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Design Control and Monitoring of Quality Purified Water in Drinking Water Storage at the Electrical Engineering Workshop of Semarang State Polytechnic

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***Abstract*—This research is a continuation of previous research related to monitoring and automation with certain controls in the electrical engineering laboratory. In the research that has been done, it is related to the design and build of monitoring of electrical quantities in Polines' electrical workshops. This research was conducted to monitor the quality of purified water using several indicators or sensors so that it can guarantee the quality of the water to be drunk. This water quality monitoring system is a system that is not widely used today, because in general the results of the water purification process are directly consumed or drunk without monitoring the quality of drinking water. This system is used to ensure the quality of drinking water including monitoring the clarity of the water and the pH of the water from drinking water. This design is made using a PLC as a processor for any water quality data such as pH and TDS in the reservoir and will later be displayed on the monitor screen near the reservoir, so that everyone who will consume it can know the quality of the water. The result of the monitoring process obtained an average pH value of 7.24 and an average TDS value of 13.21. With these results, the water that has been monitored meets the requirements for potable water.**

Keywords—water, monitoring, purification, pH, TDS

I. INTRODUCTION

The problem of clean water availability is a classic problem faced by the people of Indonesia recently, both regarding the quantity and quality of existing clean water. Increased development activities and population, caused an increase of the need clean water either directly (without processing) or indirectly (through processing). Design of Monitoring and Control of Purified Water Quality in Drinking Water Storage in the Electrical Engineering Workshop at the Semarang State Polytechnic is designed to supply water needs in the electrical workshop building, especially for drinking water.

Desalination, such as Reverse Osmosis must be involved to reduce salinity of the raw water. A complete process includes the pretreatment and advance treatment. The pretreatment are oxidation and some common filtrations [1]. Previous research by Ngafifuddin et al. regarding Application of Arduino-Based PH Meter Design on Radiographic X-Radiographic Film Washing Machine said Design of pH meter based on Arduino had done to create pH measurement instrument that compatible with automatic washing machine of x-ray radiograph film [2].

Raufun and Ardiansyah have conducted research Parallel Water Tandon Filling Prototype Using Solenoid Valve Based on ATMEGA 2560 in 2018 by design a controller to replenish water reservoirs that can help or facilitate humans in controlling water filling in several reservoirs and can prevent water overflow in reservoirs [3]. water treatment with RO has been carried out by Amri and Amri which is written in a journal entitled Implementation Of Arthesis Groundwater Treatment Technology Into Drinkable Water In Buruk Bakul Village [4].

Researchers have conducted research in 2016 regarding the Design of Telemetring Systems in Real Time Data on the Amount of Electricity in the Semarang State Polytechnic Electrical Workshop Building [5]. The description of previous research is the design of RFID-based automatic doors in electrical workshops as shown in Figure 1 as follows:

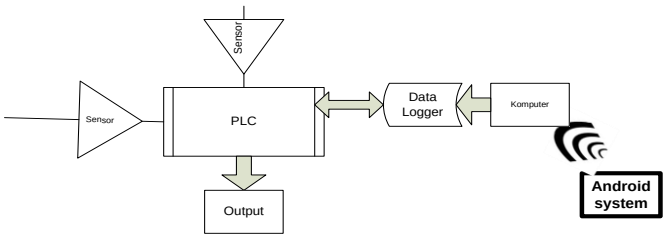

Fig. 1. Electrical power monitoring design diagram [5].

II. Research Methods

The steps taken to achieve satisfactory results in this study are described in the following methods:

A. Study of Literature

This literature study is carried out jointly by the chairman and research members who have expertise (expert) in their respective fields. This literature study activity is by collecting library materials from various journals, books, scientific magazines and from websites and conducting discussions.

B. Design and Installation of Purified Water Quality Monitoring Systems

The design and installation of the purified water quality monitoring system is carried out to control and monitor the quality of purified water in the Electrical Engineering workshop.

C. System Testing

Design and installation of monitoring and control systems for monitoring the quality of finished purified water needs to be tested by testing the devices that have been installed.

D. Report Making

All stages of preparation, processing, hardware manufacture and testing as well as measurements and the results will be made in a final report. Apart from being a report, it will also be written in the form of a research paper / paper which is also adjusted to the target.

The system design can be seen in Figure 2.

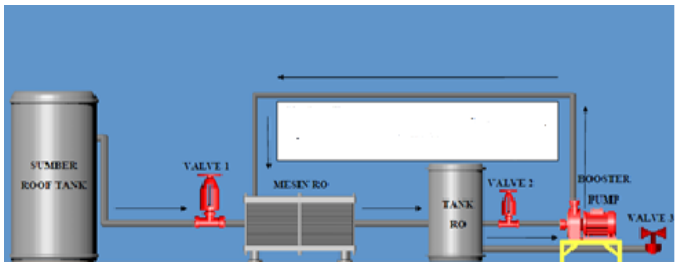

Fig. 2. Monitoring and control of purified water quality in drinking water storage.

III. Results and Discussion

The picture of the design of the purified water quality monitoring system can be seen in Figure 3.

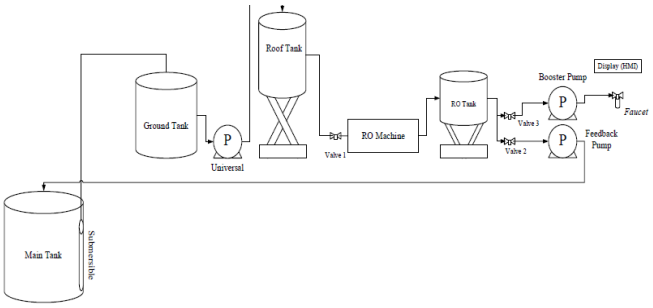

Fig. 3. Monitoring system of purified water quality.

The equipment used includes PH sensors, TDS sensors, floating control sensors, selenoid valves, booster pumps and HMI (Human Machine Interface). The way this monitoring system works can be seen in Figure 4 below.

Flowchart of the work process of the purified water quality monitoring system as follows:

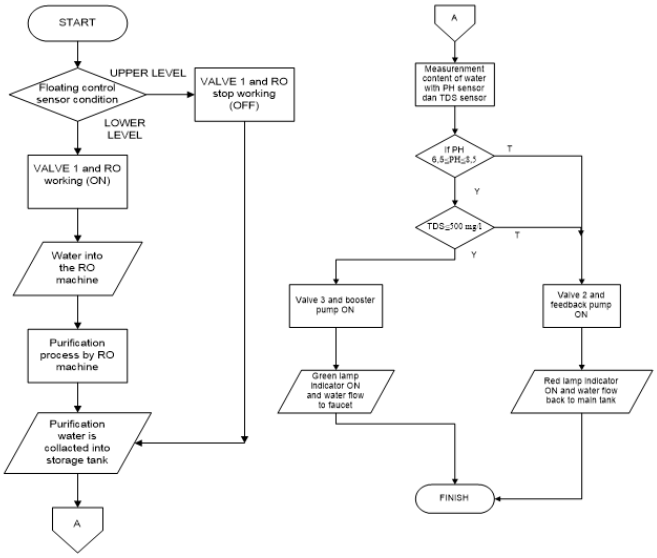

Fig. 4. Flowchart of the process of purified water quality monitoring system.

The system works when the floating sensor is in the lower position and valve 1 will open, so that water will enter the RO machine to go through the purification process and be processed in the storage reservoir. If the pH sensor detects water quality in the 6.5-8.5 range and the TDS sensor detects water quality below 500 mg / l, then valve 3 will open and water will flow to the faucet. Meanwhile, if the pH sensor detects that it is not in that range and the TDS sensor detects water quality above 500 mg / l, then valve 2 opens and the water will return to the main tank.

Data sampling was carried out for 4 days with a time range every 1 hour at 09.00-11.00 and 13.00-15.00 hours. The monitoring display with HMI is as shown in Figure 5 below:

Fig. 5. Display monitoring through HMI.

The following tabulation of the observation results for 4 days of water quality in the form of pH and TDS data can be seen in Table 1.

TABLE I. TESTING OF WATER QUALITY FOR 4 DAYS

NO	DAY	DATE	TIME	WATER QUALITY	
				pH	TDS
1	MONDAY	28-Sep-20	09.00	7.36	10
			10.00	7.36	10
			11.00	7.04	12
			13.00	7.4	13
			14.00	7.38	12
			15.00	7.36	12
2	TUESDAY	29-Sep-20	09.00	7.26	8
			10.00	7.3	12
			11.00	7.28	8
			13.00	7.27	12
			14.00	7.23	8
			15.00	7.27	12
3	WEDNESDAY	30-Sep-20	09.00	7.19	8
			10.00	7.19	8
			11.00	7.19	8
			13.00	7.27	9
			14.00	7.24	10
			15.00	7.24	10
4	THURSDAY	1-Oct-20	09.00	7.06	35
			10.00	7.23	35
			11.00	7.24	12
			13.00	7.12	10
			14.00	7.12	35
			15.00	7.24	8

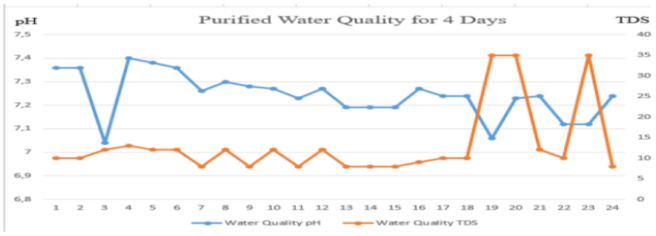

Fig. 6. Graph of purified water quality for 4 days.

From table 1 above, the average pH value is 7.24, while for the TDS average value is 13.21. Where the results obtained can still be categorized as ready-to-drink water because the pH and TDS quality meet the requirements set out in the Decree of the Minister of Health of the Republic of Indonesia number 492 / MENKES / PER / IV / 2010. Based on the results of the data above, it can be proven that this tool can function properly as a sensor to monitor the quality of purified water in the ready-to-drink water supply system at Polines' power shop in real time.

IV. CONCLUSION

Based on the data obtained from the results of testing and analysis, it can be concluded as follows.

- This monitoring system is designed with pH and TDS parameters in accordance with applicable regulations regarding drinking water.
- The quality of water produced by the RO (reverse osmosis) machine after going through the monitoring process obtained an average pH value of 7.24 and a TDS of 13.21.
- Water that is in accordance with the specified pH and TDS parameters will be pumped by the booster pump to the faucet.

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