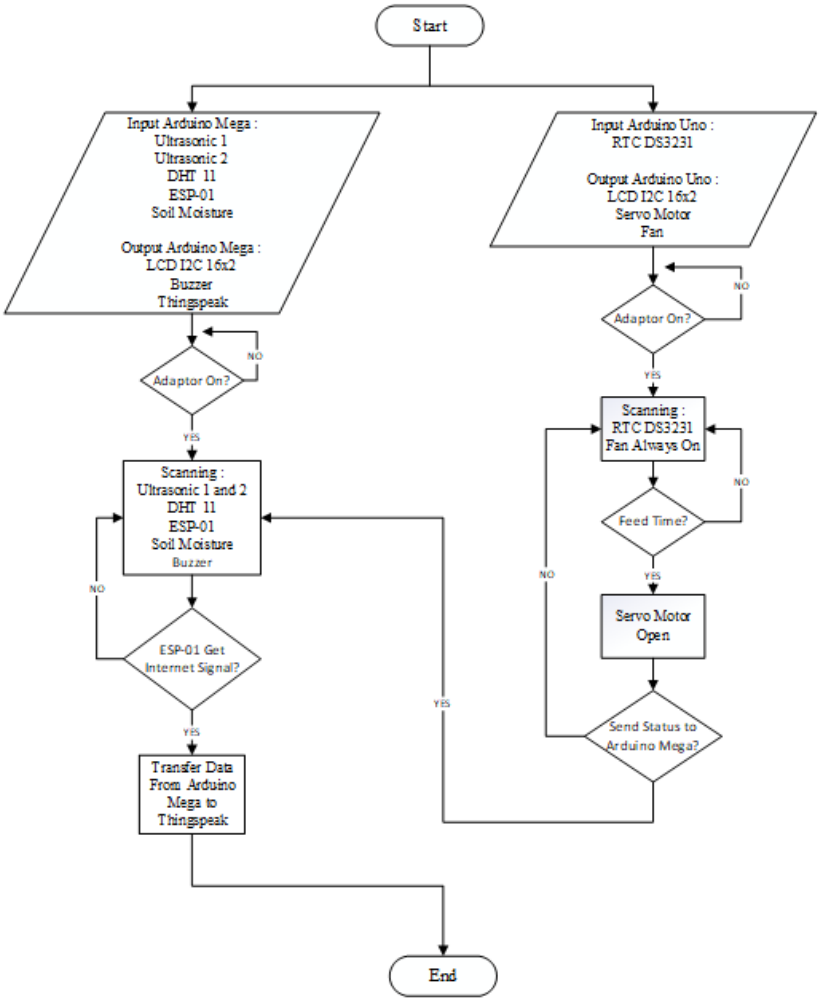

Figure 4 Flowchart of how the tool works

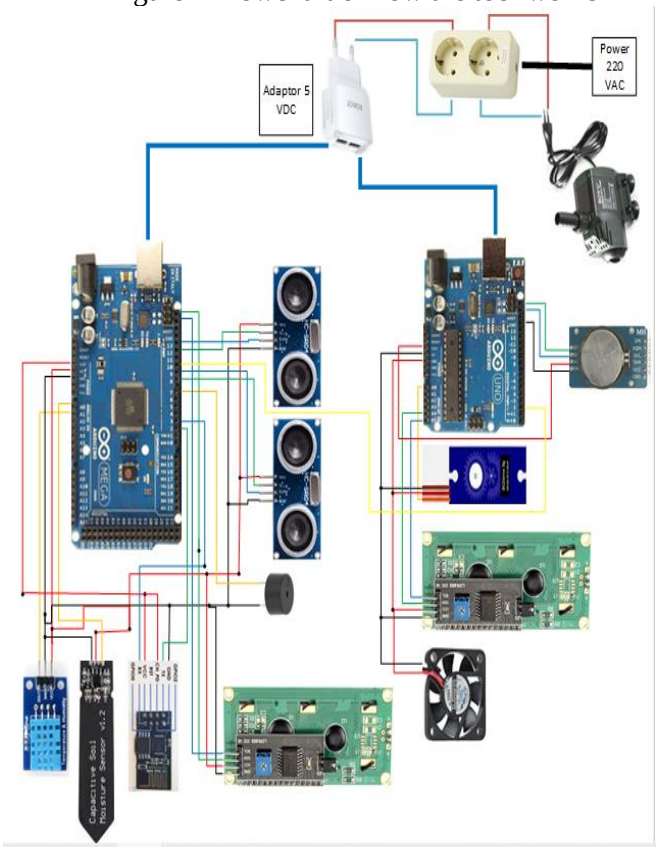

Figure 5 Wiring Diagram

3. RESULT AND DISCUSSION

Water Level Sensor

Experiments using ultrasonic sensors. LCD 16 x 2 and Thingspeak as the output of the ultrasonic sensor.

Table 3 Trial of Measuring Water Level

No	Real Numbers with Ruler	Measurement Number in LCD 16 x 2	Measurement Numbers at Thingspeak
1	0 cm	0 cm	0 cm
2	1.1 cm	1 cm	1 cm
3	2.2 cm	2 cm	2 cm
4	3.8 cm	4 cm	4 cm
5	4.8 cm	5 cm	5 cm
6	5.2 cm	5 cm	5 cm
7	5.6 cm	6 cm	6 cm
8	6 cm	6 cm	6 cm
9	6.8 cm	7 cm	7 cm
10	7.8 cm	8 cm	8 cm

From the results of the tests carried out and listed in table 4.1, namely testing the water level sensor using the ultrasonic sensor HC-SR04, it can be concluded that for each actual number behind the comma there should be but rounded up to the number above or below. As an example of the measurement results below. In Figure 5.3 the measured water shows the number 4.3 cm but what is read in Figure 4.1 shows the number 4 because the program is set to use integer numbers and not floating that's why the numbers read are rounded numbers. Data on Thingspeak shows rounded numbers.

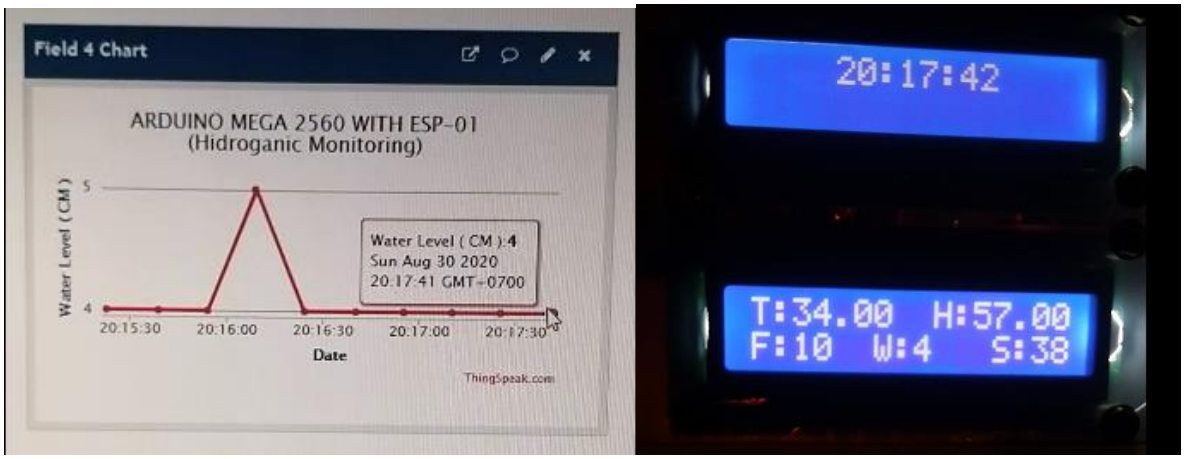

Figure 6 Display on Thingspeak and LCD

To get the measurement results, use the calculations in the Arduino program as follows.

```
jarak = ((((durasi / 2)* 0.034)-23)*-1);
```

Figure 4.2 Measurement Calculations

Fish Feed Level Sensor

Experiments using ultrasonic sensors. LCD 16 x 2 and Thingspeak as the output of the ultrasonic sensor.

Table 4 Trial of Measuring Fish Feed Height

No	Angka Real dengan Penggaris	Angka Pengukuran di LCD 16 x 2	Angka Pengukuran di Thingspeak
1	0 cm	0 cm	0 cm
2	4.5 cm	5 cm	5 cm
3	6 cm	6 cm	6 cm
4	6.5 cm	7 cm	7 cm
5	7.5 cm	8 cm	8 cm
6	8 cm	8 cm	8 cm
7	9 cm	9 cm	9 cm
8	9.5 cm	10 cm	10 cm
9	10 cm	10 cm	10 cm
10	13 cm	13 cm	13 cm

From the results of the tests carried out and listed in table 4.2, namely testing the fish feed height sensor using the ultrasonic sensor HC-SR04, it can be concluded that for each actual number behind the comma there should be but rounded up to the number above or below. As an example of the measurement results below. The result in Figure 4.3 is 0 cm.

Figure 7 Display on LCD and Thingspeak

To get the measurement results, use the calculations in the Arduino program as follows.

```
jarak = (((durasi / 2)* 0.034)-20)*-1);
```

Figure 4.4 Measurement Calculations

Temperature and Humidity Sensor

The test uses a DHT 11 sensor. 16 x 2 LCD and Thingspeak as the output of the DHT 11 sensor. Also accompanied by the time at the time of taking measurements.

Table 5 Tests for Measuring Temperature and Humidity

No	Measurement Number on LCD 16 x 2		Measurement Numbers at Thingspeak		Jam
	Temperature	Humidity	Temperature	Humidity	
1	30 ℃	72%	30 ℃	72%	6:29
2	30 ℃	71%	30 ℃	71%	6:57
3	34 ℃	60%	34 ℃	60%	11:03

4	34 ℃	61%	34 ℃	61%	11:48
5	36 ℃	59%	36 ℃	59%	13:20
6	36 ℃	56%	36 ℃	56%	14:31
7	34 ℃	60%	34 ℃	60%	17:55
8	33 ℃	65%	33 ℃	65%	19:44
9	29 ℃	75%	29 ℃	75%	5:11
10	30 ℃	71%	30 ℃	71%	7:49

Figure 8 Thingspeak Display of Temperature and Humidity
(Source: Personal Documents, 2020)

From the results of these measurements can also be made in the form of a curve from morning to night

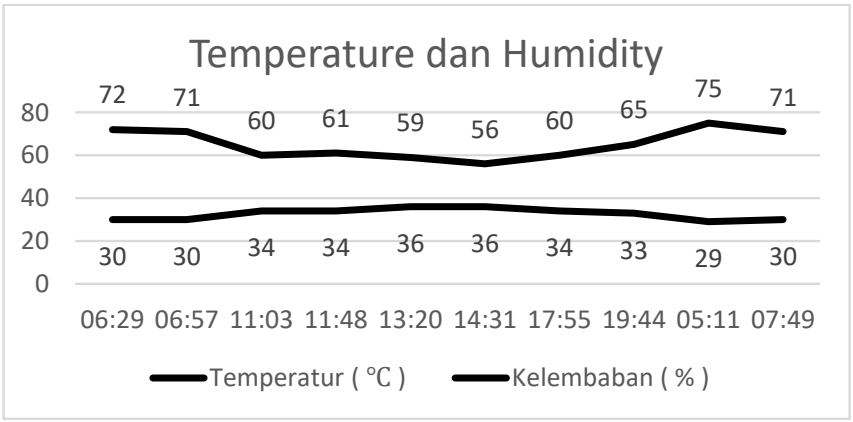

Figure 9 Temperature and Humidity Curve

Soil Moisture Sensor

Trial using Soil Moisture V 1.2 sensor. 16 x 2 LCD and Thingspeak as the output of the Soil Moisture V 1.2 sensor.

Table 6 Trial of Measuring Soil Moisture

No	Measurement Number on LCD 16 x 2	Measurement Numbers at Thingspeak	Information
1	39 %	39 %	Terbuka
2	66 %	66 %	Di Air
3	44 %	44 %	Di Tanah
4	60 %	60 %	Tanah + Sistem Hidoganik

Table 6 Trials of Fish Feeding Time
Real Time Clock (RTC) Module For Fish Feeding
Trial using Real Time Clock Module (RTC). 16 x 2 LCD, Servo Motor and Buzzer as output.

Table 6 Trials of Fish Feeding Time

No	Servo		Buzzer	
	ON	OFF	ON	OFF
1	21 August 2020, 07:45:00:00	07:45:00:05	07:45:15:00	07:45:40:00
2	21 August 2020, 07:50:00:00	07:50:00:05	07:50:05:00	07:50:35:00
3	21 August 2020, 07:55:00:00	07:55:00:05	07:55:10:00	07:55:36:00
4	21 August 2020, 08:00:00:00	08:00:00:05	08:00:15:00	08:00:31:00
5	21 August 2020, 08:05:00:00	08:05:00:05	08:05:06:00	08:05:37:00
6	22 August 2020, 07:45:00:00	07:45:00:05	07:45:06:00	07:45:36:00
7	22 August 2020, 07:50:00:00	07:50:00:05	07:50:11:00	07:50:41:00
8	22 August 2020, 07:55:00:00	07:55:00:05	07:55:16:00	07:55:31:00
9	22 August 2020, 08:00:00:00	08:00:00:05	08:00:06:00	08:00:36:00
10	22 August 2020, 08:05:00:00	08:05:00:05	08:05:12:00	08:05:42:00

Figure 10 Fish Feed Status on Thingspeak

4. CONCLUSION

Based on the implementation of the final project that has been carried out, the following conclusions are obtained:

The system has a 15 second delay for each data transmission from Arduino to the Thingspeak server. If there is a delay, no more than 20 seconds.

In this thesis the author uses an ultrasonic sensor HC-SR04, Soil Moisture v1.2 sensor, DHT11 sensor, servo motor SG-90, RTC module DS3231, ESP-01, Arduino Mega, Arduino Uno, aquarium pump and 5 VDC fan for panel cooling. .

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