International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

SMART AQUACULTURE

B.Balaji[#1],Sabarinathan V[#2], Vignesh S[#3],Sarmitha S[#4],
Assistant Professor[#1], UG Student[#2,3,4] ,
Department of Electronics and communication Engineering,
Peri Institute of Technology, India[#1,2,3,4]

Abstract **- The growing interest in the fish farming industry is driven by the depletion of natural fish stocks in the market. However, intensive aquaculture systems, which involve raising fish in artificial tanks and cages, can lead to challenges such as low-quality fish and increased mortality rates, depending on the species being cultivated. To address these issues and maximize yield, this paper proposes a fish quality monitoring system with automatic correction. The system focuses on monitoring and maintaining critical water quality parameters essential for fish growth, including temperature, water level, and pH level. The system comprises an Arduino connected to sensors and a web-based application for data collection and monitoring. Correction devices such as an aquarium heater, a valve, and a water pump are integrated into the system to maintain these parameters at optimal levels for fish development. To assess the system's efficiency and reliability, two fish monitoring setups were compared: one using the proposed controlled system and the other using a traditional setup. Results indicate that the controlled system increased efficiency, reduced stress on fish farmers, decreased**

I. INTRODUCTION

The Fish Monitoring System is designed to aid with pond water quality management. The systems continually track and monitor water quality, giving thorough data that can be done on-site in conventional methods for monitoring water quality. Testing and measurements of water are carried out in a way that restricts the data to the precise moment that it was obtained. More advanced techniques include computers and sensors that can store data in memory for subsequent retrieval and analysis by technicians [1]. Currently, water monitoring systems use two different types of control techniques. A general-purpose system to check the water status manually. The other is an industrial control system that owners' controllers and small-scale, programmable computers. Different water parameters may be monitored by both systems. Currently, water treatment plants employ these systems. Hence, application of Internet of Things (IoT) technology in fish monitoring system for pond quality management is a feasible solution to monitor quality of water for treatment plants.

II. METHODOLOGY

This project's technique makes use of an Arduino Uno as well as the key three sensors for this fish monitoring system. For electronic components like the pH sensor and temperature sensor to function, the Arduino uno was pre- programmed with instructions using the Arduino Software. To measure the features of the water quality, the sensors were utilized. Using monitoring software, the data was logged into a smartphone, and then it was provided to customers. This tiny prototype functioned as a floating platform that the entire system could use to go around the culture tank. The water level sensors are put in the pond system to monitor the water level and water quality in this suggested system of IoT based fishpond keeping system. The pH sensors are installed in the pond system to monitor the water's pH level. The temperature sensor will display the water temperature in the pond or fish farm. Each sensor is programmed with the original optimal value to determine high and low levels and act accordingly

III. BLOCK DIAGRAM

The proposed system included temperature sensors, pH sensors, and water level sensors, all of which were used to measure the water temperature, pH value, and water level between the tank wall and the water quality monitoring system, respectively. These sensors were used to measure the water temperature, pH value, and water level between the tank wall and the water quality monitoring system. The data from the sensors was collected by an Arduino Uno, which operated as a CPU. The Arduino Uno was powered by a 9V battery pack because it can accept an external supply of any voltage between 6V and 20V. In order to transfer data from Arduino to a smartphone, a 1Sheeld+ was placed on top of the Arduino board, and it is connected through Bluetooth to the 1Sheeld app. The 1Sheeld software was utilised in order to log data collected into the memory of the smartphone, after which it was emailed to other users. The proposed structure is depicted in the block diagram that may be found below. A temperature sensor, a pH sensor, a water level sensor, an Arduino Uno, a 1Sheeld+, and two DC motors make up the block.

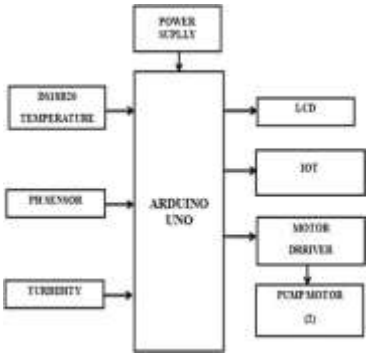

Fig. 1. System Block Diagram

International Conference on Electrical Electronics & Communication Technology (ICEECT'24) ISBN: 978-93-340-6066-9, PERI INSTITUTE OF TECHNOLOGY, Chennai.

International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

IV. SYSTEM DESCRIPTION

Hardware

A. Arduino Uno

The Arduino Uno is a microcontroller that has 14 digital input/output pins in addition to 6 analogue inputs. It is also capable of being powered by an external power source, such as a battery or an AC-to-DC adapter, in addition to being powered by a computer through a USB connection. For the board to function properly, the voltage supply must be within the range of 7 V to 12 V. The Arduino Uno can be programmed using the software that comes with Arduino. C++, a language known for its friendliness to programmers, serves as the foundational language for Arduino software. This intuitive programme is compatible with the Windows operating system. In comparison to Raspberry Pi, Arduino Uno is available at a lower cost, which was a factor in our decision to go with it. When compared to Raspberry Pi, the software that comes

Fig. 2. Arduino micro-controller

with Arduino is easier to work with. In addition, the software is distributed as open-source tools, which makes it much simpler for consumers to comprehend the platform's technological underpinnings. Users are able to cut down on the amount of time they spend developing and debugging their software thanks to open-source code contributed by expert programmers.

B.Water Level Sensor

In a stationary container, an abnormally high or low water level can be detected by a sensor known as a water level. It is classified as either a contact type or a non-contact type, and this distinction is based on the method that is used to measure the liquid level. The submersible level sensor determines the amount of liquid that is contained within the tank. The greater the amount of water that the sensor is submerged in, the greater the conductivity of the water, which in turn will result in a lower resistance. The lower the amount of water in which the sensor is submerged, the lower the conductivity of the sensor, which in turn will result in a larger resistance

C.Temperature Sensor

In the design that has been proposed, a temperature sensor that is waterproof DS18B20 is used. It is a waterproof digital temperature probe that may be submerged in any liquid without leaking or breaking. Because the DS18B20 has a 1- Wire interface, it is only necessary to connect a single wire from the Arduino to it. The temperature probe has an accuracy of 0.5 degrees Celsius and can monitor temperatures ranging from -55 degrees to 125 degrees Celsius. The sensor's output voltage is going to be measured to obtain the temperature from the sensor. Because the sensor generates an analogue voltage, the wire will be linked to the analogue input pin on the Arduino.

D. PH Level Sensor

When it comes to testing water, one of the most critical pieces of equipment to have to be the pH sensor. This type of sensor can determine the levels of alkalinity and acidity in water as well as other liquids. The aquarium hydroponic spare laboratory pH electrode probe BNC connector was the instrument that was utilised in the process of determining the pH value of the liquid that was being tested. It has an accuracy of 0.1 pH and can measure the pH range from 0 to 14 over a temperature range of 0 to 60 degrees Celsius in water. A pH sensor circuit board is required to connect to an Arduino board because the electrode probe is attached with a BNC connector. Due to the fact that the pH sensor generates an analogue output signal, it will be linked to the analogue input pin on the Arduino.

E.Water Pump

Within the context of this system, the process of water replacement is crucial to the transformation of the overall water quality. In this intelligent fish monitoring system, an R385 DC12V Diaphragm Water Pump is utilised. Bubbles are produced because of the pump drawing in air and then releasing it into the water. The water is displaced by the bubbles, which churns the water and causes the carbon dioxide to ascend to the surface. External pumps deliver air to the pump by means of a hose that is connected to the pump itself when it is submerged in water.In this system, Arduino microcontroller is used to control the all over system. RFID reader is used for patient registration. There are three tags for three different patients. Keypad is used to choose and book different wards for patients those affected by different health problems. For example, the patient will choose cardiology section if he affected by any heart problem. Bluetooth is used to enter the patient details through voice.

Software

A. Arduino Software (IDE)

The Arduino Software is an open-source Integrated Development Environment (IDE) that enables users to create code and then upload that code to an Arduino board. Users can access a variety of tutorials in order to gain a better understanding of the software's more technical aspects thanks to the fact that the Arduino IDE is an open source and extendable programme.

B. 1Sheeld App

International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

1Sheeld+ is able to connect the Arduino to 1Sheeld's own apps running on smartphones through the use of Bluetooth thanks to the software platform. 1Sheeld+ gives you access to over 40 different shields to choose from. The 'Data Logger Shield,' 'Email Shield,' and 'Push Button Shield'are the names of the several shields that were utilized in the construction of this system. The 'Data Logger Shield' is used to log data into the memory of the smartphone; the 'Email Shield' is used to email the logged data to other users; and the'Push Button Shield' enables the user to determine when to start logging the data.

.

V. RESULTS & DISCUSSION

In this project, the Arduino Uno replaces the Raspberry Pi, which is rarely utilised in IoT applications. This is because, despite its complexity, employing several sensors on the Arduino will be more efficient. This system is made up of basic monitoring sensors such as water level, temperature, and pH level, but they have been combined in an unusual method to make it more useful in a short amount of time [50].

Furthermore, this system combines various sensors into one to do the same multiple functions. Figure 3 below demonstrates the proposed schematic design, and it shows how the sensors were integrated into one system to collect all of the data from the monitoring systems and communicate it to the user. Control, optimization, and data acquisition are the three components of the system. This trio serves a specific purpose in the operation ofthe complete system.

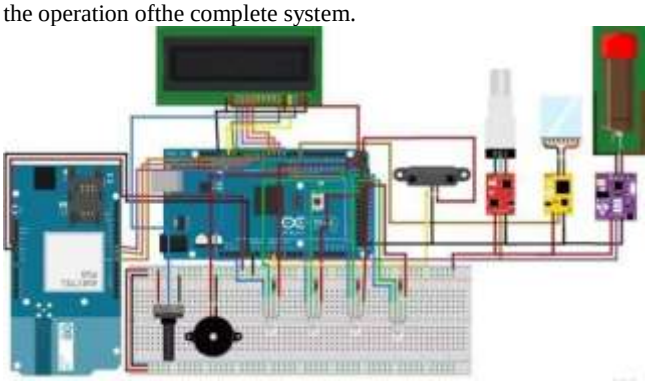

Fig. 3. Schematic design of the proposed system

As previously discussed, fish farmers employ conventional methods and techniques, as well as forecasting models to assess water quality factors. This system has provided all options for avoiding traditional methods and saving labor time. This system's primary goal is to offer real-time monitoring with the water level fixed in the system should be able to take accurate readings and switch on the water pump when the level drops or is required [51]. On the other hand, a pH level indicator should alert the user to the precise pH level in the water so that the user may adjust or balance it and trigger the water pump when the readings reach too low or high to change the water in the tank. Temperature sensor, like pH level, will always display the farm temperature in degrees Celsius in the user application [52]. The example prototype of this fish monitoring system employing the principal three sensors is depicted in Figure 3. This prototype will be tested for output before being integrated with many sensors.rear view in (b)

VI. CONCLUTION & FUTURE SCOPE

Any industry is suitable for the development of Internet of Things technologies. The incorporation of Internet of Things technology into fish monitoring systems is one of these. The idea of a smart aquarium comes from the merging of aquariums with Internet of Things (IoT) systems. A fish monitoring system is a developing and genuine concept for the world of modern maintaining fish that mixes aquaponics with internet of things technology. This concept is quite comparable to it. The development of a clever microcontroller-based instrument for measuring water quality has been fruitfully completed. [34]. It was possible for the device to cover the entirety of the aquaculture tank as long as it was operated in a continuous fashion. Because of this, measurements can be taken at any given location within the tank. The monitoring system was able to measure many aspects of the water in the aquaculture tank, such as the temperature and the pH value. It was able to move on its own and get away from the tank that was being contaminated. The system will not become stuck anywhere within the culture tank under any circumstances. As a result, the characteristics of the water's quality can be measured at various points throughout the aquaculture tank. The Arduino Uno served as the microcontroller, and a 1Sheeld+ was utilized to transport data wirelessly through Bluetooth between the Arduino and the smartphone. The sensors and motor were controlled by the Arduino Uno. Users were able to receive updated data via email after the sensor system was integrated with the Internet of Things (IoT).

International Conference on Electrical Electronics & Communication Technology (ICEECT'24) ISBN: 978-93-340-6066-9, PERI INSTITUTE OF TECHNOLOGY, Chennai.

(a)

(b)

Fig. 4. Proposed prototype outlook with top view in (a) & b

REFERENCES

1. *Afifah, C. H. B. A., R. A. Rosadi, and M. R. Hafiz, "The smart monitoring and automation control system for fish aquarium based on internet of things technology," AIP Conf. Proc., vol. 2097, no. 1, p. 030018, Apr. 2019, doi: 10.1063/1.5098193*

2. *P. L. Chong, Y. Y. Than, S. Ganesan, and P. Ravi, "An Overview of IoT Based Smart Home Surveillance and Control System: Challenges and Prospects," Malaysian Journal of Science and Advanced Technology, pp. 54–66, 2022, doi: https://doi.org/10.56532/mjsat.v2iS1.121*

3. *Peng Lean Chong, S. Ganesan, Yin Ying Than, and P. Ravi, "Designing an Autonomous Triggering Control System via Motion Detection for IoT Based Smart Home Surveillance CCTV Camera," Malaysian Journal of Science and Advanced Technology, pp. 80–88, Mar. 2023, doi: https://doi.org/10.56532/mjsat.v2is1.120*

4. *P. K. Ng, P. L. Chong, J. A. Yeow, Y. J. Ng, and R. Jeyakumar Nathan, "Ergonomic Work from Home Recommendations Using TRIZ," in Human Factors in Engineering Manufacturing Systems, Automation, and Interactions, Boca Raton: Taylor & Francis, 2023, pp. 65–82. Accessed: Feb. 25, 2024.*

5. *D. W. H. Tan, P. K. Ng, E. E. M. Noor, A. Saptari, C. C. Hue, and Y. J. Ng, "Development and Usability Testing of a Finger Grip Enhancer for the Elderly," Robotics, vol. 11, no. 1, p. 5, Dec. 2021, doi: https://doi.org/10.3390/robotics11010005*

6. *C. Q. Kang, P. K. Ng, and K. W. Liew, "A TRIZ-Integrated Conceptual Design Process of a Smart Lawnmower for Uneven Grassland," Agronomy, vol. 12, no. 11, p. 2728, Nov. 2022, doi: https://doi.org/10.3390/agronomy12112728*