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Aqua-Culture Management Using IOT

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***Abstract*: The main aim of this paper is to increase yields of aqua-culture farmers by creating ponds where aquatic animals are made to develop in their natural habitat. Water quality determines the ultimate success or failure of an aqua culture. The farmer must record and mange water quality all through the growing season. Water quality parameters affect respiration, feeding, metabolism and reproduction of aquatic animals. The parameters which are to be kept at certain optimal levels in water are dissolved oxygen, temperature, pH level.**

Theses parameters can vary a lot during the period of day and can rapidly change depending on external environmental conditions. Hence it is necessary to monitor these parameters with high frequency, if not continuously, for timely analysis and action. This need accurate real-time information system and performance in order to maximize their potential. It is found that the current manual water quality monitoring entails tedious process and is time consuming. The parameters such as temperature, pH level of the water can be measured. The measured values from the sensors can be processed by ardunio board and send to Raspberry pi board through usb. Finally, the sensor data can be viewed on internet using IOT platform (UBIDOTS).

***Keywords:* Arduino board, Raspberry Pi, PH level, Dissolved Oxygen, Ubiodots.**

I. INTRODUCTION

Different fish species have different and specific range of water quality aspects (temperature, pH, oxygen concentration, salinity, hardness, etc.) within which they can survive, grow and reproduce. Water quality monitoring can help researchers predict and learn from natural processes in the environment and determine human impacts on an ecosystem. These measurement efforts can also assist in restoration projects or ensure environmental standards are being met.

The man power needs can be minimized by implementing automation in the process. In our paper we are implementing the following modules

1. Water temperature
2. Water PH level
3. Dissolved oxygen in Water

Water Temperature:

Water temperature plays a major role in the quality of aquatic life and habitats. Heat flow and the fluctuation of temperature determine what species will live and thrive in a body of water.

Body temperature, and thus the water temperature, has an effect on level of activity, behaviour, feeding, growth, and reproduction of the fish. Each species has its tolerance limits and optimum range. When water temperatures are outside the optimum range, fish body temperature will either be too high or too low and fish growth will be affected or the fish will even die.

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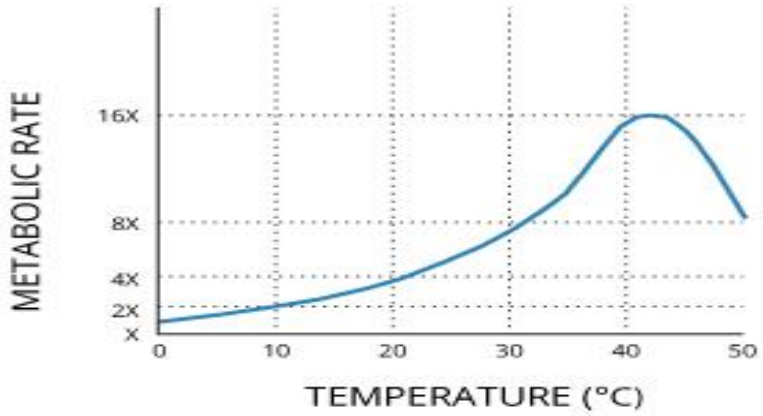

Figure1: The metabolic rates of aquatic organisms' vs water temperature

For most fish, a 10°C increase in water temperature wills approximately double the rate of physiological function.

Water pH:

Extreme pH values can even kill your fish. The growth of natural food organisms may also be greatly reduced. The critical pH values vary according to the fish species, the size of individual fish and other environmental conditions. For example, fish are more susceptible to extreme pH during their reproductive seasons, and eggs and juveniles are more sensitive than adults. Waters ranging in pH from 6.5 to 8.5 (at sunrise) are generally the most suitable for pond fish production. Most cultured fish will die in waters with pH below 4.5 and 10 or above. Fish reproduction and general performance can be greatly affected at pH below 6.5 and above 8.5.

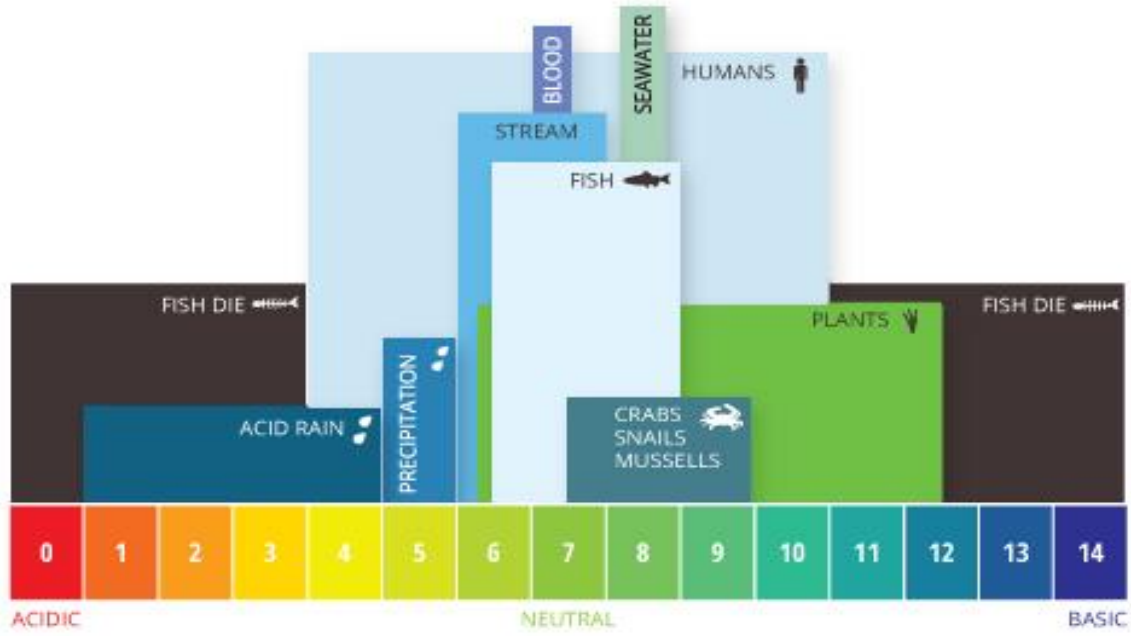

Figure2: Aquatic pH levels.

Dissolved oxygen:

The most important gas dissolved in water is oxygen. Dissolved oxygen (DO) is essential for respiration and decomposition. Dissolved oxygen in water comes from atmospheric oxygen and photosynthesis. The atmospheric oxygen diffuses and dissolves into the water. But the diffusion and its subsequent dissolves into water is a slow process. The major source of dissolved oxygen in ponds is photosynthesis.

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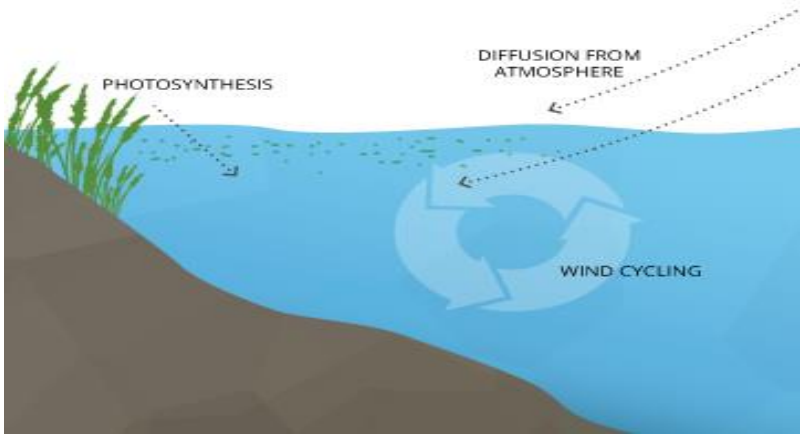

Figure3: How oxygen enter in water.

Saltwater holds less oxygen than freshwater, so oceanic DO concentrations tend to be lower than those of freshwater. In the ocean, surface water mean annual DO concentrations range from 9 mg/L near the poles down to 4 mg/L near the equator with lower DO levels at further depths. There are lower dissolved oxygen concentrations near the equator because salinity is higher.

One of the primary objectives of cognitive radio (CR) ad-hoc networks is to facilitate an efficient utilization of spectrum resources without interfering with the primary user networks.CR-Network allows intermittently connected mobile unlicensed nodes to exploit temporarily available contacts and idle licensed channels for end-to end message delivery. Cognitive Radio (CR) is a key technology to realize Dynamic Spectrum Access (DSA) that enables an unlicensed user (or, secondary user) to adaptively adjust its operating parameters and exploit the spectrum which is unused by licensed users (or, primary users) in an opportunistic manner. However, the realization of CR-Networks also brings crucial research challenges that must be addressed. In particular, due to different node mobility and spectrum availability patterns, CR-Networks is frequently divided into unpredictable partitions. These partitions are essentially intermittently-connected and deficient in complete end-to-end paths. Hence, spectrum-aware flooding (SAF) is more relevant for CR-Networks. In SAF, a message is first copied to a set of path nodes using available channels. Then, one of these path nodes delivers the message to the destination provided that it encounters. Clearly, if the message is tried to be copied to all paths that do not have the message the end-to-end message delay can be minimized. However, such a forwarding strategy is energy-inefficient and may cause a severe interference to primary user system. Hence, it is necessary to decide which path nodes and licensed channels should be used to mitigate the energy consumption and high interference for an efficient communication in CR-Networks.

II. INTERNET OF THINGS (IOT)

In the past decade, all human life changed because of the internet. The internet of things has been heralded as one of the major development to be realized throughout the internet portfolio of technologies. The Internet of Things (IOT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things represents a concept in which, network devices have ability to collect and sense data from the world, and then share that data across the internet where that data can be utilized and processed for various purposes. The internet of things describes a vision where objects become part of internet: where every object is uniquely identified and access to the network. IOT communication is quite different from the traditional human to human communication, bringing a large challenge to existing telecommunication and infrastructure. Furthermore, IOT provides immediate information regarding access to physical objects with high efficiency.

The concept of Internet of Things is very much helpful to achieve real time monitoring of sensor data. Internet of Things (IOT) is a kind of network technology, which is based on information sensing equipments such as RFID, infrared sensors, GPS, laser scanners, gas sensors and so on, can make anything join the Internet to exchange information, according to the protocol, which gives intelligent identification, location and tracking, monitoring and management. In proposing system

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we introduce cloud computing technique for monitoring sensor values on the internet. Cloud computing provides the access of applications as utilities, over the internet. The cloud computing characteristic and development approaches. Cloud computing is a large scale processing unit which processes in run time and it is also a very low cost technology based on the IP. The application area of IOT includes building and home automation, smart city project, smart manufacturing of various products, wearable's, health care systems and devices, automotive etc.

III. METHODOLOGY

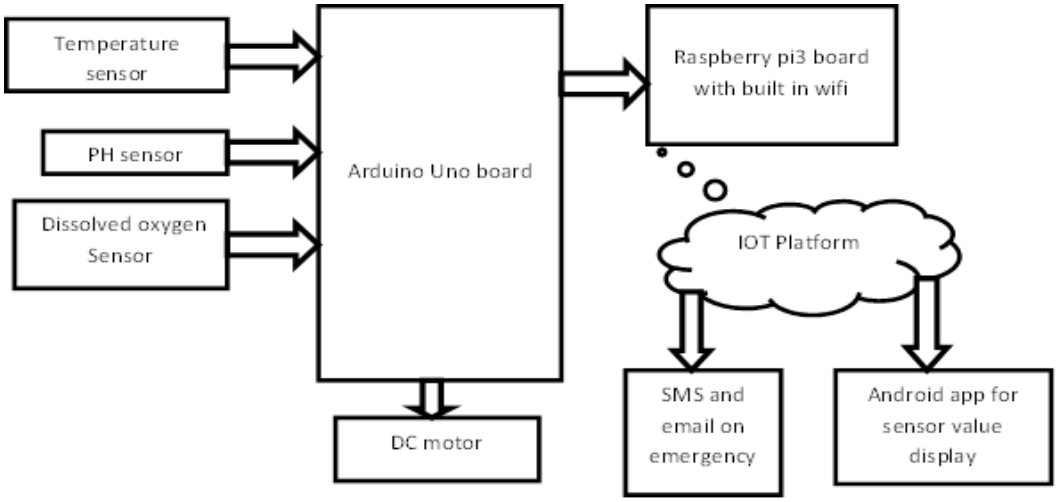


Figure4: Block diagram

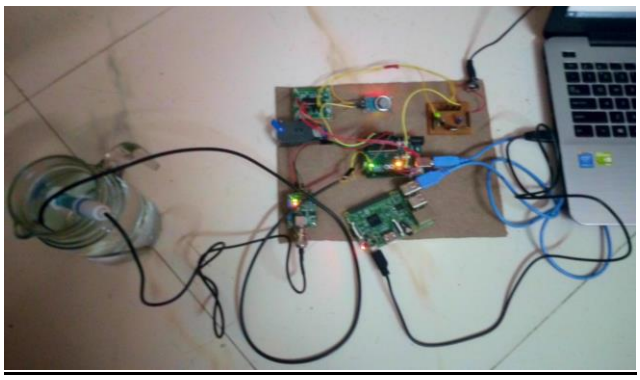
Internet of Things or IoT is an architecture that comprises specialized hardware boards, Software systems, web APIs, protocols which together creates a seamless environment which allows smart embedded devices to be connected to internet such that sensory data can be accessed and control system can be triggered over internet.

Also devices could be connected to internet using various means like WiFi, Ethernet and so on. Furthermore devices may not need to be connected to internet independently. Rather a cluster of devices could be created (for example a sensor network) and the base station or the cluster head could be connected to internet. This leads to more abstract architecture for communication protocols which ranges from high level to low level.

Ubidots was first born as an engineering services firm, specializing in hardware and software development for IoT projects in Latin America. After going through the Boston Mass Challenge Accelerator -with a purpose of turning ourselves into a global product-based start-up- the idea of an IoT cloud was born; specially one that understood the real needs of hardware engineers. Ubidots helps you create applications that capture real-world data and turn it into meaningful actions and insights.

VI. RESULT AND DISCUSSION

Experimental Setup:



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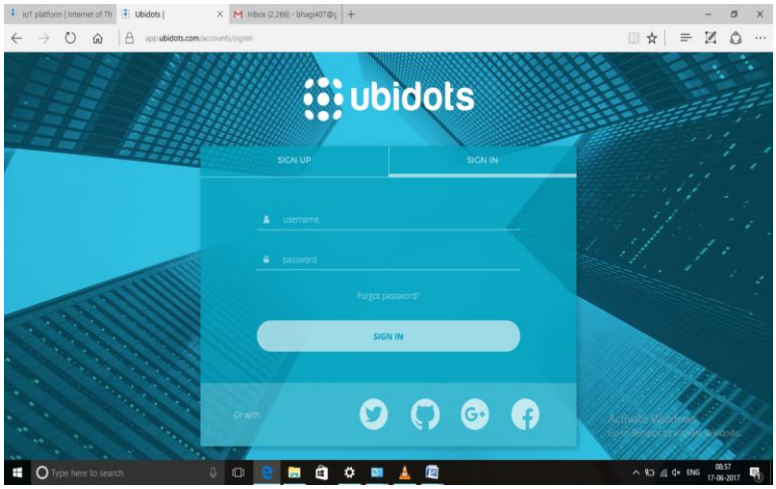
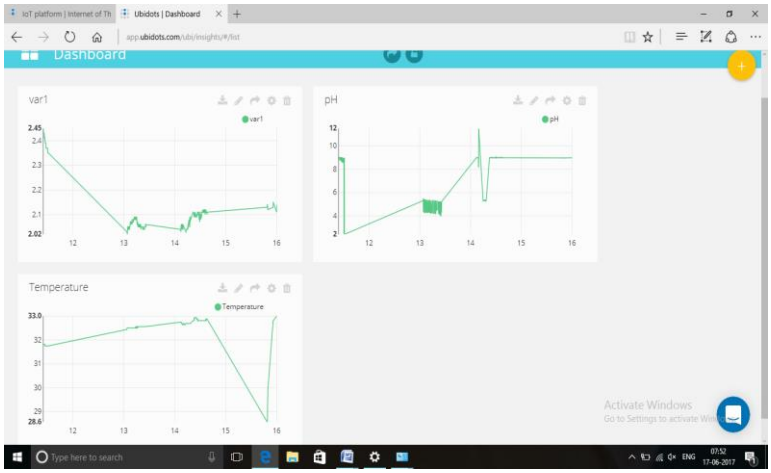
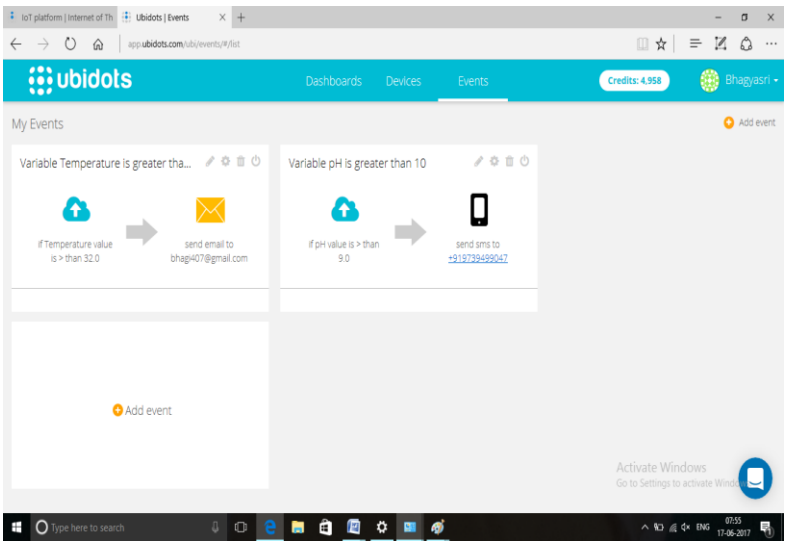
- Give the power to the raspberry pi kit by using a usb charger and 12v power adapter.
- Connect raspberry pi kit to wifi network.
- Open https://app.ubidots.com/accounts/signin/ and sign in with mail id and password.



- Observe the sensor Values in Dashboards.



- Set Event if in event Screen as shown below.



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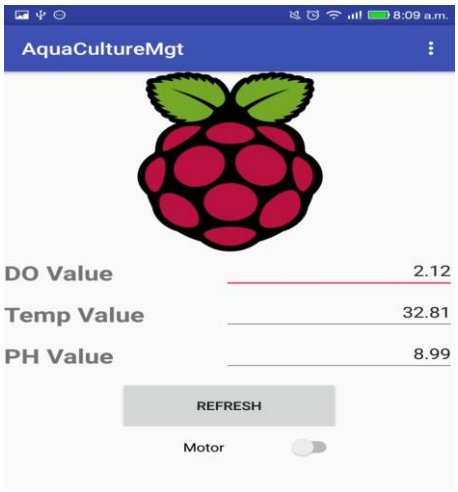
Android Application:



V. CONCLUSION

Automation in aquaculture can reduce manpower requirements and also increases the production rate. Aquaculture farmers to reduce their risk and increase productivity. We integrate sensors, mobile connectivity and decision tools for affordable aquaculture monitoring and automation.

In order to provide good water quality pH levels should be monitored. pH can be controlled by replacing the water so a relay circuit is used along with pH sensor which operates water pump accordingly. Actuators like water pump and aerators are used in aquaculture. Failures in these actuators can be detected by measuring the current continuously. It helps farmers to monitor their ponds in a better way and reduce their investments to make it sustainable.

We like to conclude with the help of my research paper, aquaculture farmers to reduce their risk and increase productivity.

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