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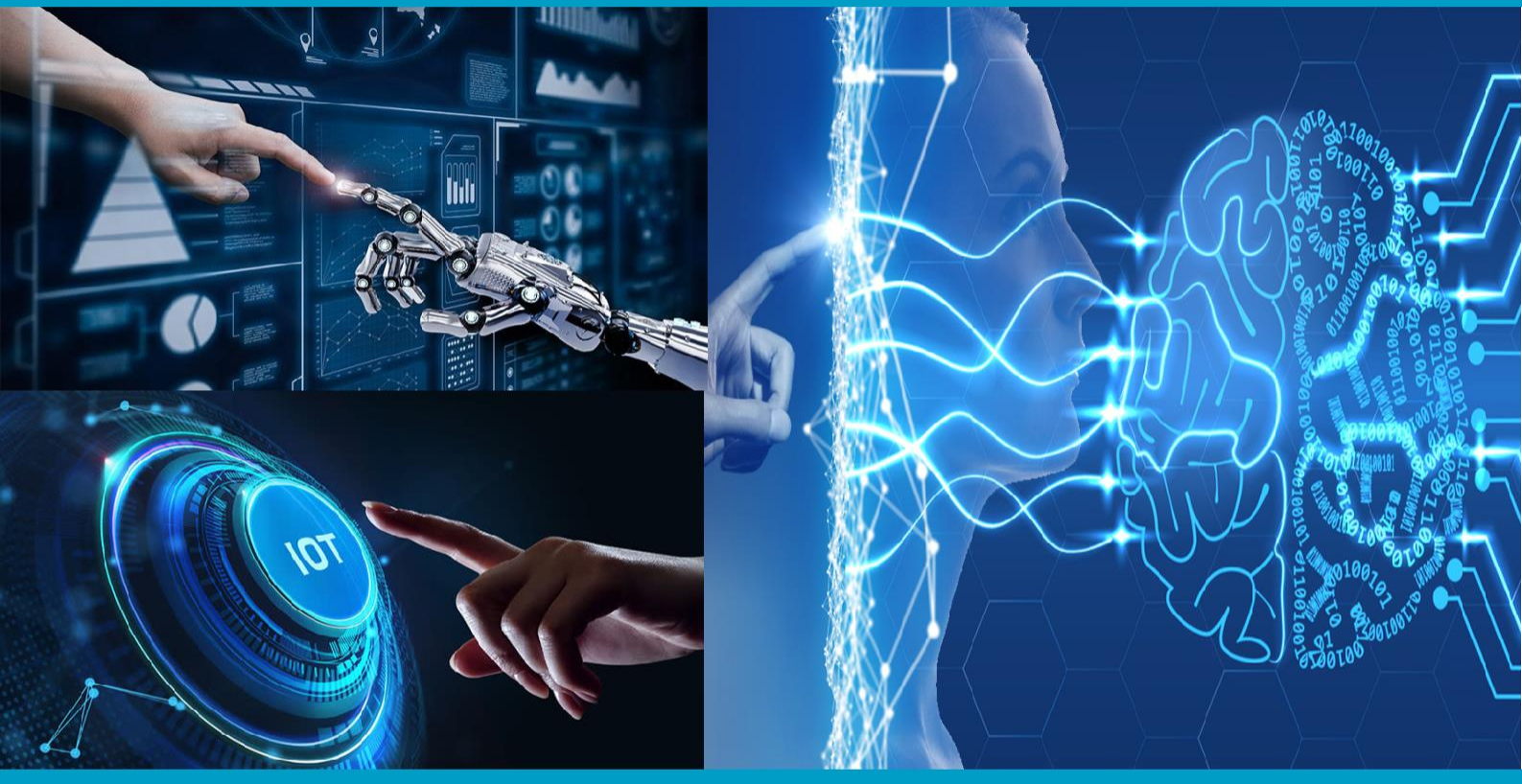

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Smart Aquaculture Quality Monitoring System

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ABSTRACT: Aquaculture, as a rapidly growing industry, faces numerous challenges in maintaining sustainable practices to meet the increasing global demand for seafood. In this context, the implementation of an advanced monitoring system has emerged as a promising solution to enhance aquaculture sustainability. This abstract explores the concept of aquaculture sustainability and highlights the role of an advanced monitoring system in achieving sustainable practices.The abstract begins by acknowledging the significance of aquaculture sustainability in meeting the demand for seafood while minimizing environmental impact. It emphasizes the need for innovative approaches to address the complex issues faced by the aquaculture industry.Next, the abstract introduces the concept of an advanced monitoring system as a transformative tool in aquaculture management. It highlights the system's capabilities in real-time data collection, analysis, and decision-making support. By continuously monitoring various parameters such as water quality, feed efficiency, and fish health, the advanced monitoring system enables proactive management, early detection of issues, and effective intervention strategies.Furthermore, the abstract discusses the direct benefits of implementing such a monitoring system. These include improved resource utilization, optimized production efficiency, reduced environmental risks, and enhanced animal welfare. It also emphasizes the potential for economic gains through better production planning, risk mitigation, and market competitiveness.Lastly, the abstract concludes by affirming that an advanced monitoring system serves as a vital component in achieving aquaculture sustainability. It encourages further research and collaboration to develop and refine monitoring technologies, integrate data-driven approaches, and promote industry-wide adoption of sustainable practices for long-term success.In summary, this abstract highlights the crucial role of an advanced monitoring system in driving aquaculture sustainability. It emphasizes the benefits of real-time monitoring, proactive management, and improved resource utilization. By embracing advanced monitoring technologies, the aquaculture industry can move towards a more sustainable future while meeting the growing seafood demand.

KEY WORDS: Water Quality, Integrated Monitoring System, Data Analysis

I. INTRODUCTION

Aquaculture is a set of activities, knowledge and techniques for the breeding of aquatic organisms. The aquaculture has a great importance in economic development and food production in our country. By observing the waters parameters physical and chemical variables such as: oxygen, temperature and salinity in water are some of the main conditions to be checked often in the pond. The Internet of Things (IOT) is an upcoming innovation for all the smart gadgets to connect people remotely. In farming system, various sensor nodes are used for checking the water parameter. The wireless sensors networks (WSN) composed of a large number of sensor nodes deployed in a monitoring region to collect transmit and process information. Currently the aquaculture has become highly challenging due to emerging problems in farming regions. Water preparation before stocking is one part of the areas where the aqua farmers in India totally neglect it, use of good quality prebiotic& prebiotic in the pond water helps in establishment of beneficial microbes in the pond ecosystem. Water rich in phytoplankton and zooplankton, which form the natural food for shrimp and also enhances the immunity in shrimp and gives better survival. The main purpose of the project is to observe the farming system remotely by using different Sensor for the water parameter, this will mainly reduce time, labor cost & also the risks

SCOPE OF THE PROJECT:

The freshwater aquaculture systems in the country has primarily confined to three Indian major carps, viz., rohu, catla and mrigala, with exotic species: silver carp, grass carp, and common carp forming the second important group. Among the catfishes, magur (Clarias batrachus) has been the single species that has received certain level of attention both from the researchers and from farmers due to its high consumer preference, high market value and most importantly its suitability for farming in shallow and derelict water bodies with adverse ecological conditions. Recent years, however

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witnessed increasing interest for farming of Pangasius spp., especially in Koleru lake region of Andhra Pradesh due to its higher growth potential and ready market. Other potential species include Labeo calbasu, Labeo gonius Labeo bata, Labeo dussumeri, Labeo fimbriatus, Barbodes carnaticus, Puntius pulchellus, Puntius kolus, Puntius sarana, and Cirrhinus cirrhosa. Some of these species are being cultured at a very low level in different parts of the country, mostly based on wild seed collection. The freshwater airbreathing and non air-breathing species, Channa marulius, Channa striatus, Channa punctatus, Channa gachua, Channa stewartii have not been taken up for the aquaculture activities in serious way. With the technology available for seed production and culture of air breathing (Clarias batrachus, Heteropneustes fossilis) and non air breathing catfish like (Wallago attu, Mystus seenghala, Mystus aor, Horabagrus brachysoma, Pangasius pangasius), scientific organized catfish farming can be taken up in extensive and semi intensive way (Ponniah and Sundaray, 2008)

II. LITERATURE REVIEW

REAL-TIME WATER QUALITY MONITORING SYSTEM WITH PREDICTOR FOR TILAPIA POND
Authors: Jake D. La Madrid1,2, Jennifer C. Dela Cruz1 , Vince Lloyd Q. Balisi2
Year: 2018
Description:
Water quality is the first most important limiting factor in pond fish production. It is also one of the most difficult production factor to understand, predict and manage. It is not just where the fish live; its quality directly affects growth rates, the fish's health and survival. Most fish kills, disease outbreaks, poor growth, poor feed conversion efficiency and similar management problems are directly related to poor water quality. The study and prediction of water quality is necessary to prevent serious problem that may occur during production period. In this study, water level, temperature, pH and DO levels are measured using Arduino microcontroller. User could receive information at predetermined intervals on preferred communication through SMS. Since integrating devices are comparatively not expensive; it usually consists of Arduino board, access to internet and relay frames and display system. With this integration system, farmer need not hire worker at their site, consequently drive down operating costs and improve efficiency. Prediction interface was developed using msSQL. The system was evaluated and it performs its intended function. In this study, segmented moving average prediction model was found to be effective in predicting water quality parameters.

SMART MONITORING AND CONTROLLING SYSTEM FOR AQUACULTURE OF BANGLADESH TO ENHANCE ROBUST OPERATION
Authors: Nagib Mahfuz, Shah Md. Al-Mayeed
Year: 2020
Description:
In recent years, the technological revolution occurs in the field of agriculture and aquaculture. Aquaculture is under pressure due to the earth's growing population and demands. The research aims to develop a smart microcontroller-based electronics system for monitoring and controlling aquaculture smartly with a mobile app. The system is equipped with the facility of monitoring important parameters of aquaculture such as water level, temperature, pH, turbidity. A user-friendly mobile app is developed for monitoring these parameters and making decisions. The system sends the data of these parameters wirelessly to a mobile app through Bluetooth communication and also print in LCD. The changes in any parameter in an unacceptable range, an automatic notifying SMS will be sent from the proposed system. This system can be monitor and control via SMS from a remote distance also. There are two high-speed dc pump is attached to the system so that we can include or exclude rated liquid as required. The major power supply for this proposed system is solar power. This system can be used in laboratory, aquarium, pond, and cage type aquaculture. The smooth operation of the hardware and mobile app works together as a system to provide great support to an aqua farmer.

AN EFFICIENT AQUACULTURE MONITORING AUTOMATIC SYSTEM FOR REAL TIME APPLICATIONS
Authors: M. Arun Kumar1 , G. Aravindh
Year: 2020
Description:
The radiological characteristics of water will generally refer to the chemical, physical, biological, and radiological characteristics of water. The water quality should be strictly maintained to ensure the survival and growth of aquatic lives. Henceforth, in order to maintain the water quality, autonomous system should be implemented for monitoring Aquaculture by implemented IOT Technology is proposed in this paper. The proposed system will contain different sensors like Temperature Sensor, Water Level Sensor and the Sensor PH Sensor. Temperature, PH and Water

level will play a major role in ensuring the water quality. The changes in these parameters may adversely affect the quality of the water and also the aquatic lives. GSM is used to communicate to the respective mobile phone of the user. Temperature Sensor is mainly used to detect the temperature changes and if the temperature rises above the normal value, the DC Motor will move to ON condition. The PH Sensor is used to monitor the PH value of the Soil continuously. The level of the water is monitored by using the Water level sensor and if level of the water exceeds the normal value, then the motor will be switched ON. The sensed data will be then transferred to the respective mobile phone through GSM. The GSM will send message to the Mobile when the sensors detect any abnormal value. LCD is used to display all the sensor values.

A FORECASTING MODEL FOR MONITORING WATER QUALITY IN AQUACULTURE AND FISHERIES IOT SYSTEMS
Authors: Nguyen Thai-Nghe, Tran Thanh Hung, Nguyen Chi Ngon.
Year: 2020
Description:
Water quality monitoring is an important task when developing IoT systems, especially for aquaculture and fisheries. By monitoring the real-time indicators (e.g., temperature, salinity, pH, Dissolved Oxygen - DO, and Chemical Oxygen Demand - COD) and getting early warning we can manage the quality of the water, thus collecting both quality and quantity in fish raising. In this work, we propose an IoT system for monitoring water quality in aquaculture and fisheries, especially the model for forecasting the quality indicators. Experimental results on two data sets show that the proposed approach can be applied for the real system. Index Terms—Forecasting model, Sensor networks, Water quality monitoring

Real-time Water Quality Monitoring and Notification System for Aquaculture
Authors: Jomsuda Duangwongs.
Year: 2021
Description:
Fish Farming has been transforming through various technological revolutions in recent years, the Internet of Things (IoT) provides very significant t echnological innovations on farming by creating a new paradigm. This paper presents a water quality monitoring system with automatic correction four types of water quality parameters. The parameters are including temperature, potential hydrogen (pH) level, turbidity, and dissolved oxygen. The system uses sensors, micro controllers, and a mobile application for acquiring and monitoring data. The notification w ill b e s ent t o u ser w hen t hose p arameters are above or below the standard values. The Arduino Nano is used as controller unit to read the analog values from the sensors. Serverless IoTs is created using Firebase Realtime Database (RTDB) and ESP8266. The experiment has been conducted at Faculty of Fisheries Technology and Aquatic Resources, Maejo University

III. METHODOLOGY

Aquaculture, which has the potential to feed the globe in the upcoming era, needs smart innovative technology for its growth. An aqua farmer's daily routine involves keeping track of the water parameter which affects the growth of fish and shrimps. While some farmers use handheld meters for each parameter, others give their pond water sample to laboratory for testing. Which is time consuming and the results may not be as accurate as real time measurement at the pond site. The system proposed includes of six sensors measuring important water parameters for monitoring the growth of fish, shrimp, and other aquatic organisms. The measured values from the sensors are compared with the established data and an alert message is processed in the form of SMS through web server

1. exactly how long to wait and where the next coming bus is. Global
2. Positioning System (GPS) is the main technology implemented
3. behind the system. A GPS receiver is used to track on real time bus
4. coordination by continuously receiving the position data which are
5. latitude and longitude values from GPS satellite, then send the
6. position data back to main server and server process the raw
7. position data into real time information for users. This system is
8. implemented on Internet so that passengers are able
9. to view the information through Internet access devxactly how long to wait and where the next coming bus is. Global
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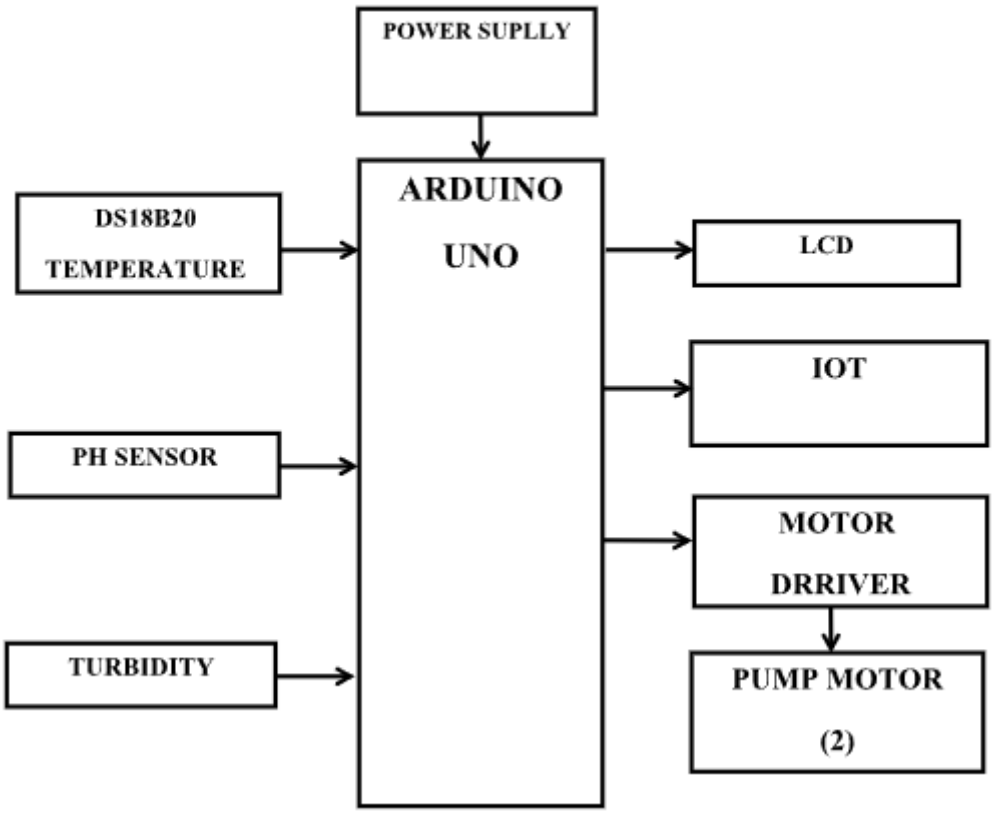
BLOCK DIAGRAM:



MODULES NAME

- CONTINUES WATER QUALITY MONITORING SYSTEM
- CHAGING THE WATER IF ANY ABNORMALITIES DETECTED BY SENSORS
- UPDATE INFORMATION IN CLOUD AND LOCAL LCD FOR USER
- MODULES NAME DESCIPTION:
- CONTINUES WATER QUALITY MONITORING SYSTEM

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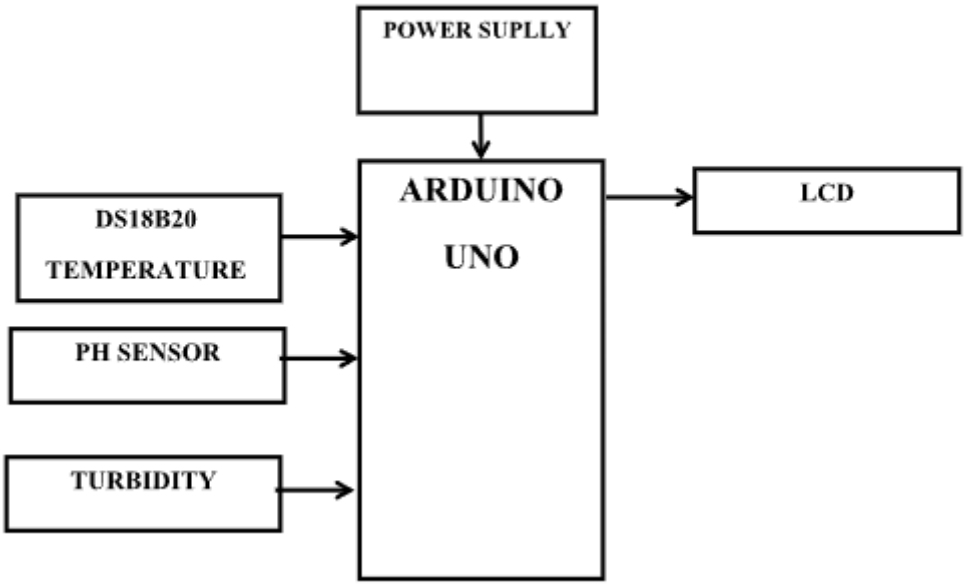
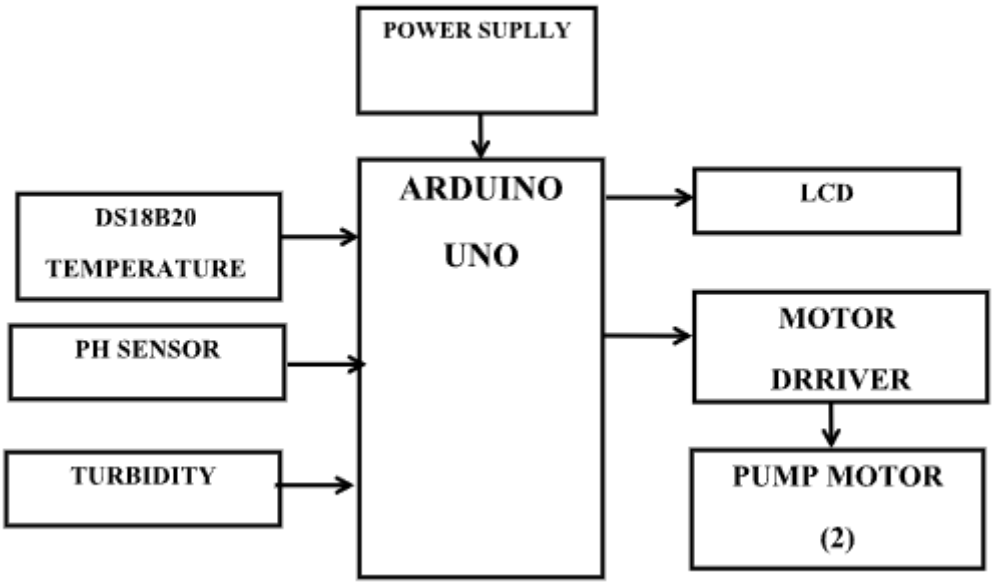


- An Arduino Uno, which serves as the main controller and acts as the "brain" of the system. All the sensors are connected to the Arduino Uno, and their data is continuously monitored and provided to the users.
- One of the sensors used is the DS18B2 temperature sensor, which detects the temperature of the pond water. If any abnormal temperature readings are detected by the sensor, an alert is immediately generated to notify the user.
- The pH sensor is another sensor employed in this system to measure the acidity or alkalinity of the water by determining the concentration of hydrogen ions (H+). It operates based on a pH-sensitive electrode and a reference electrode.
- Additionally, a turbidity sensor is used to measure the cloudiness or turbidity of the water. It quantifies the amount of suspended particles or solids present in the water, affecting its transparency.

CHAGING THE WATER IF ANY ABNORMALITIES DETECTED BY SENSORS



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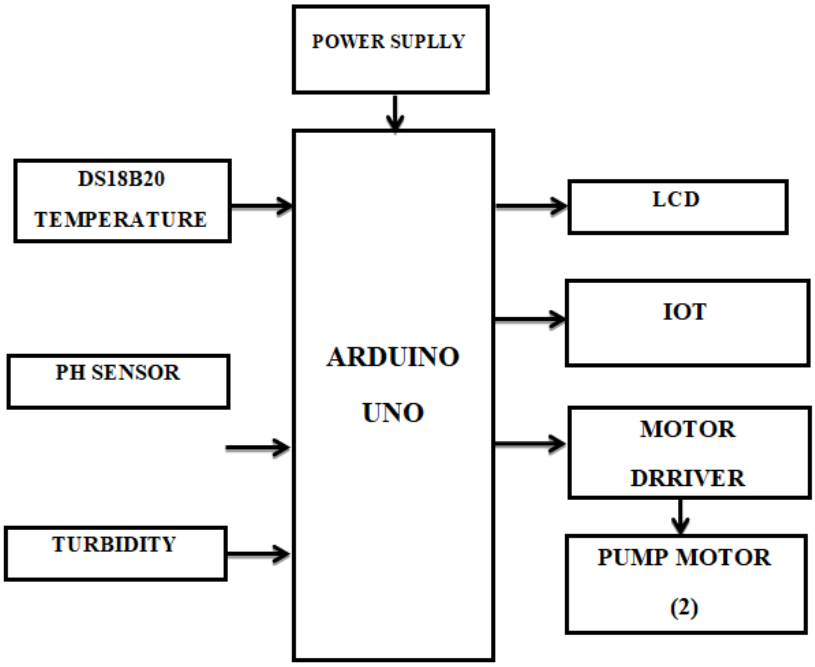
- In case any abnormalities are detected in the water by the sensors, two pump motors are incorporated into the system. When triggered, one pump motor is automatically activated to change and refill the pond with fresh water, facilitated by the other motor.

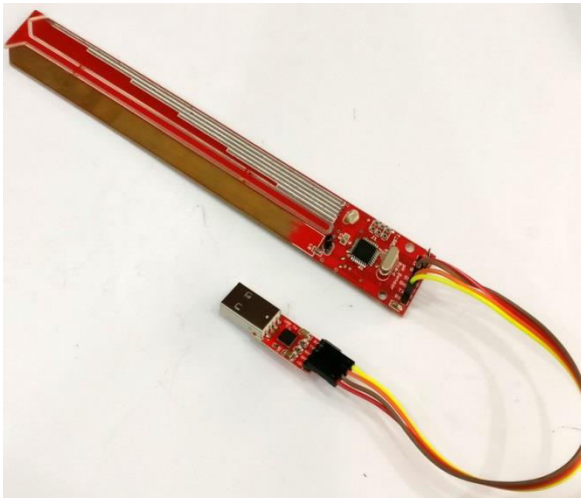
UPDATE INFORMATION IN CLOUD AND LOCAL LCD FOR USER

- To enable users to access the sensor data, an IOT (Internet of Things) component is integrated. The sensor data is updated and made available on an IOT webpage for users to monitor. Furthermore, an LCD display is employed to provide users with real-time information about the current execution of the program.
- Overall, the Arduino Uno acts as the central control unit, the sensors provide data on temperature, pH, and turbidity, pump motors ensure water quality, IOT enables remote monitoring, and the LCD display provides visual feedback to the use



IV. RESULTS AND DISCUSSION

PH Sensor



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pH sensors measure the level of pH in sample solutions by measuring the activity of the hydrogen ions in the solutions. This activity is compared to pure water (a neutral solution) using a pH scale of 0 to 14 to determine the acidity or alkalinity of the sample solutions.
A pH Meter is a device used for potentiometrically measuring the pH, which is either the concentration or the activity of hydrogen ions, of an aqueous solution. It usually has a glass electrode plus a calomel reference electrode, or a combination electrode.[1] pH meters are usually used to measure the pH of liquids, though special probes are sometimes used to measure the pH of semi-solid substances.

Features

- Measure the Ph level
- Measure the Light intensity
- Measure the Water Level
- Measure the Temperature

Specifications

- **Meter: 5 x 8 x 3.5cm [2 x 3.2 x 1.5"]**
- **Probe length: 21cm [8"]**
- **Bronze probe diameter: 4.8mm**
- **silver probe diameter: 5.1mm**
- **Distance between probes: 1.2cm**
- **Color: Green**
- **Item size: 330*100*30mm**
- **Net weight: 87g**
- **Package weight: 99g**
- **100% brand new and high quality**

pH Meter

A **pH meter** is an instrument used to measure acidity or alkalinity of a solution - also known as pH. Why is pH measurement and control a problem? pH electrodes have been around long enough to be well understood and readily applied. The problem is since pH is a logarithmic function, a change of one pH unit represents a ten-fold change in hydrogen ion concentration.

What does pH stand for?
The term pH is derived from “p,” the mathematical symbol for negative logarithm, and “H,” the chemical symbol for Hydrogen.

pH is a unit of measure which describes the degree of acidity or alkalinity of a solution. It is measured on a scale of 0 to 14.

$pH = -\log[H+]$

Understanding pH measurement
In the process world, pH is an important parameter to be measured and controlled.

The pH of a solution indicates how acidic or basic (alkaline) it is. The pH term translates the values of the hydrogen ion concentration - which ordinarily ranges between about 1 and 10 x -14 gram-equivalents per litre - into numbers between 0 and 14.

On the pH scale a very acidic solution has a low pH value such as 0, 1, or 2 (which corresponds to a large concentration of hydrogen ions; 10 x 0, 10 x -1, or 10 x -2 gram-equivalents per litre) while a very basic solution has a high pH value, such as 12, 13, or 14 which corresponds to a small number of hydrogen ions (10 x -12, 10 x -13, or 10 x -14 gram-equivalents per litre). A neutral solution such as water has a pH of approximately 7.

A pH measurement loop is made up of three components, the pH sensor, which includes a measuring electrode, a reference electrode, and a temperature sensor; a preamplifier; and an analyzer or transmitter. A pH measurement loop is

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essentially a battery where the positive terminal is the measuring electrode and the negative terminal is the reference electrode. The measuring electrode, which is sensitive to the hydrogen ion, develops a potential (voltage) directly related to the hydrogen ion concentration of the solution. The reference electrode provides a stable potential against which the measuring electrode can be compared.

TURBIDITY SENSOR

Measurement & Control

TSD-10

TurbiditySensor

The TSD-10 module measures the turbidity (amount of suspended particles) of the wash water in washing machines and dishwashers. An optical sensor for washing machines is a measuring product for a turbid water density or an extraneous matter concentration using the refraction of wavelength between photo transistor and diode. By using an optical transistor and optical diodes, an optical washing machine sensor measures the amount of light coming from

the source of the light to the light receiver, in order to calculate water turbidity.

DS18B20 TEMPERATURE

Arduino DS18B20- In this Tutorial, you will learn how to use Ds18b20 waterproof one-wire digital temperature sensor with Arduino and display the temperature in Celsius and Fahrenheit on a 16×2 LCD. So far I have covered different temperature sensors like Dht11, which can monitor temperature and humidity

Bmp180 can monitor temperature, pressure and altitude and a K type thermocouple, which can measure temperatures up to 1000 Centigrade. I will provide links at the end of this Article.

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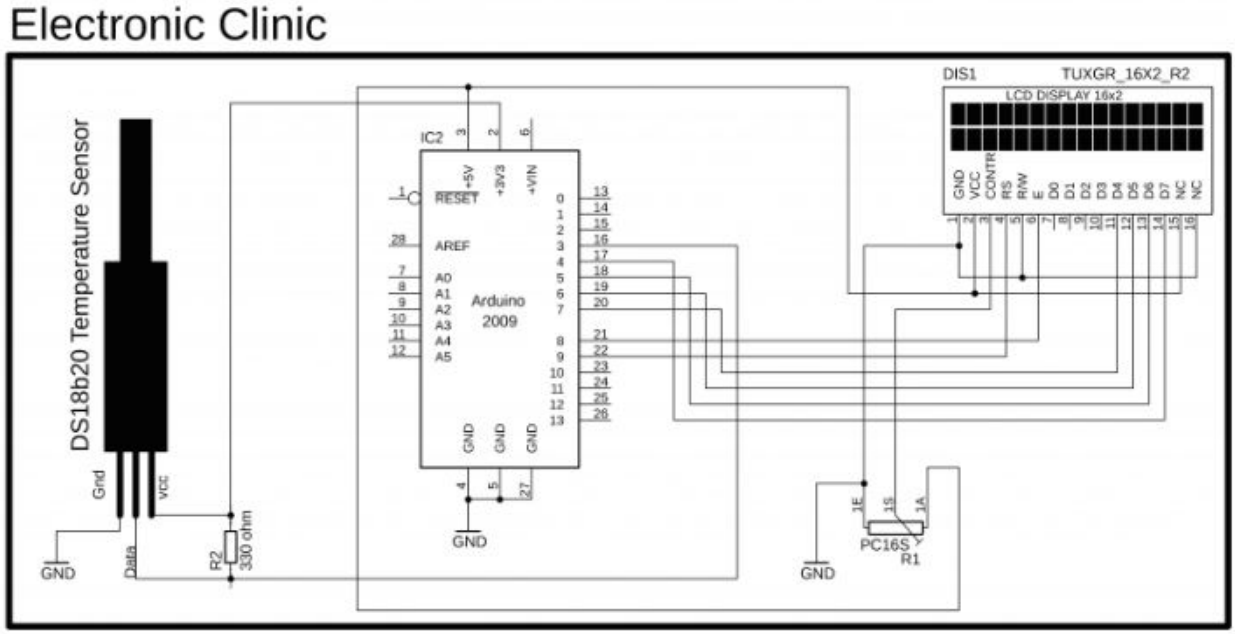
ABOUT THE DS18B20 WATERPROOF TEMPERATURE SENSOR:

One-wire temperature sensors like the DS18B20 are devices that can measure temperature with a minimal amount of hardware and wiring. These sensors use a digital protocol to send accurate temperature readings directly to your development board without the need for an analog to digital converter or other extra hardware. You can get one-wire sensors in different form factors like waterproof and high-temperature probes–these are perfect for sensing temperature in many different projects and applications. And since these sensors use the one-wire protocol you can even have multiple of them connected to the same pin and read all their temperature values independently.

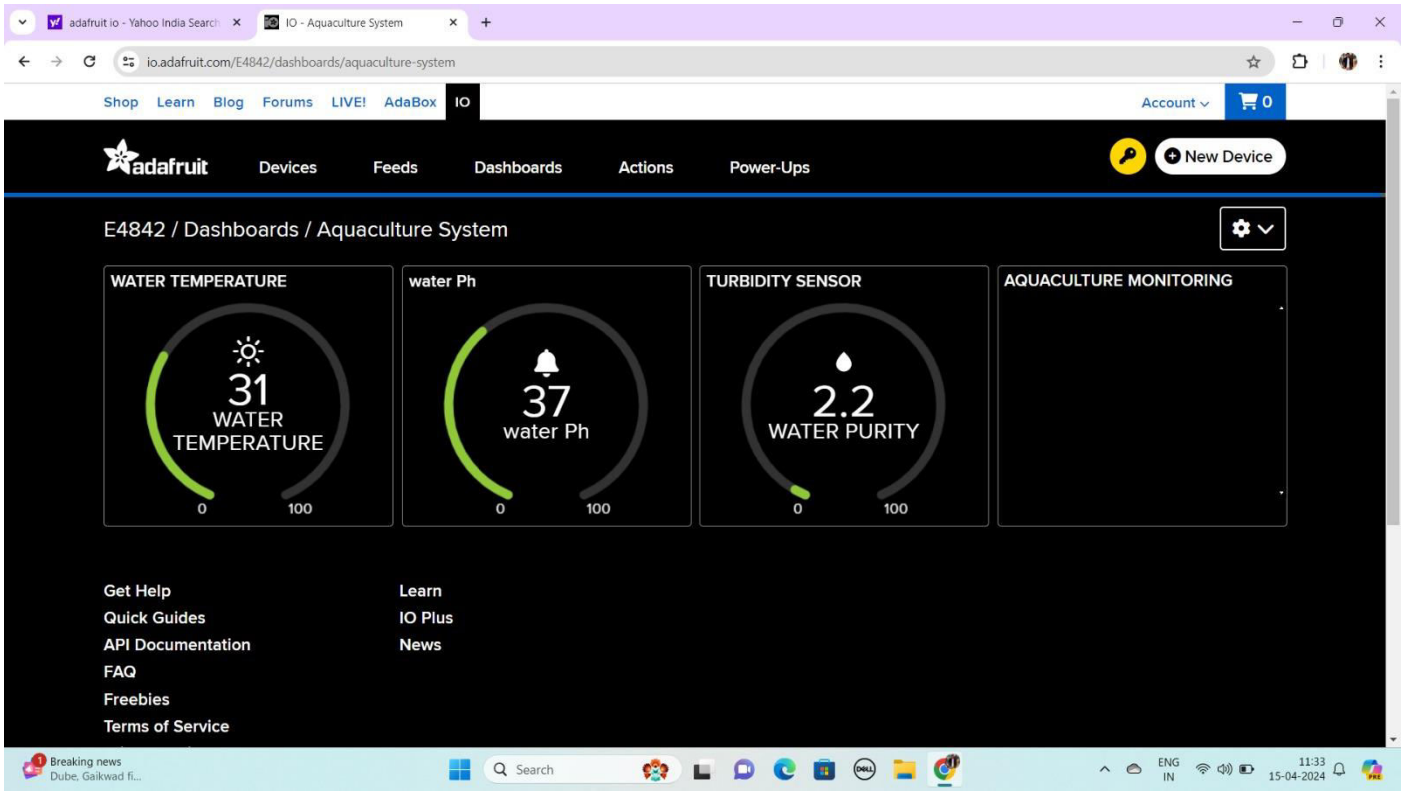
The DS18B20 Waterproof Temperature Sensor has three wires

- The red wire is the VCC wire: the operating voltage is 3 to 5 volts. In my case, I will use 3.3 volts.
- Yellow Wire is the Data wire: we usually connect a resistor between the data wire and VCC wire, I will explain this in the circuit diagram.
- The black wire is the Ground wire. This wire is connected with the Nodemcu Esp8266 wifi module ground.
- This temperature sensor is capable of measuring the temperature ranging from -55°C to 125°C

Arduino DS18B20 Circuit Diagram:



OUTPUT:



V. CONCLUSION

Thus, the proposed system is used to monitor the water quality. The sensors of different types like temperature sensor, PH sensor, and water level sensor is used to monitor the temperature, pH and water level. If the sensor detects the abnormal value of any sensors like temperature sensor, pH sensor and water level sensor, then the GSM will send the message to the mobile phone. Hence, this system will remain more economical and time efficient to monitor the aquaculture activities.

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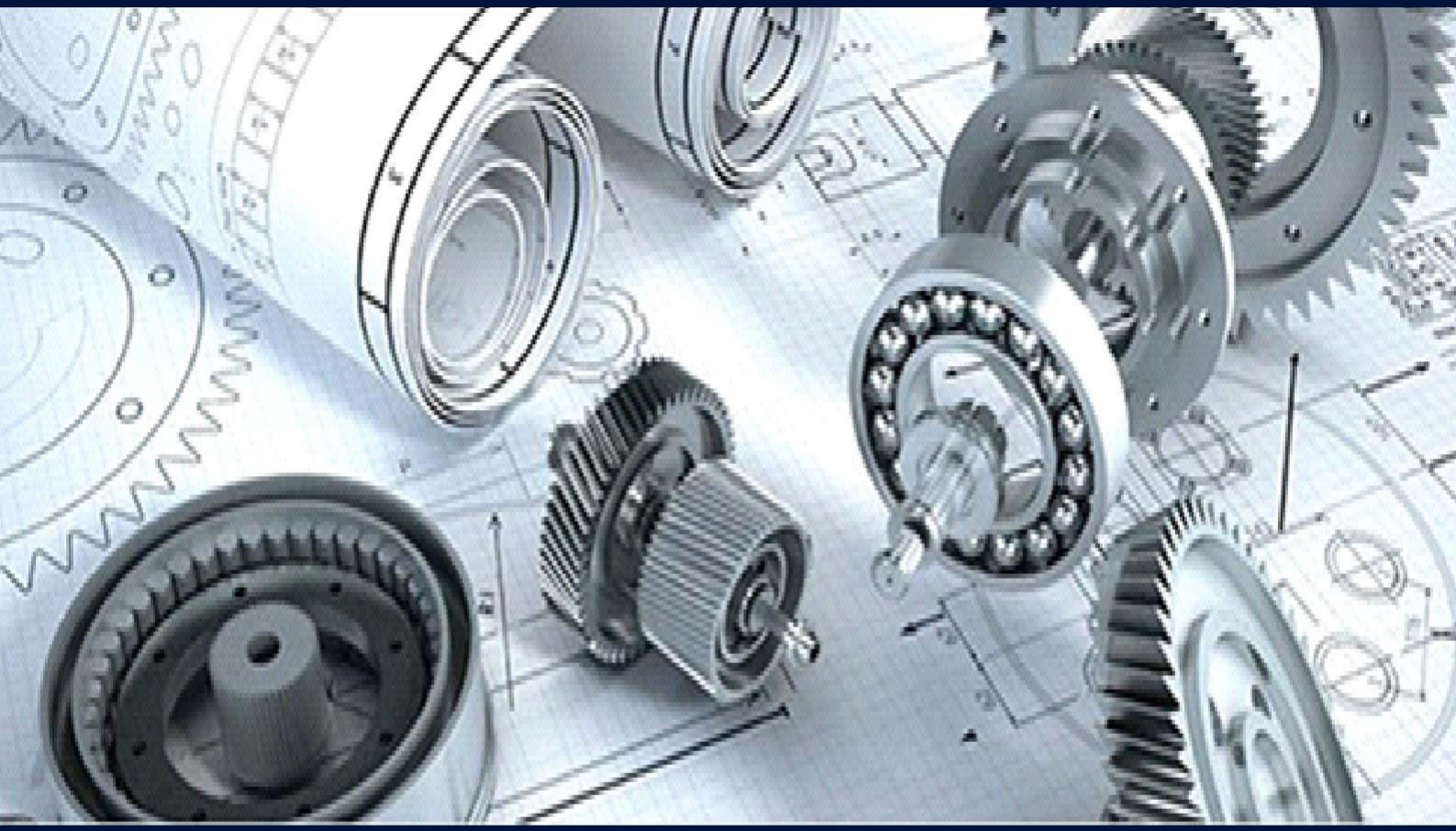

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