IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

An IoT-Based "SMART AQUA: REMOTE MONITORING AND CONTROLLING OF AQUARIUM USING IOT AND TELEGRAM"

Mrs. Leena Shruthi[1],

Gautami Gurav[2], Kritika Desai[3], Keerthana P[4], Dyuthi R[5]

Department of Computer Science and Engineering, East West Institute of Technology Bangalore, India[1]

Department of Computer Science and Engineering, East West Institute of Technology Bangalore, India[2-5]

Abstract: This IOT Project is based on monitoring the fish.As fish need lot of care to be taken unlike cats and dogs as they are very sensitive and stay in water.Hence this IOT- based smart aquarium helps to monitor the things going on insid the fish tank.Fishes usually need atmost care,the water in the tank has to be cleaned on regular bases.This system includes automatic feeding system and semi-automatic cleaning.This system will helpto keep fresh water inside the aquarium by keeping it clean and in a good working condition.This Using the mobile application users can track the situation inside hetank. Arduino MEGA and Node MCU controllers are included in this system design.So,there will be a wifi module on the Node MCU used between the smart phoneand user to control the operations.Ph level of water and its temperature will be monitored through LCD display and also on smartphone application.The fishes also requires oxygen for their survival.This oxygen supply is provided within the aquarium by the oxygen pump.This oxygen pump is a device that will provide oxygen within the water.Fish feeding is a automatic process which is done twice a day.The Embedded C coding is done using Arduino Software IDE and BLYNK Software is used for creation of applications.Basically,this project monitorsthe Ph value,Temperature through the smart phone.Due to developed economy, this project makes human life easy with time management.

Keywords: Internet of Things (IoT) ,Smart Aquarium ,pH water monitoring,fish feeders,pH Sensor

I. INTRODUCTION

As, getting pets at home has been the regular practice these days. Fishes are such pets that cannot be carried from one place to another, they are the ones that needs atmost care. Most of the owner consider fishes as the part of their family and also consider them as their home décor. But the major drawback in getting the aquarium is that, they need much attention then other pets like cats and birds. The two main points to remember here is to feed fish on time and clean the tank water which is essential for the fishes to survive.

The LCD display placed over the tank specifies the Ph value, which helps the user by indicating when the water has to be changed.With the help of Wi-Fi module, the user can feed the fish at any time being at any part of the world. The maintenance of water bodies are much complex and time consuming then other pets, unlike cats and dogs.

A. Internet of Things(IoT)

Using writers from [1] as a guide, the Internet of Things (IoT) is all about the Wireless Connections, Networks (WSAN) and Computing domains.In this the information is made available and monitored [2].Making use of IOT reduces the job of the user and makes their life easier.[3].IOT helps in environmental effects which includes water quality, industrial effects, industrial health care. [4]. ITU(International Telecommunication Union), demonstrated the key IoT idea to the user data might be taken and the desired task will be carried out by the machine. [5].The three classification or grouping under this are technologies that make things available to get the statistics or details, provides privacy and automation to manage security[6].There were many dispute due to the information achieved from the resources. [7], Undoubtedly different manufacturers would use same devices,There can be difficulty in interoperability. So,the integration to a range of information requires implementation of IOT and communication technology [8].For information that will be created, the interpreted sensor information should be capable of to come to an end that is generalized[9]. In case of investment, using IOT automatic apartment has been developed by investment[10].

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

B. pH for Water Health

Millions of people find it difficult to maintain Ph level of water which is important for the survival of fishes. Maintaining alkaline and acidity of water is important.Except that, oxygen level of water should also be considered which develops the water quality. The major change in Ph effects the survival of the fish. In case of the saline water ph level shouldn't be below 8.1.Hence, to reduce stress on aquatic life, the pH must be between 8.1 and 8.3 and shouldn't alter more than 0.5 times per day.pH sensors are used to determine the water's value.

II. RELATED WORKS

The collection of prior initiatives for an IoT based smart Aquarium Monitoring System is present in Table 1.

Project	Feature	IoT	pH	Advantage	Disadvantage
Aquarium Auto Refill With Arduino [24]	Pumping Station to Refill a reservoir	No	No	Auto refill water	Need user to Feed and Monitor the Water quality
Aquarium Temperature Monitor[25]	Manages Its own temperatu re	No	No	Maintains the aquarium temperature	Need user to Feed and Monitor the Water quality
IoT Aquarium Light Controller [26]	Better handle artificial light activation	Yes	No	Light management Byandroid user	Just good for decoration
Automatic Fish Feeder [27]	Full automated fish feeding schedule	No	No	Auto fish feeding	User need to Monitor the Water quality
pH Level Monitor[28]	Display the PH level of a certain substance	No	Yes	Can be used To monitor The acidity Of aquarium Or pond	Need user to Feedthe fish

Typically, the development of smart aquariums focuses on to feeding because it is crucial for fish survival to prevent malnutrition. In addition, several smart aquarium innovations, such temperature and pH level indicators, can be employed as monitoring systems. Every project has unique characteristics, benefits, and drawbacks. This demonstrated that the best way to enhance the current project is with an IOT-based Smart Aqua system.

III. RESEARCH METHOD

This project used a NodeMCU as a micro controller and an Arduino MEGA as the hardware implementation. Feeding system (sg90) utilized as fish feeder mechanism for actuator. The pH sensor (SKU: SEN0161) is the only sensor used in this project to calculate the water's pH level. The 16x2 LCD panel is used as a pH water level monitor for aquarium water. NodeMCU is also utilized as a Wi-Fi module, serving as a micro controller to link the project's components to the user's smartphone. BLYNK apps are used in software design to generate software for applications to the Android system.

Figure. 1 demonstrates that all of the sensors have been initialized and are connected to the Wi-Fi module while the project is running. On the At mega 328, the Arduino MEGA is built.It has 6 analogue inputs in addition to 14 digital inputs. Following this set the pH meter,which is plugged into the pH circuit,to its initial state,that will detect and calculate the pH of the aquarium , which it will then display on the LCD screen. It uses the analogue pH sensor kit, which was created to work with the Arduino MEGA.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

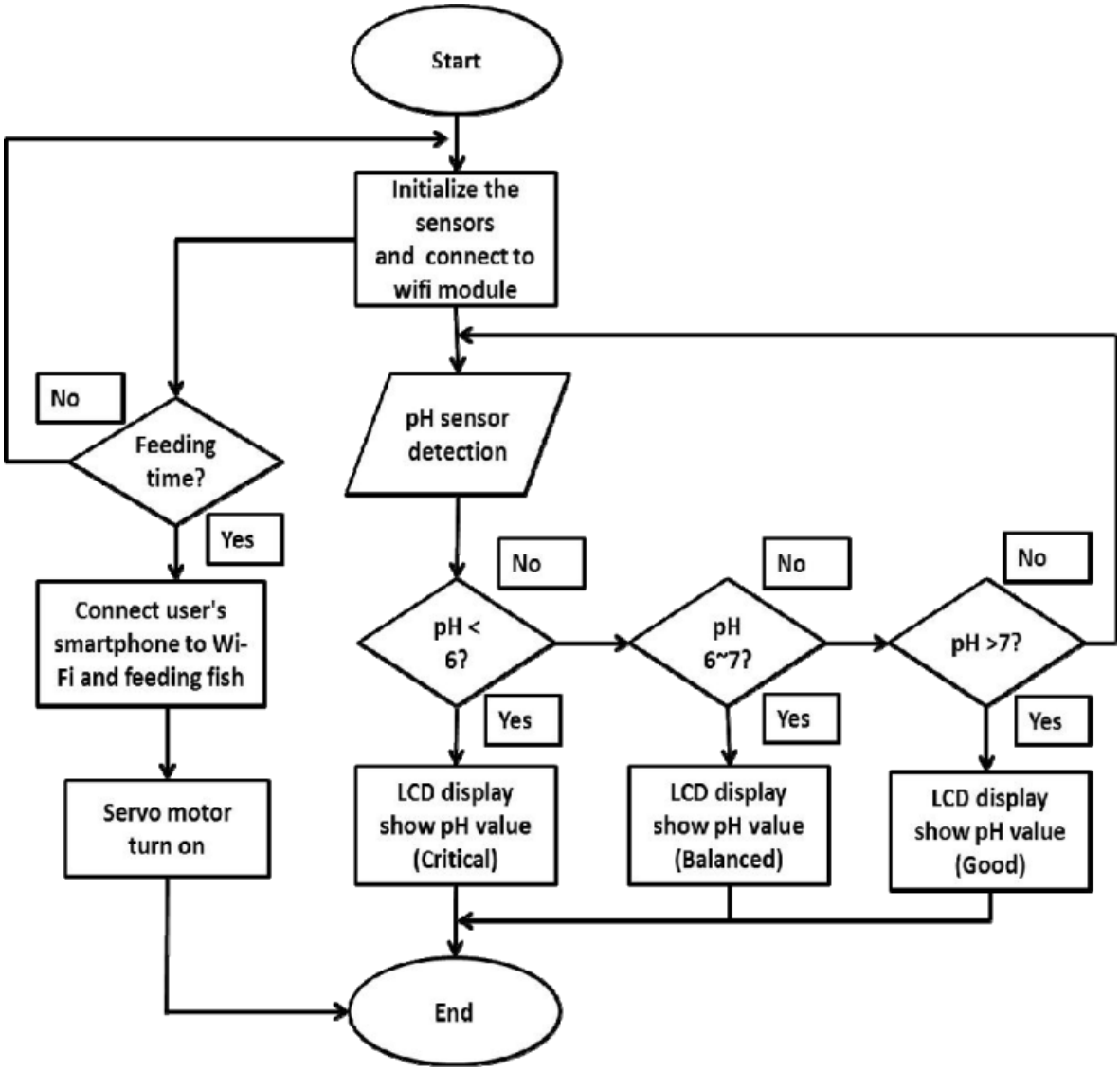

Fig.1. The Project's Flow Chart

IV. RESULTS AND ANALYSIS

All the three phases are the three sections that make up this project's outcome. Phase 1's outcome shows that the sensor and actuator have undergone functional testing,calibration. The IoT- based Smart Aqua System that was created in the end cannot accessing the to the internet, which was evaluated in phase 2.In addition of a Wi-Fi module, NodeMCU , which demonstrates to the connectivity including gadgets and apps, is included in phase 3.The data gathering is simply accessible through the apps.

A. Phase1: Components verification,data analysis and aquarium setup

Component testing, aquarium setup, and four sets of tests for various aquarium scenarios are the processes that take place in Phase 1. Considering the outcome from the elements on which the analysis is done. Phase one has four test sets. At least 7 days are needed for the complete test.

Water pump filtration is not used during the first or second case tests. In the first test, the fish are fed twice daily, whereas in the second set, they are fed three times daily. Water pump filtration is used for the third and fourth case tests, in the meantime. It goes without saying that the third and fourth tests involve feeding the fish twice daily.

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023
DOI: 10.17148/IJARCCE.2023.12238

In the mean time, water pump filtration is used for the third and fourth case tests. It goes without saying that the third and fourth test involves feeding the fish twice daily and three times daily, respectively. People may treat their fish precisely thanks to the characteristics of the sophisticated aquarium. The LCD display is pH value indicator aids. The user in determining when to change the water.

1) Test of a pH sensor module (SKU:SEN0161)

Due to the sensor's high sensitivity, it should always be covered. Lime water and distiller water are tested as part of the calibration process. Simple pH detection coding is utilized, and it pairs well with an Arduino starter kit. Given that while distilled water is neutral,lime water is acidic this demonstrates that the pH sensor is operating flawlessly.

2) Test of servo motor

There exists many servo motors in it , and per part is unique capabilities and uses. Model sg90 is the one that is most appropriate for this project. This servo spins till 180 degrees, at which point it flawlessly satisfies the project's requirements. Apart from that, this servo is holding a little container with fish pallets inside of it. It can be held in the container without any trouble having restriction of 1.80kg retaining torque (at 4.8V).

In the beginning, the calibration is carried out using a straightforward 180° rotational looping algorithm. Originally, 1000ms was set as the delay timing, which was too quick for the fish feeder because only a small pallet would fall into the aquarium." The rotation is adjusted to two rotations every feeding session to get over this problem and allow the pallet to fall just the right amount as much as the fish require. Every feeding time13–17 pallets can be fed to the fish via the servo motor.

3) Setup An Aquarium for Data Analysis

13 litres of water have been used to fill the tank. This aquarium's size is adequate for the analysis to determine whether it is neither too tiny nor too huge. Two climbing perch fish (Anabas) are present.For this project, test udineus, also known as "ikan puyu," is used. Because they can live in any kind of water, this fish was chosen. The choice of fish is crucial since the fish should not be harmed or tortured during the analytical process. As the ascent perch fish may easily leap from the aquarium because it is a tough species . This makes it obvious that the care needs to be taken.During the data analysis the top of the aquarium has to be closed. These climbing perch fish can go for long periods of time without water, even if they jump out of the aquarium.

Initial or the start Analysis was based on some cases like the water is utilized straight from the pipe, the aquarium should be set properly before adding anti-chlorine. Chlorine is present in the regular water flowing from the pipe,which is designed to kill germs or bacteria. However,because it is created by combining various chemical ingredients, it is extremely harmful to the fish. By using anti-chlorine, the water's pH level changes. The water directly coming out of the pipe has approximately

7.79 whereas after using anti-chlorine, the pH value neutralizes the chlorine portion while leaving the ammonia portion, which is harmful for the fish.

4) Resetting the pH sensor

This situation can occur at any time while the data collection for each set of analyses.During the data analysis,it was discovered that the pH sensors are more sensitive than the other sensors. A sudden shift in pH reading compared to the real measurement occurred while the data was been collected. This calibration improvement scale, which is 3.0 pH, is very far away. This problem has been resolved thanks to the time to time calibration.

Checking the water coming from a water ionizer, which is typically utilized at home is a part of this calibration.This water ionizers reading of the pH level of the water,which is 9.5,is quite precise. The DESA brand of water, which has a pH measurement of 7.20++, has been evaluated in order to use it as a reference scale of water for further calibration if there are many errors. The reading access through the water ionizer is quite helpful for detection of error.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

5) Case1: Give the fish 2 meals each day

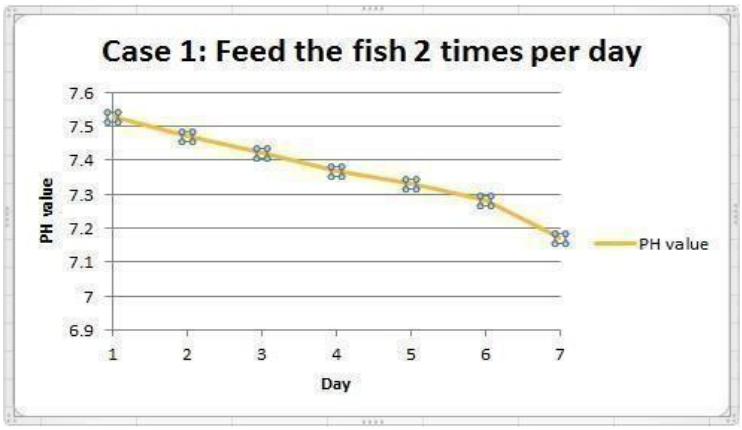

Fig. 2.pH value when feeding the fish twice a day

The pH level chart while feeding fish twice a day is shown in Fig. 2. This feeding schedule will occur early in the morning and at night. The graph shown will demonstrate that the pH level is continues to drop, with drops ranging from 0.04 to 0.09.

Additionally, this appears to demonstrate that fish can alter the pH of water by ingesting and excreting it.The ideal pH level for fish is neutral, although the water's pH level will fall within this range. Additionally, the fish are being tranquilized during this procedure as they continue to swim around the tank.

6) Case2:Give the fish 3 meals each day

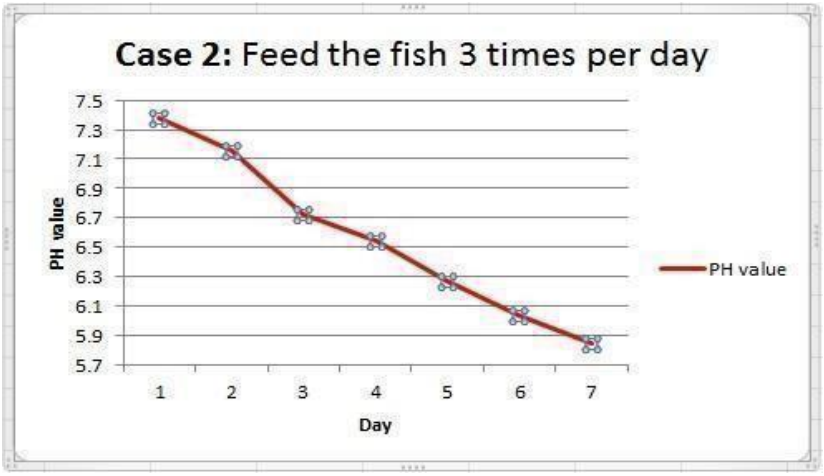

Fig. 3.pH value when feeding the fish thrice a day

The chart of pH level while giving fish meals a day is as shown through figure 3. Thus providing process in this is a part of instance will occur in the morning, late afternoon, and evening. The graph here will demonstrate how the pH of the water is steadily dropping between 0.15 and 0.22 from day to day.So, from scenario 1, the decrease is doubled. This will cause when user's overfeed the fish as they cannot consume entire pallet.

The pallet wandering aimlessly will rot as chemical by product of disintegrating under water. Additionally, the water's toxicity could rise as a result, and undesirable and unwanted algae could begin to bloom. If the pH value of water reaches acidic range, then it can end up been bad for the fish. As a result of their stressful situation, the fish are in a passive phase.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

7) Case3: Give the fish twice meals a day(with mini water pump filtration)

pH value chart for feeding fish twice daily with a mini water pump filtration is shown in Figure 4. This scenario is similar to case 1 in that feeding occurs early in the morning and late in the evening. Here, the pH level continues to drop, going from 0.03 to 0.05 everyday. The pH level of the water will be between neutral and slightly alkaline, which is the ideal pH range for fish.

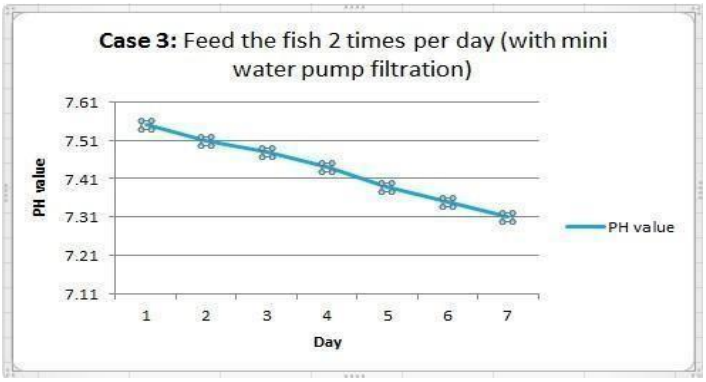

Fig 4. pH value when feeding the fish twice per day (with pump filtration)

According to the graph, the water's pH level improved by 0.14 on the seventh day of this case analysis,making it slightly better than case 1. This demonstrated to maintain clean water inside the aquarium,a water filtration system is crucial and highly helpful.

8) Case4: Give the fish thrice meals a day(with mini water pump filtration)

The pH value graph for feeding fish daily with a minimum water pump filtration is shown in fig.5.Similarly to instance 2,this situation.The pH of the water will decrease here,with a neutral reading,roughly 0.07-0.09.But on the seventh day,with a pH level of 6.98,it turns acidic.It was discovered throughout this process that incorrect fish digestion was another element that had an impact on the water's pH levelr.Therefore,poor fish digestion causes the fish to get contaminated since fish now create more waste then they created previously,which may appear shaggy and colourless.

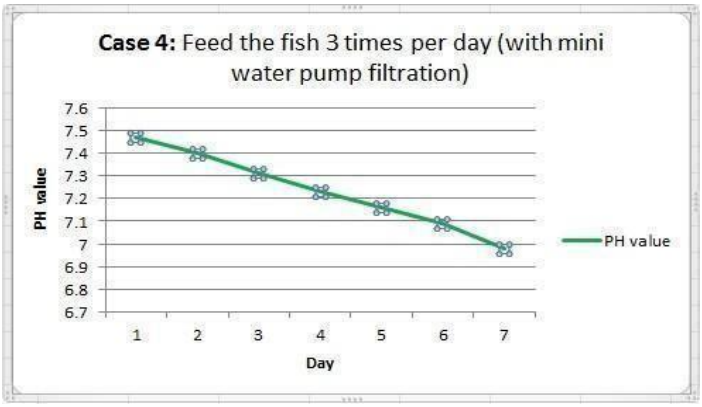

Fig 5 .pH level when feeding fish thrice daily(with mini pump filtration)

9) Comparison of every case

Comparing the pH value for each case is shown in figure 6. According to the statistics,aquarium water with a filtering system will take a while to turn acidic than water without one.

Without filtration,an aquarium harmful elements like ammonia and nitrates,the filtration system will purify the water in the tank.Without proper filtration,an aquarium can significantly reduce the pH value,overfeeding and improper fish digestion can also have an impact.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

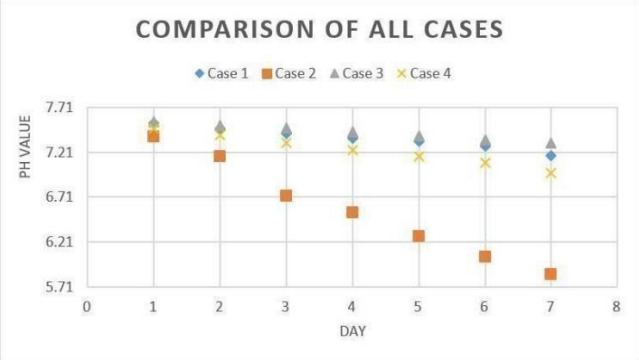

Fig 6 Comparing pH value for all cases

B. Phase2: Combination of all part of component

Phase2 involves assembling every component piece to create the complete IOT-based Smart Aqua Monitoring System.Problem- solving may if the connections aren't formed properly, be required. To prevent improper electrical contact between the boards and components, a high-quality solder lead should be utilized. As a result, the wires should be kept in the connector because they are exceedingly brittle. The connection must be methodical, fluid .

Fig 7.The front view of prototype

Prototype of the system front view is depicted in Fig.7. The concept for the design was based on the roof of a contemporary home. The attachable prototype must be positioned above the aquarium. The prototype has a 16x2 LCD display in the front. The pH level is shown on the LCD display's first line, while the state of the water is shown on the second line. Water has three levels of condition: critical , balanced , and good .

When the pH is below 6.0, the water is considered to be in critical condition, making it unfit for fish and requiring the user to take steps to clean it. pH levels between 6.0 and 7.0 indicate that the water is in a balanced state. The pH level of water in balanced condition is between 6.0 and 7.0, which indicates that maintenance is required yet the water is in even state for work purpose,it's really good when pH result provides greater than 7.0, the water is considered to be ideal for aquarium fish..

The system's top view prototype shown in Fig. 8.The prototype can fit three boards: a blue Arduino MEGA board, a red NodeMCU board with an Input and Output shield, and to an additional supply board, yellow, and. The NodeMCU only requires 3V of supply, so the supply board is made to add 5V and 3V from Arduino MEGA.

Additionally, only 5V is required for the power supply for other components such the pH sensor (SKU: SEN0161), 16x2 LCD display, and servo motor (sg90).The black portion will be replaced with the battery. With the aid of a USB adapter, electricity can be supplied from the socket. At the top of the centre, the prototype has a square hole in the centre for the pH sensor and the place for a small water pump filter at the right top.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12238

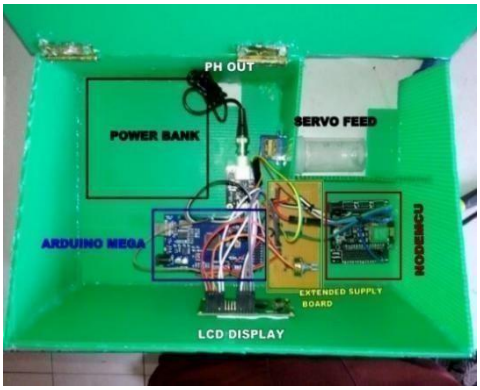

Fig 8.The top view of prototype

C. Phase3: system as a whole with an IoT applications

This model is WiFi based for phase 3. Here, coding on the Arduino IDE is used to transmit data from the NodeMCU over the Wi-Fi module. The user must first make After creating an account to access the apps, the user will receive a "auth token" through email, which is used to link token code inside the coding using the Arduino IDE.The Wi-Fi id and password should be set as soon as the power is turned on so that the NodeMCU can join automatically. The user starts off with 1900 points to add the widget. Every gadget has varying point costs. A button and gauge metre widget has been employed in the system, with the button being used for aquarium feeding and the gauge for measuring pH levels. Additionally, the notification and event widget is utilized as a notifier that beeps the user and displays pH level changes. A little notification that informs the user of the device's internet connectivity is also present at the bottom of the screen.

V. CONCLUSION

As a conclusion, this effort can benefit a lot of people, particularly today's fish keepers. The monitoring of the pH level in water and easing the Fish feeding procedures. On an LCD, the pH value and overall health of the water are shown. The growth of the Internet of Things (IoT) is extremely beneficial for modern mobile phone users. Users can monitor their aquariums with the use of a smartphone. Since this operation, the project's primary component is employing pH value coding. The pH sensor measures the pH level while keeping track of it for user's. As a result, the user may determine if the water quality is suitable for fish or whether more water needs to be added. Additionally, with IoT features, it's automatic feeding of fish can make it easier for the user to do so anytime, anywhere. People no longer need to worry about their fish because they can keep an eye on their aquarium using a device if they are on vacation or have a hectic schedule. The ability to introduce something new is incredibly helpful, especially when creating something new that will be beneficial to people's future prospects. Last but not least, the Smart IoT Aquarium is a brand-new project that will be helpful to fish keepers everywhere.

REFERENCES

[1] J. Aubin et al., Implementing escalation in fish farming: definition and principles from, Rev. Aquac., vol. 11, no. 1, pp. 149 167, 2019.
[2] A. A. Bracin, J. L. Espoñola, A. A. Bandal, E. P. Dadios,E. Sybingco, and R. R. P. Vicera,Aquaponics Biofilter dimentions Using Genetic Algorithm, J. Adv. Comput. Intell. Informatics, vol. 25, pp. 632 638, 2021.
[3].M. Sercon, A. Melgo, A. Ompad, M. Palconit, and J. Obiso, Taxi Tracking System with Cloud Logging using the Internet of Things,J. Sci. Eng. Tec., pp. 1 14, 2020.
[4]. M. G. Palonit et al., Irrigation System, 9th Int. Symp. Comput. Intell. Ind. Appl., no. November, pp. 0 6, 2020.
[5] M. G. Palonit et al., Towards Tracking: Research and Genetic Algorithm and LSTM as Fish moment in muddy water,IEEE Reg. 10 Annu. Int. Conf. vol. 2020-Novem, pp. 744 749, 2020.
[6] J. D. Aledrino et al.,Precision Farming data aquasystem with distinct protocall, J. Adv. Comput. Intell. Intell. Informatics, vol. 2,no.4, pp. 397 403 , 2021.
[7] P. Ashari, A. M. Ramani, and H. H. S. Javad, Internet of Things app: A system review, Comp. Networks, vol. 148, pp. 241 261, 2019.
[8] E. D. J. Aledrino, R. concepian, V. J. Almer,M. G. Palonit, A. Bandal, A Hybrid Data model using AI Messaging Protocol for Precision Farming,in 2020 IEEE 12th International Conference, Nanotechnology And Management(HNICEM), 2020, pp. 1 6.