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Measurement of Wastewater Turbidity Based on Total Dissolved Solids at Pancasila University

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Abstract

Groundwater is polluted by industry, house and laboratory disposal. It is necessary to measure the value of water turbidity quality. Application of prototype design of tool design in this study will provide solutions. It is expected that the results of the research analysis and measurement of water turbidity and do the filtering to get the quality of clean water quality and can be reused. The method is carried out by monitoring the process of Total Dissolved Solids (TDS) using Arduino-based Turbidity Sensor with digital display and using short message service (SMS) display network. Implementation steps to maintain the quality standard of water quality before being discharged into the groundwater catchment around the Engineering Department Pancasila University (FTUP) campus, the FTUP Green plan educational institution becomes the Green Campus. The results obtained show that the measuring instrument is functioning properly and it has avarage error value about 0.98 %.

Keywords: Measurement, Wastewater, Turbidity, Water Quality, TDS (Total Dissolved Solids).

1. Introduction

Turbidity and water filter measurement tool is designed to accommodate water quality standard around FTUP. It is stated in FTUP Development Mother Plan term 2019-2024 year, Pancasila University is expected to be a Green Campus. In this research will be designed turbidity measurement for wastewater by making the design of a tool that can monitor remotely using the IoT in conducting the filtering process to get clean water quality. Based on the Regulation of the Minister of Health No. 907 / Menkes / SK / VII / 2002, there are several conditions that must be met by water so that it becomes water that is suitable for consumption. At present most people do not know about drinking water quality standards. Drinking water is safe for health if it meets the physical, microbiological, chemical and radioactive requirements [1].

Table 1. Requirements & supervision of drinking water quality [1].

Parameter	Maximum allowed level	Unit
Taste & Smell	Odorless and tasteless	-
Dissolved solids (TDS)	1000	mg / l
pH	6.5 - 8.5	-
Colors	15	TCU
Turbidity	5	NTU
Temperature	Air temperature ± 3	ºC

The selection of important parameters in the measurement of water in order to meet the provisions of good water that is tasteless, odorless and colorless. The first parameter is the value of turbidity of water which is a parameter that will be measured according to the conditions of changes that occur whether under (≤ 4 NTU) or greater value of turbidity value (≥ 4 NTU), then the tool design system will function, carry out according to the monitoring process.

2. Literature review.

Several studies related to water quality measurement tools have been carried out measurement of Arduino-based results reading with digital display as follow;

- Linda Handayani, Rhyan Prayuddy Reksamunandar, Lulu Brianni Puteri, and Hendro "Design of Water Turbidity Measuring Instruments using Photodiode Microcontroller-Based Light Sensor AT Mega 328" [2].
- Fauzi Amani & Kiki Prawiroredjo "Measuring the quality of drinking water with parameters PH, temperature, turbidity level, and the amount of dissolved solids" [3].
- Ronaldi Zamora1, Harmadi and Wildian "Design of water dissolved solid measuring devices (TDS) with conductivity sensors in real time"[4].
- Refendi Sinaga, "a water PH meter with an arduino-based digital display", Batam State Polytechnic Electronics Engineering study program, [5].

The difference with [2],[3],[4],[5], this research will carry out the process of filtering turbidity, motoring using the internet network and improving the value of turbidity of water [1], as a further step before being discharged into the groundwater infiltration flow.

3. Design system

3.1 Block diagram of Design.

Diagram block design illustrates differences and similarities in water quality based on measurement results and water quality standards. Next, the design makes a Total Dissolved Solids (TDS) turbidity monitoring tool using an Arduino-based Turbidity Sensor with a digital display and uses a short message service display network (SMS).

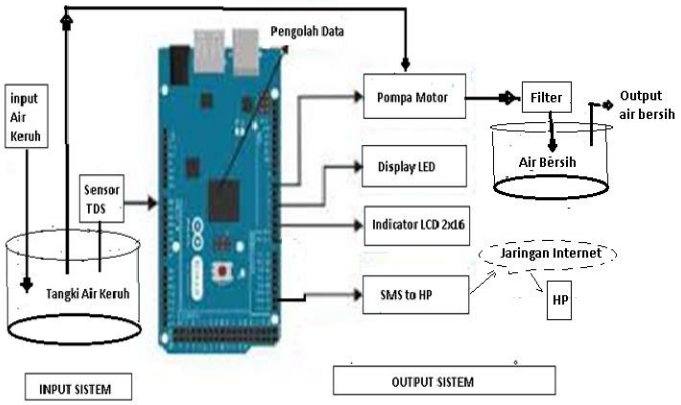

Fig. 1: Design of a turbidity tool block diagram.

3.2 Turbidity Sensor Circuit.

The working system of this design tool is given by changes in the data input turbidity value, which is owned by the capability of the turbidity sensor process that serves to detect turbidity in water, in the use of changes in turbidity value as the input value of the ATMega328 microcontroller system process. And the following (figure 2) is a schematic diagram of the turbidity sensor.

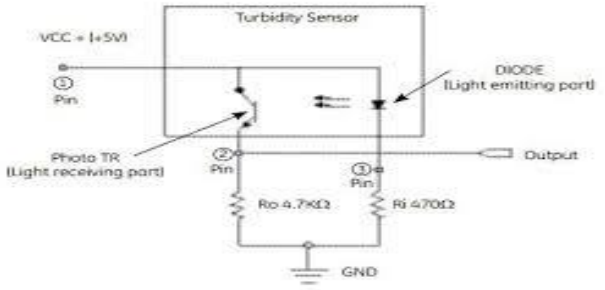

Fig. 2: Schematic diagram of the turbidity sensor.

Data is collected by performing calibration of turbidity sensor readings with the Arduino hardware program.

$$NTU = 100 - \left(\frac{V_{Terbacakeruh}}{V_{Saatjernih}} \right) x100\% \qquad (1)$$

3.3 SIMA6 GSM / GPRS Module is a GSM module (Global mobile system).

GSM module (Global Mobile System) has the role of sending SMS functions according to the programming workflow (figure 3). Its module uses the UART (Universal Asynchronous Receiver Transmiter) communication protocol in communicating data with Arduino. It has 8 pins that can be used for combining with arduino (pins 0 to pin 7) 2 pins will be used as RX and TX pins which will be used in UART communication with Arduino.

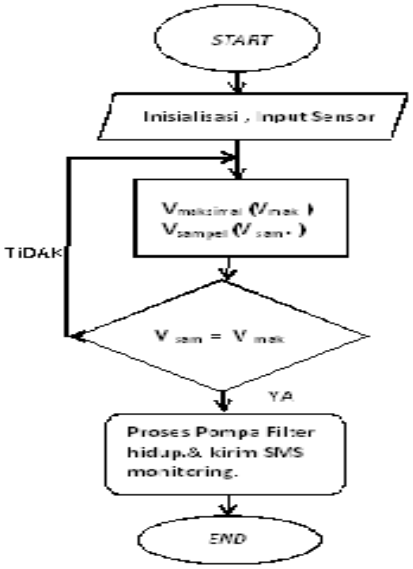

Fig. 3: Programming workflow diagram.

4. Simulation

The results of tool design are shown in (figure 4). The first test carried out was to measure the electrical voltage on water that has vary NTU values. The voltage is measured with the help of a color indicator on several types of LED lights (Green, Yellow, Red LED lights) shown in figure 5. It is done to find out which LED has the best linearity. The measurement results obtained are shown in table 2 and table 3,

Fig. 4: Design of turbinity measurement

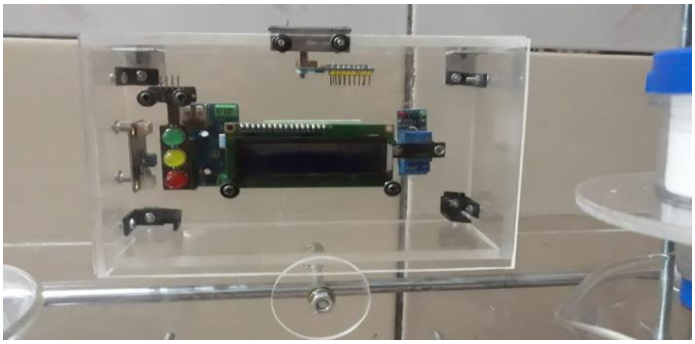

Fig. 5: LED Indicators Green, Yellow, Red.

Table 2. Test results for measuring the design tools (volts).

No		Tegangan Air terbaca oleh Sensor Turbidity (V), [volt]							
	Nilai NTU	LED Hijau		Nilai NTU	LED Kuning		Nilai NTU	LED Merah	
		V_{Jernih}	V_{Keruh}		V_{Jernih}	V_{Keruh}		V_{Jernih}	V_{Keruh}
1	= 3	3,58	3,58	= 3	3,58	3,65	= 4	3,58	3,72
2		3,58	3,59		3,58	3,66		3,58	3,73
3		3,58	3,60		3,58	3,67		3,58	3,74
4		3,58	3,61		3,58	3,68		3,58	3,75
5		3,58	3,62		3,58	3,69		3,58	3,76
6		3,58	3,63		3,58	3,70		3,58	3,77
7		3,58	3,64		3,58	3,71		3,58	3,78

Table 3. Tests of water turbidity read by means (%).

No	Ujikekeruhan air terbaca oleh alat rancangan *Sensor Turbidity* (%).										
	Nilai NTU	LED Hijau		% kesalahan	Nilai NTU	LED Kuning		% kesalahan	Nilai NTU	LED Merah		% kesalahan
		V_{Jernih}	V_{Keruh}			V_{Jernih}	V_{Keruh}			V_{Jernih}	V_{Keruh}	
1	= 3	3,58	3,58	0,99	= 3	3,58	3,65	0,98	= 4	3,58	3,72	0,98
2		3,58	3,59	0,99		3,58	3,66	0,98		3,58	3,73	0,98
3		3,58	3,60	0,99		3,58	3,67	0,98		3,58	3,74	0,98
4		3,58	3,61	0,99		3,58	3,68	0,98		3,58	3,75	0,98
5		3,58	3,62	0,98		3,58	3,69	0,98		3,58	3,76	0,98
6		3,58	3,63	0,98		3,58	3,70	0,98		3,58	3,77	0,98
7		3,58	3,64	0,98		3,58	3,71	0,98		3,58	3,78	0,98
Rata-rata kesalahan				0,98	Rata-rata kesalahan			0,98	Rata-rata kesalahan			0,98

The water turbidity measurement test is shown in table 2. The results of the design measurement device turbidity test value increase are read by the tubidity sensor in the voltage value (volts) with a functioning design system tool. Meanwhile, It can be seen in table 3 the avarage error value of water turbinity is 0.98 %. At the start of the clear water reading sensor condition are shown Green LED (figure 6). This process continues until turbidity is read, the tubidity sensor is shown on the Yellow LED lights shown (Figure 7) and at the maximum level conditions are shown Red LED, the process of sending short message service (SMS) is carried out by a system that has been notification send "Detected turbidity of water carry out water purification" indicated (figure 8).

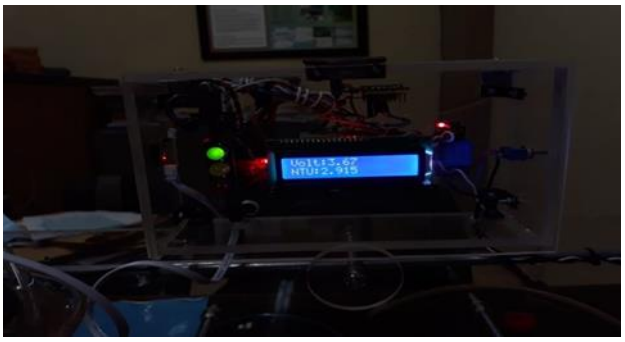

Fig. 6: The sensor reads clear water shown in Green LED.

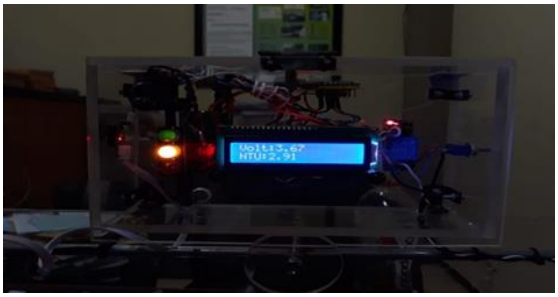

Fig. 7: the sensor reads increasing turbidity indicated the Yellow LED.

Fig. 8: Cellphone Receive short message service (SMS).

In the process of increasing the turbidity of the water shown by the Yellow LED to the red LED. Its system sends SMS according to the data of programmed phone numbers and the system starts the pump engine. It carries out the water purification process (filtering) moving turbid water from tank 1 to tank 2 through the process accordingly as shown in Programming workflow diagram of turbidity monitoring tool design in figure 3.. The results of the test data are summarized in Table 3 which the turbidity test was read by a turbidity sensor have average error value 0.98 (%).

5. Conclusions

- Voltage is measured with the help of a color indicator on several types of LED lights (Green, Yellow, Red LED lights), design tool is functioning properly.
- Application of design tools using TDS Turbidity sensor. The results of data testing conducted have an average error value of 0.98%.
- The device application design system can be functioned by sending the SMS program network according to the data of the HP number programmed.

6. References

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