Water PH Monitoring and Fish Feed Scheduling Device for Aquarium with ATMEGA and SMS Gateway

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Abstract: Automated technologies need to be applied in terms of manual work performed by humans including monitoring on pets, one of that is fish. The problem happening is monitoring the fish manually will not be maximal if the keepers are traveling. Beyond the feed quality, feed on the pH level of the timely water will affect the health of the fish. Automated fish feed and water pH monitoring are very important because it benefits fish keeperss and health. This research provides a solution to monitor water pH and Fish Feed automatically using ATMEGA 2560 and SMS Gateway. The fish watcher will automatically feed you when it fits the fish feeding schedule and when the water pH level does not match or feed the fish is low, the alarm will ring and the device will send a message to the fish keepers.

Keywords: Fish, Feed Monitoring, measurement of water pH, SMS Gateway, ATMEGA 2560

I. INTRODUCTION

In maintaining water quality and availability of fish feed is very important. Potential water Hydrogen (pH) lower than 5.0 causes mucus to become frozen in fish so that fish will suffocate while acidity level higher than 9,0 will cause fish not to have appetite (Rukmini, 2013). pH is one of the most common water quality tests performed. pH indicates the sample's acidity but is actually a measurement of the potential activity of hydrogen ions (H+) (Rukmini, 2013; R.Suchitra et al., 2016) in the sample. pH measurements run on a scale from 0 to 14, with 7.0 considered neutral. Solutions with a pH below 7.0 are considered acids. Solutions with a pH above 7.0, up to 14.0 are considered bases. The pH of the water which is used for drinking purpose is always maintained as 7 (L.S.H Soares et al., 2018). Previous research has found that the pH of water that does not fit human needs can affect health (L.S.H Soares et al., 2018).

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Feed is one of the supporting fish farms, where its main function is to feed viability and growth. So that we can provide adequate, timely and sustainable food and quality nutrition and digestion, need to be artificial food (Rukmini, 2013).

The portrayal of eating interactions is crucial for building food nets and understanding the functioning of ecosystems (S. Emaminejad et al., 2017).

Control of water and food should be done regularly. The problem that arises is when the owner of the fish in must leave the house long enough, there is no pH of aquarium water and no control and feed the fish in the aquarium when leaving the house long enough. Then the technology needed to help people who have a hobby of fish can still take care of the fish although far outdoors, that is something that can monitor the condition of water and feed the fish in the aquarium.

II. LITERATURE SURVEY

In the previous study, automatic control of remote has become a lot of subjects for research, due to the speed of change in parameters. Sensor technology is always used to declare one or more sensors inserted into the device. In existing studies, the usable sensor manuscripts have been electrolytes (T. Glennon et al., 2016; W. Gao et al., 2016), metabolites (A. Koh et al., 2016; S. Nakta et al., 2017) and pH measurements (Raghavendra & Naveen, 2016). Microcontrollers are energy-efficient, cost-effective, and high-performance chips manufactured by Silicon Labs, Texas Instruments, Atmel, NXP, and STMicroelectronics and are suitable for almost all application markets. Currently, the CortexM series, Cortex-M0, Cortex-M3, Cortex-M4, and CortexM7, have attracted real attention, especially from industry (R. Suchitra et al., 2016). Microcontroller has its own address space which is called memory. Memory in microcontroller memory consists of program and data memory in which both are a separate, which allows the use of 8-bit memory data, so that it can be directly stored and manipulated by microcontroller with 8-bit access capacity. Program memory is only readable (ROM/EPROM). As for the memory data we can use external memory (RAM).

Ultrasonic Sensors, a blend of acoustic emissions and ultrasonic characterization (T. Kundu, 2014), have been subject to rigorous scrutiny for years and are now on the verge of maturity for real-world engineering applications. It has became notable for developing various structural health monitoring approaches [SHS] (L.S.H Soares et al., 2018; J.L Rose, 2014) in the past decade, and it is important to increase the preference of using acoustoultrasonics that lies at the beginning in the fact that it exploits the advantages of AE and is guided. ultrasonic waves (GUWs) in broad frequency regimes, allowing multi-scale monitoring to accommodate different demands. Acousto-ultrasonics proved cost-effective in attacking the compromise between resolution, detection, practicality and cost, strengthening philosophy.

III. PROPOSED SYSTEM

When the fish keepers feeds the fish manually, there will be a possibility of negligence such as forgetting to feed or when the keepers is traveling, feeding the fish will be neglected. Besides controlling the pH of water should have more knowledge about the water element, not all fish keepers have that knowledge. To facilitate fish keepers, the proposed device aims to control the pH of the water and schedule the feeding of fish automatically. Identify Servo Motor and pH meter kit shield designed for fish feed scheduling and water pH control. Ultrasonic sensors mounted on the device to measure the availability of feed to be displayed on LCDx20. If the feed amount is less than 20% or the water pH level does not match then the device will send a message to the fish keepers in the form of SMS and alarm.

IV. IMPLEMENTATION

Board

Figure 1 shows the device using the Arduino Mega 2560 to store and transmit instructions to each module and is used to monitor the amount of feed existance in the feed tank, while the RTC is used to set feeding schedules of the fish.

Power Adapter

Power adapter used for this microcontroller that is power adapter that has output voltage 5 - 9 volt with 1 amper current power. Power adapter serves to deliver electricity to the required system on built devices.
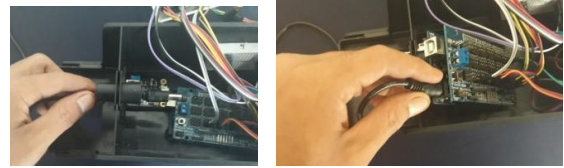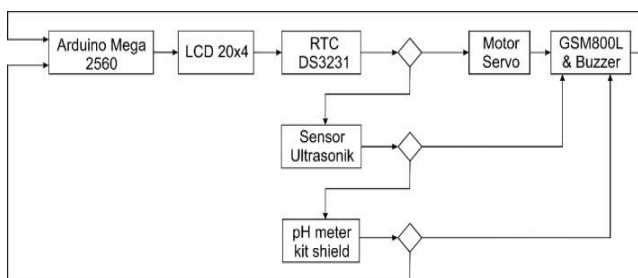

Fig. 2 Power Adaptor

pH Sensor

PH sensor is connected to the jack connector located below pH pipe adapter cable in the box microcontroller. This sensor is used to measure the water hardness in the aquarium.
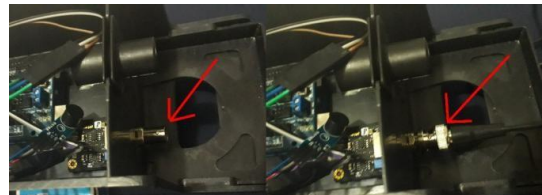

Fig. 3 pH Sensor

LCD 20x4

The 20x4 LCD Connection Circuit uses an additional component of I2C shield soldered on a 20x4 LCD used to adjust the screen brightness and save pins from 16 pins to 4 pins ie SDA, SCL, VCC, and GND. To connect it with Arduino Mega 2560 we can use jumper cable with installation rules in Table 3.1 20x4 LCD Pin Connection.
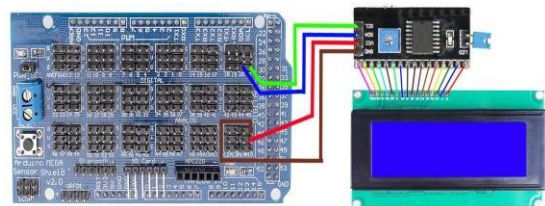

Fig. 4 LCD 20x4

Servo Motor

Servo motor is used to rotate the feed spinner, so that the fish feed will come out in accordance with a predetermined schedule.
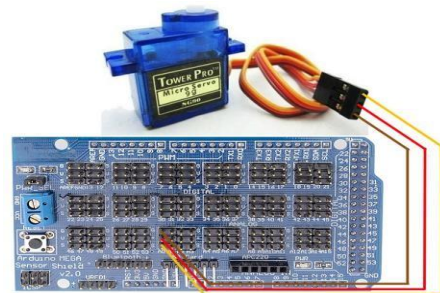

Fig. 5 Servo Motor

Ultrasonic Sensor

Ultrasonic sensor is used to measure the height of the feed in the tank, so that when the feed is running low the ultra sonic sensor will send instructions to another module.
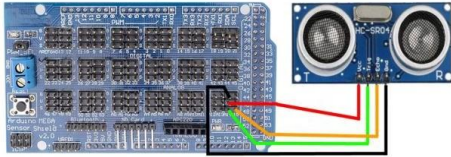

Fig. 6 Ultrasonic Sensor

V. TRANSMISSION OF DATA

When the Arduino 2580 stores the data (time, water pH value and fish feed amount) or receives an input, the data will be displayed on the 20x4 LCD. In order to facilitate the timing of the fish feeding it automatically requires a DS3231 RTC Module, the module will function as a scheduling, if the feed amount is less than 20% then the Ultrasonic Sensor will instruct the GSM800L module to send SMS to the fish keeper and will issue the alarm sound from Buzzer, but if the fish feed is sufficient then RTC Module DS3231 will give orders to Servo Motor that serves to remove feed from the feed. In addition, the control of aquatic pH in the aquarium is done by pH meter kit shield which will send commands to GSM800L and Buzzer Modules when the water pH is less than 5.0 or more than 9.0.Authors and Affiliations.

To use this microcontroller tool system is simply installing above the aquarium and connect the adapter to the power supply. Microcontroller tool system easy to be installed because the box case using a water filter box for the aquarium, so that it makes easier in installation. Example of microcontroller system installation in Figure 7 Use of Microcontroller System System in Aquarium.
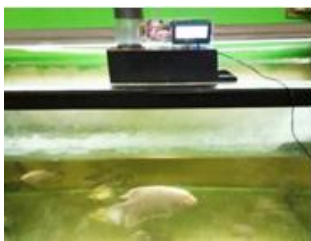

Fig. 7 Use of Devices In Aquarium

VI. TESTING

Timeliness On Devices

At the time test is done to know the time difference of the System Tools Microcontroller with the real time. The test results data are shown in Table 1.

Table. 1 Time Testing

Day	Mikrokontoler	Real
1	00:00:00	00:00:00
	06:00:00	06:00:00
	12:00:00	12:00:00
	18:00:00	18:00:00
2	00:00:00	00:00:00
	06:00:00	06:00:00
	12:00:00	12:00:00
	18:00:00	18:00:00

According to the test timeliness results in microcontroller system that has been done there is conformity with the real time.

Timeliness of Feeding Schedule

Feeding test is done to ensure the system of microcontroller tool to spread the feed according to a predetermined schedule. The test results data are shown in Table 2.

Table. 2 Fish Feed Schedulling

Day	Feed spreading schedule	Spreaded feed
1	Pukul 07:00	Yes
	Pukul 19:00	Yes
2	Pukul 07:00	Yes
	Pukul 19:00	Yes

According to the results of testing the accuracy of feeding on schedule that has been done, there is conformity with the instructions that have been determined.

Timeliness of Feeding Schdulling

Testing the accuracy of the amount of feed out is done to ensure the amount of feed that comes out in accordance with the instructions given. The test results data are shown in Table 3.

Table. 3 Trial Results of Feeding Speading Schedule

Day	Feed spreading schedule	Amount that must be spreaded	Speaded Result
1	07:00 AM	5 times	5 times
	19:00 PM	5 times	5 times
	07:00 AM	5 times	5 times

2	19:00 PM	5 times	5 times

According to the results of testing the accuracy of feeding on schedule that has been done, there is conformity with the instructions that have been determined.

Accuracy of Water pH Measurements

Water pH measurement accuracy test is done to ensure no difference in measurement results with other water pH measurements. The test results data are shown in Table 4.

Table. 4 Water pH Measurements Test Results

Measured pH	Measurements pH Results
pH 4,00	pH 4,02
pH 6,86	pH 6,87

According to the test results, the accuracy of the measurement of the pH of water that has been done does not occur a very significant difference. When the measurement of the pH of the water temperature can affect the pH value of the water being measured, and slight differences always occur because the water temperature can change to adjust the temperature in the surrounding environment.

Accuracy of SMS Delivery

SMS accuracy testing is done to ensure every SMS sent by microcontroller system to the destination number. Testing is done using 2 SIM CARDS with different provider. The test results data are shown in Table 5 of SMS Delivery Results.

Table. 5 Results of SMS Delivery Trial

GSM Numbers	The Number of sent SMS	The Number of received SMS
SIM A	10 SMS	9 SMS
SIM B	10 SMS	6 SMS

The result of the SMS sending test conducted using SIM A shows the difference of 1, and using SIM B shows the difference of 4 SMS which is not delivered. Signals obtained by the GSM module affect the sending of SMS, if the SMS sending command is done when GSM Module does not get signal then the SMS will not be sent or delay occurs.

VII. CONCLUSION

By using this device the user can know the pH value of the water and monitor the pH changes that occur in the aquarium water. If the pH of the water shows a value of less than 5.0 or more than 9.0 it indicates the water in the aquarium is not in accordance with the needs of fish and it is needed to do aquarium water replacement. In addition, the device can help the fish keepers freely go anywhere even in a long time without worrying the fish in the aquarium starved to death. The automated tool system that has been made has a feed size to be given so that there will be no excess feeding that can make turbid water in aquarium and cause seeds of disease or germs to the fish. Further development can improve the delivery of messages via SMS, so that when GSM has a low signal.

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