POLITEKNIK MALAYSIA SULTAN SALAHUDDIN ABDUL AZIZ SHAH

ELECTRICAL ENGINEERING DEPARTMENT

SESSION 2 2022/2023

BACKWASH TURBIDITY SENSOR USING IOT

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This project is submitted in partial fulfillment of requirements for the award of Diploma in Electrical Engineering (Control)

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CONFIRMATION OF THE PROJECT

The project report titled "Backwash Turbidity Sensor using IOT" has been submitted, reviewed and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

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Date	: **25/5/2023**

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Date	:

"I acknowledge this work is my own work except the excerpts I have already explained to our source"

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DECLARATION OF AUTHENTICATION AND OWNERSHIP

TITLE : BACKWASH TURBIDITY SENSOR USING IOT
SESSION : 2 2022/2023

1. I am, **PREMKUMAR A/L SIVAKUMAR 08DJK20F2023**

the final year student of **Diploma in Electrical Engineering (Control), Politeknik Sultan Salahuddin Abdul Aziz Shah**, located at **Persiaran Usahawan, 40150 Shah Alam, Selangor.**

2. We verify that **Backwash Turbidity Sensor using IOT** and its intellectual properties are our original work without plagiarism from any other sources.

3. We agree to release the project's intellectual properties to the above said polytechnic in order to fulfil the requirement of being awarded **Diploma in Electrical Engineering (Control).**

ACKNOWLEDGEMENT

The accomplishment of our project would be unachievable without the involvement and support of many individuals who contributed to this project and. However, we want to convey our gratitude and obligation to our supervisor, Encik.Wan Mohd.Zamri Wan Ab.Rahman for giving the knowledge and resources required for this project. We also would like to sincerely thank our beloved parents and friends for their kind encouragement and moral support throughout the project execution period. In completing this final project, there were many expectations and challenges that I had to face, but I made it a very valuable lesson and experience because the fatigue I faced finally paid off when this final project was finally completed within the stipulated time. Thank you.

ABSTRACT

Wireless communication developments are creating new sensor capabilities. The current developments in the field of sensor networks are critical for environmental applications. Internet of Things (IoT) allows connections among various devices with the ability to exchange and gather data. IoT also extends its capability to environmental issues in addition to automation industry by using industry 4.0. Water supplied to residential areas is prone to contaminants due to pipe residues and silt, and therefore resulted in cloudiness, unfavorable taste, and odor in water. As water is one of the basic needs of human survival, it is required to incorporate some mechanism to monitor water quality time to time. Around 40% of deaths are caused due to contaminated water in the world. Hence, there is a necessity to ensure supply of purified drinking water for the people. Turbidity, a measure of water cloudiness, is one of the important factors for assessing water quality. This paper proposes a low-cost turbidity system based on a light detection unit to measure the cloudiness in water. In this paper, we propose a low cost system for real time water quality monitoring and controlling using IoT. This system consists of turbidity sensor pH level detector. The turbidity detection unit consists of a Light Dependent Resistor (LDR) and a Light Emitting Diode (LED). Once the turbidity level reached a threshold level, the system will trigger and send notification to the display panel and also android phone using WiFi. Not only that, it also has the access for DC water pump to drain in chlorine to stable the pH level of water.

ABSTRAK

Perkembangan komunikasi tanpa wayar mencipta keupayaan sensor baharu. Perkembangan semasa dalam bidang rangkaian sensor adalah kritikal untuk aplikasi alam sekitar.IoT membenarkan sambungan antara pelbagai peranti dengan keupayaan untuk bertukar dan mengumpul data. IoT juga meluaskan keupayaannya kepada isu alam sekitar selain industri automasi dengan menggunakan industri 4.0. Air yang dibekalkan ke kawasan kediaman terdedah kepada bahan cemar akibat sisa paip dan kelodak, dan oleh itu mengakibatkan kekeruhan, rasa tidak enak dan bau dalam air. Memandangkan air merupakan salah satu keperluan asas kelangsungan hidup manusia, ia diperlukan untuk menggabungkan beberapa mekanisme untuk memantau kualiti air dari semasa ke semasa. Sekitar 40% kematian disebabkan oleh air yang tercemar di dunia. Oleh itu, terdapat keperluan untuk memastikan bekalan air minuman yang disucikan untuk rakyat. Kekeruhan, ukuran kekeruhan air, adalah salah satu faktor penting untuk menilai kualiti air. Kertas kerja ini mencadangkan sistem kekeruhan kos rendah berdasarkan unit pengesan cahaya untuk mengukur kekeruhan dalam air dan juga tahap pH air. Dalam kertas ini, kami mencadangkan sistem kos rendah untuk pemantauan dan kawalan kualiti air masa nyata menggunakan IoT. Sistem ini terdiri daripada sensor kekeruhan.Unit pengesan kekeruhan terdiri daripada Perintang Bersandar Cahaya (LDR) dan Diod Pemancar Cahaya (LED). Setelah tahap kekeruhan mencapai tahap ambang, sistem akan mencetus dan menghantar pemberitahuan kepada panel paparan dan juga telefon android menggunakan WiFi. Bukan itu sahaja, ia juga mempunyai akses untuk pam air DC mengalirkan klorin untuk menstabilkan tahap pH air.

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Water is essential for all living things and can be considered as one of the basic needs for human being. Water quality standards described the parameters set which indicates whether the water is safe for human consumptions. The standards are important because they affect major environmental, social and economic values of society and if water supplied to us is not up to the stipulated standards, it means the water is harmful to human being. In Malaysia, the drinking water quality standard is conforming to National Standard for Drinking Water Quality (Second Version, January 2004) issued by the Engineering Services Division, Ministry of Health Malaysia which was adopted from the World Health Organization (WHO) guidelines for drinking water quality . Therefore, water should be checked now and then. Since water has a direct effect on life on earth; it has become crucial to check whether the water is in a good condition to use. Since water dissolves most of the materials that exist on Earth, it is very difficult to determine the amount of the matter mixed in it. Water being a universal solvent varies from place to place, depending on the condition of the source of water and the treatment it receives. Freshwater is a world resource that is a gift of nature and important to farming, manufacturing, and the life of human beings on earth. Currently, drinking water facilities face new real-world problems due to the limited drinking water resources, intensive money requirements, growing population, urban change in rural areas, and the excessive use of sea resources for salt extraction has significantly worsened the water quality available to people .The high use of chemicals in manufacturing, construction and other industries, fertilizers in farms and also directly leaving the polluted water from industries into nearby water bodies have made a huge contribution to the global water quality reduction, which has become an important problem. Even due to containment water various water born are increasing day by day, due to which many human beings are losing their lives. Traditionally, detection of water quality was manually performed where water samples were obtained and sent for examination to the laboratories which is time taking process, cost and human resources. Such techniques do not provide data in real-time. The proposed water quality monitoring system is consisting of a microcontroller and basic sensors, is compact and is very useful for turbidity of the atmosphere, continuous and real-time data sending via wireless technology to the monitor. Turbidity is the measure of water visibility at which the amount of light level that can pass through the water. Turbidity measures the Total Suspended Solid (TSS) in water. Nephelometry refers to the process of aiming a beam of light at a sample of liquid and measuring the intensity of light scattered at 90° to the beam. This method of measuring turbidity is recognized by Environmental Protection Agency (EPA) called Method 180.1. Another method called the attenuation method measures the loss of light between a light source and detector directly across from it at 180° . In developing turbidity sensor, these two methods are often considered. Current trends in water quality monitoring system are focused on continuous sensing, multiple sensors, automated control and wireless data acquisition mechanism. For instance, work done by uses ultrasonic and water sensors where the system transmits data by integrating a wireless gateway within a consumer network. The system stores acquired information in a database and this information can be accessed through web-based monitoring services globally using GSM. Moreover, via GSM technology used, the system in has an advantage in terms of wireless coverage over because it still able to submit measured data from sensors in the absent of internet connection.

1.2 BACKGROUND RESEARCH

Based on the survey and research made, when using ladders people find it difficult to place their tools and equipment while working on ladder. Furthermore, getting up and down to move the ladder every time when they change platforms to work would be another problem.

The project aims to help the users be convenient and safe when using an ergonomically designed ladder. That is why Advanced Ladder is designed in a way where storage spaces are provided at several heights of the ladder to ensure that the users can reach their tools easily. Our project also can be controlled through Bluetooth of mobile phones to move the ladder horizontally and vertically. Last but not least, ultrasonic sensors are installed at two sides of the project for detecting any obstacles or uneven surfaces to avoid unnecessary accidents.

1.3 PROBLEM STATEMENT

The problem statement is bad quality state of water due to growing population, urban change in rural areas, and the excessive use of sea resources for salt extraction has significantly worsened the water quality available to people .The high use of chemicals in manufacturing, construction and other industries, fertilizers in farms and also directly leaving the polluted water from industries into nearby water bodies have made a huge contribution to the global water quality reduction, which has become an important problem. Not only that, health problems caused due to consumption of polluted water and linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio.

1.4 OBJECTIVE OF THE PROJECT

One of the main objectives of this project is to build a working system that can detect the quality state of water and to ensure the water consumed is good in quality. Moreover, by the end of this process, this project also helps us to prevent health issues due to unhealthy water consumption.

1.5 SCOPE OF THE PROJECT

In today's world of modern technology, many products are invented to make them easier and faster for people. The Backwash Turbidity Sensor project aims to ensure that the project is carried out in a way that achieves the requirement. The purpose of the project is to be able to detect the quality state of water. Apart from that, this project also can helps us to prevent consumption of contaminated water so that it can helps us to get rid of cholera, diarrhea, dysentery, hepatitis A, typhoid and polio.

1.6 CONTRIBUTION OF THE PROJECT

As the world is moving forward with Industrial Revolution 4.0, it is a necessary to have technology in innovation and invention to boost economic growth. Even though there is a lot of project to measure the turbidity and pH in water but our project has included a component of IoT which is by providing sensors.

1.7 SUMMARY

In a nutshell, this chapter can be concluded by saying that the study from research have helped to develop this project as stated that it can overcome the common challenges experienced by individuals. Although the primary goal of this initiative is to achieve the objectives, the project has also implemented the importance of technology in the creation. This isbecause technological advancement enables the production of more and better assets in a more efficient way.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter aims to use the findings from the Internet to focus on how ergonomic a backwash turbidity sensor should be. Review of the literature also supports the conclusion on how Backwash Turbidity Sensor has been designed to prevent the target users wasting time and energy while doing work more efficient. The purpose of the review is also to evaluate the existing backwash turbidity sensor by improvising the features to make the users more beneficial.

2.2 HISTORY

Water quality testing has traditionally been done manually, involving the collection of water samples and sending them to labs for analysis. This method takes time, money, and human resources. Some methods do not deliver data instantly. The proposed water quality monitoring system, which consists of a microcontroller and simple sensors, is small and extremely useful for measuring the turbidity of the atmosphere and transmitting continuous and real-time data to the monitor. The amount of light that can penetrate the water is measured by the turbidity of the water. The Total Suspended Solid (TSS) in water is measured by turbidity. Nephelometry is the technique of shining a light beam onto a sample of liquid and measuring the amount of light that is reflected back at a 90-degree angle to the beam. Environmental Protection Agency (EPA) approves of this turbidity measurement technique. The attenuation method, another technique, gauges the amount of light that is lost between a light source and detector. These two approaches are frequently taken into account while building turbidity sensors. The focus of current trends in water quality monitoring systems is on wireless data collecting, many sensors, automated control, and continuous sensing. For instance, work done by integrates a wireless gateway into a consumer network and employs ultrasonic and water sensors to convey data.

2.3 PREVIOUS RESEARCH ON BACKWASH TURBIDITY SENSOR

- Smart water quality monitoring system with cost-effective using IoT

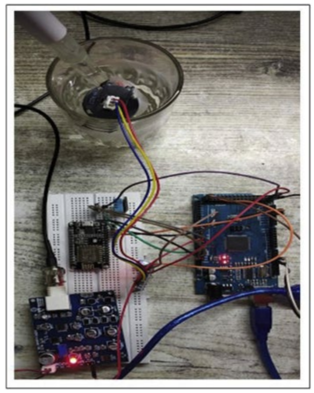


Figure 2.1: Smart water quality monitoring system with cost-effective using IoT

This system uses two transceivers of radio frequency (RF) and a transmitter mounted on the tank and sump at the place where they wanted to check the quality of water. The RF transceivers used for wireless communication to the internet server. With the help of a micro controller, the system is fully programmed of the user unless the water the bottle is drained or overflowed. The sensor array is used to measure various parameters such as dissolved Oxygen, Tumble, pH, Temperature, etc. Sensor array. Costs of installation are reduced because of the wireless system.

- Web based Water Turbidity Monitoring and Automated Filtration System: IoT Application in Water Management

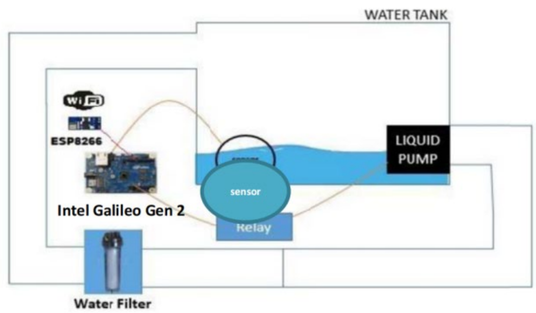


Figure 2.3.2: Web based Water Turbidity Monitoring and Automated Filtration System: IoT Application in Water Management

The system is capable of monitoring water turbidity inside water tanks equipped with an automated water filtration function. Meanwhile the system architecture consists of three parts; the turbidity sensing, the gateway device and the user interface as illustrated. The water turbidity sensor was developed using a simple voltage divider circuit which consists of LDR or LED. This sensing unit connected the Intel Galileo Gen 2 via a relay circuit. The two channel relay module enables a micro controller such as Intel Galileo Gen 2 with digital outputs to control larger loads and devices like AC or DC motors which require an external power source .Changes in water turbidity can be characterized from changes due to light incident absorption at LDR which result in changes of voltage at voltage divider. A program was written using C language to obtain measured data from the sensor, analyze the data and send them to internet. Meanwhile, for the filtration process, a bilge pump is used to pump out the water from tanks.

- Water Quality Monitoring using IoT

Figure 2.3.3: Water Quality Monitoring using IoT

The various sensors used for water quality assessment are pH Sensor, turbidity sensor and temperature sensor. Out of this the pH sensor and turbidity sensor are analog sensors while the temperature sensor is a digital sensor. Raspberry Pi 3 B+ used in the proposed system accepts only digital inputs. Therefore the temperature sensor is connected directly to the GPIO pins of the Raspberry Pi while the pH sensor and the turbidity sensor are connected to the Analog to Digital Converter (ADC) to obtain digital output. This digital output is then given to the Raspberry Pi for further processing. A pH sensor measures the hydrogen ion activity in a liquid. At the tip of the pH probe is a glass membrane that permits hydrogen ions from the liquid being measured to diffuse into the outer layer of the glass, while larger ions remain in the solution. The difference in the concentration of hydrogen ions outside and inside the glass membrane creates a very small current. This current is proportional to the concentration of hydrogen ions present in the liquid being measured. If the concentration of hydrogen ions inside the glass membrane is lesser than hydrogen ions outside it, the solution is an acid. Otherwise the solution is a base. The turbidity sensor uses light to detect suspended particles in water. Murkier the water more is the amount of suspended particles in it. The turbidity sensor consists of an IR LED and a photo diode on its probes. The IR LED emits light rays that are supposed to reach the photo diode. These light rays come across the water flow and are scattered when they hit any suspended particle in the water. As a result, the light received at the photo diode is less when compared to the amount of light that was emitted. This difference in amount of light sent and received is used to calculate the turbidity of the liquid under consideration. Once the sensor data reaches the Raspberry Pi, it processes the data to determine whether the data lies in safe range or not. The water quality parameters thus recorded are further shown on a web server where the respective authority can monitor it and control the water supply manually too. As the system independently processes the data and takes decisions on whether to allow or restrict the water supply, it saves (important) time spent in human calculation (errors) and communications and may prevent any hazard. After the sensor values are received by the Raspberry Pi, they are processed and output is obtained at the Output pin of Raspberry Pi. If the status is “good” i.e. all water quality parameters are in the desired range, pin 17 goes high (3.3V) and if the status is “bad”, the pin goes low (0V).However the 3.3V output of Rpi GPIO pin is insufficient to drive the 5V relay. To overcome this issue, a npn transistor is connected between the Rpi and relay as shown in Fig-2. This transistor acts as a switch thus operating in either saturation or cutoff region. Output of Rpi is given to base of the npn transistor. One terminal of relay coil is connected to collector terminal of transistor and the other terminal is connected to the 5V supply pin of Raspberry Pi. Thus when status is “good”, 3.3V is given to base of transistor which is sufficient to turn the transistor ON in saturation region. This provides a short circuited path between collector and emitter of the transistor and 5V supply is applied to the relay coil terminals triggering the relay to NO (Normally Open) position. On the other hand, if the status is “bad”, then output of 0V is applied to transistor which turns the transistor OFF (i.e. cutoff region) and the 5V supply is disconnected from relay coils triggering it to NC (Normally Closed) position. When the relay is in Normally Closed (NC) state, connection between the solenoid valve and 12V external DC supply is open circuited and hence valve remains in OFF condition not allowing water to flow from tanks to the houses. On the other hand, when the relay is triggered to NO state i.e. status is “good”, the solenoid valve is connected to the 12V DC supply with common terminal of relay connected to negative of 12V supply. Thus the circuit is complete and solenoid valve is turned ON. Hence, water flows from the overhead tanks to houses through pipes.

- Management of Smart Water Treatment Plant using IoT Cloud Services

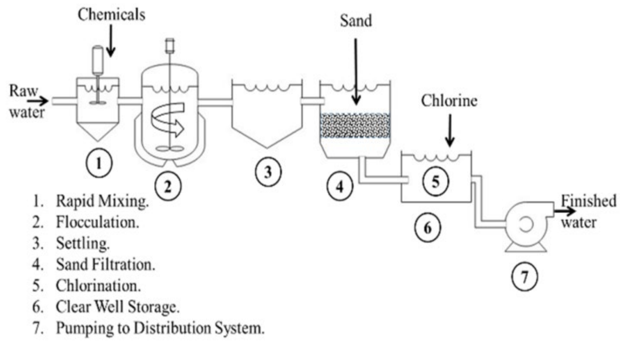


Figure 2.3.4: Management of Smart Water Treatment Plant using IoT Cloud Services

The proposed solution is based on sensors monitoring and Big Data analysis of Smart Water Treatment Plant (SWTP) using IoT hardware devices that have an internet connection to an IoT Cloud platform. The Cloud platform such as Thing Speak has the capability to analyze, visualize and react based on the Big Data analytics to send risk alarms and operate risk management plans to overcome the failure scenarios and minimize the downtime operation of the Smart WTP. The proposed system has been simulated using MATLAB/ThingSpeak Toolbox. Using virtual sensors data to simulate the water purity meter and flow rate sensors readings in a MATLAB program. The reading was sent using Wi-Fi interface to the ThingSpeak Cloud platform, which is an IoT analytics platform service that analyze and visualize sensor data. The water purity meter and flow process control efficiency shown respectively. Also, the Data measurement values such as maximum, minimum and average values could be shown. Our proposed solution will improve the overall management services on the on-site processing of SWTP and enable the supervisory control of the overall system. This offers the proven reliability and the safety to SWTP system operation.

- Water Filter Automation System Using Fuzzy Logic Controller

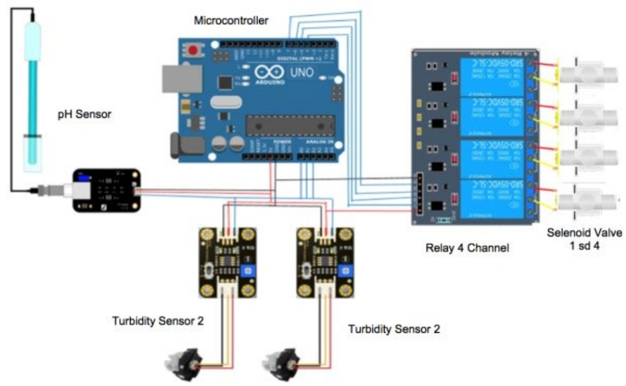


Figure 2.3.5: Water Filter Automation System Using Fuzzy Logic Controller

This system can monitor water quality parameters in filter tank, in this case, is turbidity level and water pH level in water tank, and the system can then perform automatic backwash functions when the filter media is saturated, which is indicated by the high value of NTU at the filter tank outlet. The automatic backwash function is not based on human intervention; thus the water quality as the results of water filtering can be done anytime to meet the standard. Backwash is carried out when the value of a turbidity sensor is exceeding NTU 25 with a pH between 6-8. In the water tank, when the source of water does not meet the standard of drinkable water, which is indicated by abnormal pH level, the water filter inlet valve will be closed automatically. This is done to avoid the filtration process containing too acid or too alkali water. The first experiment is conducted to read the value of sensors and then to find out the turbidity parameters and the acidity level of several types of liquids. The sensor used in this system is a turbidity sensor, which is to detect the level of turbidity of the liquid, and the pH sensor or acidity of the liquid.

2.4 SUMMARY

In short, Backwash Turbidity Sensor is designed to be convenient and affordable. To make the users feel comfortable while using the equipment, we have attentively concentrated on the common problems faced by the users and enhanced some features in the project.

First of all, to tackle the problem where the high use of chemicals in manufacturing, construction and other industries, fertilizers in farms and also directly leaving the polluted water from industries into nearby water bodies have made a huge contribution to the global water quality reduction, which has become an important problem. Even due to containment water various water born are increasing day by day, due to which many human beings are losing their lives. Not only that, health problems caused due to consumption of polluted water and linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio.

Secondly, the traditional way, detection of water quality was manually performed where water samples were obtained and sent for examination to the laboratories which is time taking process, cost and human resources. Such techniques do not provide data in real-time.

Next, to show that our project is up to date representing the Internet of Things (IoT) aspect, Backwash Turbidity Sensor has been designed with consisting of a microcontroller and basic sensors, is compact and is very useful for turbidity of the atmosphere, continuous and real-time data sending via wireless technology to the monitor.

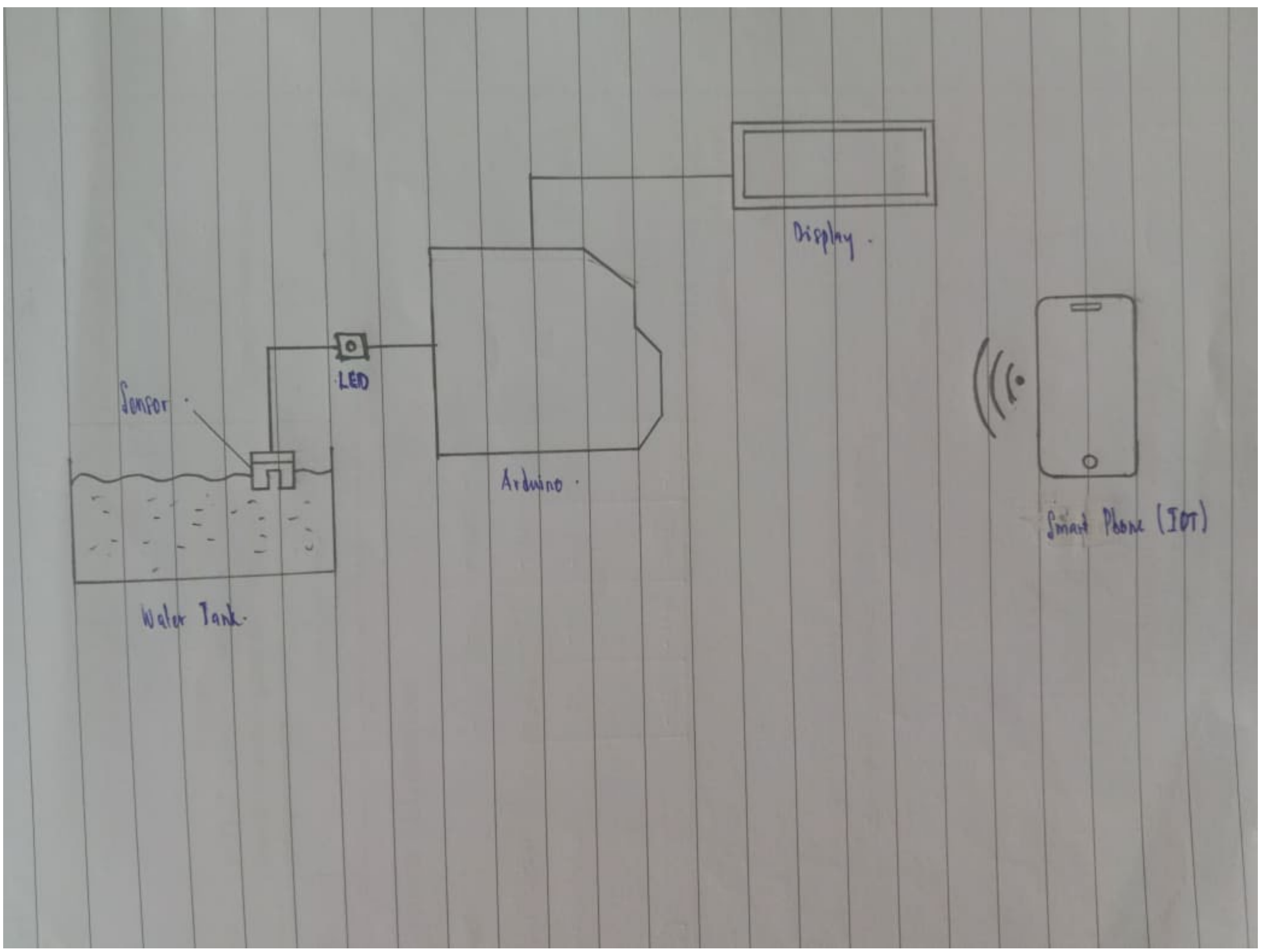
CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will explain the methods used to do this project. This chapter will also include every component's function that is installed in this project. Total budget of making this project is shown by the end of this chapter.

3.2 DESIGN OF THE PROJECT



3.3 FLOW CHART

In the accomplishment of the Backwash Turbidity Sensor, the flow chart below assists us to completethe project.

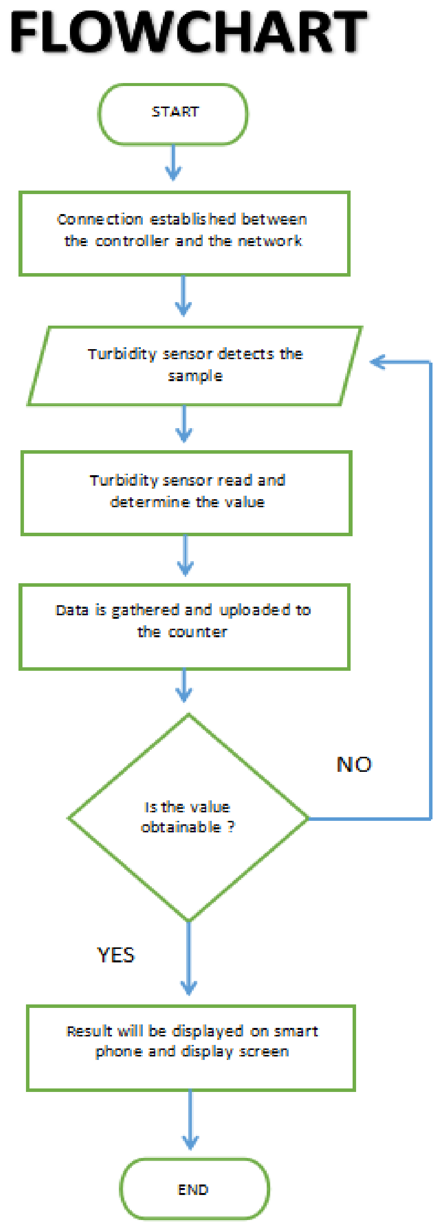


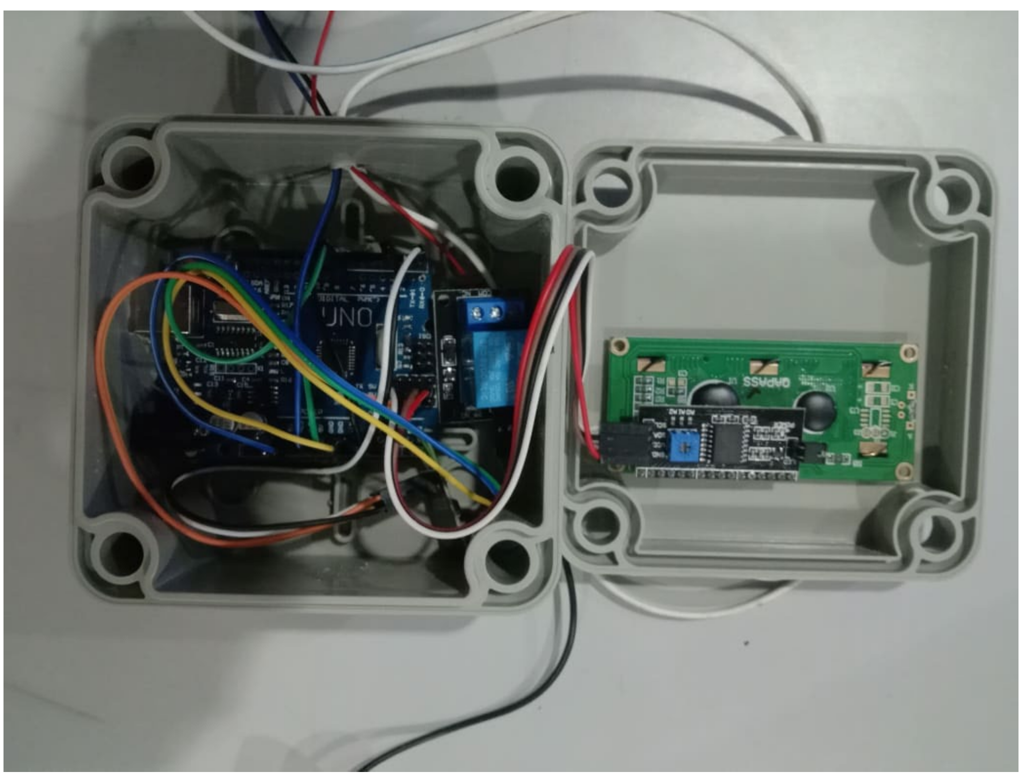
Figure 3.3.1: Flow chart

3.4 Project Description

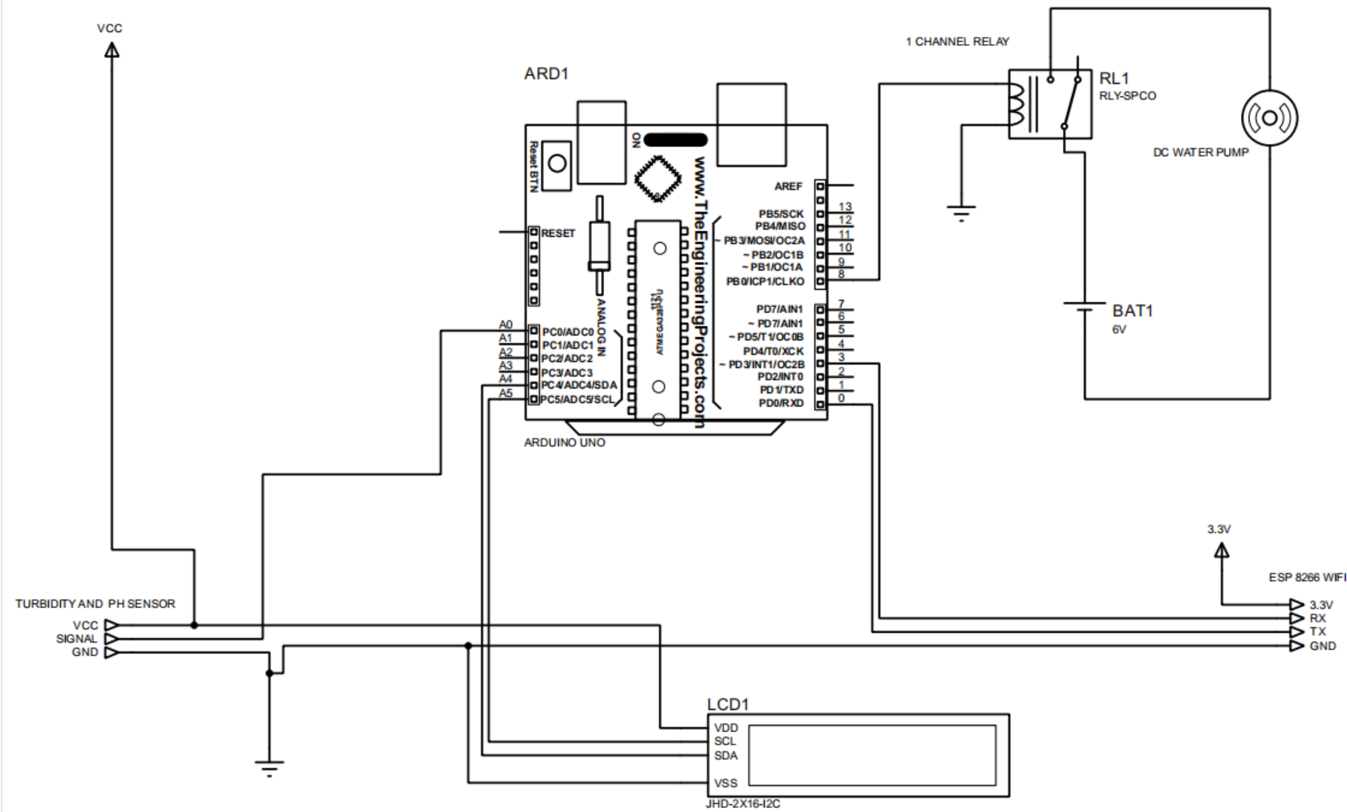
The Backwash Turbidity Sensor and pH Sensor Using IoT is a project aimed at monitoring water quality in real-time, particularly in water treatment plants. The system is made up of two sensors, a Backwash Turbidity Sensor and a pH Sensor, which are linked to an IoT device like an Arduino. The IoT device collects data from sensors and transfers it to a cloud-based platform, where water treatment plant management or other stakeholders can view it. The Backwash Turbidity Sensor detects the presence of suspended particles in water, which can create cloudiness or turbidity. This sensor is critical for water treatment plants since it monitors the amount of turbidity to guarantee the water is safe to drink.

Another crucial component in determining water quality is the pH level of the water, which the pH Sensor detects. Too high or too low pH levels can be detrimental to humans and aquatic life. Data from both sensors is collected by the IoT device and sent to the cloud platform via Wi-Fi or cellular connectivity. The data is received by the cloud platform and stored in a database, where it can be visualized using graphs or charts. The platform may also alert water treatment plant managers if turbidity or pH levels exceed predefined parameters, allowing them to take prompt corrective action.

3.5 Project Hardware



3.6 Schematic Circuit



3.7 Description of Main Component

Figure 3.1: Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

Figure 3.2: ESP-01S

The ESP-01S ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can grant any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Figure 3.3: LCD 16X2

LCDs (Liquid Crystal Displays) are used in embedded system applications for displaying various parameters and status of the system. LCD 16x2 is a 16-pin device that has 2 rows that can accommodate 16 characters each. LCD 16x2 can be used in 4-bit mode or 8-bit mode.

Figure 3.4: DC Water Pump

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power.

Figure 3.5: Turbidity and pH sensor probe

Turbidity and pH sensor probe measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids (TSS) in water increases, the water's turbidity level (and cloudiness or haziness) increases. Not only that, also measures the pH level of the water.

3.8 PROJECT EXECUTION

3.8.1 PROJECT STRUCTURE BUILDING

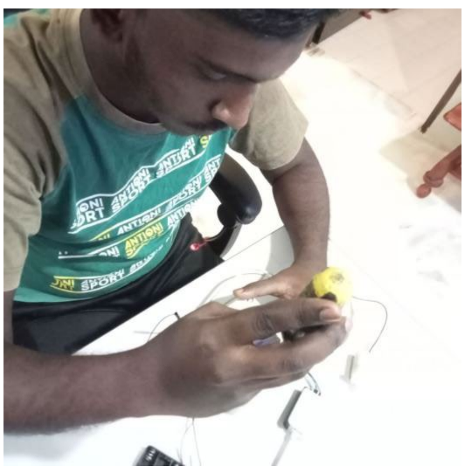
i. **Wiring Connection**

Make wiring connection for each components by following the schematic diagram that have been planned.

Figure 3.8.1: Wiring Connection

ii. Casing

Place all the components inside the casing and glue it to look neater.



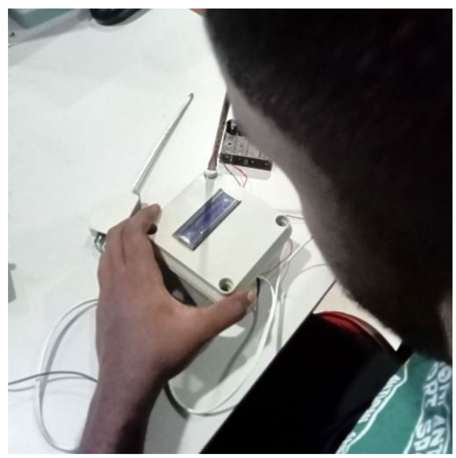


Figure 3.8.2: Casing Process

3.8.2 PROJECT MOVING MECHANISM

i. **Arduino Uno board**

Arduino Uno board plays as the CPU of the whole system of innovation. The Arduino Uno board is a portal to receive and send out signal.

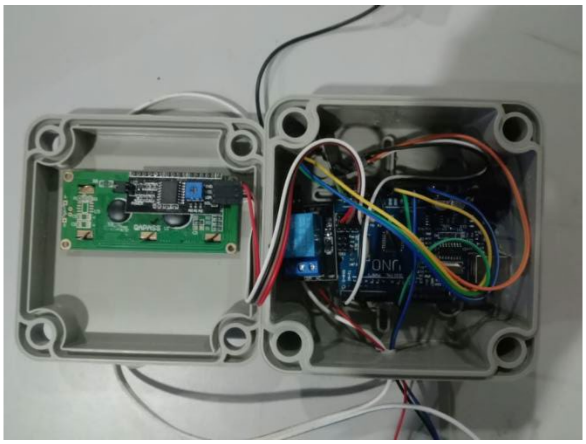


Figure 3.8.3**:** Arduino Uno board

3.8.3 CODING AND PROGRAMMING

The process of translating codes from one language to another is known as coding.Because it implements the earliest steps of programming, it can also be considered a subset of programming. It requires writing programmes in a variety of languages as instructed. The machine cannot speak with humans and can only read machine code, sometimes known as binary language. The fundamental task of a coder is to convert requirements into machine-readable language. Coders must be well-versed in the project's working language. They do, however, mostly code in accordance with the project's specifications and directions. This is the initial step in developing a software product. The process of generating a machine-level executable programme that can beperformed without error is known as programming. It is the practice of writing formalcodes to keep human inputs and machine outputs in sync.

The first stage is to write code, which is then analyzed and implemented to generatethe desired machine level output. It also incorporates all the major parameters, such asdebugging, compilation, testing, and implementation. Programmers use to analyze andcomprehend the various communication components to generate the necessary machine outputs. Arduino programmes are created using the Arduino IntegratedDevelopment Environment (IDE). The Arduino IDE is an application that runs on yourcomputer and allows you to generate sketches (Arduino lingo for programmes) for multiple Arduino boards. The Arduino programming language is based on processing,a very simple hardware programming language similar to C. After writing the sketch in the Arduino IDE, it should be uploaded to the Arduino board for execution.

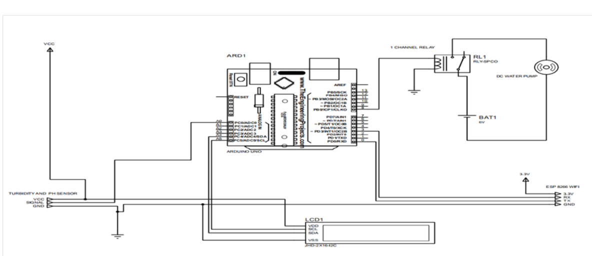


Figure 3.8.4: Schematic Diagram

Figure 3.8.5: Arduino Software

Coding and Programming for this project

```
#include <Wire.h>
#include <SoftwareSerial.h>

#include <OneWire.h>
#include <LiquidCrystal_I2C.h>


SoftwareSerial ss(2, 3); //(RX,TX)



LiquidCrystal_I2C lcd(0x27, 16, 2);



#define PUMP 8




float TBx=0;
float SALINITY=0;
float PHx=0;
float LVL=0;
float TANK=19;
float ActTemp=0;
float temperature = 25;
int ALM1=0;
float Hum,Temp;
int TWIFI=0;
float Sens1,Sens2,Sens3,EC;
int pos=0;
float calibration_value = 21.34;
int phval = 0;
```

```
unsigned long int avgval;
int buffer_arr[10],temp;
int WIFI=0;
float TB=0;

void setup()
{
  pinMode(PUMP,OUTPUT);


 Serial.begin(9600);
 ss.begin(9600);


  delay(1000);

lcd.begin();
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Initialize..");
  lcd.setCursor(0,1);
  lcd.print("Pls wait..");





  delay(1000);


}
void loop() {



 for(int i=0;i<10;i++)
 {
   buffer_arr[i]=analogRead(A0);
   delay(30);
 }
 for(int i=0;i<9;i++)
 {
 for(int j=i+1;j<10;j++)
 {
 if(buffer_arr[i]>buffer_arr[j])
 {
   temp=buffer_arr[i];
   buffer_arr[i]=buffer_arr[j];
   buffer_arr[j]=temp;
 }
 }
 }
 avgval=0;
 for(int i=2;i<8;i++)
 avgval+=buffer_arr[i];
 float volt=(float)avgval*5.0/1024/6;
 float ph_act = -5.70 * volt + calibration_value;
 ph_act=ph_act*1.3035381750;
 ph_act=(ph_act*2.03488372)-0.8;





    Sens3 = analogRead(A0);           //read the value from the sensor
  EC = (5.0 * Sens3 * 100.0)/1024.0;  //convert the analog data to DC AC VOLTAGE
  TB=30-((EC*1.61579892)/10.0);

  if (TB>100){
```

```
    TB=100;
  }

  if (TB<0){
    TB=0;
  }
 // EC=EC*0.0225;
TBx=TB/15*100.0;
if (TBx>100){
  TBx=100;
}

//7.05   49     211





TWIFI++;
if (TWIFI>5){
  PHx=EC/2 * 0.7469879518;

  PHx=PHx*0.15869565;
  PHx=PHx*0.7346534;

  if (PHx>14 && PHx<=18){
    PHx=14;
  }
    if (PHx>18 ){
    PHx=0;
  }
  TWIFI=0;
  Serial.println("UPDATE WIFI");
```

```
ss.print("*");

ss.print(TBx);
ss.print("*");
ss.print(PHx);
ss.println("#");




}

lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("PH: ");
  lcd.print(PHx,1);

  lcd.setCursor(0,1);
lcd.print("TURBIDITY: ");
  lcd.print(TBx,0);
  lcd.print("%");


  Serial.print(TBx);
Serial.print("\t");
Serial.println(PHx);


 delay(100);



}
```

3.8.4 APPLICATION SOFTWARE

Blynk is a mobile app designed for IoT (Internet of Things) applications that allows users to control and monitor connected devices and sensors remotely. It was created to simplify the process of building IoT applications and to provide an easy-to-use platform for people without extensive programming experience. Blynk provides a graphical interface that can be used to create custom dashboards for controlling and monitoring connected devices. Users can drag and drop various widgets onto the dashboard, such as buttons, sliders, graphs, and displays, and then link these widgets to their connected devices or sensors. Once the dashboard is set up, users can use the Blynk app to interact with their devices from anywhere in the world. Blynk supports a wide range of hardware platforms, including Arduino, Raspberry Pi, ESP8266, and Particle, and can communicate with these platforms over various communication protocols such as Wi-Fi, Bluetooth, and Ethernet. It also provides a cloud-based service that can be used to securely store and access data generated by the connected devices. Overall, Blynk is a powerful and user-friendly IoT app that simplifies the process of building IoT applications and makes it easy for anyone to create custom dashboards to control and monitor connected devices.

Figure 3.8.6: Application Software

3.9 THE FINISHING PROJECT

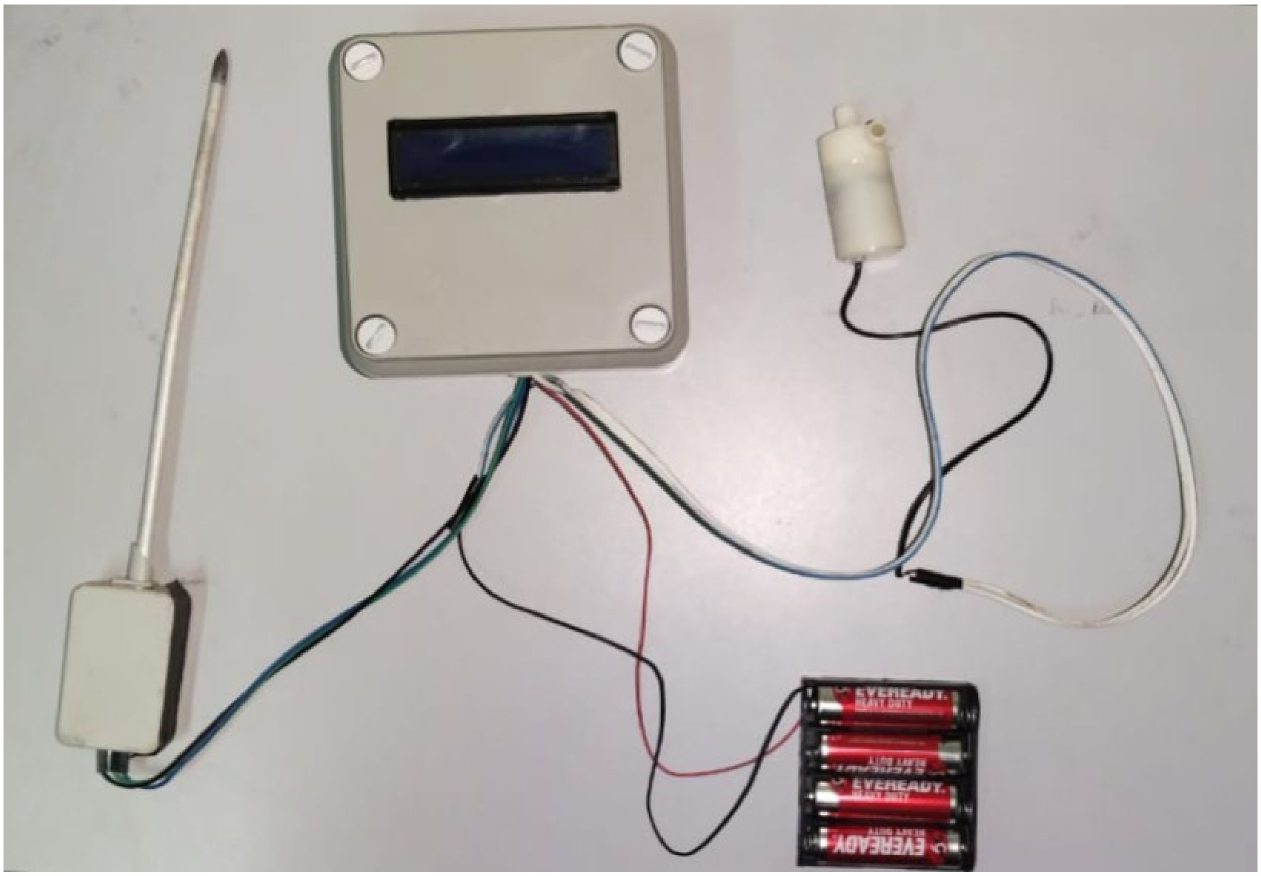


Figure 3.9.1: Project’s Final Look

3.10 PROJECT BUDGET

Table below shows the amount of money spent to purchase the materials needed to produce the project.

Table 3.10: Project Budget

Items	Units	Price (per unit)
Arduino UNO	1 unit	RM 30.72
LCD Display (16X2 I2C LCD Display)	1 unit	RM 9.90
Turbidity Sensor and pH sensor	1 unit	RM 50.00
Battery AA	4 pieces	RM 8.00
Connecting Wires	10 pieces	RM 2.90
ESP-01S	1 unit	RM 9.00
TOTAL		RM 110.52

3.11 SUMMARY

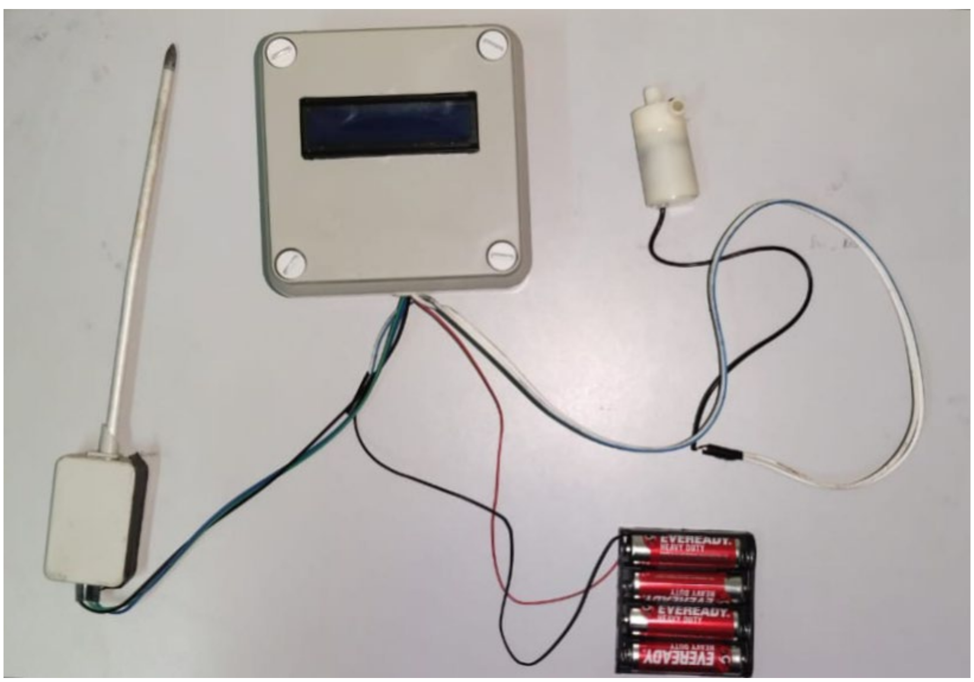
At the end of this chapter, a clear picture has been showed on how I made the Backwash Turbidity Sensor step by step. We also did survey before selecting the equipment and materials at Shopee, Lazada and also at some hardware to get the best materials with reasonable project budget.

CHAPTER 4

ANALYSIS DATA & DISCUSSIONS

4.1 INTRODUCTION

This chapter will explain about the importance of doing data analysis before planning a project. We have collected some data while using Backwash Turbidity Sensor using IOT. Not only that, doing discussion from the analyzed data is alsovery useful because there is where we learn and improve our thinking to determine the materials for the project. On the other hand, ensuring safety measures is the must element that have been considered while doing the project.



4.2 DATA ANALYSIS

4.2.1 pH ANALYSIS

The pH of water indicates how acidic or basic it is. The scale runs from 0 to 14, with 7 being neutral. pH less than 7 indicate acidity, while pH greater than 7 imply baseness. The pH of water is a measure of the relative number of free hydrogen and hydroxyl ions. Water with a higher concentration of free hydrogen ions is acidic, whereas water with a higher concentration of free hydroxyl ions is basic. Because chemicals in water can influence pH, pH is a significant indicator of chemically changing water. pH is expressed in "logarithmic units." Each value reflects a 10-fold increase or decrease in the acidity/basicity of the water. Water with a pH of five is ten times more acidic than water with a pH of six.

4.2.2 TURBIDITY ANALYSIS

Turbidity analysis not only gives information regarding filtration process performance, but it is also utilized to ensure product quality in a number of sectors. Turbidity, often known as haze, is not a well-defined physical property like temperature or liquid density, but is always represented in relation to a well-defined standard. Color has nothing to do with haze. The juice on the left side of the shot is turbid, while the juice on the right is clear; nonetheless, both are yellow: the color is the same, but the turbidity is not.

4.2.3 SURVEY ANALYSIS

Data below shows the responses from Google form survey regarding this Backwash Turbidity Sensor.

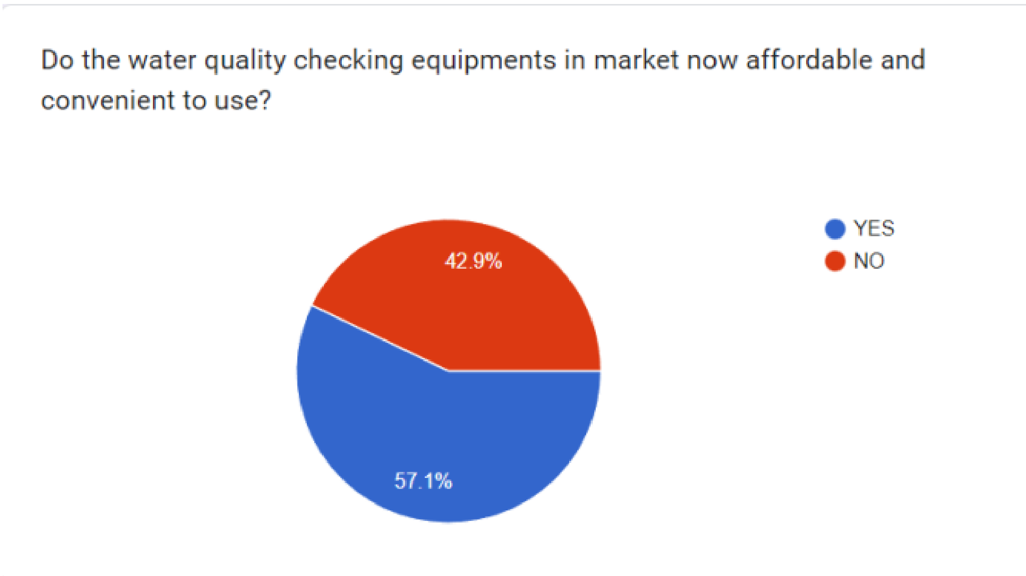


Figure 4.2.1: Survey Analysis 1

According to the survey, 57.1% of the respondents only stated that the water quality checking equipment's in market are affordable and convenient to use and 42.9% of the respondents stated that NO.

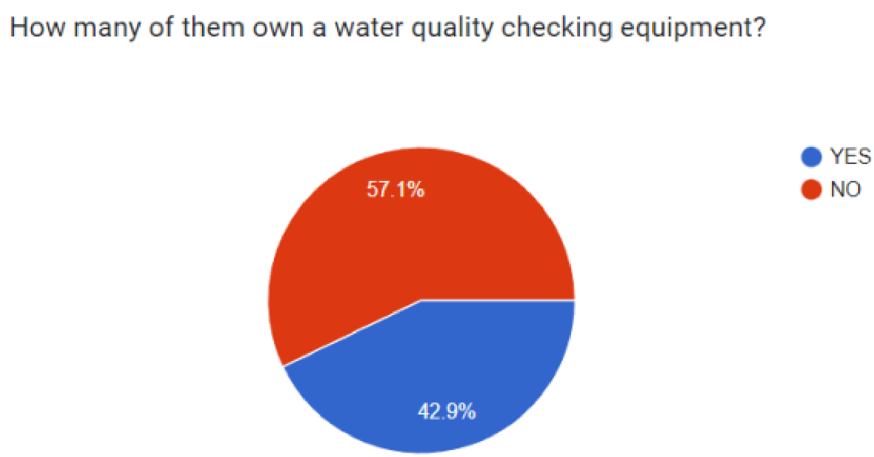


Figure 4.2.2: Survey Analysis 2

According to the survey, 42.9% of the respondents own a water quality checking equipment's in market 57.1% of the respondents doesn't own it.

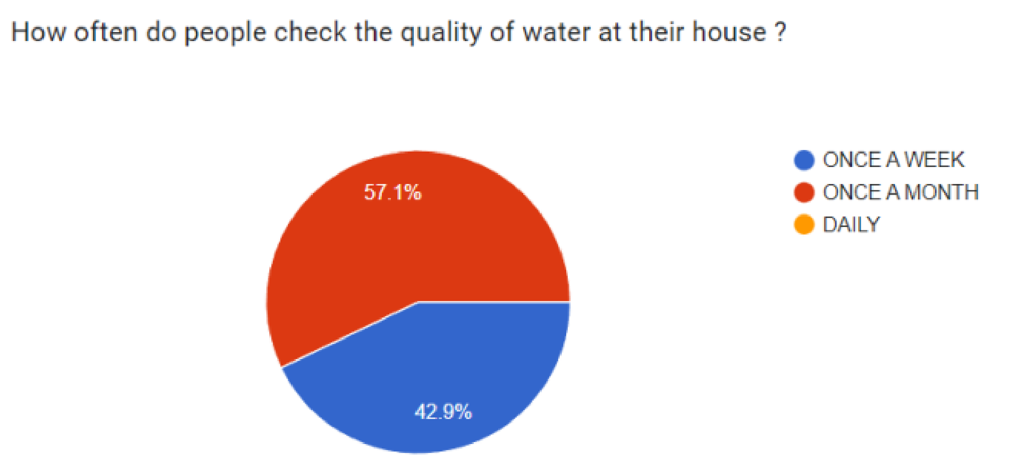


Figure 4.2.3: Survey Analysis 3

According to the survey, 57.1% of respondents only check the quality of the water in their house once a month. Next, 42.9% of respondents said they check the quality of the water in their house once a week.

4.3 SUMMARY

This chapter describes Turbidity, which measures water cloudiness, is a significant component in determining water quality. This research presents a low-cost turbidity system for measuring cloudiness in water that is based on a light detecting unit. In this study, we present a low-cost IoT-based system for real-time water quality monitoring and control. This system is made up of a turbidity sensor and a pH level detector. A Light Dependent Resistor (LDR) and a Light Emitting Diode (LED) are used in the turbidity detection unit. When the turbidity level reaches a certain level, the system will activate and transmit a notification to the display panel as well as an Android phone over WiFi. Not only that, but it also allows the DC water pump to drain in chlorine to keep the pH level steady. Furthermore, this chapter discussed about the safety measures that are takeninto concern in this project.

CHAPTER 5
CONCLUSION

5.1 INTRODUCTION

In this chapter, discussions made by evaluating current design of the project through limitation aspect and upgrade plans in future to have a conclusion on the project. The project limitation aspect is to clarify the ability of the project. The recommendations on upgrade plans are to sustain the importance and benefits of our project to the target users.

5.2 PROJECT LIMITATION

The Backwash Turbidity Sensor using IOT has its own ability and restrictions. This is because we only have installed low capacity components especially for my Final Year Project purpose as we have mentioned previously. These are the required limitations:

- Only can be used in water container or tank which has less depth. For example: 1 feet depth fish aquarium
- DC Motor cannot accommodate to pump in or pump out a large scale of liquid since it has low capacity (can upgrade the motor capacity in future according to requirement)
- The sensor probe is not advised to keep in either Acidic or Alkaline solution since it is corrosive and can damage the sensor probe. It is advised to use a probe which are made of stainless steel since it contains at least 10.5% chromium. The chromium forms a self-healing oxide layer, which provides corrosion resistance

5.3 CONCLUSION

In conclusion, Backwash turbidity sensor is a most important equipment that each household should have. The main reason for it is a must to have in every household because nowadays due to water supplied to residential areas is prone to impurities due to pipe residues and silt, resulting in cloudiness, an unpleasant taste, and an odor in the water. Because water is one of the most basic need for human living, some technique for monitoring water quality has to be included from time to time.

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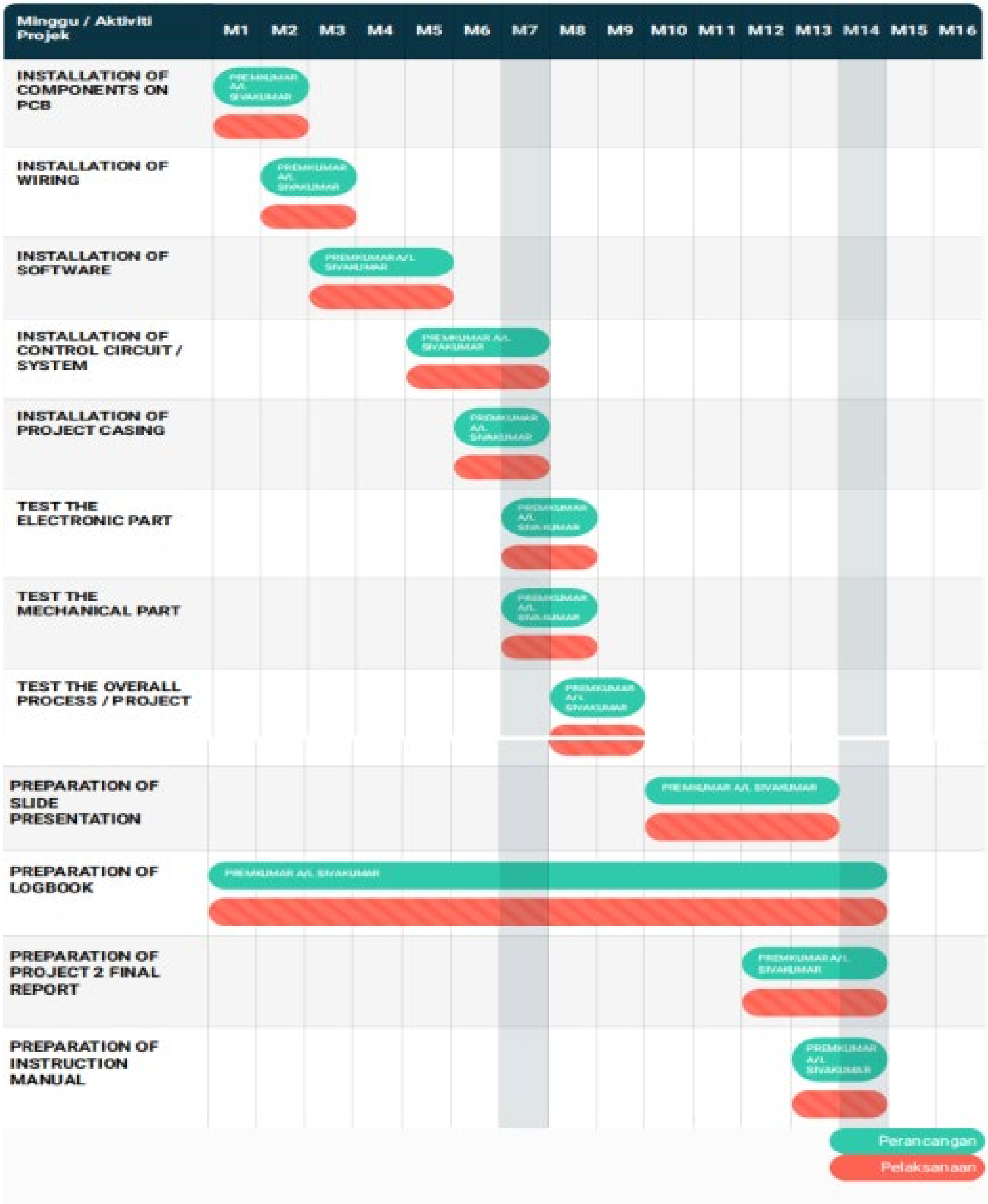
https://www.cdc.gov/healthywater/drinking/public/water_treatment.html

APPENDIX

APPENDIX A – GANTT CHART



APPENDIX B – Coding and Programming of Arduino Software

```
#include <Wire.h>
#include <SoftwareSerial.h>

#include <OneWire.h>
#include <LiquidCrystal_I2C.h>


SoftwareSerial ss(2, 3); //(RX,TX)



LiquidCrystal_I2C lcd(0x27, 16, 2);



#define PUMP 8




float TBx=0;
float SALINITY=0;
float PHx=0;
float LVL=0;
float TANK=19;
float ActTemp=0;
float temperature = 25;
int ALM1=0;
float Hum,Temp;
int TWIFI=0;
float Sens1,Sens2,Sens3,EC;
int pos=0;
float calibration_value = 21.34;
int phval = 0;
unsigned long int avgval;
int buffer_arr[10],temp;
int WIFI=0;
float TB=0;

void setup()
{
```

```
  pinMode(PUMP,OUTPUT);


 Serial.begin(9600);
 ss.begin(9600);


  delay(1000);

lcd.begin();
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Initialize..");
  lcd.setCursor(0,1);
  lcd.print("Pls wait..");






  delay(1000);


}
void loop() {


 for(int i=0;i<10;i++)
 {
   buffer_arr[i]=analogRead(A0);
   delay(30);
 }
 for(int i=0;i<9;i++)
 {
 for(int j=i+1;j<10;j++)
 {
 if(buffer_arr[i]>buffer_arr[j])
 {
   temp=buffer_arr[i];
   buffer_arr[i]=buffer_arr[j];
   buffer_arr[j]=temp;
 }
 }
 }
 avgval=0;
 for(int i=2;i<8;i++)
```

```
 avgval+=buffer_arr[i];
 float volt=(float)avgval*5.0/1024/6;
 float ph_act = -5.70 * volt + calibration_value;
 ph_act=ph_act*1.3035381750;
 ph_act=(ph_act*2.03488372)-0.8;




    Sens3 = analogRead(A0);           //read the value from the sensor
  EC = (5.0 * Sens3 * 100.0)/1024.0;  //convert the analog data to DC AC VOLTAGE
  TB=30-((EC*1.61579892)/10.0);

  if (TB>100){
    TB=100;
  }

  if (TB<0){
    TB=0;
  }
 // EC=EC*0.0225;
TBx=TB/15*100.0;
if (TBx>100){
  TBx=100;
}

//7.05   49     211





TWIFI++;
if (TWIFI>5){
  PHx=EC/2 * 0.7469879518;

  PHx=PHx*0.15869565;
  PHx=PHx*0.7346534;

  if (PHx>14 && PHx<=18){
    PHx=14;
  }
    if (PHx>18 ){
    PHx=0;
```

```
  }
  TWIFI=0;
  Serial.println("UPDATE WIFI");

ss.print("*");

ss.print(TBx);
ss.print("*");
ss.print(PHx);
ss.println("#");




}

lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("PH: ");
  lcd.print(PHx,1);

  lcd.setCursor(0,1);
lcd.print("TURBIDITY: ");
  lcd.print(TBx,0);
  lcd.print("%");


  Serial.print(TBx);
Serial.print("\t");
Serial.println(PHx);


 delay(100);



}


//---------------------------------------------------------------------------------------------------------------------------
-----

void serialEvent() {
  while (Serial.available()) {
    // get the new byte:
    char inChar = (char)Serial.read();
```

```
    // add it to the inputString:
    //inputString += inChar;
    // if the incoming character is a newline, set a flag
    // so the main loop can do something about it:
   if (inChar=='!'){
    digitalWrite(PUMP,HIGH);
   }
   if (inChar=='@'){
    digitalWrite(PUMP,LOW);
   }

}
}

//-----------------------------------------------------------------------------------------------------------------------------------------
----------------------------
```

APPENDIX C – EEEiC Poster

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

BACKWASH TURBIDITY SENSOR USING IOT

NAMA PELAJAR : PREMKUMAR A/L SIVAKUMAR
NO.PENDAFTARAN : 08DJK20F2023
NAMA PENYELIA : ENCIK Wan Mohd Zamri Wan Ab Rahman

PROBLEM STATEMENT

- Bad quality state of water due to growing population, urban change in rural areas, and the excessive use of sea resources for salt extraction has significantly worsened the water quality available to people .
- The high use of chemicals in manufacturing, construction and other industries, fertilizers in farms and also directly leaving the polluted water from industries into nearby water bodies have made a huge contribution to the global water quality reduction, which has become an important problem.
- Health problems caused due to consumption of polluted water and linked to transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid and polio.

OBJECTIVES

- To build a working system that can detect the quality state of water and to ensure the water consumed is good in quality .
- This project also helps us to prevent health issues due to unhealthy water consumption.

IMPACT

- The Backwash Turbidity Sensor project aims to ensure that the project is carried out in a way that achieves the requirement.
- The purpose of the project is to be able to detect the quality state of water.
- This project also can helps us to prevent consumption of contaminated water so that it can helps us to get rid of cholera, diarrhoea, dysentery, hepatitis A, typhoid and polio.

INNOVATION