An Undergraduate Internship/Project on Topic

By

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Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

Department of Computer Science & Engineering

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Attestation

This is to certify that the report titled " Implementation of an IoT based smart monitoring system for examine aquatic life" was completed by Tanjir Ahmed Emon (1620688) submitted in partial fulfillment of the requirement for the Degree of Computer Science from Independent University, Bangladesh (IUB). It has been completed under the guidance of Md. Fahad Monir (Internal Supervisor) and Md. Mozaffor Hossain Papu (External Supervisor) . I also certify that all my work is original and has not been submitted earlier to this university or any other institution. All the source of information used in this Project Report has been duly acknowledged in it.

_____ _____

Signature Date

_____

Tanjir Ahmed Emon

Acknowledgement

I am using this opportunity to express my gratitude to everyone who supported me throughout the course. I am thankful for their aspiring guidance, invaluably constructive criticism, and friendly advice during the internship. I am sincerely grateful to them for sharing their truthful and illuminating views on a number of issues related to the course.
I am grateful to **Independent University, Bangladesh (IUB)** for offering me this course and I express my thanks to my faculty and internship supervisor, **MD Fahad Monir** .

I want to stretch out my earnest gratitude to him. I am profoundly obligated to **Independent University, Bangladesh (IUB)** for their direction and consistent supervision just as for giving important data with respect to the course.

I am very much grateful towards my external supervisor, **Md. Mozaffor Hossain Papu** for his guidance and support that I needed for the fulfillment of my internship and project. I might want to offer my extraordinary thanks and gratitude to the **Dhaka Distribution Limited** developers and employees for giving me such consideration and time and directing through the internship.

I also want to thank my parents for who have not only supported me financially but have always believed in me and always motivated me to accomplish the things that I achieved.

Letter of Transmittal

Date:

Md. Fahad Monir
School of Computer Science and Engineering
Independent University Bangladesh.
Subject: Submission of Internship Report.

Dear Sir,
It is a great pleasure to submit my report on Internship at **Dhaka Distribution Limited**. I have tried to narrate my project works, achievements and experiences in this report. All the works presented here are done with utmost sincerity and honesty.

During the internship period, I have served in **Dhaka Distribution Limited** for three months where I have not only gained real life work experience but understood the process of the department and its various aspects. This report includes a detailed review of the office as well as the functionalities of the department. As a document of my effort during the internship periods I have conducted all the project works that I have done during my internship periods, especially their requirement, functionalities, and technical specifications.

I pray and hope this report will be quite interesting and fulfil your expectations. I have tried my best to avoid my deficiencies and hope that my report will satisfy you. I also would like to thank you again forgiving me the opportunity to submit this report.

Sincerely,
Tanjir Ahmed Emon
Id - 1620688

Evaluation Committee

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Signature

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Name

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Supervisor

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Signature

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Internal Examiner

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External Examiner

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Convener

Abstract

My internship was to develop an IoT based device that will transfer data based on the Water quality to the web server and show real time data with graph on the web application. Firstly, the main duty was brainstorming to come up with ideas to design the whole mechanism.

Also, to design the device first as well as its components such as Circuit , device micro-controller box , Sensor Box. Also, I had to sort out for data transferring method from control station to web server. As per requirement the application is expected to use **Adafruit IO** API to receive data from control station, and feedback to web server.

The design of the circuit was done by using Proteus and the device boxes were made by using 3d printer.

The data collection method from the sensors was done by using **Arduino IDE** . The data from sensors is feedback to Adafruit IO API where it receives data. The data collection is handled by the Adafruit API and then data processing is done through **AJAX** which helps to send data from server to the web browser. Also, as per requirement the data should be real time data (RTD) , and this RTD should be displayed on the web browser as dynamic chart.

Using Ajax, it helps to update a web page without reloading the page, as a result to display RTD on web page there is no need to refresh the web page again and again. The application then takes the different sensors data in the csv files and inserts them into the database tables.

My final project and main task of this report is to automate the whole process described above. This was to be done to help user to get statistics about the aquatic environmental condition very quickly at a low-cost.

During working at **Bangladesh Securities Limited,** I was able to develop new skills and learned to work with new platform such as HTML, CSS, JavaScript, jQuery, Ajax, Nodejs, PHP, MySQL, Arduino IDE, Proteus, SolidWorks, Adafruit IO API,

Contents

Chapter 1

Introduction

1.1 Overview/Background of the Work

Water is one of the most important resource on earth. water contained in underground geologic formations called aquifers is a source of drinking water for many people. According to United Nations in 2005, an estimated 1.1 billion people worldwide lack clean water and 2.6 billion lack access to basic sanitation[2].
Due to the human activities river ocean are being polluted by dissolved chemicals, plastic and by bacteria and viruses. Over the years, we have seen tremendous development of technology which transformed our daily lives at its best. Nowadays, technology plays a vital role to fight the climate change and reduce pollution. Internet of Things (IoT) is now one of the new automation technologies that is widely used all over the world that can help us to analyze data and statistics over climate change, pollution etc.

Internet of Things (IoT) is defined as the network of physical objects or things embedded with sensor, micro-controller, and network connectivity that enables objects to collect and exchange data. The IoT architecture fabricated with built-in wireless technologies so that they can be monitored, controlled, and linked within the existing Internet infrastructure[1]. IoT provides dynamic control of industry and daily life. However, IoT device must be able to capture real-time data autonomously and can be send to the web server.

Monitoring the aquatic environment of a certain area provides information that is useful in knowing water quality , level of water pollution, the effect on human health and their way of life. In this project, the design, and implementation of a low-cost and portable Water Quality monitoring system is proposed. The proposed system is designed and built exploiting Internet of Things (IoT) architecture. This will help the user to monitor the current water quality using a web application. The proposed system is an IoT solution consisting of an IoT device and user interface software. The proposed device has functionalities of measuring PH, Temperature, TDS level of water.

The user easily gets the information using a web application after setting up the device on water. Since there will be a database for backing up the data, user can access to the database at any time.

1.2 Objectives

The objective is to develop a system that will be fast, labor-saving as well as robust for autonomous system. Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming[3]. The traditional method of testing water quality is to gather samples of water manually and send to the lab to test and analyze. Now days manual system is outdated as various forms of automation have been used in industry . So here the project proposes a sensor-based water quality monitoring system. However, building an efficient system at low cost remains a difficult challenge.

Implementation of the whole system for automation: -

- **To Make a Robust Hardware Design** : - Firstly, design of the whole device should be made by using SolidWorks model computer aided design (CAD). The two section of device box one is control station and another is sensors box fabricated through 3D printer. The Circuit board should be design through Proteus simulation software that allows to design a Printed Circuit Board (PCB). Developed Circuit board is Compatible with ESP-32 Wi-Fi module to merge all electronics components in one place. As a result , it gives not only less visible wire connections but also a compact product for day-to-day use.
- **Sensors Monitoring** : - Three different types of sensors needed for monitoring among these three one is PH sensor, Temperature sensor and TDS sensor. The three sensors receive data in the form of analog signals. ESP-32 Wi-Fi module receives these analog signals and converts them into the digital format.
- **Fetch data Using API's** : - . The data collection is handled by the Adafruit API. Adafruit IO HTTP API known as IoT broker used to fetch data from the control station using a unique Adafruit IO key. This API is supported to Arduino IDE and using this IoT broker real time data can be fetch as a JSON format. Also, the real time data (RTD) will be stored in its database.
- **Upload Data to Server: -** The data fetched by Adafruit IO API is being sent to the web server through PHP for showing the graph trend.
- **Update the browser using AJAX : -** The data communication from server to web browser handle by Ajax. As the system required real time data it helps to update a web page without reloading the page, as to display RTD.
- **Alert User though GUI : -** The application will notify user instantly for any poor condition of the water quality through an interactive user interface.

- **Download and Report Generation :** - The application will allow user to download data report.

1.3 Scopes

The scope of this project is to remove the time consuming and tedious procedures and replace it with ease and comfort for the users. Also, to have a lesser error prone and time and space saving system.

The User/Consumers mainly involves:

- Property Owners
- Fish Farm Owners
- Aquarium Owners

This project is essential for these users because there is a lot of manual activity involved in traditional aqua monitoring system and data is prone to being lost, misplaced, duplicated. This is also for systems where monitoring takes a lot of time and effort for aquatic environment. The proposed project is also used to introduce the idea of Database Management System.

This project will facilitate different types of users in their own ways or similar ways:

- Property Owners:
  - View Information about the Temperature, PH level, TDS level of the drinking water from water storage tank. Also, user can view information of the swimming pool.
  - Search for Information of previous conditions.
  - Will have access to Adafruit IO API
  - Able to View Dynamic Charts
  - Will get alert for any poor conditions of aqua environment.
  - Will be able to View Suggestion For any Poor Condition of aqua environment through User Interface of Web Application.
  - Able to Download the report as PDF.
- Fish Farm Owners
  - View Information about the Temperature, PH level, TDS level of the pond , lake where fish farming cultivated.
  - Search for Information of previous conditions of ponds, lakes.

- Able to View Dynamic Charts
- Will have access to Adafruit IO API
- Able to view Dynamic Charts.
- Will get alert for any poor conditions of aqua environment.
- Will be able to View Suggestion For any Poor Condition of aqua environment through User Interface of Web Application.
- Able to Download the report as PDF.

➢ Aquarium Owners:

- View Information about the Temperature, PH level, TDS value of the aquarium.
- Search for Information of previous conditions of water quality in aquarium.
- Able to View Dynamic Charts
- Will have access to Adafruit IO API
- Able to view Dynamic Charts.
- Will get alert for any poor conditions of aqua environment.
- Will be able to View Suggestion For any Poor Condition of aqua environment through User Interface of Web Application.
- Able to Download the report as PDF.

Literature Review

2.1 Relationship with Undergraduate Studies

This project is related to my undergraduate studies as I am from Computer Science and Engineering Department, I had learned coding of making various application. Some of the course where I can relate.

CSE204 -(Digital Logic Design)

In this course I have learned about digital and analog systems and design techniques for sequential circuits. I worked with Arduino microcontroller for the course project and made an obstacle avoiding robot which uses ultrasonic sensors . this project helped me to learn about how microcontroller works and how can we use it to take input from the sensors and control the robot .

CSE216 -(Microprocessor, Interfacing and Assembly Language)

This course teaches us how different microprocessors works and its architecture and mechanism . In this course the project I have made a line following robot using Arduino which uses an Atmel 8-bit AVR microprocessor . in this project i used a IR sensor which can detect color changes (black and white). I took the different readings from the sensor and control the motors speed and direction .

2.2 Related works

The Internet of things is dynamic wireless network infrastructure that integrates various communication technologies and solutions to enable the interaction between people and things/ objects.

Jadhav et al. [4] developed an automatic system for measuring water quality in real-time. The system uses water pH, turbidity, and temperature levels to determine the quality of the water. The data collected is sent to the Global System for Mobile Communications (GSM) monitoring center in the form of a Short Message Service (SMS). If water does not present the expected quality level, it sends data to the management center and mobile devices. The solution is low cost and does not require personnel to be on call. However, the work is limited to water quality measuring. It does not address other aspects of water supply systems, such as water leakage or interruption of water supply.

Robles et al. [5] proposed an architecture to describe physical water scenarios to allow the integration of water equipment into an interoperable environment. The authors claim that the use of a platform-independent service-oriented architecture would simplify the integration of new water equipment. They evaluated the architecture through an experiment conducted in their laboratory to demonstrate the application of their architecture. In the context of water supply systems, it is essential to understand the performance behavior of the solution. Unfortunately, the experiment does not evaluate the performance of the proposed architecture.

Shah [6] implemented an IoT infrastructure that includes water flow sensors, water control valves, and a raspberry PI core controller. They use a web interface to monitor and control the water system to ensure equal water distribution to each connection point. This solution is a typical engineering work that demonstrates the practical implementation of infrastructure in a specific context. Hence, it is very difficult to replicate their work or apply their solution in water systems with different characteristics.

Yang et al. [7] proposed an intelligent application for real-time monitoring of water supply systems based on CEP technology to anticipate risks and to control

devices remotely. Despite having the objective of monitoring in real-time, the work does not demonstrate the scalability of the solution in a real environment. Moreover, the paper does not consider the flexibility that water management processes need.

Allen et al. [8] developed a platform called Water Wise that manages and analyzes data from a water network through wireless sensors. water Wise supports a variety of applications, including continuous water demand and hydraulic state forecasts, online detection of events such as pipe leaks, and data mining to identify long-term trends. They deployed a platform to represent water network management. However, their solution only takes into account the infrastructure, which generates reports to indicate the occurrence of predefined issues but does not deal with the decision-making process.

Pesic et al. [9] argue that replacing the imperative with the declarative paradigm is essential to make business process management more flexible. The authors demonstrated that the adoption of the declarative paradigm could (a) avoid changes in the business process to relax stringent rules, (b) provide support for changes at the instance level (ad-hoc change) and type (evolutionary change), and (c) simplify the distinction between mandatory and optional restrictions. The focus of their work is not water management systems.

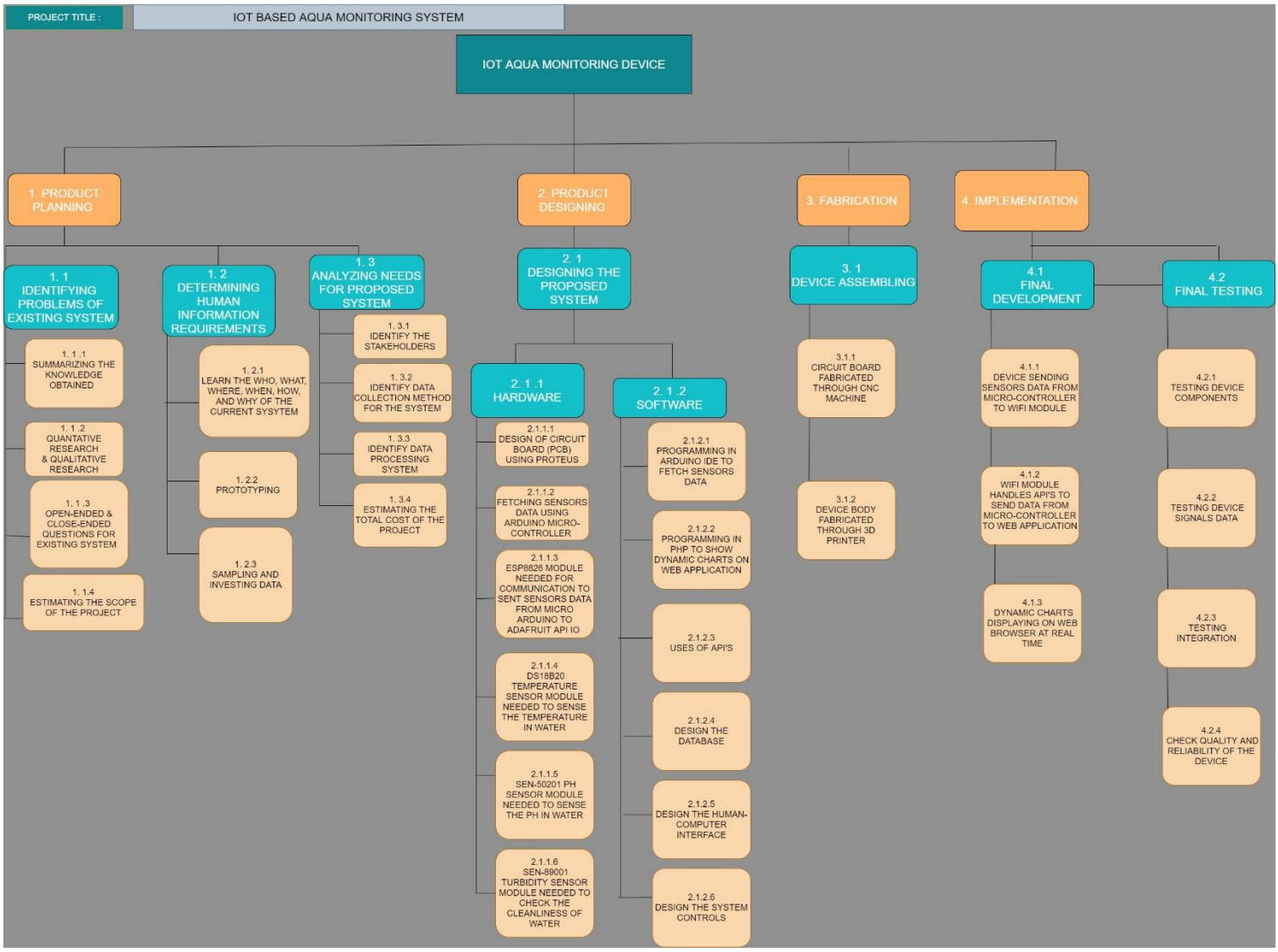
Döhring et al. [10] observed that existing reference workflow often has to be adapted according to specific contextual factors. The authors proposed extending basic changing operations, such as task insertion and removal, with a pattern catalog. The work only reinforces the need for more flexibility in workflow-based (imperative) processes.

Afflerbach et al. [11] proposed an optimization model that takes into account the principles of value-based business process management, from an economic perspective, to determine the optimal level of process flexibility. The authors evaluated the model through an experiment conducted using production processes from an international company in the semiconductor industry. The work reinforces the arguments presented in this document: water management business processes must provide sufficient control to respect defined policies and the flexibility to allow all actions not to be restricted by those policies. Afflerbach

et al. [18] proposed an optimization model that considers the principles of value-based business process management, from an economic perspective, to determine the optimal level of process flexibility. The authors evaluated the model through an experiment conducted using production processes from an international company in the semiconductor industry. The work reinforces the arguments presented in this document: water management business processes must provide sufficient control to respect defined policies and the flexibility to allow all actions not to be restricted by those policies.

Project Management & Financing

3.1 Work Breakdown Structure



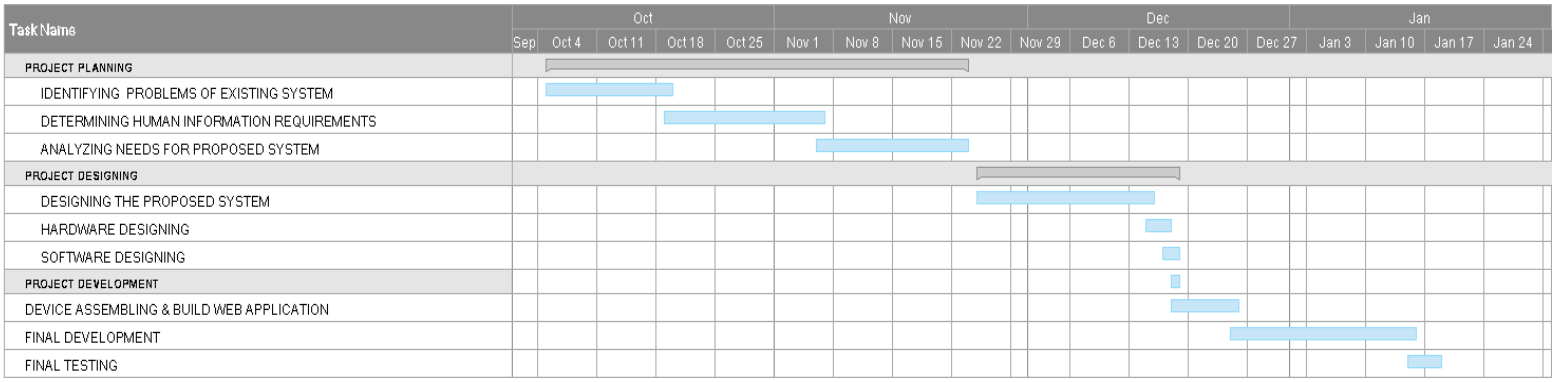
3.2 Process/Activity wise Time Distribution

*** Critical Path Method ***

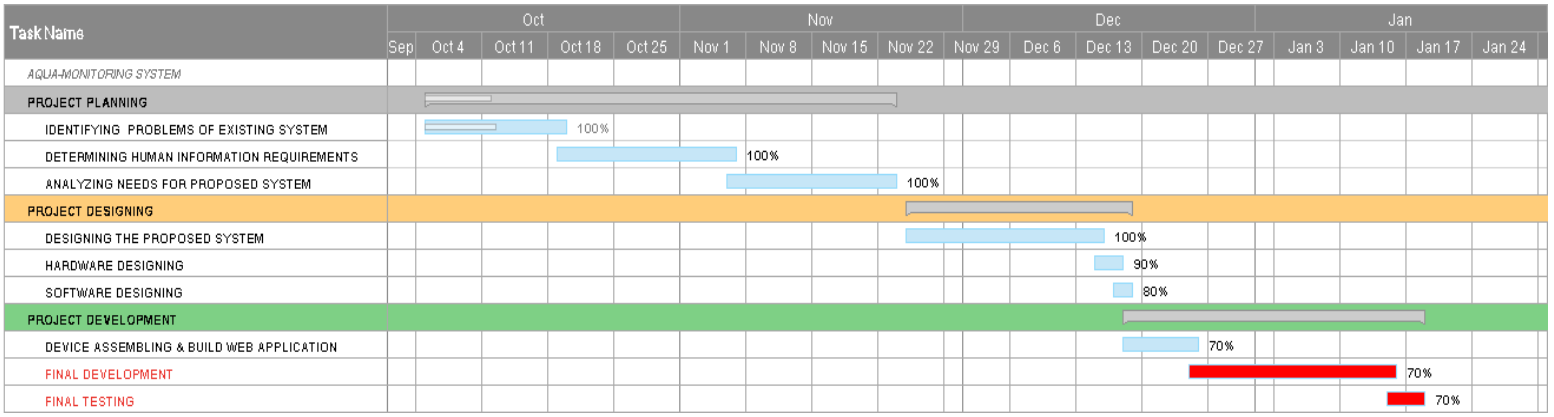
PROJECT TITLE :	IOT BASED AQUA MONITORING SYSTEM
	CRITICAL PATH METHOD

ACTIVITY	IMMEDIATE PREDECESSOR	DURATION (WEEKS)
A IDENTIFYING PROBLEMS OF EXISTING SYSTEM	----------	2
B DETERMINING HUMAN INFORMATION REQUIREMENTS	----------	3
C ANALYZING NEEDS FOR PROPOSED SYSTEM	----------	2
D DESIGNING THE PROPOSED SYSTEM	C	3
E BUILD IOT DEVICE & WEB APPLICATION	C,D	4
F FINAL DEVELOPMENT & TESTING INTEGRATION	E	6

3.3 Gantt Chart



3.4 Process/Activity wise Resource Allocation



3.5 Estimated Costing

HARDWARE

The Proposed system uses several sensors which is tabulated in Table I.

Project	AQUA MONITORING SYSTEM	
METRIC	SENSOR NAME	SENSOR COST (TK)
TEMPERATURE	DS18B20	120
PH	SEN-50201	4000
TOTAL DISSOLVE SOLIDS (TDS)	SEN-89001	1300
	TOTAL	5,420

Three sensors were used Temperature, PH, TDS for water quality testing which is mentioned in Table I.

The proposed system uses several devices which is tabulated in Table II.

Project	AQUA MONITORING SYSTEM	
ITEM	DEVICE NAME	COST (TK)
MICRO-CONTROLLER	Arduino Pro Micro	350
WIFI-MODULE	ESP8266	295
BATTERY MANAGEMENT SYSTEM (BMS)	BMS-11013	150
	TOTAL	795

Three devices were used Arduino Pro Micro, Wi-Fi-Module and BMS which is mentioned in Table II.

SOFTWARE

Project	AQUA MONITORING SYSTEM

ITEM	COST (TK)
ADAFRUIT IO HTTP API	FREE FOR 1 USER
DOMAIN & HOSTING	1800
TOTAL	1800

For Proposed System Adafruit IO HTTP API , Domain & Hosting were needed for Web Application. All these resources were provided by the **COMPANY** for project completion.

Methodology

In this project I have used the agile methodology for our development.

I have adapted this for several reasons:

- It has a lower cost, as there is always a scope for correction and changing the implementation and carry out something better as the project grows.
- It enables our clients (Fish Farm Owners) to take part in the development process and voice what they require from our program and taking their feedback into consideration to make the end product better.
- It enables us to openly communicate with the clients, take their suggestions and visions, and also show them what other alternatives we have and how we can make it better by discussing amongst ourselves.
- Debugging and testing becomes easier as we are constantly checking for defects and errors and fixing them as we go, and not at the complete end of the project. Thus, making us more competitive in the market and other developers as well.
- Evaluating and preparation time is sped up greatly as each iteration consists of a small section of the entire project, so we can finish it and then focus on the next rather than the whole project.
- Assessments are made quickly, and the product is evaluated at every stage of the process.
- It is easier to make sure that our product is meeting the requirements requested at every stage.
- High product quality is ensured through regular testing to make sure the product is working during the development phase.

- It enables continuous and regular testing during the development process.
- Consumers are involved and engaged in the process making them more confident on our product and enabling us to understand them better.
- If anything is not favorable or accepted positively, it can be quickly changed in the next iteration.
- Agile process enables more control over the project through daily meetings.
- Agile gives the opportunity when newer changes need to be incorporated.
- The consumers' needs and preferences can be adapted to, in the development process.
- A functional ready to use product is made after a few iterations thus more beneficial.
- Every iteration allows changes to be made to the product easily making it grow and develop.
- Users are given top priority, and this ensures the product is useful and tries to meet their demands every stage of the way.
- Small teams work better using agile development process as on developer can possess multiple skills and can utilize them at several stages of the iteration without conflicts.

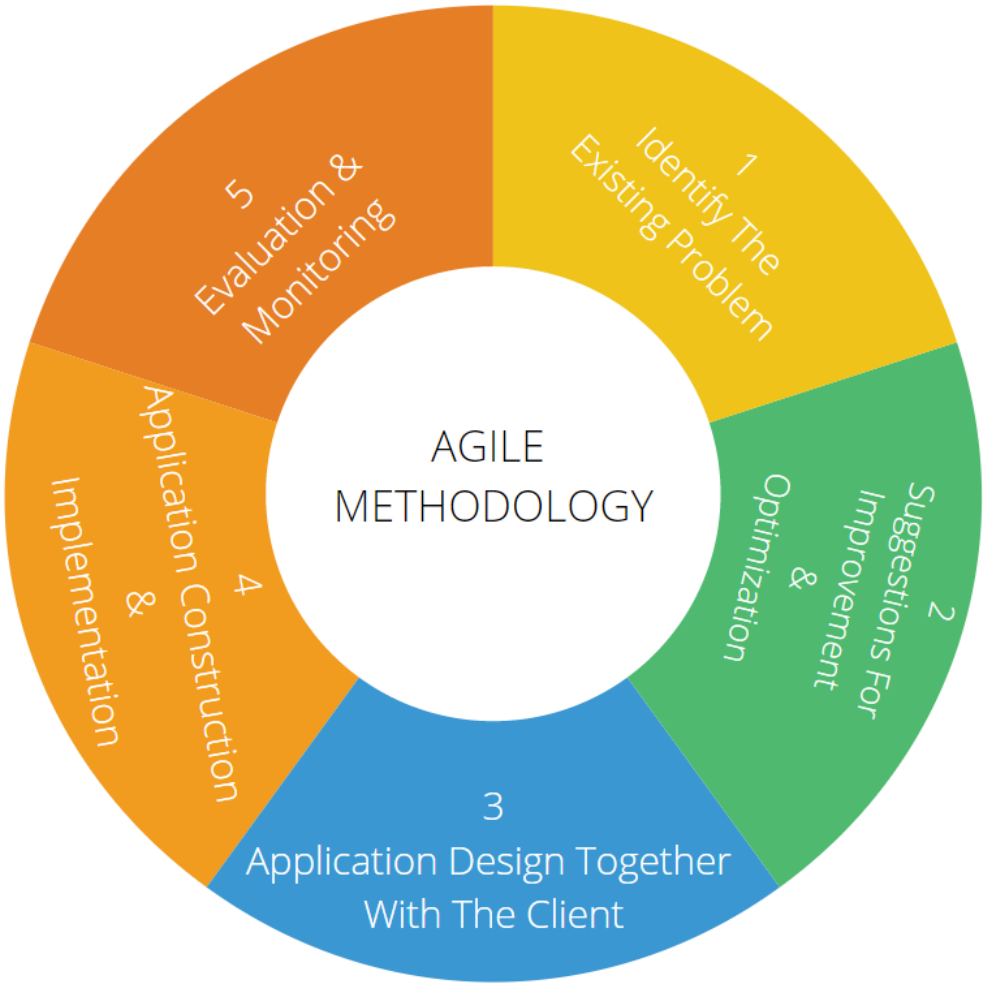


Figure : - **Agile Methodology**

Body of the Project

5.1 Work Description

The main goal is to develop a low-cost robust system for continuous monitoring of pond, lake, river water quality wirelessly at remote places. Following the ideas implementation which is Product Designing that is basically fabrication of the product.

First of all, after brainstorming with ideas I have divided the project into subparts, where Hardware Section comes first and after integrating the hardware, I have gone through the Software Development.

Hardware Design

In hardware section I have built a custom Printed Circuit Design (PCB) for the system to merge all the electronics components which will be used to monitor the water parameters. Here I have used Proteus Simulation Software to design the circuit board and also test the connection of every electrical components through this software.

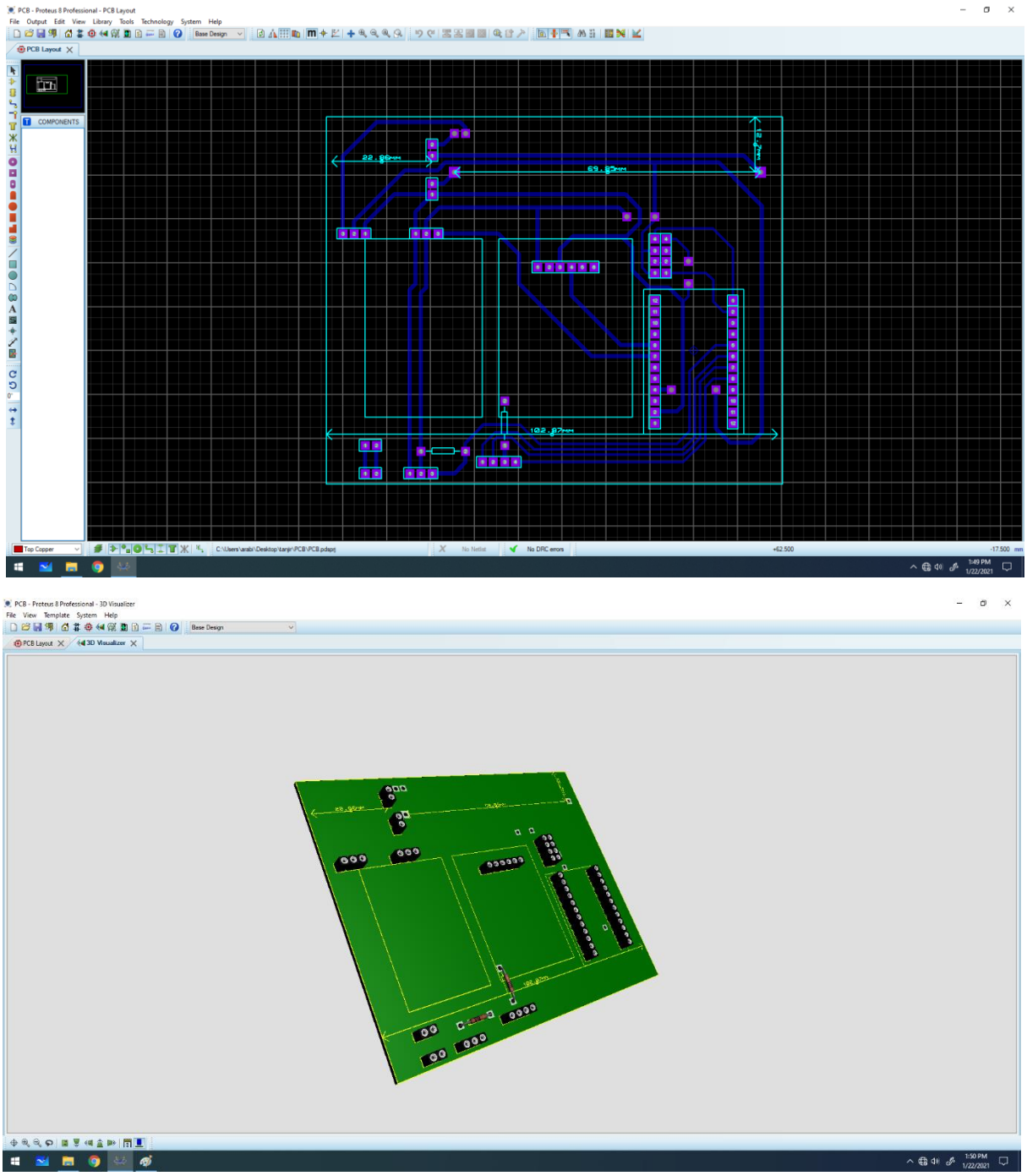


FIGURE : - SIMULATION OF PCB

The Developed Circuit Board is compatible with Arduino pro Micro, Wi-fi Module, Sensors, BSM and Lipo-Battery. It is designed and developed to merge all the electronics components in one place . As a result, it gives not only less visible wire connections but also a compact product for day-to-day use.

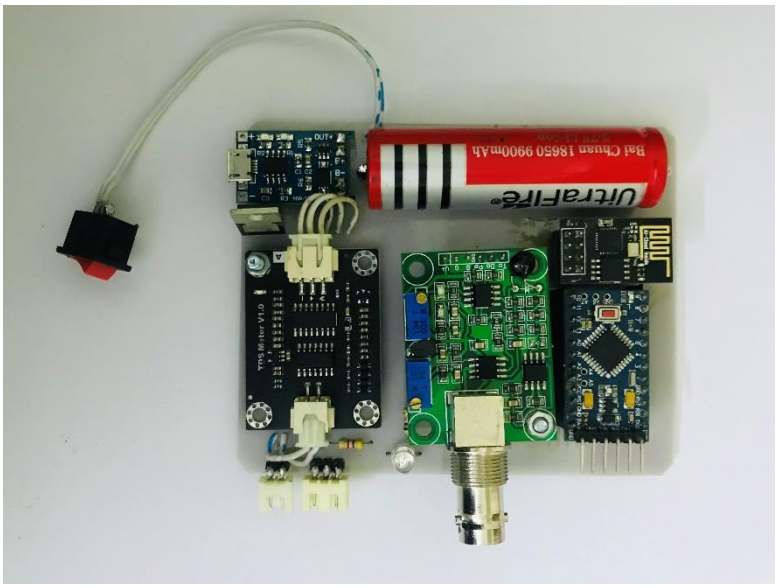


Figure : - Fully-Functional IoT device

The figure state that three different type of sensor has been used which helps to fetch data in the form of analog signal. Then ADC converts these signals into digital forms and sent it to micro-controller (Arduino pro Micro) . After receiving signals from sensors micro-controller converts these digital signals into absolute data . These data are sent to Wi-fi module which then sends information with water parameters to the Adafruit IO HTTP API.

Software Design

Software Design section mainly focus on Programming, designing system controls, developing user interface etc. Here In this section, I have started doing Programming in Arduino Ide to fetch sensors data.

First of all, I have done programming for reading sensors data from Arduino pro Micro where I have declared and defined from which ADC PIN, I will take the water parameters which is the OUTPUT.

Figure : - Reading Sensors Data

To send sensors data I need to add Adafruit library to Arduino Ide. Here I have created a new project in Adafruit and named it “aquatest” where data can be fetched from here as well as can be stored.

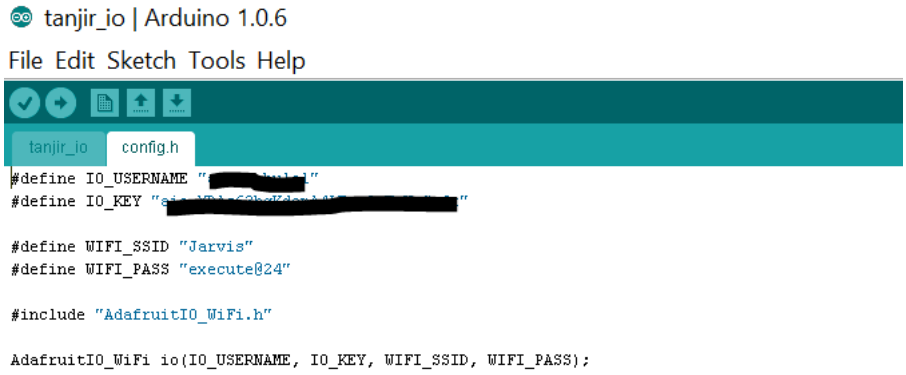


Figure : - Connection between ESP8826 Wi-fi Module with Adafruit Io

The figure state that I have connected ESP8826 wi-fi module with the router also I define Username and unique Authentication key of Adafruit. So, this how I send sensors data from my IoT device to the API.

Moreover , I wrote several PHP scripts to display data fetched from API to my Web Page where I displayed these sensors data in three different dynamic charts.

File Edit Selection Find View Goto Tools Project Preferences Help

index.php × sensor.php × adafruitio.php ×

```php
<?php

class AdaFruitIO
{
    public $key;
    public $url;

    public function __construct($key, $url="https://io.adafruit.com")
    {
        $this->key = $key;
        $this->url = $url;
    }

    /**
     * Returns a feed wrapper
     * @param string $name
     * @return AdaFruitIOFeed
     */
    public function getFeed($name)
    {
        return new AdaFruitIOFeed($this->key, $name, $this->url);
    }

    /**
     * Returns the all the feed names in an array
     * @return array of string
```

File Edit Selection Find View Goto Tools Project Preferences Help

index.php × sensor.php × adafruitio.php ×

```php
    public function getFeed($name)
    {
        return new AdaFruitIOFeed($this->key, $name, $this->url);
    }

    /**
     * Returns the all the feed names in an array
     * @return array of string
     */
    public function getFeedNames()
    {
        $url = $this->url."/api/feeds.json";

        $c = curl_init($url);

        $headers = array();
        $headers[] = "X-AIO-Key: ".$this->key;
        curl_setopt($c, CURLOPT_RETURNTRANSFER, true);
        curl_setopt($c, CURLOPT_HTTPHEADER, $headers);

        $json = json_decode(curl_exec($c));

        curl_close($c);

        $arr = array();
        foreach($json as $j)
            $arr[] = $j->name;

        return $arr;

    }
}
```

Figure : - PHP Script of Adafruit IO

Here I am using getFeed() function to return my Adafruit name and Authentication Key. So, the value I am fetching from this API placing in an array and returning the array.

However, the values I am placing in an array now converting by using **json_encode**() function which is an inbuilt function in PHP that is used to convert PHP array or object into JSON representation.

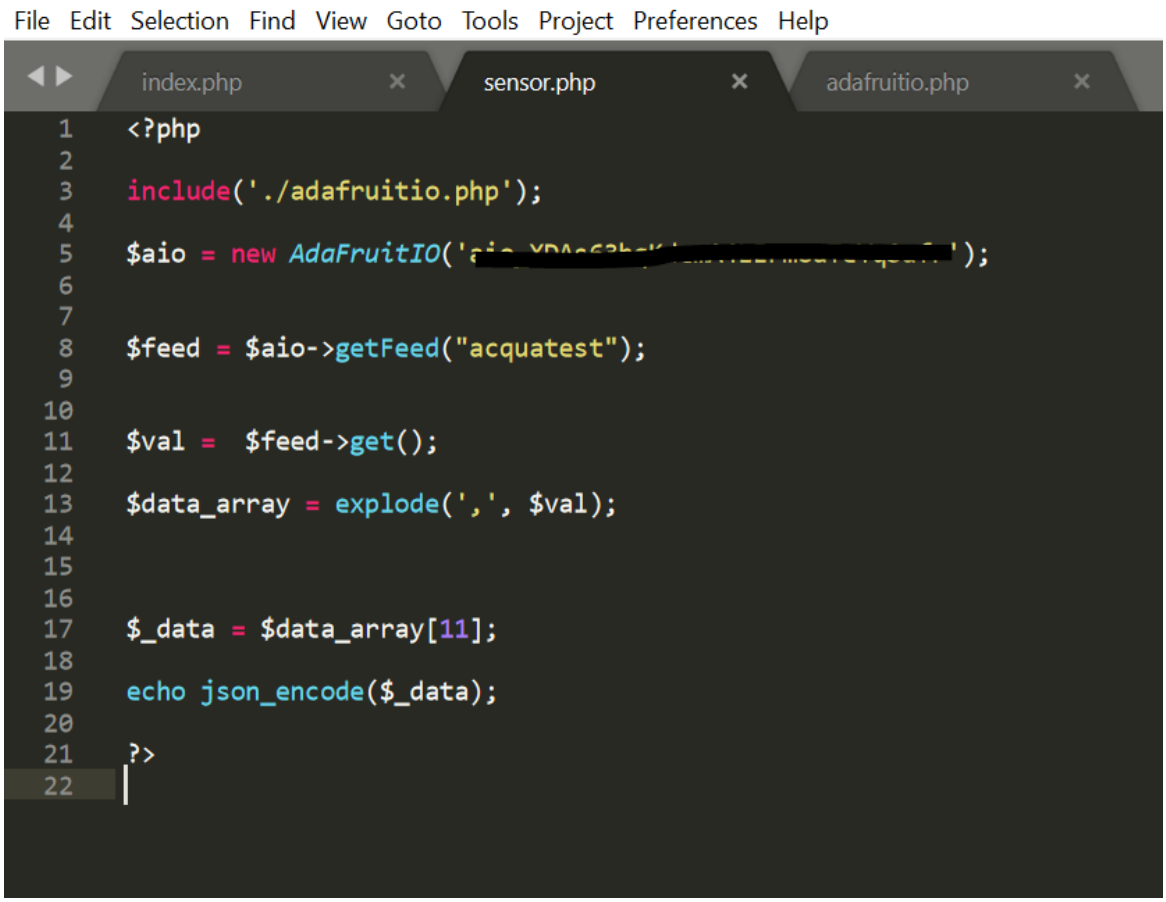
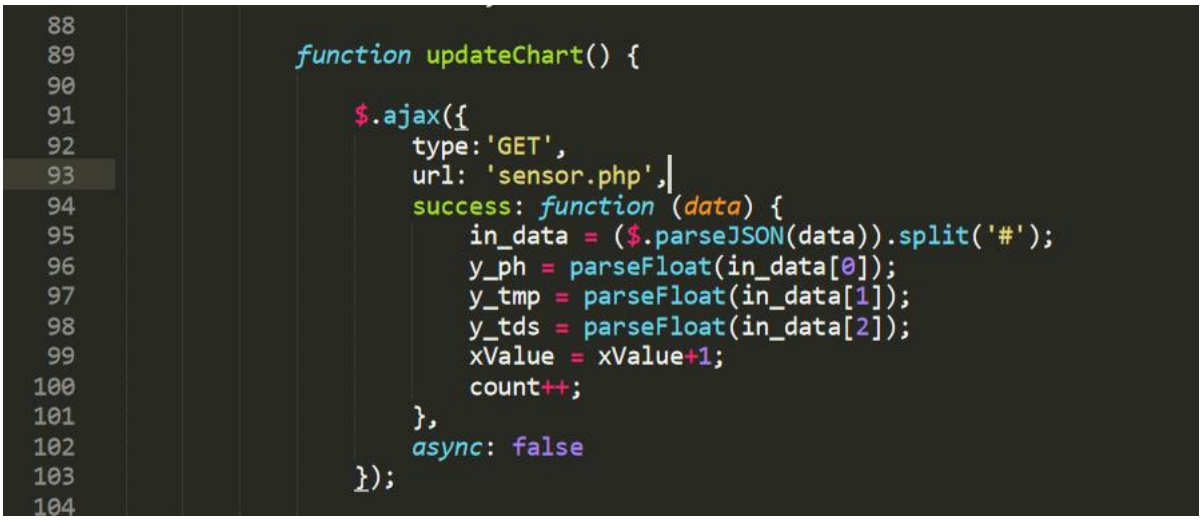


Figure : - PHP Script of Sensor



```
88
89          function updateChart() {
90
91              $.ajax({
92                  type:'GET',
93                  url: 'sensor.php',
94                  success: function (data) {
95                      in_data = ($.parseJSON(data)).split('#');
96                      y_ph = parseFloat(in_data[0]);
97                      y_tmp = parseFloat(in_data[1]);
98                      y_tds = parseFloat(in_data[2]);
99                      xValue = xValue+1;
100                     count++;
101                 },
102                 async: false
103             });
104
```

Figure : - PHP Script To Update Chart

I have written a updateChart () function, where I am updating the chart with real time data (RTD) using Ajax. This will allow to display dynamic chart with a pattern into the Web Page.

5.2 System Analysis

5.2.1 Six Element Analysis

Process along with Six Element Analysis of Existing System (**AS IS**):

Process	Human	Non Computing Hardware	Computing Hardware	Software	Database	Network & Communication
Data Collection	FISH FARM OWNERS (sends request to Chemists for required data)	Application Letter (Hard copy)	Personal Computer	Microsoft Word or application to write request.	No Database in the present manual system	Internet with Email service.
Reporting Process	Laboratory Report Maker (Prepares report based on the received data)	Report Form	Laboratory Computer	Microsoft Excel Compatible	N/A	N/A
Data Analysis	Laboratory Report Maker (sets report as format)	Report Form	Laboratory Computer	Microsoft Word	N/A	N/A

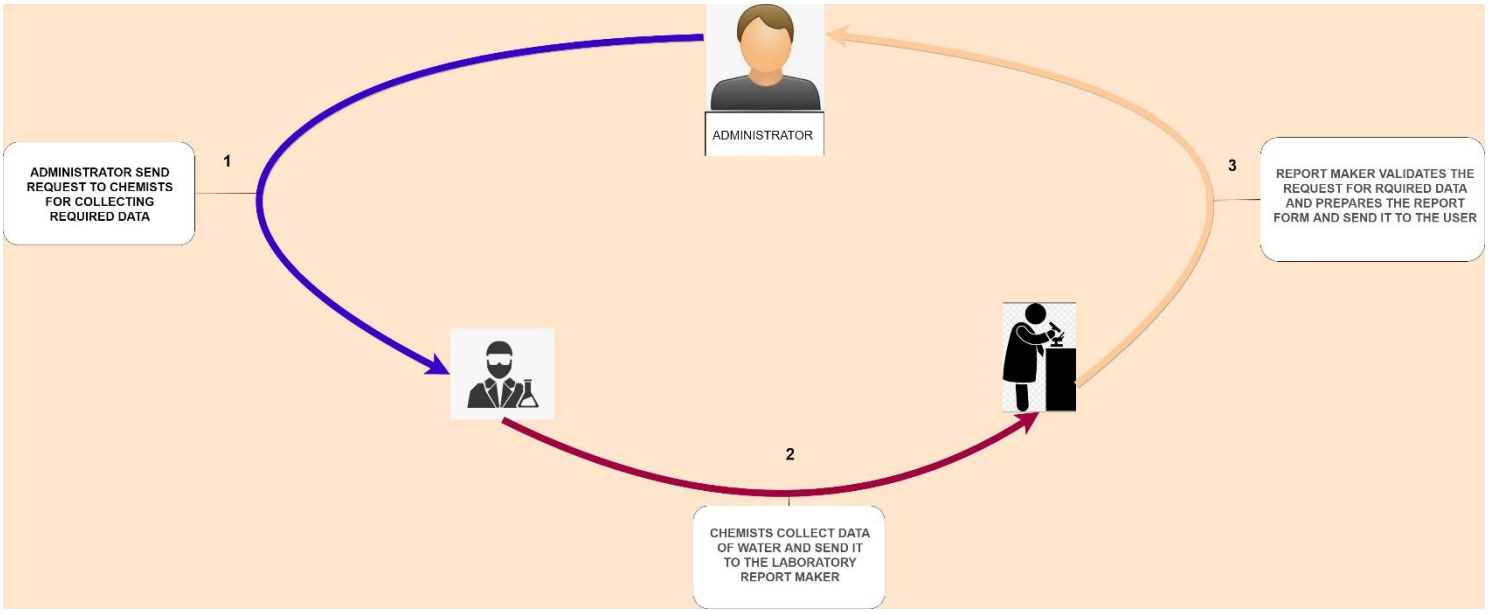
Process along with Six Element Analysis of Proposed System (**TO BE**):

Process	Human	Non Computing Hardware	Computing Hardware	Software	Database	Network & Communication
Data Collection	FISH FARM OWNERS (Can see the information at real time after entering to the Application)	Not Required Anymore	IoT Device	WEB application	AQUA	Internet Browser
Reporting Process	Not Required Anymore	N/A	IoT Device	WEB APPLICATION	AQUA	SERVER
Data Analysis	Not Required Anymore	N/A	IoT Device	WEB APPLICATION	AQUA	Internet Browser
View Charts of Temp, PH, TDS	Fish Farm Owners, Property Owners, Guest	N/A	IoT Device	WEB APPLICATION	AQUA	Internet Browser

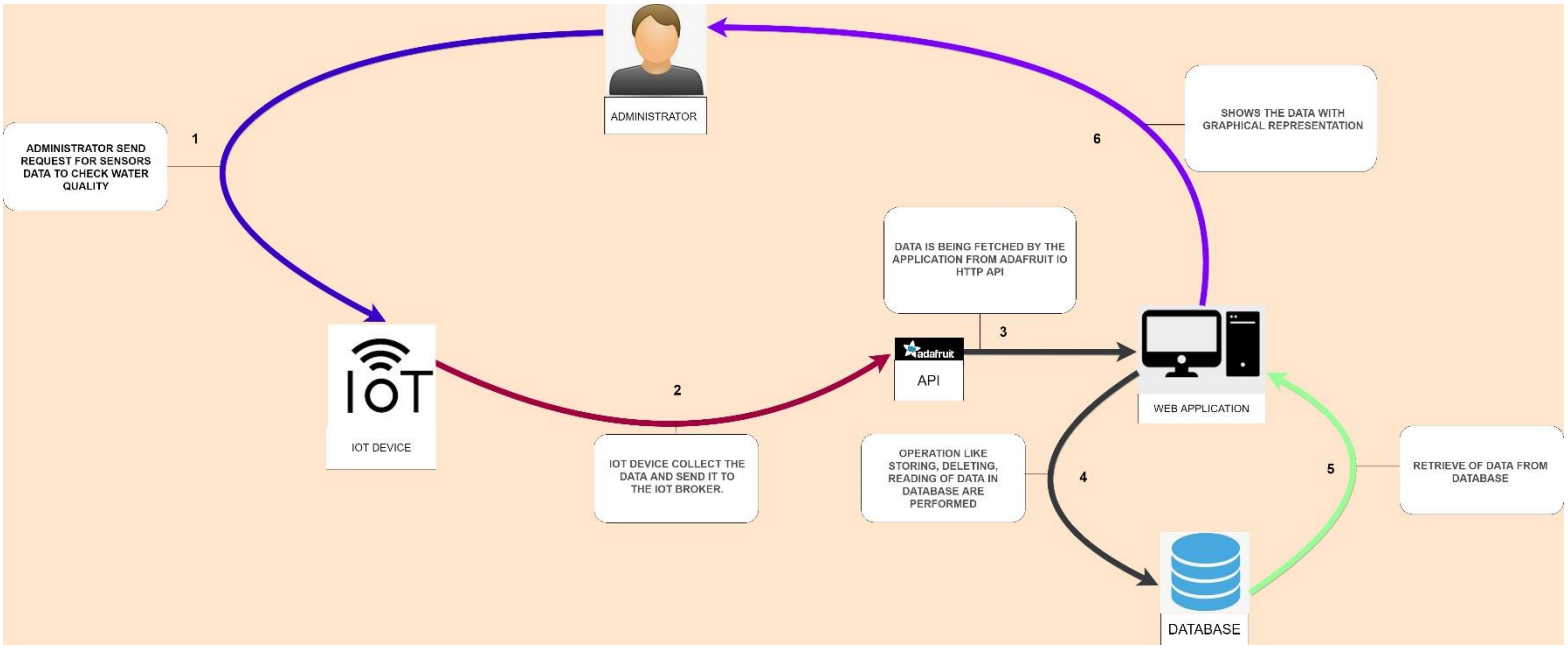
5.3 System Design

5.3.1 Rich Picture

Rich Picture of Existing System (AS IS):



Rich Picture of the Proposed Business System (TO BE):



5.3.3 Functional and Non-Functional Requirements

FUNCTIONAL REQUIREMENTS:

This subsection contains the requirements for the Project Aqua Monitoring System. These requirements are organized by the features discussed in the product functions. Features from there, they are then refined into to the best capture the functional requirements of the system.

Provide personalized profile: -

The Users profile contain all details of Customer respectively like contact, location, address, and User Type.

Tailored Content for the User: -

Assist Users how to view graphical representation and download the records using cookies.

Displaying Related Items: -

The system should be able to show graphical representation of three water parameters temperature, PH, TDS.

NON-FUNCTIONAL REQUIREMENTS:

Performance: The Application shall be based on web and has to be run from a web server. The Application take initial load time depending on internet connection strength which also depends on the media from which the application is running. The performance shall depend upon hardware components of the Users.

Security: The application shall never display Users data to others. The system's backend servers shall only be accessible to authenticated administrators. The system's back-end databases shall be encrypted and within Company perimeter.

Reliability: The main pillar of reliability of the system is to keep backup of the database which is continuously maintained and updated to reflect the most recent changes.

Maintainability: A commercial database is used for maintaining the database and the application server takes care of the site. In case of a failure, a re-initialization of the program will be done. Also, the System design should be done with modularity in mind so that maintainability can be done efficiently.

TECHNICAL ISSUES:

This system will work on client-server architecture. It will require an internet server, and which will be able to run PHP application. The system should support some commonly used browser such as IE, Google Chrome, and Mozilla Firefox etc.

INTERFACE REQUIREMENTS:

Interfaces for the product could be : -

1) There will be a UI for displaying Graphical representation of the Real Time Sensors Data .

EXTERNAL USER REQUIREMENTS: Hardware Interface Device should be enabled with Internet.

SOFRWARE INTERFACE: The user's browser should be HTML5 compatible for a satisfactory user experience.

Chapter 6

Results & Analysis

Authorized users can access the web application and can see the graphical representation of the three water parameters , where the data are being displayed at real-time.

For investing Water Quality, some experiments were carried out on normal drinking water & with soft drinks.

The figure below shows the live graph of sensors data on drinking water : -

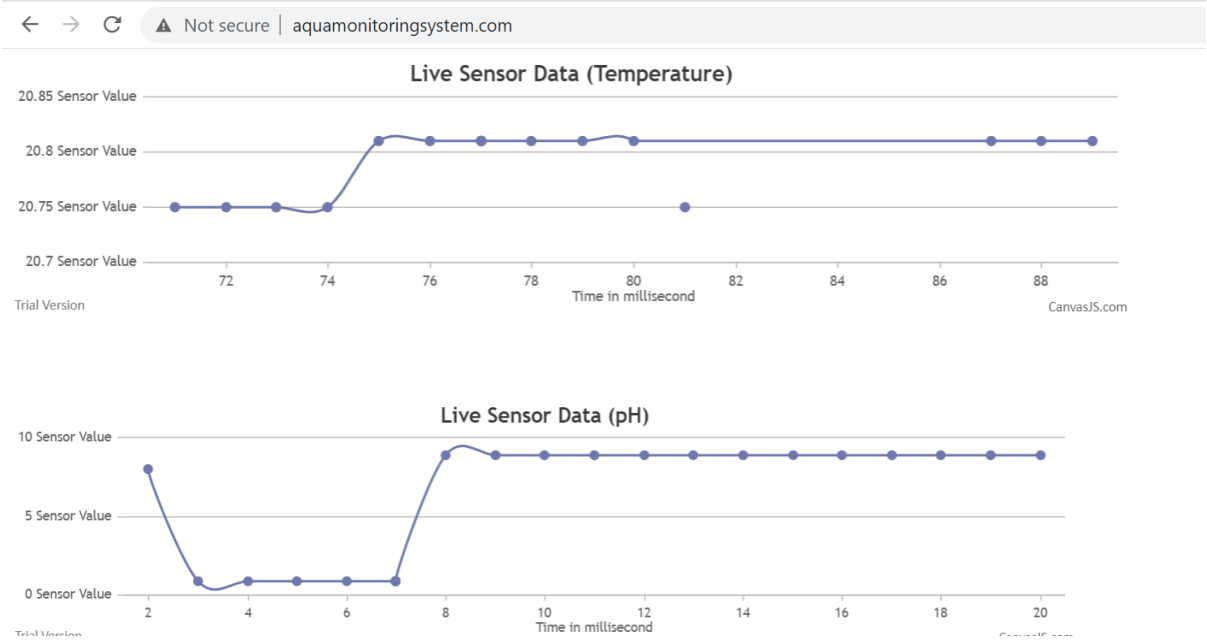


FIGURE I : - LIVE SENSOR DATA OF DRINKING WATER

The figure I state that Temperature of the drinking water remains at 20.8 C to 20.85 C, TDS remains at 256 mg/liter which is excellent, and PH remains at 8 to 8.5 means the water is neutral and nonacidic.

The figure below shows the live graph of sensors data on Soft Drinks : -

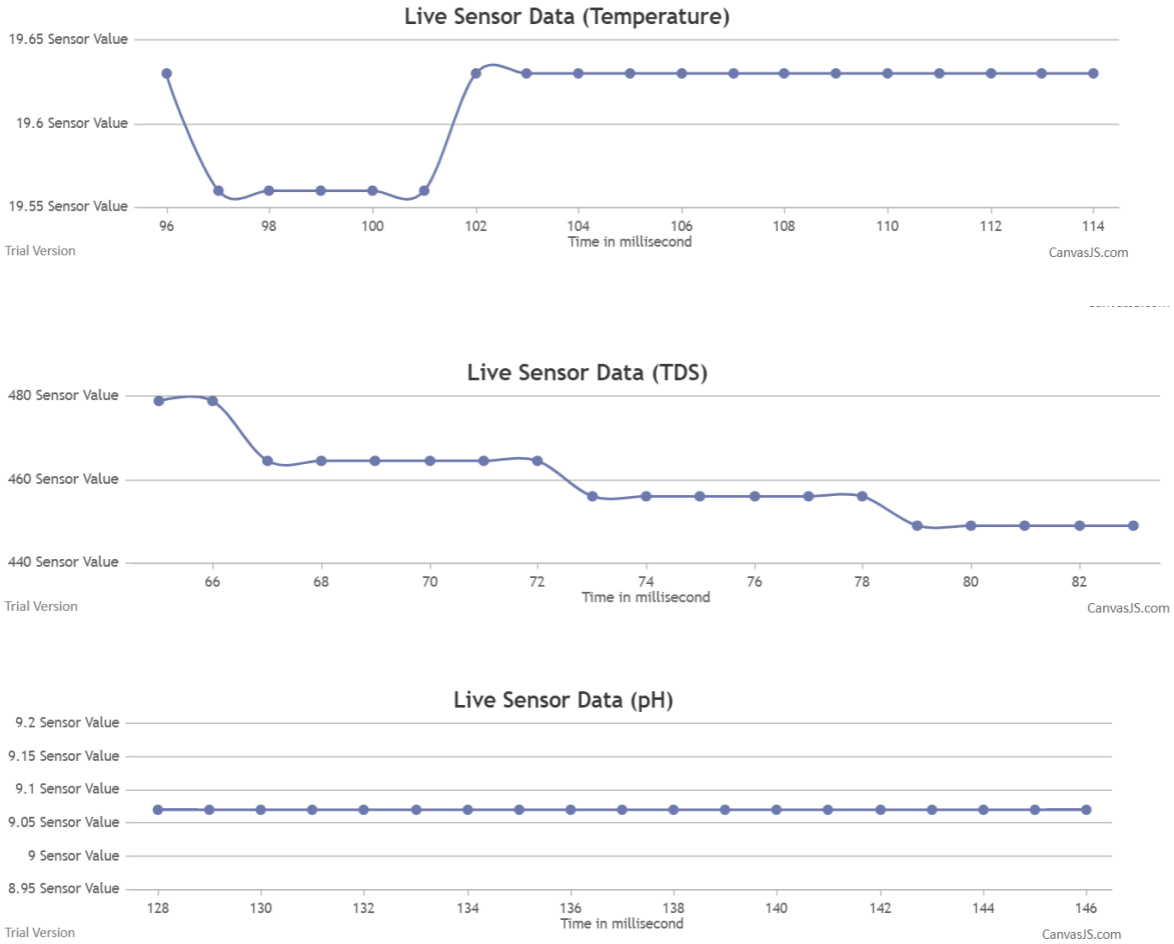


Figure II : - LIVE SENSORS DATA OF SOFT DRINKS

The figure II state that Temperature of the drinking water remains at 19.5 C to 19.65 C, TDS remains at 440 mg/liter to 480 mg/liter which is good , and PH remains at 9.05 to 9.1 means the soft drink is alkaline.

Chapter 8
Future Work & Conclusion

8.1 Future Works

To include Neural network models in Big Data Analytics and water quality management which will help fish farmer to classify and analyze the water quality. So, the main advantage of feeding

these sensors data to the Neural Network will help to classify sensors data as dangerous, Good, and Poor. Moreover, in the dynamic chart we will get another line for using AR model in the system. Also, have to add more sensors such as DO, Conductivity to the IoT device as more parameters will help to analyze the water quality.

8.2 Conclusion

The low cost, robust and efficient, real-time water quality monitoring system has been implemented and tested. Through this system, the different type of user can keep track of the levels of pollutions occurring in the water bodies using web Application and can take immediate action. This can help in preventing diseases caused due to polluted water and presence of metals. Also, the system is able to monitor Polluted rivers of our country such as Buriganga River, Turag River and will help to reduce pollution of its water bodies.

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