

Water Monitoring System in Aquaculture Using IoT

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Abstract

Water is a natural resource and is becoming a more valuable asset due to scarcities and misuse. Water resource management planning has respect to all the rival demands for water and seek to allocate water on a reasonable source to satisfy all uses, demands. Water monitoring is an important since it helps determine future Irrigation expectations, Industrial needs, drinking and household purpose etc. So for this purpose a new approach IoT based multi-purpose water monitoring system is developed in this project. This system contains sensors which measure quality parameters like pH, temperature sensors, and Dissolved oxygen (DO) Sensor. The data from these Sensors are collected by Beagle Bone Black board development kit. After processing the data, the board will send the data into Cloud using GSM module. The user can access the data at any time from the cloud and also message/alarm is send to the farmer at the Time of crisis. Based on the data, precautions can be taken in time to increase productivity and minimize losses.

Keywords: Beagle Bone Black, pH, Temperature, Turbidity, Conductivity, GSM, Cloud.

INTRODUCTION

India currently stands as a developing nation in aquaculture wing with its own water bodies and produces a huge quantity of aqua foods. In addition to these natural water bodies, most of the farmers in India adopted aquaculture. In aquaculture, water quality is the critical factor. But in India most of the farmers are illiterates and don't have much awareness about the water quality parameters which may result in a damaged yield. Continuous monitoring of water is essential to reduce this damage. So, Water monitoring system with IoT is developed. This IoT system measure Water Parameters like temperature, pH values by using different sensors. These sensors are connected and controlled by a microcontroller Beagle Bone Black(BBB). At this stage, IoT comes into picture which adds intelligence to the system. The Data from the Sensors will be loaded in to cloud using GSM module. This data can be accessed from any remote location. If there are any abnormalities in the values with respect to standard values, preventive

measures can be taken immediately by alerting the farmers.

INTERNET OF THINGS (IoT)

Today, the demand for Internet application development is too high. IoT is a main technology by which we can produce various valuable internet applications. Mostly IoT is a network in which all physical objects are connected to internet through network routers (or) devices and exchange data between people and things, and between themselves. It controls the objects remotely across the existing network without any human interaction. The devices in the IoT are provided with unique identifiers.



Kim J. *Internet of Things*. Lüder: Huffington Davis.

Fig 1: Internet of Things

PROPOSED SYSTEM

In the present scenario, humans are involved in sampling the water, testing and performing analysis. But it is not possible in all situations. So, here we are planning to develop an IoT based water monitoring system. Different types of sensors are used to measure the water quality parameters in this system. All these sensors will be interfaced to a microcontroller. In earlier days, microcontrollers like Arduino and Raspberry pi are used. In this paper, we are using Beagle Bone Black. Using BBB we can send the information at 1GHz speed which will alert the user very quickly. Here installed OS is Debian. Software named as Putty, is used to communicate with the board. Block Diagram of the proposed system is as Shown below.

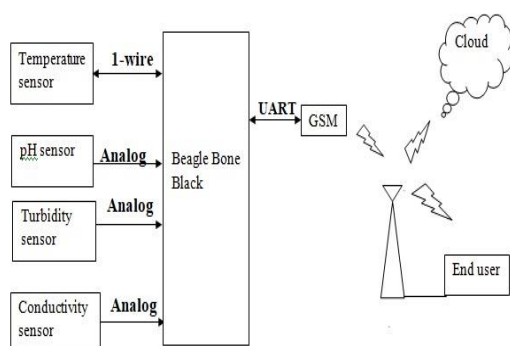
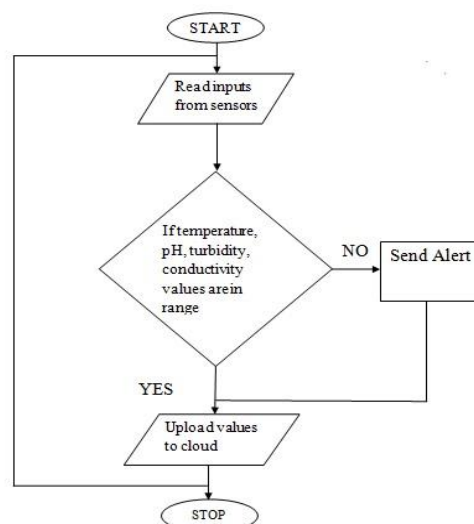


Fig 2: Block Diagram

The system mainly consists of sensors, microcontroller and GSM module. Here, four different types of sensors are used to measure the water parameters. All these sensors are deployed in water for sensing. These sensors are attached to BBB using different communication protocols and processing of data will be done in BBB such that the parameter values will be understandable by the user. Finally, BBB will upload the values to cloud using GSM module so that data can be accessed from anywhere.

FLOWCHART



IMPLEMENTATION

1) Temperature:

In this project Temperature Sensor (DS18B20) is used. It is a 1-wire programmable Temperature sensor. It is also waterproof which means it can be used to measure the Temperature of Water under any conditions. It can measure a wide range of temperature from -55°C to +125°C. It has a built-in 12 bit ADC. The Device interconnects over a 1-Wire bus that by definition requires only one data line, ground for communicating with a processor.

2) pH:

Definition of pH is as the -ve logarithm of active hydrogen ion. It is a measure of the acidity or alkalinity of an aqueous solution.

pH electrode consists of mainly two electrodes:

1) Glass

2) Reference

pH is determined basically by measuring the voltage difference between these two electrodes. At the tip of the electrode is a thin membrane that is glass which is made with specific type is capable of ion exchange. It is element that senses the hydrogen ions concentration of the test solution. The reference electrode potential is constant and is produced by

the internal element in contact with the reference, fill solution that is kept at a pH of 7.

3) Turbidity:

Turbidity is one of the parameter which is used to find the water quality. It is the measure of amount of suspended particles present in water which are invisible to naked eye. Turbidity blocks the sunlight to pass into water which will affect the aquatic life. Turbidity should be less for good quality of water.

Turbidity sensors gives measurement value of the light amount of that is scattered by the suspended solids in water. As total suspended particles count increases, water turbidity level increases.

4) Conductivity:

Conductivity is a measure of ability of water to pass/flow electric current. Conductivity is directly related to concentration of ions in water. It is due to salts or chemicals present in the water.

Conductivity sensor contains two metal electrodes are separated with one centimetre apart. A constant voltage is applied across the electrodes change in electrical current results. Since the current flowing through the water is proportional to the concentration of ions dissolved in the water, conductivity of electrical signal can be measured. As the concentration of ions is more the conductivity will be more.

5) GSM Module:

In this project SIM900 is used as GSM module. It is an ultra solid and reliable wireless module. It works around the frequency of 850MHz, 900 MHz, 1800 MHz, and 1900MHz. It can be used not only to access the Internet, but also for voice messages and for sending SMS. The module is managed by an AMR926EJ processor which controls phone communication, data communication, the communication with the circuit interfaced with the

phone to phone. It can be controlled using AT Commands.

Features:

Power supply : 5V,2A

Works based on AT commands.

UART communication.

Supports RTC (Real Time Clock).

Has MIC and Headphone Jack for phone calls.

Can be connected using software serial or Hardware serial ports.

Allows sending and receiving SMS, MMS, GPRS and Audio signals.

6) BeagleBone Black:

Beagle Board is a mini CPU by Texas instrument. It has all the functionalities of a computer and supports various operating systems like android, debian and ubuntu. Beagle gallery contains large collection of boards, beagle bone black is one from it.

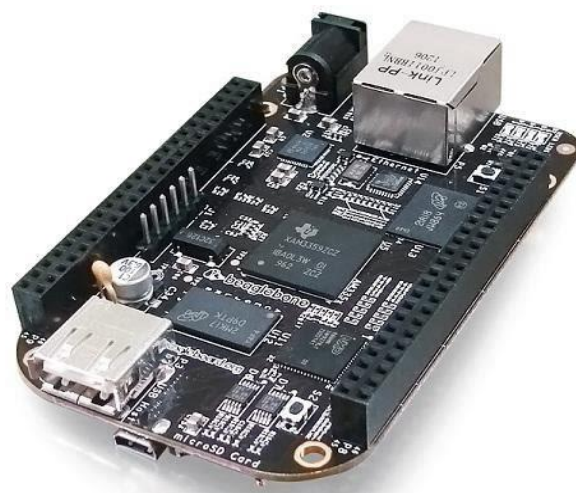


Fig 3: Beagle Bone Black

Features:

An open-hardware embedded computer with USB cable.

Flash memory 4GB eMMC.

Connectivity- USB for powering, USB host, Ethernet, □HDMI, 2X46 Headers.

Software Compatibility--- Android Debian, Ubuntu.

Processor – ARM Cortex A8.

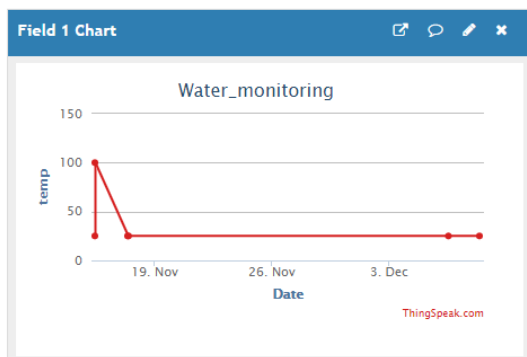
Speed – 1GHz.

RESULTS

The IoT based water monitoring system involves Beagle Bone Black as a microcontroller. The temperature and pH sensors are deployed in water and are connected to microcontroller for collecting water parameters. By using microcontroller the values are analysed to determine the quality of water. Finally, the values are uploaded to cloud and alerting messages sent to the end user.

```
debian@beaglebone: ~/IOT_PROJECT
debian@beaglebone:~/IOT_PROJECT$ sudo python final.py
echo: write error: File exists
Starting...
echo: write error: File exists
['28-0117c2a145ff', 'wl_bus_master1']
28-0117c2a145ff
temperature=
28.062
echo: write error: File exists
2234
pH=
6.87216796875
echo: write error: File exists
turbidity=
57.2998046875
AT
```

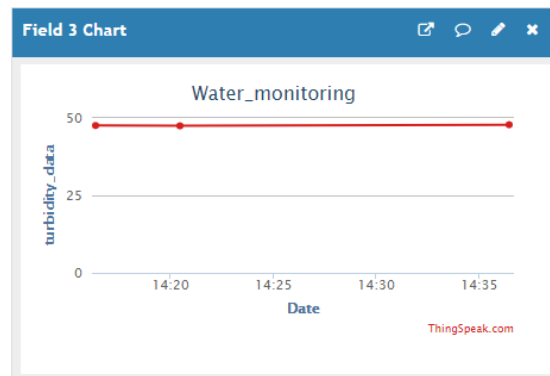
Fig 4: Sensors outputs



a) Temperature



b) pH



c) Turbidity

Fig 5: Data in Thingspeak

CONCLUSION

This project demonstrates the water quality monitoring system in aquaculture. Water is tested at regular intervals of time and values are stored in cloud, such that precautions can be taken at the time of crisis reducing the damage and increase the productivity.

REFERENCES

- [1] Liu FeiFei. Determination of ammonia nitrogen in industrial waste water with chemical oxygen demand rapid analyzer. Shanxi Chemical Industry, 2011; volume31, issue1, 49–51.
- [2] Han W T, Xu Z Q, Cao P, Zhang Y, , Ooi S K, Chen X W,. “Real Time Remote Monitoring System for Crop Water Requirement Information”. International Journal of Agriculture & Biological Engineering, 2014; volume 7 issue 6, 37–46.
- [3] Christos G. Panayiotou, Theofanis P. Lambrou,. “A Low Cost System For Real Time Monitoring and Assessment of Potable Water

Quality at Consumer Sites.” Proc. IEEE Sensors, 2012, pp. 1–4.

[4] Muhammad Hafiz M, Shah Rizam M. S. B. Mobile buoy, MohdAkmalHelmi A, H, for “Real Time Monitoring And Assessment of Water Quality”. 2014 IEEE Conference on Systems, Process and Control, 12–14 December 2014, Kuala Lumpur, Malaysia.

[5] U N, Sidek O, Nasirudin M A, Za’bah. “Fresh Water Real-Time Monitoring System Based On Wireless Sensor Network and Global System For Mobile”. 2011 IEEE Conference on Open Systems, Sept. 25–28, 2011, Langkawi, Malaysia.

[6] Zhou H D, Liu W, Huang Y. “Design Of Water Quality Monitoring System Based On Wi-fi Wireless Sensor Network.” Transducer and Micro system Technologies, 2015, volume 34, issue 5, 99–102.