SMART WATER SENTINEL SYSTEM

BY

SHIMUL BANIK SANTO
ID: 161-15-7166

SHIHAB KHAN
ID: 161-15-7394
AND

ANOWER HOSSAIN
ID: 161-15-7135

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Fahad Faisal
Assistant Professor
Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY
DHAKA, BANGLADESH

June 2020

APPROVAL

This Project titled "**Smart Water Sentinel System**", submitted by **Shimul Banik Santo**, **Shihab Khan** and **Anower Hossain** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **6th November, 2019**.

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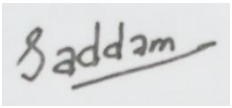

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We hereby declare that, this project has been done by us under the supervision of **Fahad Faisal** Assistant Professor of Department of CSE Daffodil International University. It is also declared that neither this project nor any part of this thesis has been submitted elsewhere for award of any degree or diploma.

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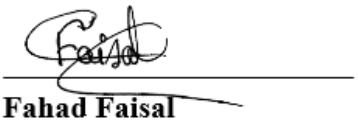

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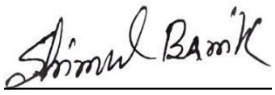
Department of CSE
Daffodil International University

Submitted by:



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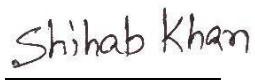

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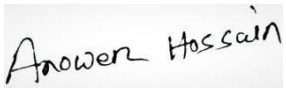

Anower Hossain
ID: 161-15-7135

ACKNOWLEDGEMENT

First I express my heartiest thanks and gratefulness to '**Almighty Allah**' for His divine blessing makes us possible to complete the final year project successfully.

I am really grateful and wish my profound our indebtedness to **Fahad Faisal, Assistant Professor,** Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of "IOT-Internet of Things" to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to Dr. Syed Akhter Hossain, Professor, and Head, Department of CSE, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

We have built an IOT device, which is for monitoring water purity continuously. This device is basically for fishing farms. The device is portable. So that, farm owner can move the device to any of the fishing ponds. This device needs an external power supply to work. The device is connected with an internet based mobile app (Blynk) through Wi-Fi and also contains a display. So that, people near the pond can see the purity measurement instantly. Also, the device uploads the data to cloud storage. The blynk app shows the data. So, the data's can be acceded from anywhere of the world. So that, the person registered with the app, can get the data from anywhere. Through this device, instant action can be taken if any problem occurs in the farming pond. It could reduce the damage and also the amount of loss in fish farming.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Bangladesh is the land of rivers the common food for Bangladeshi people is fish. But day by day our rivers are dying so the alternative source of fish is ponds people are farming fishes to overcome the need of fish. For fish farming we need to prepare the water to ensure the perfect environment for the perfect growth of fishes. So we need to monitor the pond/tank water perfectly and continuously. [6] To check the quality from a far distance we need the help of IOT. To ensure the quality and monitor it face to face and also from anywhere of the world we have develop this project.[10]

1.2 Motivational

There are huge numbers of fish farms in Bangladesh. But for the lacking's of proper monitoring system we can produce that huge quantity of fishes. But if we build a proper system we may overcome the needs and ensure a better environment for the fishes in farm.

1.3 Objectives

To build this project we need the help of IOT. That's why we have used several equipment's to monitor the water quality over internet. So with the development of modern communication system we can use this technology to help the farmers improving their fish farming quality and reduce their time. Through this project we can introduce them a better system which will improve their farming and reduce their work time period.

1.4 Expected Outcome

Through this project farmer will be able to monitor their fish ponds of the tanks water quality continuously through display also with the help of IOT they can observe the water quality (Temperature and Ph level) from a far distance through mobile apps. So in case of emergency they can warn if any think unusual happens to their fish farm.

1.5 Project Outline

Create our report with all the details and information you need. We have reached the conclusion our report as follows:

Chapter 1: Introduces the project "Smart Water Sentinel System". Explain the motivation, objectives and expected outcomes of our project.

Chapter 2: Here we talk about the introduction, the related works, the comparative studies, the duration of the problems. This chapter discusses the background of our project.

Chapter 3: After that, we composed about business process modeling, requirement collection and analysis. Here we have shown the use of case modeling and the description of our project.

Chapter 4: Here we give an end font design, back end design and implementation requirement to our project.

Chapter 5: We have specified database implementation, font end design implementation, implementation of interaction and also testing implementation of our project.

Chapter 6: We discussed about discussion and conclusion. We have also provided our scope for future development of our project.

CHAPTER 2

BACKGROUND ANALYSIS

2.1 Introduction

There are several devices which can check water quality but it is lengthy process. Also there are some devices which can show result in a short time but complex to use. Like Ph miter, water electrolyze, using TDS with water sampling. [5]

2.2 Related Work

“Liquid Telecom” has invented and IOT device helping fish water in fish farms but it is a costly device for our country people though it works perfectly all of our farmers can afford this device in their fish farming.

2.3 Comparative Studies

To build this project we have to learn some new topics. As our project is and IOT base project, we have to study about network devices. We have to learn Arduino language. We have to learn how to take inputs from digital and analog Sensors. We. We also have to learn the basics of IOT and database connection. Finally, we have to learn microcontroller connection system. [17]

2.4 Scope of the Problem

As we have simplified the IOT device currently we can watch the temperature and ph level. [5] In future it may be develop to observe more water components to ensure the best quality of water for fish farming.

2.5 Challenges

- We have to learn the working principal of ESP 8266 nodemcu Wi-Fi module.
- We have to learn about the blynk database system, how it works.
- We have to learn how to connect the hardware's with blynk app.

CHAPTER 3

REQUIREMENT & SPECIFICATION

3.1 Business Process Modeling

Here all equipment connected by microcontroller. microcontroller unit with an extra feature of connecting with internet through Wi-Fi.

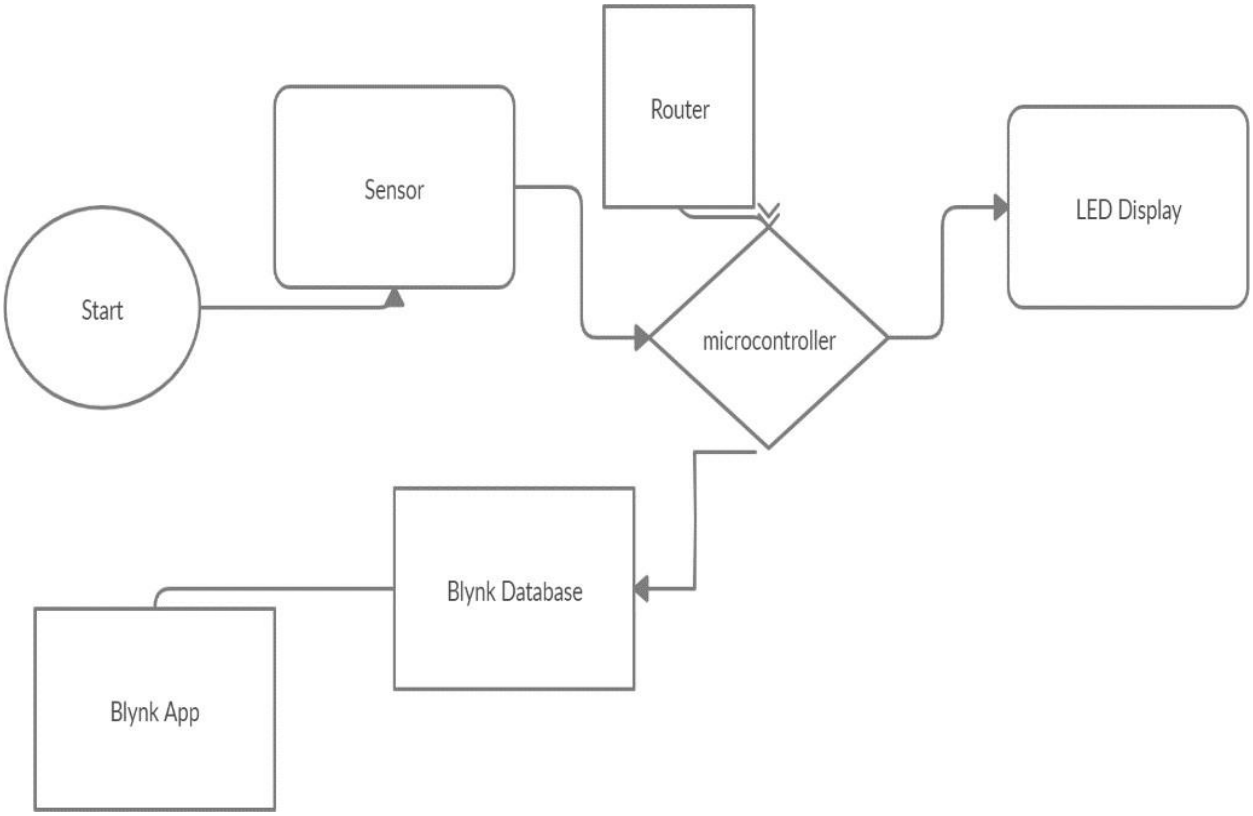

Figure 3.1: Business process modeling

3.2 Use-Case Modelling & Description

The sensors devices are working as instructed. The temperature & Ph sensor is getting data's ad showing it on LED Display. Sending data to blynk data base.

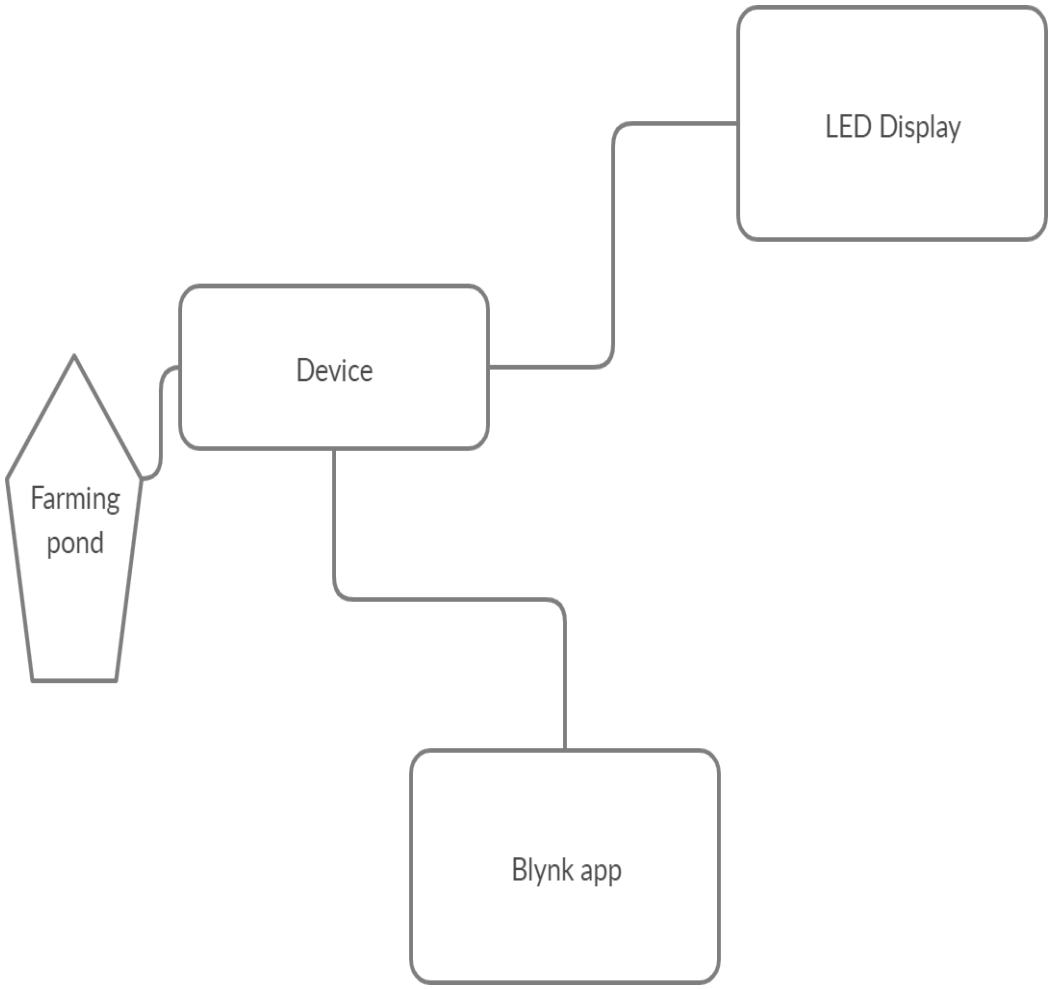

Figure 3.2: Use-case modeling & description

3.3 Requirement Collection and Analysis

To build this project we have to use several equipment's; [3]

- Esp 8266 nodemcu
- Waterproof temperature sensor
- Ph sensor
- LED display
- Breadboard
- Jumper wire
- 5v power supply
- Wi-Fi router
- Blynk app

3.3.1 ESP 8266 Nodemcu

ESP 8266 nodemcu is a microcontroller unit which has a Wi-Fi module nodded with microcontroller it works same as a microcontroller unit with an extra feature of connecting with internet through Wi-Fi. [3], [9]

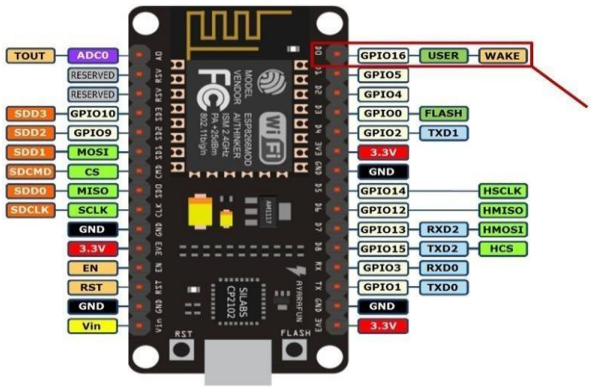

Fig 3.3: ESP 8266 nodemcu

3.3.2 Waterproof Temperature Sensor

DS18B20 has a waterproof version. Basically it is a temperature sensor which is used to measure the temperature of liquid elements. Its temperature range is from (- 55) degree Celsius to (125) degree Celsius. It required 3 volt to 5.5-volt power supply to measure the temperature. [15]

Figure 3.4: Waterproof temperature sensor

3.3.3 PH Sensor

Ph sensor detects the ph level of water. Basically it is an analog sensor which gives analog data to Arduino. [17] We need to use the library function and assign formula to get the digital value which is the actual level of ph. [7] It needs 5-volt power supply to power on. It will operate between the temperature ranges of 7 degrees Celsius to 46 degrees Celsius. [5]

Figure 3.5: PH sensor

3.3.4 LED Display

We have used a blue led display which is an I2C module. It is a 16/2 led display. We have to use the Liquid Crystal library to operate this module. We have used this led display to show the real time data on the spot. [7]

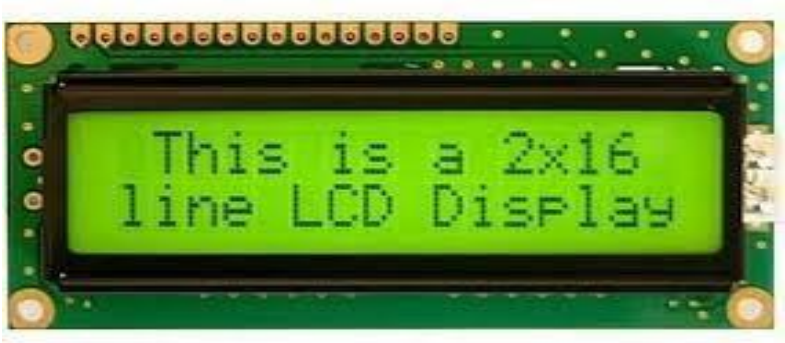

Fig 3.6: LED display

3.3.5 Breadboard

Breadboard is a device where electric component doesn't need to solder. It is used for making prototype electronics circuit's. As we have used very sensible development board and sensors we didn't take the risk of solder. [9]

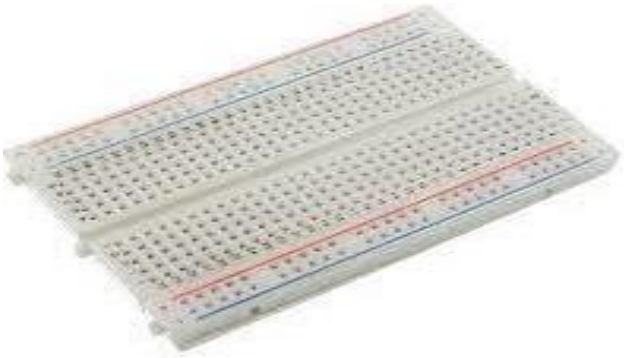

Figure 3.7: Breadboard

3.3.6 Jumper Wire

Jumper wire is basically use in non-soldered electronic circuit's also it has a benefit of less short circuit's and a clean wiring setup. [4]

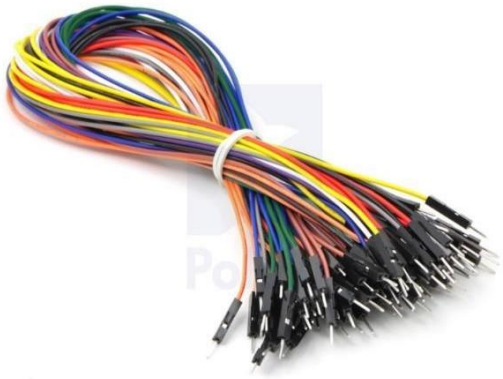

Figure 3.8: Jumper wire

3.3.7 5-Volt Power Supply

As we have use ESP 8266 nodemcu as our project development board we need a 5-volt DC power supply. [3]

Figure 3.9: 5-Volt power supply

3.3.8 Wi-Fi Router

As our project is an IOT base project we need internet. The ESP 8266 nodemcu has a built in Wi-Fi module so to send the data to the database we need Wi-Fi internet that's why we have used Wi-Fi router. [1], [3]

Figure 3.10: Wi-Fi router

3.3.9 Blynk App

Blynk app is an open source app for IOT projects as our project is a prototype IOT base project we have used blynk app. It a supper easy to use and it has many useable features. It also has a secured database. [13]

Figure 3.11: BLYNK app

CHAPTER 4

SYSTEM DESIGN AND IMPLEMENTATION

4.1 Frontend Design

- Front end design requires building the device.
- Connecting it to blynk app

Frontend Design Requires Building the Device

To build this device we have to connect the temperature sensor, PH sensor and LCD display with the ESP 8266 nodemcu. To connect the temperature sensor, we have to short the ground pin and the data pin with a 100k ohm resister. For the PH sensor we have to connect the data pin with the analog input to get the data. For the i2c LCD module we have to connect the SDA & SCL pins with D2 & D1 pins of nodemcu. [11],[12]

Connecting it to Blynk App

Blynk app is an open source app for IOT devices and project. Whenever we resister in blynk app we will get a data base secret which the data base secret we can connect our project with the blynk database.

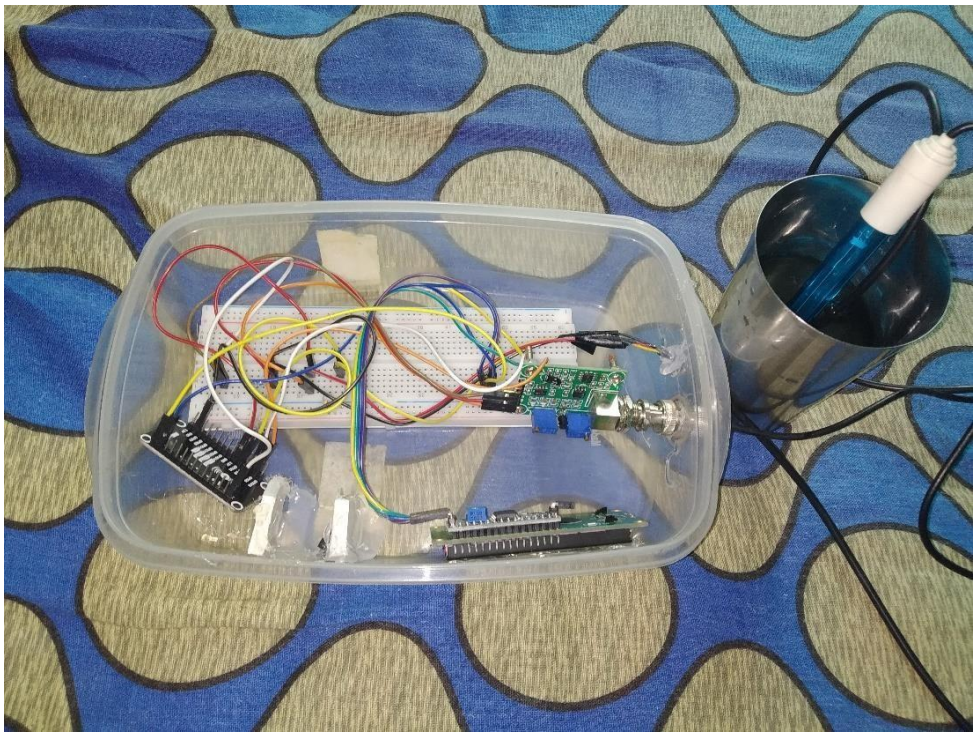

Figure 4.1: Connecting it to blynk app

4.2 Implementation Requirement

To implement this project, we need [16]

- Arduino IDE
- Blynk app

Arduino IDE

Arduino IDE is a free package software. It is used to program the Arduino based development boards. [17]

Blynk App

Blynk app is the most used IOT platform for IOS and android device. It has a lot of free feature with free cloud services through this app we can create a prototype IOT app interface with zero cost. [15]

Figure 4.2: Blynk app

4.3 Backend Design

Backend design includes

- Connecting sensor with ESP 8266 nodemcu.
- Connecting ESP 8266 nodemcu with internet.
- Displaying data to LCD display.
- Sending data to blynk data base.
- Displaying to blynk app. [15]

Connecting Sensor with ESP 8266 Nodemcu:

```
#include <Wire.h>
const int phPin = A0;
int sensorValue = 0;
unsigned long int avgValue;
float b;
int buf[10],temp;
#include <OneWire.h>
#include <DallasTemperature.h>
// GPIO where the DS18B20 is connected to
const int oneWireBus = 2;
// Setup a oneWire instance to communicate with any OneWire devices
OneWire oneWire(oneWireBus);
// Pass our oneWire reference to Dallas Temperature sensor
DallasTemperature sensors(&oneWire);
```

Figure 4.3**:** Connecting Sensor with esp8266 nodemcu

Connecting ESP 8266 Nodemcu with Internet:

```
char auth[] = "wFybvbQS0MgdsHcfnITFpTH4n7GpyRgQ";          // You should get Auth Token in the Blynk App.
                                                          // Go to the Project Settings (nut icon)
char ssid[] = "Sbs";    // Your WiFi credentials.
char pass[] = "161157166";  // Set password to "" for open networks.
```

Figure 4.4**:** Connecting ESP 8266 nodemcu with internet

Displaying Data to LCD Display

```
#include <LiquidCrystal_I2C.h> //This library you can add via Include Library > Manage Library >
LiquidCrystal_I2C lcd(0x27, 16, 2);
```

Figure 4.5**:** Displaying data to LCD display

Sending Data to Blynk Data Base:

```
    Blynk.begin(auth, ssid, pass);
    timer.setInterval(2000, sendUptime);
}


void loop()
{
  Blynk.run();
  timer.run();
}
```

Figure 4.6**:** Sending data to blynk data base

Displaying to Blynk App

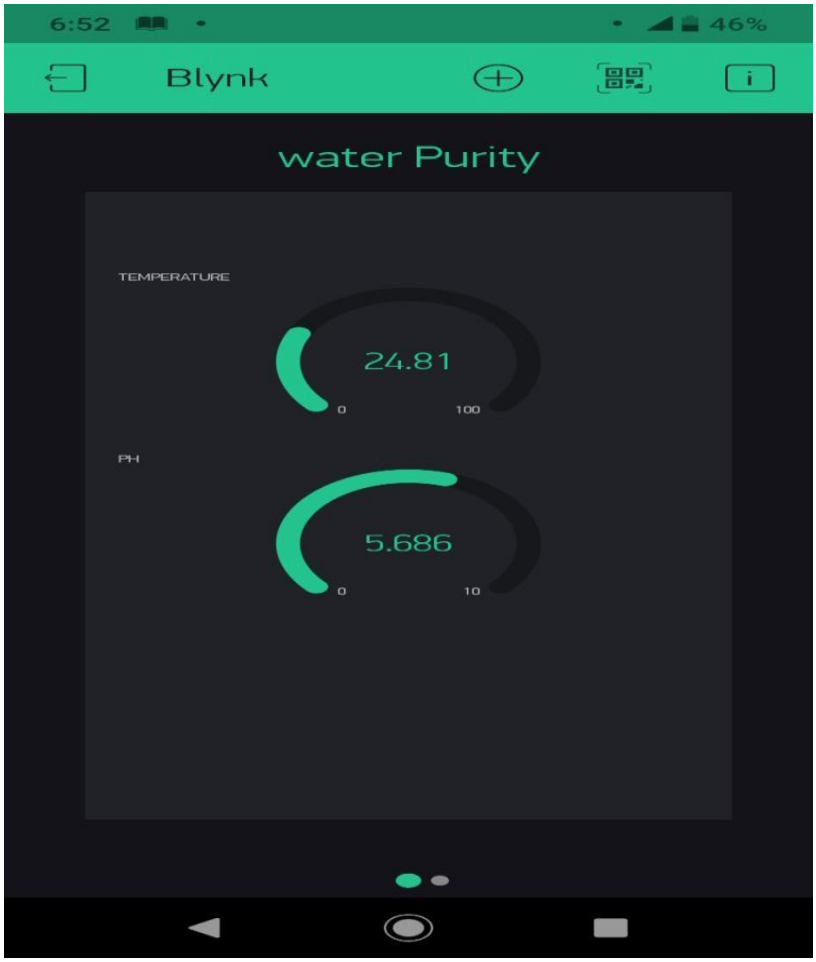

Figure 4.7: Displaying to blynk app

CHAPTER 5

TESTING AND DISCUSSION

5.1 Implementation of Frontend Design

If the connections are perfectly done and the development board is perfectly power supplied, Ones it connects with Wi-Fi internet the data of the water will be started displaying on LCD display.[8]

Again, if the code runs perfectly the data will be shown on blynk app whenever we login to it.

5.2 Implementation of Database

```
char auth[] = "wFybvbQS0MgdsHcfnITFpTH4n7GpyRgQ";          // You should get Auth Token in the Blynk App.
                                                          // Go to the Project Settings (nut icon)
char ssid[] = "Sbs";    // Your WiFi credentials.
char pass[] = "161157166";  // Set password to "" for open networks.
float t;                                                  // Declare the variables
float h;
```

Figure 5.1**:** Implementation of database

5.3 Test Result and Reports

Table 5.1: Test result & report

Device	Display	Blynk App	Comment
Starts collecting data	LED display doesn't show any data	Doesn't show any data	Device is not working perfectly
Starts collecting data	LED display shows water temperature	Doesn't show any data	Ph sensor is not working
Starts collecting data	LED display shows water temperature & water Ph	Doesn't show any data	Device can't get connected with Internet network.
Starts collecting data	LED display shows water temperature & water Ph	App shows both temperature & Ph level	Device is working perfectly

5.4 Final Output

Our device is working perfectly as its final output is absolutely perfect. The sensors devices are working as instructed. The temperature & Ph sensor is getting data's ad showing it on LED Display. The nodemcu is also sending data to Blynk app's database. So, we can say that, the IOT project is successfully working.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Discussion and Conclusion

The device is working as per our expectation from it. Our device is working perfectly as its final output is absolutely perfect. The sensors devices are working as instructed. The temperature & Ph sensor is getting data's ad showing it on LED Display. The nodemcu is also sending data to Blynk app's database. [12] So, we can say that, the IOT project is successfully working.

6.2 Scope for Future Developments

As we have implemented our project, the device can get water temperature & Ph level instantly. [11] For future development, its working boundary can be expanded. Now it shows temperature and Ph only, in future, it may be able to show food amount in farming pond, oxygen level of water, etc.

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Appendix A

Appendix-A

List of sensors & basic uses of the sensors:

Waterproof temperature sensor is with digital output. We have used this sensor to measure the water temperature.

Ph sensor gives analog input. With this sensor, we can measure the Ph level of water.

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CHAPTER 1 INTRODUCTION 1.1 Introduction Bangladesh is the land of rivers the common food for Bangladeshi people is fish. But day by day our rivers are dying so the alternative source of fish is ponds people are farming fishes to overcome the need of fish. For fish farming we need to prepare the water to ensure the perfect environment for the perfect growth of fishes. So we need to monitor the pond/tank water perfectly and continuously. [6] To check the quality from a far distance we need the help of IOT. To ensure the quality and monitor it face to face and also from anywhere of the world we have develop this project.[10] 1.2 Motivational There are huge numbers of fish farms in Bangladesh. But for the lacking's of proper monitoring system we can produce that huge quantity of fishes. But if we build a proper system we may overcome the needs and ensure a better environment for the fishes in farm. 1.3 Objectives To build this project we need the help of IOT. That's why we have used several equipment's to monitor the water quality over internet. So with the development of modern communication system we can use this technology to help the farmers improving their fish farming quality and reduce their time. Through this project we can introduce them a better system which will improve their farming and reduce their work time period. 1.4 Expected Outcome Through this project farmer will be able to monitor their fish ponds of the tanks water quality continuously through display also with the help of IOT they can observe the water quality (Temperature and Ph level) from a far distance through mobile apps. So in case of emergency they can warn if any think unusual happens to their fish farm. 1.5 Project Outline Create our report with all the details and information you need. We have reached the conclusion our report as follows: Chapter 1: Introduces the project "Smart Water Sentinel System". Explain the motivation, objectives and expected outcomes of our project. Chapter 2: Here we talk about the introduction, the related works, the comparative studies, the duration of the problems. This chapter discusses the background of our project. Chapter 3: After that, we composed about business process modeling, requirement collection and analysis. Here we have shown the use of case modeling and the description of our project. Chapter 4: Here we give an end font design, back end design and implementation requirement to our project. Chapter 5: We have specified database implementation, font end design implementation, implementation of interaction and also testing implementation of our project. Chapter 6: We discussed about discussion and conclusion. We have also provided our scope for future development of our project. CHAPTER 2 BACKGROUND ANALYSIS 2.1 Introduction There are several devices which can check water quality but it is lengthy process. Also there are some devices which can show result in a short time but complex to use. Like Ph miter, water electrolyze, using TDS with water sampling. [5] 2.2 Related Work "Liquid Telecom" has invented and IOT device helping fish water in fish farms but it is a costly device for our country people though it works perfectly all of our farmers can afford this device in their fish farming. 2.3 Comparative Studies To build this project we have to learn some new topics. As our project is and IOT base project, we have to study about network devices. We have to learn Arduino language. We have to learn how to take inputs from digital and analog Sensors. We. We also have to learn the basics of IOT and database connection. Finally, we have to learn microcontroller connection system. [17] 2.4 Scope of the Problem As we have simplified the IOT device currently we can watch the temperature and ph level. [5] In future it may be develop to observe more water components to ensure the best quality of water for fish farming. 2.5 Challenges ? We have to learn the working principal of ESP 8266 nodemcu Wi-Fi module. ? We have to learn about the blynk database system, how it works. ? We have to learn how to connect the hardware's with blynk app. CHAPTER 3 REQUIREMENT & SPECIFICATION 3.1 Business Process Modeling Figure 3.1: Business process modeling 3.2 Use-Case Modelling & Description Figure 3.2: Use-case modeling & description 3.3 Requirement Collection and Analysis To build this project we have to use several equipment's; [3] ? Esp 8266 nodemcu ? Waterproof temperature sensor ? Ph sensor ? LED display ? Breadboard ? Jumper wire ? 5v power supply ? Wi-Fi router ? Blynk app 3.3 .1 ESP 8266 Nodemcu ESP 8266 nodemcu is a microcontroller unit which has a Wi-Fi module nodded with microcontroller it works same as a microcontroller unit with an extra feature of connecting with internet through Wi-Fi. [3], [9] Fig 3.3: ESP 8266 nodemcu 3.3.2 Waterproof Temperature Sensor DS18B20 has a waterproof version. Basically it is a temperature sensor which is used to measure the temperature of liquid elements. Its temperature range is from (- 55) degree Celsius to (125) degree Celsius. It required 3 volt to 5.5-volt power supply to measure the temperature. [15] Figure 3.4: Waterproof temperature sensor 3.3.3 PH Sensor Ph sensor detects the ph level of water. Basically it is an analog sensor which gives analog data to Arduino. [17] We need to use the library function and assign formula to get the digital value which is the actual level of ph. [7] It needs 5-volt power supply to power on. It will operate between the temperature ranges of 7 degrees Celsius to 46 degrees Celsius. [5] Figure 3.5: PH sensor 3.3.4 LED Display We have used a blue led display which is an I2C module. It is a 16/2 led display. We have to use the Liquid Crystal library to operate this module. We have used this led display to show the real time data on the spot. [7] Fig 3.6: LED display 3.3.5 Breadboard Breadboard is a device where electric component doesn't need to solder. It is used for making prototype electronics circuit's. As we have used very sensible development board and sensors we didn't take the risk of solder. [9] Figure 3.7: Breadboard 3.3.6 Jumper Wire Jumper wire is basically use in non-soldered electronic circuit's also it has a benefit of less short circuit's and a clean wiring setup. [4] Figure 3.8: Jumper wire 3.3.7 5-Volt Power Supply As we have use ESP 8266 nodemcu as our project development board we need a 5-volt DC power supply. [3] Figure 3.9: 5-Volt power supply 3.3.8 Wi-Fi Router As our project is an IOT base project we need internet. The ESP 8266 nodemcu has a built in Wi-Fi module so to send the data to the database we need Wi-Fi internet that's why we have used Wi-Fi router. [1], [3] Figure 3. 10: Wi-Fi router 3.3.9 Blynk App Blynk app is an open source app

for IOT projects as our project is a prototype IOT base project we have used blynk app. It a supper easy to use and it has many useable features. It also has a secured database. [13] Figure 3.11: BLYNK app CHAPTER 4 SYSTEM DESIGN AND IMPLEMENTATION 4.1 Frontend Design ? Front end design requires building the device. ? Connecting it to blynk app Frontend Design Requires Building the Device To build this device we have to connect the temperature sensor, PH sensor and LCD display with the ESP 8266 nodemcu. To connect the temperature sensor, we have to short the ground pin and the data pin with a 100k ohm resister. For the PH sensor we have to connect the data pin with the analog input to get the data. For the i2c LCD module we have to connect the SDA & SCL pins with D2 & D1 pins of nodemcu. [11],[12] Connecting it to Blynk App Blynk app is an open source app for IOT devices and project. Whenever we resister in blynk app we will get a data base secret which the data base secret we can connect our project with the blynk database. Figure 4.1: Connecting it to blynk app 4.2 Implementation Requirement To implement this project, we need [16] ? Arduino IDE ? Blynk app Arduino IDE Arduino IDE is a free package software. It is used to program the Arduino based development boards. [17] Blynk App Blynk app is the most used IOT platform for IOS and android device. It has a lot of free feature with free cloud services through this app we can create a prototype IOT app interface with zero cost. [15] Figure 4.2: Blynk app 4.3 Backend Design Backend design includes ? Connecting sensor with ESP 8266 nodemcu. ? Connecting ESP 8266 nodemcu with internet. ? Displaying data to LCD display. ? Sending data to blynk data base. ? Displaying to blynk app. [15] Connecting Sensor with ESP 8266 Nodemcu: Figure 4.3: Connecting Sensor with esp8266 nodemcu Connecting ESP 8266 Nodemcu with Internet: Figure 4.4: Connecting ESP 8266 nodemcu with internet Displaying Data to LCD Display Figure 4.5: Displaying data to LCD display Sending Data to Blynk Data Base: Figure 4.6: Sending data to blynk data base Displaying to Blynk App Figure 4.7: Displaying to blynk app CHAPTER 5 TESTING AND DISCUSSION 5.1 Implementation of Frontend Design If the connections are perfectly done and the development board is perfectly power supplied, Ones it connects with Wi-Fi internet the data of the water will be started displaying on LCD display.[8] Again, if the code runs perfectly the data will be shown on blynk app whenever we login to it. 5.2 Implementation of Database Figure 5.1: Implementation of database 5.3 Test Result and Reports Table 5.1: Test result& report Device Display Blynk App Comment Starts collecting LED display doesn't Doesn't show any Device is not data show any data data working perfectly Starts collecting LED display shows Doesn't show any Ph sensor is not data water temperature data working Starts collecting data LED display shows water temperature & water Ph Doesn't show any data Device can't get connected with Internet network. Starts collecting data LED display shows water temperature & water Ph App shows both temperature & Ph level Device is working perfectly 5.4 Final Output Our device is working perfectly as its final output is absolutely perfect. The sensors devices are working as instructed. The temperature & Ph sensor is getting data's ad showing it on LED Display. The nodemcu is also sending data to Blynk app's database. So, we can say that, the IOT project is successfully working. CHAPTER 6 CONCLUSION AND FUTURE SCOPE 6.1 Discussion and Conclusion The device is working as per our expectation from it. Our device is working perfectly as its final output is absolutely perfect. The sensors devices are working as instructed. The temperature & Ph sensor is getting data's ad showing it on LED Display. The nodemcu is also sending data to Blynk app's database. [12] So, we can say that, the IOT project is successfully working. 6.2 Scope for Future Developments As we have implemented our project, the device can get water temperature & Ph level instantly. [11] For future development, its working boundary can be expanded. Now it shows temperature and Ph only, in future, it may be able to show food amount in farming pond, oxygen level of water, etc. REFERENCES [1] Techshopbd," ESP8266 ESP-01 Wi-Fi Module" techshopbd, April 12,2019 . techshopbd.com/product-categories Wi-Fi esp8266-esp-01-wifi-module-techshop-bangladesh [2] Usgs, "Turbidity and Water", usgs may2,2019 usgs gov special-topic water-science-school science turbidity-and-water? qtr .-science center objects qtr. science center objects [3] Sparkfun, "Wi-Fi Module - ESP8266", sparkfun[may27,2019 sparkfun products 13678 [4] Wikipedia.org,"alkalinity", Wikipedia[june27,2019 en.wikipedia.org wiki Alkalinity [5] chemengonline, "ph", chemengonline july12,2019 chemengonline.com ph-measurement- industrial-waters [6] Thedailystar, "what should be the ph value of drinking water",.thedailystar.net aug11,2019 thedailystar.net health/what-should-be-the-ph-value-drinking-water-138382 [7] Koi health,"what are the impact of low ph koi" sep27,2019 koihealth.info/understanding-ph.html [8] Espressif, "duel-core modules with Wi-Fi & dual mode Bluetooth" sep29,2019 espressif.com/en/products/hardware/modules [9] Techshopbd,"Esp Module" oct2,2019 techshopbd.com/product-categories/wifi/2583/esp8266-esp-01-wifi-module-techshop-bangladesh [10] Ncbi, "introduction" oct7,2019 ncbi.nlm.nih.gov/p.m./articles/PMC3752848/ [11] Mt.com,"ph measure of pure water" may13,2019 mt.com/ ch /en/home/library/white-papers/lab- analytical-instruments/pH-measurement-pure-water .html [12] Assets.thermofisher.com ,"Measuring pH of Pure Water and Other Low Conductivity Waters" oct15,2019 assets.thermofisher.com/TFS-Assets/LSG/Application- Notes/AN-PHPURE-E-0914-RevA-WEB.pdf [13] Globalw.com,"water level" [oct18,2019] globalw.com/support/ph-measurement.html [14] En.wikipedia.org,"ph meter" [oct23,2019] en.wikipedia.org/wiki/PH_meter [15] Presens.de,"FEATURED PH SYSTEMS" oct27,2019 presens.de/products/ph/meters?gclid=Cj0KCQjw9fntBRCGARIsAGjFq5FWT3gB7jtBHPniuB1rLRjkBnmA- FWgaob7pcRROkp7-_6wcuhjpmwaAvNyEALw_wcB [16] Technobyte.org,"power-up-the-arduino-uno" oct29,2019 technobyte.org/2016/07/power-up-the- arduino-uno/ [17] Store.arduino.cc ,"arduino uno REV3" oct30 ,2019 store.arduino.cc/ use /arduino-uno-rev3 Appendix A Appendix-A List of sensors & basic uses of the sensors: Waterproof temperature sensor is with digital output. We have used this sensor to measure the water temperature. Ph sensor gives analog input. With this sensor, we can measure the Ph level of water. @Daffodil International University 1 @Daffodil International University 2 @Daffodil International University 3 @Daffodil International University 4 @Daffodil International University 5 @Daffodil International University 6 @Daffodil International University 7

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