International Journal of Software Engineering and Informatics
Vol. 1, No.1 March 2023 Pp 1-10.
ISSN: xxxx xxxxx,

ANALYSIS OF GSM (GLOBAL SYSTEM FOR MOBILE) WORK SYSTEM ON GSM POS PROTOCOL (PRODUCT OF AUTOMATIC FEED CATFISH POND MONITORING TOOL BASED ON GLOBAL SYSTEM FOR MOBILE)

Tahta Herdian Andika[1], Dwi Feriyanto[2], Panji Bintoro[3], Dwi Yana Ayu Andini[4]

[1,2,3] Universitas Aisyah Pringsewu, Indonesia
[1]Tahta.herdian.a@aisyahuniversity.ac.id,[2]dwiferiyanto@aisyahuniversity.ac.id,[3]panjibintoro@aisyahuniversity.ac.id,[4] dwiandini983@aisyahuniversity.ac.id

Article Info

Keywords:

GSM
PH
Temperature
Turbidity
LCD

ABSTRACT

Water quality is one of the important factors for a person's success in conducting fishery cultivation. Water content that is too acidic or alkaline, turbidity level, and water temperature that is too high can cause fish death. In addition, fish must be fed regularly and on time. Therefore, a tool was created that functions to automatically feed and control or maintain pond water quality to prevent death in fish, namely the GSM POS PROTOCOL (Global System for Mobile-Based Automatic Feeding Catfish Pond Monitoring Tool Product). The GSM POS PROTOCOL requires components in the form of an RTC (Real Time Clock) sensor, a water ph sensor, a turbidity or turbidity sensor, and a temperature sensor to obtain water quality report data. Apart from sensors, this tool requires a GSM to send messages and an LCD (Liquid Crystal Display) as a screen to display water quality information. Based on the test results, this tool reads the pH of pool water with a value of 7.09-8.07, a temperature of 25.06°C-26.73°C, a turbidity level of 6NTUs-40NTUs, and has a message-sending delay rate with an average of 18.17 seconds. It can be concluded that this tool has a fairly high level of accuracy, and the fish feed works according to the commands entered in the program.

Author Correspondence:

Tahta Herdian Andika ,
Software Engineering Study Program,
Aisyah Pringsewu University, Indonesia
Email: tahta.herdian.a@aisyahuniversity.ac.id

1 INTRODUCTION

In the opportunity to develop the fisheries business, Indonesia has very high prospects. In the economic potential of marine and fisheries resources that can be utilized for media, economic growth is estimated to reach USD 82 billion per year. The volume and production value for each leading commodity of aquaculture from 2010-2014 increased, consisting of (1) Shrimp experienced an average increase per year of 14.03%; (2) Grouper experienced an average annual increase of 9.61%; (3) Bandeng experienced an average annual increase of 10.45%; (4) Patin experienced an average annual increase of 30.73%; (5) Tilapia experienced an average annual increase of 19.03%; (6) Goldfish experienced an average annual increase of 14.44%; (7) Catfish experienced an average annual increase of 26.43%; (8) Gurame experienced an average annual increase of 17.70%; and (9) Seaweed experienced an average annual increase of 27.72%[1][2].

A pond is a land that is made to hold a certain amount of water so that it can be used for the maintenance of fish or other aquatic animals. P there is a freshwater pond is an artificial pond that is usually filled with river water or water filling that uses fresh water so that it can be used as a medium of aquatic biota life, especially in terms of fisheries cultivation.

Monitoring pond water quality in fish farming is currently still mostly done manually by directly measuring water quality in aquaculture ponds, this is very ineffective and requires a very long time, and is inefficient.

Fish farming activities must pay attention to several parameters that affect the quality of water used for aquaculture so that it will improve the quality of fish production. This is fish farming, many farmers do not understand how the factors that cause fish to die suddenly for example water turbidity levels, high water temperature increases, and the presence of toxic substances in pond water. So an integrated water quality monitoring system is needed that can reach the parameters needed simultaneously at one time (*real-time*) to maintain the quality of fish production.

Catfish is a type of fish that can survive and breed in water conditions that lack oxygen and low pH levels because catfish in general have additional respiratory organs called *arborescent cells*. This is what causes catfish to survive in waters where oxygen levels are only 2-3 mg / L, low pH conditions are up to 2-4, and high ammonia levels are up to 0.5-1 mg / L. The advantages of catfish include the ability to reproduce more eggs, reaching 60,000 eggs with a degree of hatching eggs > 90, and the average length of catfish fry aged 26 days can reach 3-5 cm [3].

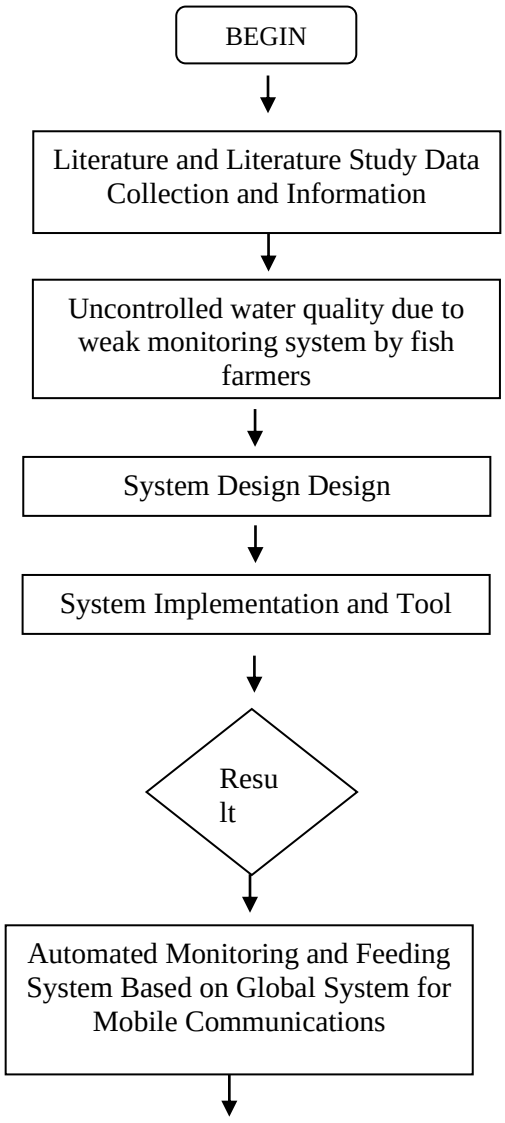
So based on the background above, the author wants to design a system that can monitor the ph, turbidity of the water, and water temperature and even regulate feeding to fish automatically. This system can be implemented in aquariums or freshwater fish farming tubs/ponds. So making this automatic system uses ph, turbidity, and temperature sensors as a pool water monitor. While feeding by automatically using RTC (*Real Time* Clock) sensors and servo motors. In data processing using a microcontroller from Arduino Uno[4][5].

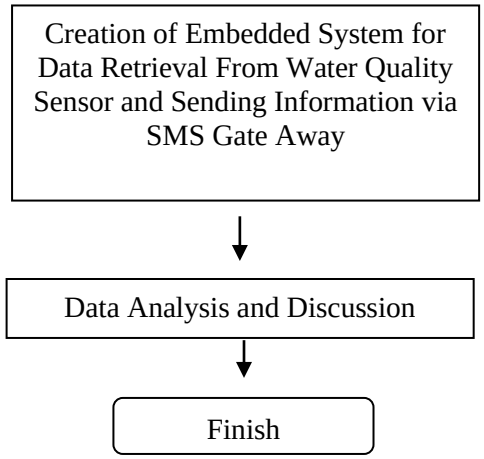
The innovation in this study is how to monitor a condition in a fish pond using a remote system, so the author designed a POS GSM PROTOCOL tool to help farmers. Information on the condition of the water will be displayed on the LCD camera and will also be sent by *the user* (owner). In certain data that is the limit on ph, turbidity, and temperature, in addition to information that will be sent automatically using a short SMS (*Short Message Service*) to the owner as a notification, the system will also provide fish feed automatically.

The purpose of designing this product is: (1) To provide information or early warning if there is a change in water quality. (2) To monitor water quality in catfish ponds using an SMS system. (3) To ensure fish feed is given in *real-time*. (4) To facilitate farmers in monitoring the condition of the pond[6].

2 RESEARCH METHODS (10 PT)

This research method uses qualitative methods with a frame of mind as presented in Figure 1.





2.2 Literature Study

This literature study is a method of seeking understanding in analyzing information on object phenomena through a related question, how and why it can happen. The following literature study was used in this study[7]:

a. Literature Study
b. Guidance Studies
c. Field Studies

2.2.1 System Design Design

Design of hardware and software systems that will be used in this study.

2.2.2 System Implementation

Hardware and software that have been designed will be implemented to find out whether the system is by the design.

2.2.3 Tool Testing

If the system implemented is by the design, the next step is to test the tool. The purpose of testing this tool is to find out whether the performance of the tool is designed accordingly or not.

2.2.4 Data Collection

In testing the tool is carried out, the stage to be carried out is the collection of data to achieve information from the tool used as achieving the objectives of the research.

2.2.5 Data Analysis and Discussion

Data analysis and discussion is the final stage in research, so this stage will get the results of the data processing that is studied and discuss whether the data is by the values and characteristics that have been determined.

2.3 Data Collection Methods

This method with the collection of embedded system design data is divided into 3 stages, namely[8][9:

2.3.1 Literature study

This literature study is the first stage in data collection which includes searching and learning library materials related to all problems regarding system design. In this study, researchers spread information from previous researchers as a comparison material, both in terms of the disadvantages and advantages of each study

2.3.2 Design

At this stage, the Automatic Feed Catfish Pond Monitoring Tool Product is based on *the Global System for Mobile* (POS GSM PROTOCOL) and the design of a series of components used in the embedded system.

2.3.3 Testing

This stage is the last, namely testing the tool to get results that are following the purpose of making this system.

2.4 Analysis Methods

The analysis method is the stage where the process of testing data that has been studied and processed to get conclusions. The test data is used for analysis obtained from testing several components, namely the display results on the LCD, testing the solution response on the pH sensor, testing the humidity response on the water temperature sensor, testing the turbidity response on the turbidity sensor, testing the time accuracy response on the RTC sensor, testing the motion response time of the Servo Motor, testing the response time on the GSM sensor in sending messages.

2.5 Measurement Methods

The measurement method is a stage used to obtain some data on the system that has been created. Measurement methods in embedded POS GSM PROTOCOL systems include:

a. Measurement testing on LCD and LCDs will display information periodically during the use of *monitoring* and feeding equipment is being used.
b. Testing measurements on pH sensors regarding detectable, responsiveness in water that will later be responded to by the sensor.
c. Testing measurements on water temperature sensors regarding detected, responsiveness in water which will later be responded to by the sensor.
d. Testing measurements on turbidity sensors regarding detected, responsiveness to water which will later be responded to by the sensor.
e. Testing measurements on RTC sensors regarding detection, and responsiveness to water that will later be responded to by the sensor.
f. Testing measurements on servo motors regarding the responsibility of the actuator to which the component will later respond.
g. Testing measurements on GSM regarding responsibility in sending messages that will later be responded to by gadgets.

2.6 System Design

2.6.1 Identify Needs

The design of a tool that will be made needs to be considered with all the needs and equipment that will be needed. So this needs to be used in the form of components that function in the compiler and support. These needs include:[10] :

a. Requires *power supply input* in running this embedded system circuit.
b. Requires *input* components as the process of executing the main commands in the system to be created.
c. Requires components that display information on the LCD screen as a result of water quality measurement and feeding.
d. Requires a microcontroller that is used to process the programming code data in the embedded system circuit.
e. Requires an actuator for feeding fish in the pond.
f. Requires a GSM component that provides information to the owner of the pool with the *SMS Gateway* mechanism.

2.7 Needs Analysis

In the next stage, if you have identified the needs above, the needs of the system made can be obtained, including:

a. Using a 9 Volt 2 Ampere *power supply*.
b. It uses Ph Module MSP340, RTC DS3231, Turbidity, and DS18B20 as input to run the main system of the created tool.
c. Using a 20x4 LCD with a 12C chip as a viewer whether water quality information and feeding the tool is detected running or not in the pond.

d. It uses Arduino Uno R3 as a procedure and storage of programming code used in embedded system circuits.
e. Using a servo motor as a mechanical component in the feed valve drive aims to deliver feed within a predetermined time.
f. Use GSM as information provided to the owner to get notifications of a message related to information on the pool.

2.8 Block diagram System

This section is a description of the block diagram of the formed system. The system to be formed is an embedded implementation of the POS GSM PROTOCOL system based on Arduino Uno R3.

Is a block diagram designed to build an embedded POS GSM PROTOCOL system that has a *power* supply of 9 Volt 2 Ampere as a voltage supply in the circuit? The circuit has Arduino Uno R3 input, MSP340 Ph Module Sensor, DS3231 RTC Sensor, Turbidity Sensor, DS18B20 Water Temperature Sensor, Servo Motor, and 20x4 and GSM LCD outputs as message information.

The sensors used are pH sensors, turbidity sensors, and water temperature sensors, used for water quality monitoring in fish ponds. The information data to be measured in water will then be displayed on the LCD screen. The RTC sensor is used as a timer to display the day, date, and time and feed that has been determined, at that time the actuator or servo motor will move to open the valve to feed the fish and will be displayed on the LCD screen. GSM components are used as if the owner cannot *monitor* nearby then the system will send a message to the owner in the form of predetermined information.

2.9 Hardware Design

At the hardware design stage, it is to use *wiring circuit diagrams* that are used to facilitate the creation of systems so that they can be integrated between other components so that the system collaborates with the given program. Here is the series of *wiring diagrams* used:

a. *Wiring* Ph circuit diagram
b. *Wiring* circuit diagram Water temperature
c. *Wiring* Turbidity circuit diagram
d. *Wiring* RTC circuit diagram
e. *Wiring* diagram of GSM circuit
f. *Wiring* servo motor circuit diagram
g. *Wiring* LCD circuit diagram
h. *Wiring diagram* of the whole circuit

3 RESULTS AND ANALYSIS

Results and Discussion

Table 4.1. Results of the Time Delay Experiment

Sample Experiment	Time Delay
1	19 Second
2	20 Second
3	19 Second
4	18 Second
5	18 Second
6	18 Second
7	18 Second
8	18 Second
9	17 Second
10	18 Second

11	16 Second
12	17 Second
13	17 Second
14	18 Second
15	18 Second
16	18 Second
18	20 Second
19	20 Second
20	20 Second
21	19 Second
22	20 Second
23	17 Second
24	18 Second
25	17 Second
26	18 Second
27	18 Second
28	17 Second
29	18 Second
30	18 Second
Average Waktu *Delay*	**18.17 seconds**

Table 4.2. Water quality Display Results on LCD screen

Reading	**LCD Display**				**Condition**
	PH	**Water temperature**	**Turbidity**	**RTC**	
1	7.09	25.26^{0}C	34	21-07-2022	Unreadable
2	7.28	25.25^{0}C	30	21-07-2022	Unreadable
3	7.41	25.20^{0}C	26	21-07-2022	Unreadable
4	7.47	25.26^{0}C	23	21-07-2022	Unreadable
5	7.87	25.06^{0}C	21	21-07-2022	Unreadable
6	7.50	25.19^{0}C	21	21-07-2022	Unreadable
7	7.63	26.26^{0}C	21	21-07-2022	Unreadable

8	7.77	26.69^{0}C	24	21-07-2022	Unreadable
9	7.61	26.50^{0}C	20	21-07-2022	Unreadable
10	7.77	26.63^{0}C	18	21-07-2022	Unreadable
11	7.77	26.63^{0}C	17	21-07-2022	Unreadable
12	7.75	26.63^{0}C	14	21-07-2022	Unreadable
13	7.10	26.63^{0}C	13	21-07-2022	Unreadable
14	7.74	26.63^{0}C	8	21-07-2022	Unreadable
15	7.69	26.63^{0}C	6	21-07-2022	Unreadable
16	7.82	26.69^{0}C	16	21-07-2022	Unreadable
17	7.72	26.73^{0}C	25	21-07-2022	Unreadable
18	8.73	26.66^{0}C	40	21-07-2022	Unreadable
19	7.58	25.96^{0}C	19	21-07-2022	Unreadable
20	7.80	25.96^{0}C	18	21-07-2022	Unreadable
21	8.07	26.73^{0}C	18	21-07-2022	Unreadable
22	7.85	26.66^{0}C	18	21-07-2022	Unreadable
23	7.77	26.73^{0}C	11	21-07-2022	Unreadable
24	7.77	25.96^{0}C	13	21-07-2022	Unreadable
25	7.93	26.66^{0}C	18	21-07-2022	Unreadable
26	7.77	25.94^{0}C	11	21-07-2022	Unreadable

27	7.88	25.96^{0}C	13	21-07-2022	Unreadable
28	7.88	25.69^{0}C	11	21-07-2022	Unreadable
29	7.93	26.50^{0}C	15	21-07-2022	Unreadable
30	7.69	26.50^{0}C	14	21-07-2022	Unreadable

4.1.1 Arduino IDE

Implementation of Arduino IDE in this tool by entering programs or commands on the Arduino Uno microcontroller, MSP340, DS3231, Turbidity, and DS18B820 with Arduino IDE software. If the writing of the program is following the board used, then the program can be executed properly. Before being executed, the program must first be compiled or checked. If it is not appropriate or there is an error then there is an error warning in the program that is designed and immediately corrected, if the program is appropriate and there are no errors then the program can be executed and uploaded to the Arduino Uno microcontroller. The results of the program according to or not with the desired results can be seen on the serial monitor owned by the Arduino IDE software.

The following is a program to calibrate a pH sensor to determine a pH of 7 which is normal water by shorting the circuit of a pH sensor to find the lowest normal number in the program for calculation in determining alkaline pH.

Figure 4.1. PH Measurement Results

Figure 4.1 Results of a serial pH sensor monitor using Arduino IDE Here is a result that has been done in the program description above to find the lowest value in a pH sensor, the value is said to be for a normal pH value of 7.

Before entering the Ph4 value, test first on the water to find the value in the program to perform a calculation of the pH step and pH voltage. It is a program on the sensor to calculate the pH of water with program input to determine a pH step of water by calculation, namely (voltage pH4 - voltage pH7) (pH7 - pH4).

Figure 4.2 Serial monitor results on a pH sensor

Is the result of a program on a water pH sensor with an Analog to Digital Converter (ADC) pH value, pH voltage, and pH liquid value.

It is a program to determine the temperature in water by finding the temperature value at the temperature of the water. In the sensor.requestTemperatures code, the value data issued is a digital number. The data to be displayed at the output is what temperature data temperature °C.

Figure 4.3 Monitor serial results from a temperature sensor

Based on the results obtained on the serial monitor to find a value in water temperature in real-time, a sensor will be inserted in the catfish pond to monitor the pond temperature.

Is a program aimed at measuring turbidity in ponds The program is above 25 Nephelometric Turbidity Units (NTU) then it is diagnosed that the water is clean, if the range of NTU numbers is more than 10 to less than 30 then it is diagnosed that the water is turbid, if the range of NTU numbers reaches more than 80 then it is diagnosed that the water is dirty.

Figure 4.4 Serial monitor results from turbidity sensor

Based on a serial monitor result on the Arduino IDE, a turbidity sensor by inserting the sensor into the water by finding the cleanliness value of the pool water by showing the results that have been set in the program.

It is a program created to inform the owner to know a Day, Date, and Time. And the program is also arranged for servo motors so that at certain times they will be given to catfish and can check the air temperature.

Figure 4.5. Monitor serial results from RTC sensors

Is the result of a serial monitor that shows the Day, Date, and Time as well as the temperature that has been set in the program.

Is a program designed to be able to connect to GSM used to catfish pond owners. To configure the GSM card that has been inputted.

Figure 4.6. Serial monitor results on GSM configuration

Based on the results of the programmed serial monitor, it will show the results if it is connected to the connected gsm, the serial monitor will display the SIM800L O.K.

Is a program made to be able to send a message to the owner of the cellphone with predetermined information. By typing the letter "s" on the serial monitor to send a message. That the designed program is already functioning properly so that it can send messages that have been programmed and the number to be addressed when sending messages.

Figure 4.7. Is the result of a serial monitor sending messages using GSM

Based on the results of the serial monitor which shows that the message sent to the user is sent, the message will reach the owner of the cellphone

4 CONCLUSION (10 PT)

Based on the results of research and discussion, there are conclusion points, namely:

1. This tool is called POS GSM PROTOCOL which stands for GSM (*Global System for Mobile)* based Fish *Pond Monitoring* Tool Product.
2. This tool works according to the commands given by the fish breeder.
3. Based on the experiments conducted, the average result of the delay in sending messages is 18.17 seconds.
4. From 30 experimental *sample* results carried out obtained water quality measurement results that are quite stable or not much different values from one experiment and another.

BIBLIOGRAPHY

[1] Andrianto, Heri and An Dermawan. 2016. Arduino Fast Learning and Programming. Informatics, Bandung.

[2] Vidyapu, S., Vedula, V. S., &; Bhattacharya, S. 2020. Weighted Voting-Based Effective Free-Viewing Attention Prediction on Web Image Elements. Interacting with Computers, 32(2), pp. 170-184.

[3] Duski Saad Harahap . 2020. Thesis "AUTOMATIC FISH FEEDING MONITORING SYSTEM USING ARDUINO-BASED HC-SR04 SENSOR WITH SMS CONTROL SYSTEM". University of North Sumatra, Medan.

[4] Singh, B., Ranjan, K. S., &; Aggarwal, D. 2020. Smart voting web-based application using face recognition, Aadhar and OTP verification. International Journal of Research in Industrial Engineering, 9(3), pp. 260-270.

[5] Wayan Eka Prastia1, Wayan Arta Wijaya, Wayan Sukerayasa. Journal of SPEKTRUM Vol. 6, No. 1 March 2019. Design groundwater level monitoring in peatland plantations using SMS as a microcontroller-based data information sender. Electrical Engineering, Udayana University Bali.

[6] Hermansyah., E. Derdian, F.T. Pontia. 2017. Design a Water pH Controller for Catfish Farming Based on Atmega 16 Microcontroller. Journal of Electrical Engineering Universitas Tanjungpura 2(1): 1-13.

[7] Lintang et al., 2017.Water Quality Monitoring System in Fish Ponds Based on Wireless Sensor Network Using Zigbee Communication. SNATIVE Proceedings. Holy Muria University . Holy. 145-152.

[8] Eberspacher, J and friends. 2009. GSM – Architecture, Protocols and Services Third Edition. John Wiley & Sons.

[9] S. Yudho and T. Koerniawan, "Energy and Electricity: Scientific Journal of Off-Grid Shs Energy Monitoring Applications Using Energy and Electricity Lora: Scientific Journal," vol. 13, no. 1, pp. 26–32, 2021, doi : 10.33322/energi.v13i1.1149.

[10] Soegoto, E. S., &; Sani, R. 2018. Development of Information Technology Structural Scheme For Monitoring Business Process. In IOP Conference Series: Materials Science and Engineering, 407(1), p. 012001.