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UTILIZATION OF TDS SENSORS FOR WATER QUALITY MONITORING AND WATER FILTERING OF CARP POOLS USING IOT

Sulistiyanto✉
Electrical Engineering Study Program[1]
Faculty of Engineering[1]
sulistiyanto@ymail.com

Ranu Setyobudi
Electrical Engineering Study Program[1]

Tijaniyah
Electrical Engineering Study Program[1]

[1]University of Nurul Jadid
1 K.H. Zaini Munim, Probolinggo, Indonesia, 67291

✉**Corresponding author**

Abstract

Carp is a type of consumption fish that is much favored by people in Indonesia, because Carp has a lot of protein and meat with good taste. In addition, Carp can be cultivated using tarpaulin ponds, because it saves land and land rental costs. In addition, Carp can be harvested in just 7 months. According to carp cultivators, market demand tends to increase every day, making the need for carp increase and causing Indonesian people to cultivate carp. In this case, it is necessary to apply technology that can help the community in the field of aquaculture, which can be controlled remotely and can monitor the condition of the water in the ponds. The purpose of this study is to find out how pool water filtration works and monitor water conditions using a Total Dissolved Solids (TDS) sensor. The selection of sensor inputs and set point values must be in accordance with the water quality conditions in the Carp pond. The use of the TDS sensor here functions as a detector for turbidity values in Carp ponds that have been set on the NodeMCU ESP32, a submersible water pump as output and the Blynk application as monitoring. The method used, Literature Study, Research Design, Field Study, Functional Testing, Data Processing, Analysis. Because it uses Internet of Thing (IoT) technology in this study, the monitoring and filtering control process can be done anywhere and anytime as long as it is connected to the internet network. From the results of testing the tool on 3 types of water, namely mineral water, clean water, and turbid water, the results for turbid water with 400–600 ppm turned out to be 479 ppm, the value is in the middle between 478 ppm mineral water and 480 ppm clean water. So, it can be concluded that this tool works well and can be used in Carp ponds.

Keywords: Carp, pool, monitoring system, filtering, sensor, TDS, Microcontroller, NodeMCU ESP32, Blynk, IoT.

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1. Introduction

The rapid development of technology is widely used by humans to facilitate their daily work. The application of technology really helps humans in fields such as agriculture, economics, fisheries and others. By implementing various technologies that can shorten and simplify the results of the business being carried out at this time, technological developments make it very possible to use the internet to be able to control on a remote scale [1, 2].

Carp is a consumption that is much favored by the people of Indonesia, because carp has a lot of protein and meat with a delicious taste. According to carp breeders, market demand is increasing every day for the need for carp and causing people to cultivate carp. Carp farming does not require large areas of land and a fairly high stocking density so that it grows quite fast [3, 4].

In cultivating fish, there are bound to be obstacles, as well as in cultivating carp. The volume or quality of pond water is a benchmark for the success of a fish farming business. The condition of the pond water that does not meet the size that will have an impact on fish yields. Pond water with a high level of turbidity causes the failure of carp farming. Not only the turbidity of the pond water, the temperature of the water also affects the death rate of carp, the quality of the water greatly influences the cultivation of carp so that in carp cultivation monitoring the quality of pond water and filtering fish pond waste is very important to do. Lack of understanding of incorrect water levels can affect yields in fish farming, pond water that is cloudy and unsuitable will cause stress and make fish susceptible to disease, causing many carp to die so that cultivators suffer losses [5].

Youth from Sidodadi paiton probolinggo village formed a carp farming group under the auspices of the village head of Sidodadi, Ppaiton sub-district, Probolinggo district. From the start of sowing carp seeds to the forty days of the harvest process, the cultivators experienced many difficulties starting from draining the water which was still manual, so the carp cultivators had to drain the dirty water every two weeks so that the carp were not susceptible to disease and resulted in fish dying.

In a study entitled Implementation of the Fuzzy Method on Goldfish Pond Water Quality Based on Water Temperature and Turbidity. Here only use a control system that functions as a controller for pool water disposal. as well as using a monitoring system for the quality of turbid water and can filter pool water [6].

Based on this, i aim to design and build a water quality monitoring and filtering system for mas pond water based on turbidity based on the Internet of Things (IoT) with a tds sensor. This aims to make it easier for carp cultivators and carp yields not to fail. This water quality monitoring system tool and pool water filtering can be controlled in real time by changes in pool water quality values [4, 7].

2. Materials and methods

2. 1. NodeMCU ESP32

ESP32 is one of the microcontroller families introduced and developed by Espressif Systems. ESP32 is the successor to the ESP8266 microcontroller. This microcontroller is compatible with Arduino IDE. ESP32 is integrated into a standalone WiFi network as an ESP32 bridge with WiFi and adds Bluetooth Low Energy (BLE) to get a good chip for IoT application systems [8, 9].

2. 2. Sensor TDS

The TDS sensor is a device that detects solid particles in liquids or water. Particles of substances in the form of organic and inorganic compounds. The term dissolved refers to solid particles in water that are smaller than 1 nanometer, the unit is usually ppm (parts per million) or the equivalent to milligrams per liter (mg/L) for measuring chemical mass, i.e. the number of grams of substance. in one liter of liquid. Substances or particles dissolved in water are usually sodium (grams), calcium, magnesium, potassium, carbonate, nitrate, bicarbonate, chloride, and sulfur. These substances can dissolve in water because the places or streams of water contain minerals. Naturally, soil or rock contains different concentrations of minerals, if water flows through the soil or rock, then the water also carries a charge of these particles. This also applies when water flows into areas polluted by waste, then consumed by humans, harmful particles are also carried into the water [10, 11].

Naturally, soil or rock contains different concentrations of minerals, if water flows through the soil or rock, then the water also carries a charge of these particles. This also applies when water flows into areas polluted by waste, then consumed by humans, harmful particles are also carried into the water [12–14].

According to WHO (Word Health Organization), the mineral content of water does not affect health, even though the diving water is still relatively fresh, WHO sets standards for dissolved solids in drinking water which are divided into several level criteria, as in **Table 1**.

Table 1
Dissolved solid content

Content dissolved in water (mg/L)	Water taste assessment
<300	Very good
300–600	Good
600–900	Clean/drinkable
900–1200	Bad
900–1200	Dangerous

2. 3. Blynk App

Blynk App is an application designed for the Internet of Things. This application is able to control hardware remotely [15].

There are 3 blynk platforms provided, namely:

a) Blynk App, functions to create application projects using a variety of widgets that have been provided. However, the limit for using widgets in one account is only 2000 energy. This energy can be added by buying it via playstore;

b) Blynk server, functions to handle projects on blynk app and communicate between smartphone and hardware which are made. Blynk server (Blynk Cloud) can be used online local network and is open source;

c) Blynk libraries, serves to facilitate communication between hardware with servers and the entire process of command input and output. This research is designed to improve water quality in carp ponds by maintaining 400–600 ppm and can be monitored remotely.

2. 4. Work System Flowchart

The workflow design of the tool can be seen in **Fig. 1**.

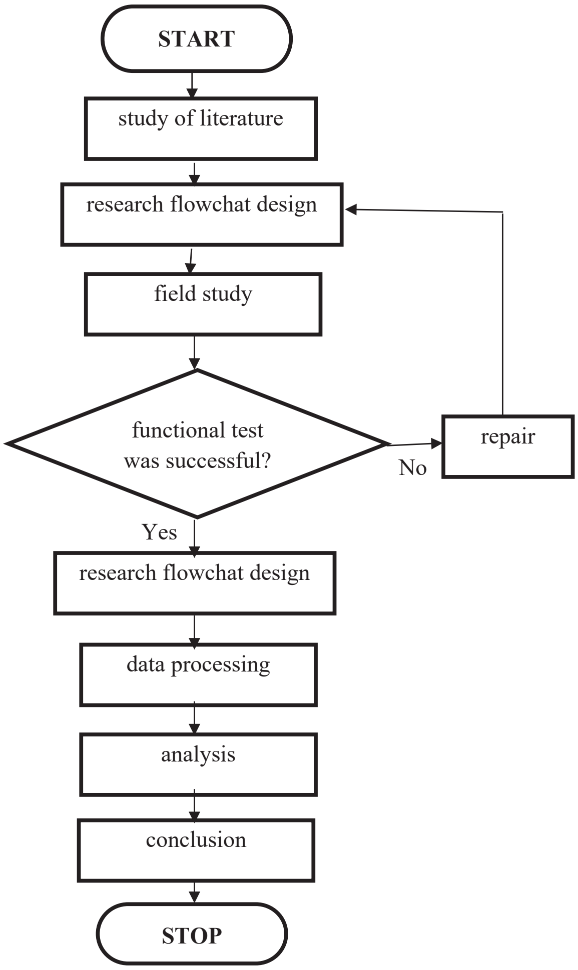


Fig. 1. Research Flowchart

With the following details, the TDS sensor is placed in the pool water to simultaneously assess the water quality. The value generated by the TDS sensor will be sent to NodeMCU. After receiving a report from the sensor, it will immediately instruct the Blynk application to display the value sent by the sensor. When the quality of the pool water produced by the TDS sensor is cloudy, the water pump will automatically turn on to filter the pool water until the pool water is good enough, with that it is possible to find out the water quality in catfish ponds via a smartphone remotely (**Fig. 2**).

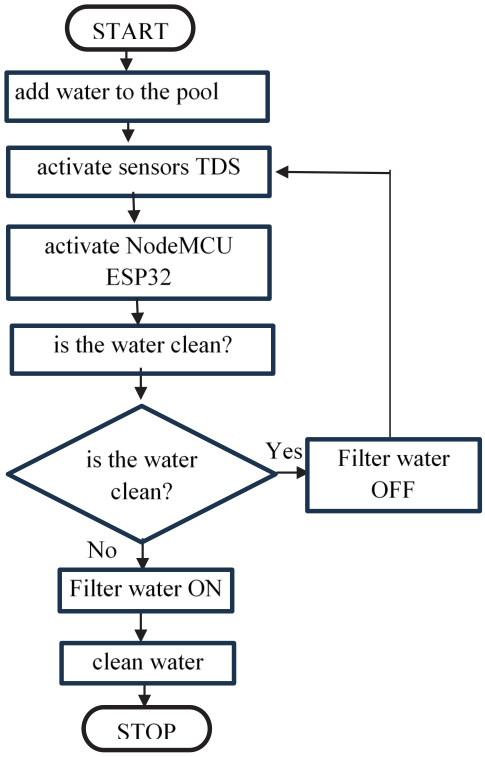


Fig. 2. Work System Flowchart

With a TDS sensor placed in the pool water to assess water quality simultaneously. The value produced by the TDS sensor will be sent to the NodeMCU. After receiving the report from the sensor, it will immediately command the Blynk application to display the value that has been sent by the sensor. When the quality of the pond water produced by the TDS sensor is murky, the water pump will turn on automatically to filter the pond water until the pond water is good enough, so it is possible to find out the water quality in the carp pond via smartphone remotely.

2. 5. Carp pond mechanical design

Make a pond design using a water quality monitoring system and filtering carp pond water based on turbidity based on the internet of things (IoT) with a TDS sensor, can be seen in **Fig. 3**.

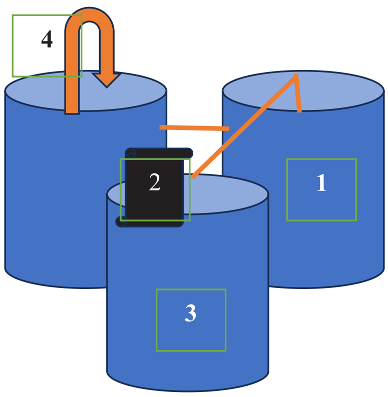


Fig. 3. Mechanical design of carp ponds

Information:
1. Pond as a place for carp.
2. Filter to filter water.
3. Panel as a cover for the controller.
4. TDS sensor as a detector for cloudy water.

2. 6. Overall Wiring Figure

Overall a series of components for TDS sensors, NodeMCU, Arduino ESP 32 with IoT can be described as shown in **Fig. 4**.

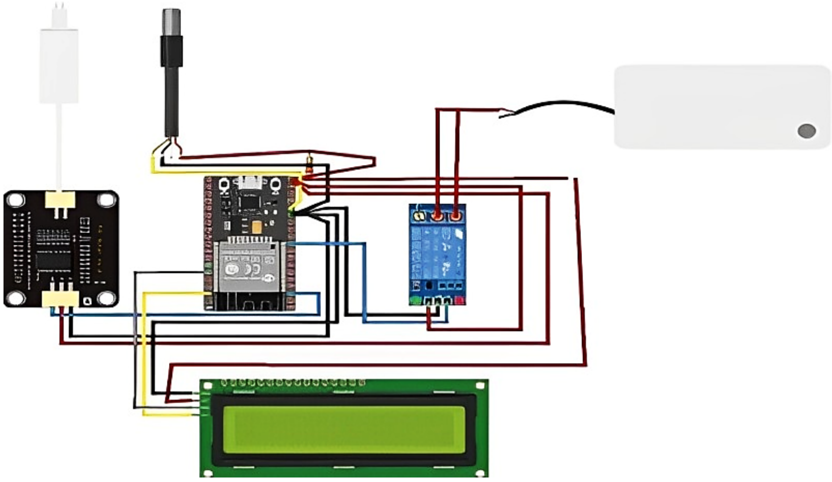


Fig. 4. Overall wiring

2. 7. The purpose of testing

The aim of this test is to determine the accuracy of the water TDS sensor reading by comparing it with a TDS measuring instrument. The sensor will be tested by taking clean water and dissolved pool water. This test will take samples 3 times. There are three types of water from which data will be collected, namely mineral water, water from pools that are still clean and pool water that is cloudy or dirty. In testing the TDS sensor, pool water data will be taken with a value of 0–600 Ppm.

This study will discuss data that has been taken in the field for analysis and data collection is carried out in a way that refers to the design of a water quality monitoring system and filtering catfish pond water based on turbidity based on the Internet of Things (IOT) with a TDS sensor and measuring directly with a tool. measure in the field. The purpose of testing and analyzing the design of a water quality monitoring system and filtering gold fish pond water based on turbidity based on the internet of things (IOT) with a TDS sensor is to determine the success of the program or tool that has been designed.

3. Results and discussion

3. 1. Purpose of Data Collection

The purpose of data collection is to find out the correctness of the work of the circuit and the operation of the water quality monitoring system and filtering of gold fish pond water based on turbidity based on the Internet of Things (IOT) with a TDS sensor. This test includes testing the turbidity sensor (TDS) and testing how the pool water filter works.

3. 2. Data Collection

Data collection from the water quality monitoring system and filtering of gold fish pond water based on turbidity based on the Internet of Things (IOT) with the TDS sensor is only carried out 4 times in 1 month. Which is located in the village of Sidodadi Paiton, Probolinggo.

3. 3. Tools and Materials

Data collection on the design of a water quality monitoring and filtering system for carp pond water based on turbidity based on the Internet of Things (IOT) with a TDS sensor only requires a few observations so it doesn't require a lot of equipment. The equipment used is as in **Table 2**.

Table 2
Materials Used

No.	Hardware and software	Information
1	NodeMCU ESP32	microcontroller
2	Sensor TDS	Water Turbidity Detector
3	Relay	As a trigger between arduino and output
4	Kabel jumper	Connect components
5	Blynk	Display monitoring Intenet of Things
6	Pompa air	As a water filter

The purpose of this test is to find out the accuracy of the water TDS sensor reading by comparing it with the TDS measuring instrument. The sensor will be tested by taking clean water and pool water that has been dissolved, this test will be sampled 3 times. The results of test 1 are shown in **Table 3**.

Table 3 TDS sensor trial results from pool water data collection of 3 types of the same pool water at 0–200 ppm.

Table 4 TDS sensor trial results from pool water data collection of 3 types of the same pool water at 200–400 ppm.

Table 3
Water 0 – 200 Ppm

No.	Result of water trial 0–200 ppm	Result data on LCD	Result data on blynk
1	Experiment 1	83 ppm	83 ppm
2	Experiment 2	85 ppm	85 ppm
3	Experiment 3	85 ppm	85 ppm

Table 4
Water 200–400 Ppm

No.	Result of water trial 200–400 ppm	Result data on LCD	Result data on Blynk
1	Experiment 1	333 ppm	333 ppm
2	Experiment 2	330 ppm	330 ppm
3	Experiment 3	332 ppm	332 ppm

Table 5 TDS sensor trial results from pool water data collection of 3 types of the same pool water at 400–600 ppm.

Fig. 4 is the display result on the smartphone device and the LCD screen for the results of the 0–200 ppm water test.

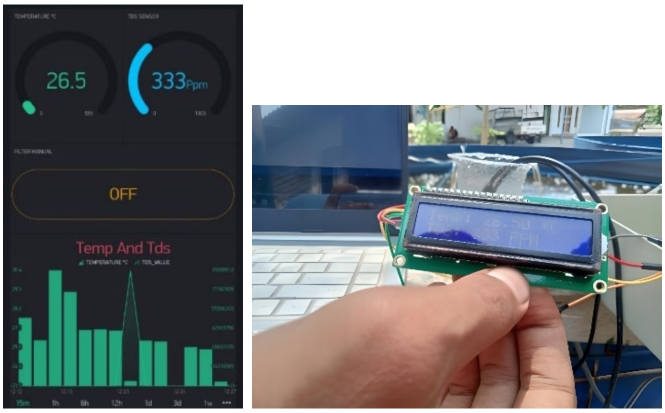
Table 5
Water 400–600 Ppm

No.	Result of water trial 400–600 ppm	Result data on LCD	Result data on Blynk
1	Experiment 1	478 ppm	478 ppm
2	Experiment 2	480 ppm	480 ppm
3	Experiment 3	479 ppm	479 ppm

a *b*

Fig. 5. Display of Water Trial Results 0 – 200 ppm: *a* – Display on smartphones;
b – Display on the LCD Screen

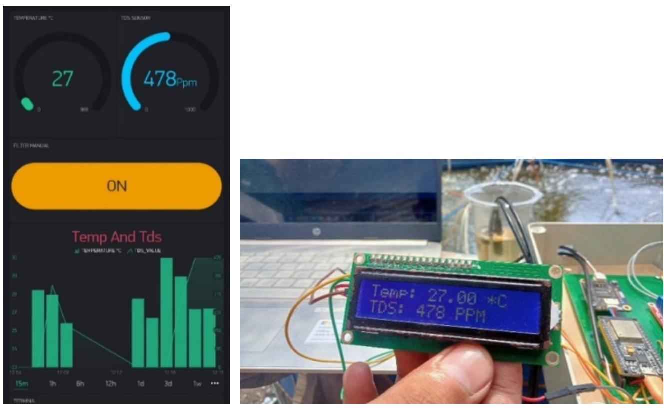
Fig. 5 is the display result on the smartphone device and the LCD screen for the results of the 200 – 400 ppm water test.



a *b*

Fig. 6. Display of Water Trial Results 200–400 ppm: *a* – Display on smartphones;
b – Display on the LCD Screen

Fig. 6 is the display result on the smartphone device and the LCD screen for the results of the 400–600 ppm water test.



a *b*

Fig. 7. Display of Water Trial Results 400 – 600 ppm: *a* – Display on smartphones;
b – Display on the LCD Screen

4. Conclusions

The TDS sensor reading is functioning well, this has been proven that the water turbidity can be read by the TDS sensor which will automatically turn on the relay and pump according to the program created so that it can make the water clearer up to the standard limit for water turbidity. The use of IoT can display results on the LCD that are the same as the values on the cellphone layer, where in the mineral water test setting 0–200 ppm the average result was 84.3. Meanwhile, for setting clean pool water at 200–400 ppm, it is possible to obtain an average result of 331.67 ppm. The results for testing turbid water with 400–600 ppm average value is 479 pm. So, it can be concluded that this tool functions well and can be used in goldfish ponds. When the TDS sensor reaches the setpoint, the filtering system will automatically turn on.

Conflict of interest

The authors declare that they have no conflict of interest with respect to this research, whether financial, personal, authorial or otherwise, that could affect the research and results presented in this paper.

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Data availability

Data cannot be provided for reasons disclosed in the data availability statement.

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Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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