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Sounding Automation Prototype in Storage Tank Model Based On Arduino Uno

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ABSTRACT

Sounding is the process of measuring and calculating a product to find out the amount. In the process of CPO sounding, measurements are made of the temperature of the oil in the storage tank. Storage tank is a tank used to store crude palm oil (CPO) produced before shipping. Sounding crude palm oil is an oil measurement process that includes the measurement of CPO levels and temperatures as an item to get the mass of CPO (kg CPO). The process of measuring the volume of oil is done using a sounding meter dipped in CPO in a storage tank to the measuring table. Temperature measurements are carried out using a thermometer that is inserted into a storage tank. In conditions on the ground that the measurement of the storage tank or storage tank is done manually to calculate the tank volume and there are many weaknesses. In this study, we will describe the sounding technique or measure the volume of oil in a storage tank by means of automation, where the automation system is designed with the aim of being able to carry out the measurement process on the storage tank in an automatic way. The results of this study can be concluded that measurements on storage tanks can be done automatically with the help of the HC-SR04 proximity sensor, thermocouple sensor, flow meter sensor and Arduino UNO which are passed on to laptops and gadgets, where based on the results of the experiments carried out the percentage of accuracy is obtained each sensor starts from the proximity sensor with 99.98%, temperature sensor 99.47% and flow meter sensor 99.88%.

INTRODUCTION*

Poor storage and handling during the transportation of palm oil can cause contamination by both metals and other materials which will reduce the quality of palm oil. Supervision of the quality of palm oil during storage, transportation and stockpiling needs to be carried out strictly to prevent a decline in the quality of palm oil. One way that can be taken is to make standard procedures for storing, transporting and storing palm oil, which are binding on all parties involved in the palm oil trade. (Naibaho, 1998).

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Sounding is the process of measuring and calculating a product to find out the amount that exists. In the process of CPO sounding, measurements are made of the temperature of the oil in the storage tank.

Storage Tank

Storage tank is a tank used to store Crude Palm Oil (CPO) produced before shipping. (Siregar, 2012). Sounding crude palm oil is an oil measurement process that includes the measurement of CPO levels and temperatures as an item to get the mass of CPO (kg CPO). The process of measuring the volume of oil is done using a sounding meter dipped in CPO in a storage tank to the measuring table. CPO volume measurement results can be seen in the sounding table based on the height of oil in the storage tank. Temperature measurements are carried out using a thermometer that is inserted into a

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storage tank. (Pahang, 2006). In conditions on the ground that the measurement of the storage tank or storage tank is done manually to calculate the tank volume and there are many weaknesses.
The water flow sensor consists of a plastic valve body, water rotor and hall effect sensor. When water flows through the rotor, the rotor will spin. The speed of rotation matches the average speed of water flow through it. Hall effect sensor will produce digital pulses that are in accordance with the rotor speed (Kautsar, 2015).

Arduino UNO

Arduino UNO is a microcontroller board based on ATmega328. Arduino UNO has 14 digital input / output pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz Crystal oscillator, a USB connection, a power jack, an ICSP header and a reset button. Arduino UNO contains everything needed to support a microcontroller, easily connect it to a computer with a USB cable or supply it with an AC to DC adapter or use a battery to start it. (Helmi, 2013).

Delphi 7

Delphi is a visual-based programming language used to create application programs on computers. The programming language used by Delphi is actually a derivative of the Pascal programming language, which was formerly known as Delphi in the Pascal object. The current Delphi interface makes it very easy for users to make an application look as they wish (Fatim, 2015).

EXPERIMENTAL METHOD

The methodology used in this research is shown Figure 1.

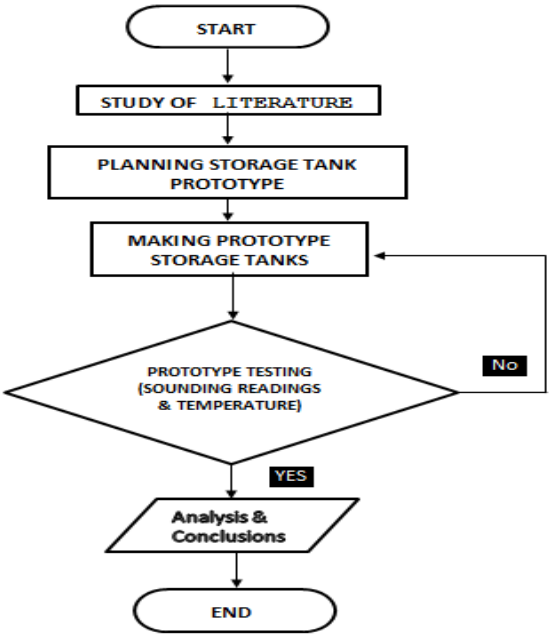

Fig. 1. Flowchart this research

RESULTS AND DISCUSSION

Testing

The testing phase that is carried out is checking and making sure all the series of installed devices such as sensors must work properly and accurately so that the test will later provide the appropriate results, besides ensuring the device does not suffer damage both the tank and the sensors installed. Before the sounding automation tool is used, ensure that the measurement results of the proximity sensor when the tank is empty actually shows the number zero "0" or empty, because this can affect the results of subsequent measurements when reading the movement of volume (height) and temperature (temperature) in the tank. As shown in the following Figure 2 and 3.

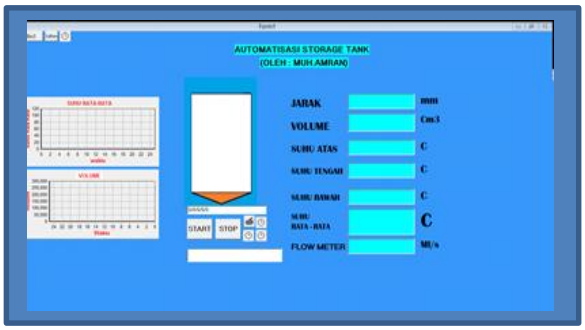

Fig. 2. Before Running

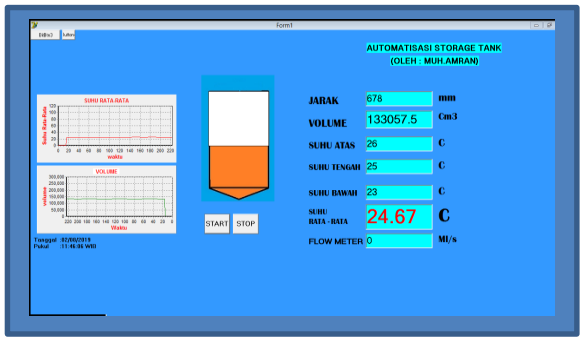

Fig 3. After Running

Proximity Sensor

The proximity sensor used is the HC-SR04 type where the ultrasonic module can measure distances between 3 cm to 300 cm and the output of the HC-SR04 ultrasonic sensor module is a pulse that represents the distance. The results of the proximity sensor reading can be seen in the following measurement comparison Table 1.

Table 1. Result Proximity Test

No.	Manual (mm)	Proximility Sensor (mm)	Time (s)
1.	678	678	0
2.	678	678	1
3.	678	677	2
4.	678	678	3
5.	678	678	4
6.	678	678	5
7.	678	677	6
8.	678	679	7
9.	678	678	8
10.	678	677	9
11.	678	678	10
$\bar{x}$	**678**	**677.81**	-

Temperature Sensor

Thermocouple is a temperature sensor that is used to convert temperature differences in objects into changes in electrical voltage. The amount of voltage generated depends on the type of conductor material used, and the temperature inequality of the two conductors. The IC or chip used for digital thermocouple conversion is MAX6675. The resulting digital data will go to Arduino-UNO for data processing.

Data from Arduino UNO is then sent to the Borland Delphi 7 display where the data is in accordance with the results of previous readings. The data can be seen in the table of experimental results below Table 3.

Table 2. Result temperature test

No.	Manually measurement (°C)				Temperature Sensor measurement (°C)				time (s)
	Top (°C)	Midle (°C)	Bottom (°C)	Rate (°C)	Top (°C)	Midle (°C)	Bottom (°C)	Rate (°C)	
1.	29	31	30	**30**	29	31	30	**30**	0
2.	30	32	32	**31.33**	30	32	32	**31.33**	600
3.	29	33	33	**31.67**	29	33	33	**31.67**	1200
4.	30	33	34	**32.33**	30	33	34	**32.33**	1800
5.	31	34	35	**33.33**	31	34	35	**33.33**	2400
6.	31	35	36	**34**	31	35	35	**33.67**	3000
7.	32	36	37	**35**	32	36	36	**34.67**	3600
8.	33	37	38	**36**	33	37	38	**36**	4200
9.	34	37	39	**36.67**	34	37	38	**36.33**	4800
10.	34	39	40	**37.67**	34	39	39	**37.33**	5400
11.	35	40	41	**38.67**	35	39	40	**38**	6000
$\bar{x}$	-	-	-	**34.24**	-	-	-	**34.06**	

Level of accuracy

$$= 100\% - \frac{34.24 - 34.06}{34.24} \times 100\%$$

$= 100\% - 0.53\%$

$= 99.47\%$

In testing the temperature manually or with sensors can be seen the results in the table above where the difference is not too far away, we can also see the difference in the following graph:

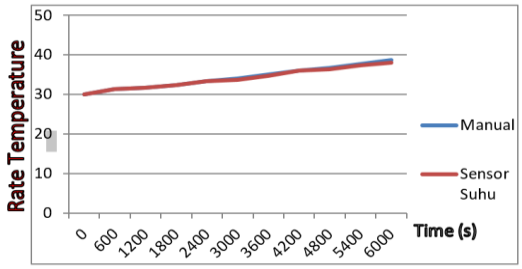

Fig. 4. Graph Comparison of Temperature Measures Manually with a Thermocouple Sensor MAX6675

Here are some data on the volume of water in the tank based on the calculation results of the formula, namely:

Table 4. Tank volume

High	Volume		High	Volume	
Mm	mm^3	cm^3	Mm	mm^3	cm^3
1	196,250.00	196.25	21	4,121,250.00	4121.25
2	392,500.00	392.5	22	4,317,500.00	4317.5
3	588,750.00	588.75	23	4,513,750.00	4513.75
4	785,000.00	785	24	4,710,000.00	4710
5	981,250.00	981.25	25	4,906,250.00	4906.25
6	1,177,500.00	1177.5	26	5,102,500.00	5102.5
7	1,373,750.00	1373.75	27	5,298,750.00	5298.75
8	1,570,000.00	1570	28	5,495,000.00	5495
9	1,766,250.00	1766.25	29	5,691,250.00	5691.25
10	1,962,500.00	1962.5	30	5,887,500.00	5887.5
11	2,158,750.00	2158.75	31	6,083,750.00	6083.75
12	2,355,000.00	2355	32	6,280,000.00	6280
13	2,551,250.00	2551.25	33	6,476,250.00	6476.25
14	2,747,500.00	2747.5	34	6,672,500.00	6672.5
15	2,943,750.00	2943.75	35	6,868,750.00	6868.75
16	3,140,000.00	3140	36	7,065,000.00	7065
17	3,336,250.00	3336.25	37	7,261,250.00	7261.25
18	3,532,500.00	3532.5	38	7,457,500.00	7457.5
19	3,728,750.00	3728.75	39	7,653,750.00	7653.75

CONCLUSION

Based on the results of research on the Prototype of Sounding Automation in the Storage Tank Model Based on Arduino UNO, the following conclusions can be drawn: The sounding process in the storage tank can be done automatically with sensors and several other components, where based on the results of the experiments conducted, the percentage value of accuracy is obtained. - each sensor starts from the proximity sensor with 99.98%, temperature sensor 99.47% and flow meter sensor 99.88%.

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