Monitoring system water pH rate, turbidity, and temperature of river water

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Abstract. Water is a substance that is important in life after air if it has been polluted by chemicals it is very dangerous for living things. The development of the industry uses chemicals in a production that causes hazardous waste, even though it has been reprocessed in the filtering process, if it is less than perfect, the water will be polluted if disposed of in the river flow. Identification and monitoring measures are needed that require media to use a device that includes a sensor containing the pH of water that comes from the content of acidic substances in water, turbidity or the content of solid objects in the water, and water temperature. The data collection method uses a nodeMCU microcontroller. Then the data is sent via a wireless connection to be stored on the database server. Testing to see the results of monitoring using an Android application that is connected to the server. From the results, it can be concluded that the data displayed on the application can run smoothly, the value displayed can be seen in real-time.

1. Introduction

One of the impacts of the city development that is quite rapidly with the increasing number of factories popping up has a negative impact, because factories in producing goods that are not uncommon that use chemicals in the form of metals and other chemicals that will produce waste that is harmful to the environment and to the body human. The waste generated by the factory is then filtered, if it is less than perfect it can cause the environment around the industry to be polluted by industrial waste. The land and streams that are polluted by industrial waste are then drained by rainwater which can spread throughout the river flow. While water is one of the excellent solvents, so that the water contained in the environment polluted by waste will also be polluted [1].

Water is the most important substance in life after the air. In the survival of living things, water is needed for metabolism in the body. It is important for humans to continue to preserve and maintain water, such as savings, not throwing away garbage and waste that can make water pollution so that it can disrupt existing ecosystems [2].

Industrial effluents can affect pH, temperature and turbidity levels in the water. Important parameters in the measurement of water quality standards, according to PP No. 2 of 1990 [3]. The process of measuring water quality parameters carried out by BLH (the Environment Agency) in the context of overseeing the disposal of industrial waste is still done manually and within a certain period. Manual measurement is done by taking river water samples and testing them in the laboratory [4].

One reference from previous research as conducted by Zulkarnain, MR In 2015 with the title "River Water Quality Monitoring System Equipped with Data Loggers and Wireless Communications as a Medium for Monitoring Liquid Waste, Pollution" using At Mega162, water and oxygen, pH sensors that are, the results can be seen through the Wireless connection that is the pH and oxygen levels detected in the test water from rivers at pH 7 and oxygen in DO 5.31. According to PPNO. 2 of 1990 concerning water quality standards which range of pollution, according to the pH level limit of 6 > 79 and for oxygen of ≥ 6 which means it can be said to be successful [3].

Based on the background and previous studies, it was decided to design a monitoring system that could detect pH, temperature, and turbidity levels contained in water, to determine pollution of wastewater contaminated (contaminated) by excessive substances, the researchers designed a device using NodeMCU so that the data could be monitored through the network Wifi / wireless connection monitoring of liquid waste pollution can be done remotely, continuously, in real-time and there is a warning system if the level of waste in the water exceeds the specified threshold. It is expected that this water level detector can help to check the feasibility of water in the waters.

2. Literature review

2.1. NodeMCU
NodeMCU an IoT platform in the development of open source technology, using System on Chip ESP8266, the Lua scripting programming language [5]. The term NodeMCU by default actually refers to the firmware used rather than the hardware development kit, can also be analogous to the ESP8266 Arduino board, which has subsequently packageESP8266 into a compact board with various features like a microcontroller plus access capability using USB to serial communication. To program, it requires a USB data cable media that are used as a data cable Android smartphone [6].

2.2. Water pH sensor
The pH sensor is one of the chemical sensors that are quite popular and we often use it in the laboratory, either in the form of litmus paper or pH paper or pH meters with potentiometric measurements. The measurement system in the pH meter contains a working electrode for the pH and the reference electrode, which is the potential difference between the two electrodes as a function of the pH in the solution being measured. Therefore the measured solution that is Optical Applications and Optical Fiber as a pH sensor must be electrolyte to know the results of these measurements [7].

2.3. Temperature sensor
The temperature sensor is one of the sensors that is also used in chemical laboratories, Resistive Temperature Detector or RTD whose function is to change the amount of heat and cold temperatures detected into electrical quantities [8]. Temperature sensors take measurements of the amount of heat and cold energy produced by an object with high accuracy so that it can know the change in temperature, which is then displayed in the form of digital or analog numbers [9].

2.4. Total dissolved solid (TDS)
Total Dissolved Solids (TDS) is a sensor that detects the amount of dissolved solids (both organic and inorganic substances) contained in a solution in units of parts per million (ppm) or equal to milligrams per liter (mg / L). Can detect the content of dissolved solids including abundance from agriculture, household waste, and industrial. The most common chemical elements are calcium, phosphate, nitrate, sodium, potassium, mercury, lead and chloride. Chemicals can be cations, anions, and molecules. There are also a total dissolved solid naturally derived from weathering or dissolving rocks and soil. optimal water TDS parameters between 300 - 400 PPM, if less or more than these parameters are not optimal, because the smaller TDS will cause a reduction in the mineral content required by plankton as a portion of natural food for fish, and if the greater the impact will be dissolved toxins [10].

2.5. Firebase

Firebase is a facility from Google that is often used to make it easier for application developers to advance in making a service-based product, which can focus on developing applications without having to give a big effort [11]. Two interesting features of Firebase that are often used are Firebase Remote Config and Firebase Realtime Database [12].

2.6. Water quality
Water is an important factor in life after air, not a single living thing in this world that does not need water. The human body consists of water that is as much as 90% of body weight. Adult bodies have 55-60% water, children around 65%, and for babies around 80% [3]. Clean water is needed in life every day, there are several requirements that must be met, which include physical quality, namely odor, color and taste, chemical quality, namely pH, turbidity, etc. and biological quality where the water is free from disease-causing microorganisms [13].

3. Method
In this section, there is a block diagram of a method for monitoring water quality levels, which includes pH, temperature, and water drought, which in Figure 1 describes each stage for monitoring the value of the sensor used.
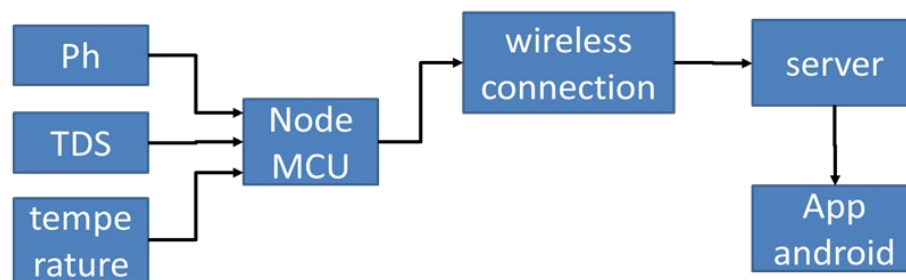

Figure 1. Method monitoring water quality.

The data shown is based on sensors that read pH content, turbidity or TDS, and temperature. Data from the three sensors is then collected temporary storage at node MCU. Furthermore, the data are sent in stages according to the time and date the data was retrieved using a wireless connection, to be stored on a server that has been determined. Using a service database from Google, Firebase, where data is stored in accordance with the categories of each sensor in each table, sequentially based on the time and date sent makes the results can be seen directly or in real-time by monitoring using an Android application that is connected to the database through connection wireless.

4. Result and discussion
The method used to determine water quality is to use data collection which can be monitored through an Android application that contains information about the pH content, water content, and turbidity.

4.1. Business understanding
This study aims to collect data from sensors to find out the quality of water quickly and can be seen directly, so it can make it easier to conduct early monitoring of water quality based on existing data, which is easy to monitor and see the results of data in real time can help in the evaluation and prevention of water pollution levels, where results can be judged good, moderate or worse [14].

4.2. Data understanding
Data is obtained from sensors, which can be viewed through a database on firebase services from Google, or using applications installed on Android devices. Data is transformed in the form of digital data in the form of numbers. Figure 2 shows the process of retrieving data from sensors displaying on an Android application.
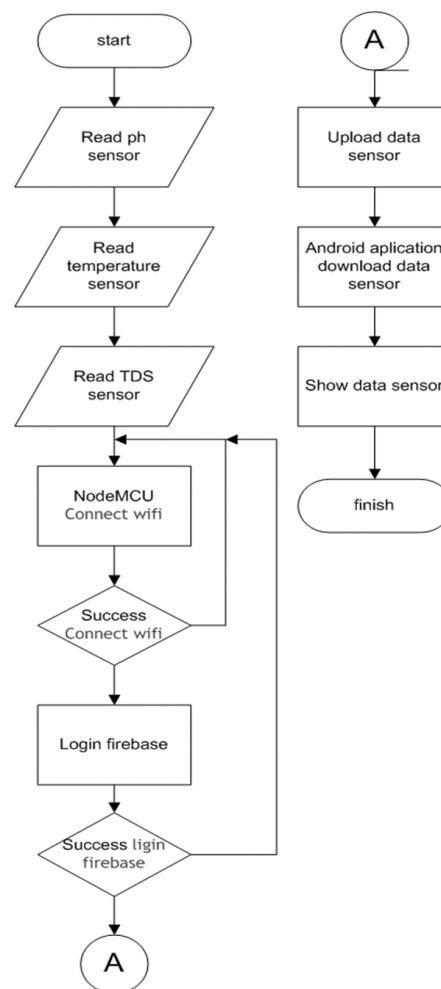
Figure 2. The process of taking data from the sensor displays on the android application.

4.3. Data preparation

Data processing is needed for data collection in order to get maximum results in accordance with the desired criteria. Data to be processed are data on water pH content, water temperature, and level of water turbidity, which have quality criteria.

Table 1. Water quality criterion data.

Sensor	Good	Moderate	Bad	Unit
pH	6 -7	8 – 9	9 -14	pH
Temperature	10-15	15-35	35+	^oC
TDS	300	400	400+	ppm

4.4. Modelling

To conduct data collection on the sensor using nodeMCU in this study using C programming language written what is the IDE Arduino application to make it easier to input nodeMCU data collection commands [15].

4.5. Evaluation

Evaluations use assessments according to quality levels to ensure that the data collected is appropriate. Assessment according to quality level can make it easier to know and take action. The tests in this

study are used to produce models and test data to test models. Here are the results of testing in Figure 3. Firebase database and Android application results.
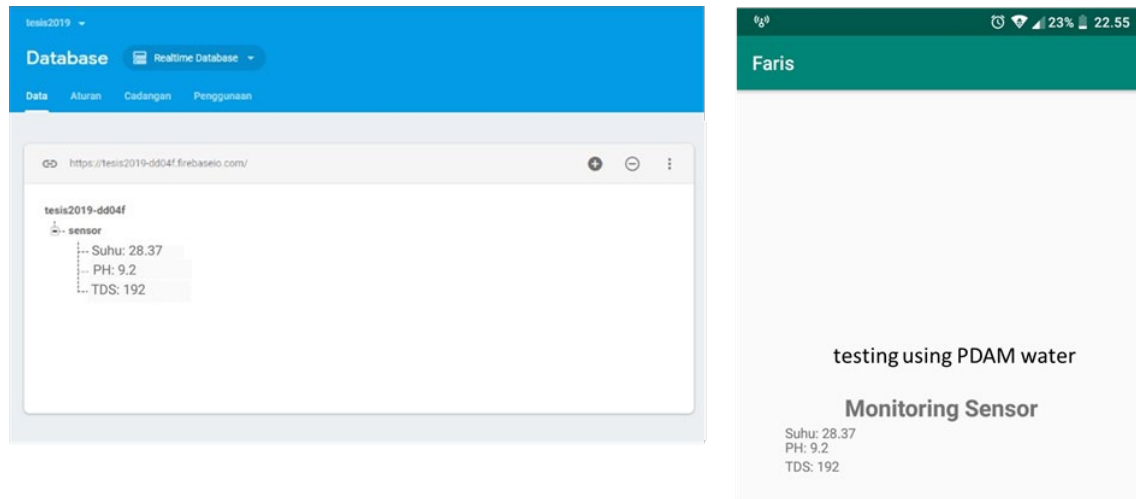

Figure 3. Firebase database and android application results.

4.6. Deployment

Making prototypes of planning results to produce sensor accuracy values that are displayed properly in real-time, using nodeMCU to retrieve data and firebase automatically displays panda data on android applications from the database.

5. Conclusion

From the results of the experiment, it can be concluded that the data displayed on the application can run smoothly, it can be seen from the results of the displayed values, for example in testing using PDAM water. At temperatures reaching 28.37 ^{O}C medium criteria, the pH of water reached 9.2 poor criteria, and while the TDS or turbidity reached 192 ppm the bad criteria. The displayed values can be seen in real-time on the android application. If there are obstacles to the accuracy of the sensor results, calibration is needed and if there is a delay between the appearance of the data in the application then what happens on the wireless connection is interrupted.

6. Acknowledgment

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