“AIR WATER POLLUTION SENSING SMART WATCH”

Submitted in partial fulfilment of the requirements of the University of Mumbai

Submitted by

HAMZA MULLA (21)

AMOL PAWAR (51)

MISBA SAYYAD (60)

Under Guidance of

Prof. Dr. K. T. PATIL

Department of Computer Engineering

Smt. Indira Gandhi College of Engineering

Affiliated to University of Mumbai

(2022-2023)

Project Synopsis Approval certificate

This project report entitled as

“AIR WATER POLLUTION SENSING SMART WATCH”.

By

Hamza Mulla (21)

Amol Pawar (51)

Misba Sayyad (60)

Is approved for the degree of **<u>Bachelor of Engineering in Computer Engineering</u>** **Semester VIII, University of Mumbai.**

Date:

Place: Ghansoli

External Examiner

(Prof. Dr. <u>K.T. Patil</u>)
Internal Guide

(Prof. Dr. <u>K.T. Patil</u>)
Head of Department

(Dr. <u>Sunil Chavan</u>)
Principle

(20**22**-20**23**)

DECLARATION

We declare that this written submission repents our own ideas in our words and where others have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academics honestly and integrity and have not misrepresented or fabricated or falsified any idea/fact/data/source in our submission. We understand that any violation of the above will cause disciplinary action by the institute and can also awoke penal action from the sources which have thus not been properly cited or from permission that has not been taken when needed.

Hamza Mulla (21)

Amol Pawar (51)

Misba Sayyad (60)

ABSTRACT

Air and water pollution are causes of global warming. The first step towards stopping pollution is to be able to measure it. People need to know the exact pollution level they are standing in so that they can respond to it. In this age of smart watches, we have watches to track our own health and fitness, but what about environmental health. If environmental health degrades so will the health of all humans and future generations too. So here we develop a smart watch that also measures air and water pollution along with displaying time. With this people will no longer need special equipment to measure pollution levels, they can monitor pollution levels anywhere and anytime desired.

LIST OF ABBREVIATIONS

- PH :- Potential of Hydrogen
- PPM :- Parts per million
- OLED :-Organic light emitting diodes
- PCB :-Printed circuit board
- DFD :-Data flow Diagram
- LCD :-Liquid Crystal Display
- GPS :-Global Positioning System
- GUI :-Graphical User Interface
- IOT :-Internet Of Things
- LPG :-Liquefied petroleum Gas
- CO2 :-Carbon Dioxide
- NH3 :-Ammonia
- NOX :-Nitrogen Oxide
- I2C :-Inter Integrated Circuit
- ERD :-Entity Relationship Diagram
- EPA :-Environmental Protection Agency
- NTU :-Nephelometric Turbidity Unit
- LDR :-Light Dependent Resistor
- MQ6 :-LPG Gas Sensor
- MQ135:-Air Sensor

LIST OF FIGURES

LIST OF TABLES

INDEX

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

A smartwatch is a wearable computer in the form of a watch. Modern smart watches provide a local touchscreen interface for daily use, while an associated smartphone app provides for management and telemetry (such as long-term biomonitoring). While early model could perform basic tasks, such as calculations digital time telling, translations, and game-playing, smartwatches released since 2015 have more general functionality closer to smartphones, including mobile apps, a mobile operating system and WiFi/Bluetooth connectivity. Some smartwatches function as portable media players, with FM radio and playback of digital audio and video files via a Bluetooth headset. Some models, called watch phones (or vice versa), have mobile cellular functionality like making calls. While internal hardware varies, most have an electronic visual display, either backlit LCD or OLED. Some use transflective or electronic paper, to consume less power.

They are generally powered by a rechargeable lithium-ion battery. Peripheral devices may include digital cameras, thermometers, accelerometers, pedometers, heart rate monitors, altimeters, barometers, compasses, GPS receivers, tiny speakers, and microSD cards, which are recognized as storage devices by many other kinds of computers. So here we develop a smart watch that also measures air and water pollution along with displaying time. With this people will no longer special equipment to measure pollution levels, they can monitor pollution levels anywhere and anytime desired. This battery powered smartwatch system is operated by an STM32 controller along with an air quality sensor, gas sensor, ph sensor, turbidity sensor and mini display. The smart watch is a combination of sensors and electronics to enable every citizen monitor and protect our environment.

1.1 PROBLEM STATEMENT

Air pollution is one of environmental issues that cannot be ignored. Inhaling pollutants for a long-time causes damage to human health. Traditional air quality monitoring methods, such as building air quality monitoring stations, are typically expensive. This project is suitable for air quality monitoring in real time. Design a tool which will sense quality of air and display it in the form of percentage, Sense how much gases are present in air and display in the form of percentage, Sense the temperature and display it in degree Celsius.

Water quality monitoring is important as there is a growing concern that the drinking water quality is deteriorating due to contamination of water bodies from industrial waste, sewage, wastewater, chemical pesticides and fertilizers. Although public water systems install water purifying treatments and monitoring systems, water coming out from the treatment plants could be safe but water is easily contaminated along distribution network due to household plumbing and service lines. To cope with the problems stated above, a real-time water quality monitoring system is implemented to check the water quality using various sensors.

1.2 OBJECTIVES

- To measure and display temperature and humidity level of the environment.
- To combine advanced detection technologies to produce an air quality sensing system with advanced capabilities to provide low-cost comprehensive monitoring.
- To display the sensed data in user friendly format in LCD display panel.
- Design and develop an embedded system architecture to perform real-time water quality monitoring based on parameters such as pH, turbidity, temperature.
- Develop GUI to display the water quality in a graphical format for greater visual interactions.

1.3 SCOPE

Air and water pollution are the causes of global warming. The first step towards stopping pollution is to be able to measure it. People need to know the exact pollution level they are standing in so that they can respond to it. In this age of smart watches, we have watches to track our own health and fitness, but what about environmental health. If environmental health degrades so will the health of all humans and future generations too. The scope of this study is to develop an embedded system that is able to perform real-time water quality in water storage tanks and air quality in air with the integration of IoT. This project is separated into two parts in which the first part is on developing the hardware of the system and the second part is implementing IoT into the system by creating a GUI for users to view data and control particular sensors.

1.4 METHODOLOGY

Many of the water and air quality monitoring devices and automatic water saving devices are facing a lot of problems. The fresh water can be appraised through the benefit of pH sensor. The system will show the air quality in PPM on the LCD so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system.

LPG gas is detected usingwMQ6 sensor andwMQ135 sensor is used for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately.
These sensors are connected to the microcontroller Arduino Uno board. And this device is made more adaptable, the real time data is collected, processed and stored.
Data are collected through the sensors that are been used and then these data are sent to the watch and displayed on the LCD Screen.

In this project, it can monitor the pollution level from any here using your watch. This system can be installed anywhere and can also trigger some alert when pollution goes beyond some level
The air quality sensor is used to detect the amount of air pollution in the air as ppm levels. This data is processed by microcontroller to get the current air quality. The watch also monitors for any flammable gases in the vicinity to detect any flammable gas leakages using flammable gas sensor. This sensor is constantly monitored by controller.

Now we have a ph sensor that is used to detect the ph level of any water body. The user can just dip the ph sensor on his/her smart watch to get ph level. The sensor data is processed by controller and displayed on the display module. Similarly, we here have a turbidity\ sensor attached to the smart watch as well. The sensor is used to transmit the water turbidity value to controller which is displayed on display.

Ph and turbidity are used to display water quality of any water body (lake, pond, canal, sea). The smartwatch allows to set high and low acceptance values of each parameter using push buttons. If any of the values scanned shows up higher/lower than set limits it sounds a buzzer alert as well displays the alert message on display to the user.

1.5 REPORT ORGANIZATION

The organisation of the project report is given as follow:

1. **In Chapter 1,** The starting chapter gives us the brief introduction about the project. We get to know few other concepts like scope, objectives, methodology and problem statement.
2. **In Chapter 2,** We will see the Literature survey which will tell us more about the background of the project including the work that has already been done in this field.
3. **In Chapter 3,** The Third chapter of Planning and Formulation tells us about the feasibility studies and the requirement for the project. It also highlights the project plan and model of working.
4. **In Chapter 4,** The fourth chapter shares the knowledge about the analysis of the system by using data analysis and functional as well as non-functional analysis.
5. **In Chapter 5,** This is one of the most important chapters as it highlights the architecture of the project, shares a brief knowledge of System design, Gui design, Hardware design and Database design.
6. **In Chapter 6,** We will tell which algorithm, model and framework we used to develop our system. And which performance evaluation parameters we identified while developing the system.
7. **In Chapter 7,** This section should describe the steps taken to implement the project, including any

challenges that were encountered and how they were addressed.

8. **In Chapter 8,** This section should present the results of the evaluation, including any data or metrics that were collected to measure success. The results should be presented in a clear and organized manner, using pictorial format.
9. **In Chapter 9,** here we conclude our report and share the conclusion perspective of the system by end the end of developers and also shares what future additions can be done in the part of future scope.
10. At the end of the report, we assemble all the references which are used while development of the project and a letter of acknowledgement

CHAPTER 2

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

2.1 SURVEY OF EXISTING PAPERS

YEAR	PAPER NAME	AUTHOR	DESCRIPTION	LIMITATION
2015 IEEE	Design of water management system	F Ntambi, C P Kruger, B J Silva, G P Hancke	The system consist of 3 wireless sensor sub-system. All communicate with each other wirelessly and send information to gateway connected to a computer which hosts the GUI.	Due to wireless transfer of data sometimes delivery of data is not ensured. There are chances of loss of data.
2016 IEEE	Smart water management using IoT	Sayali Wadekar, Vinayak Vakare, Ram Ratan Prajapati	Water level sensor will provide the level of water present in the water tank and according to the level of water, water motor will automatically turn ON and OFF. Data is displayed on android application.	No quality monitoring is performed, so even if water is available in tank, without performing quality check, water will be supplied. The application needs to be downloaded and updated from time to time.
017 IJIRSET	An IoT based model for smart water distribution with quality monitoring	Joy Shah	The paper focuses on water distribution using water flow sensor and water control valve will help in even distribution of water and provide adequate amount of water.	The model does not use water level sensor, so the availability of water in the tank will not be known. People will not be aware of unavailability of water.

Table 2.1: Comparison of system architectures for water quality monitoring systems

By considering the limitation of previous models of water management, The model overcomes the drawbacks as it includes use of various sensors in one smart watch. This will ensure safety of data and prevent data loss. Quality monitoring will ensure supply of safe water. It displays data on screen. system allow users to observe water quality remotely and alerts users through electronic devices such as buzzers when water quality is poor.

The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g. construction activities) and location-dependent (e.g., the traffic choke-points have much worse air quality than average). IOT Based Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are amount of harmful gases present in the air likewCO2, smoke, alcohol, benzene, NH3,wNOx and LPG.

The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system. International Journal of Scientific & Engineering Research Volume 9, Issue 2, February-2018 ISSN 2229-5518 62 IJSER © 2018 http://www.ijser.org IJSER LPG gas is detected using MQ6 sensor and MQ135 sensor is used for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately. In that IOT project, it can monitor the pollution level from anywhere using your computer or mobile.

The worrying state of the environment has affected the quality of rivers, seas and ponds. The shameless act of disposing trash into the sea has impacted their quality negatively deeply. Smokes from factories rose and soon form acidic rain that will pour on the land and water (Samsudin, Salim, Osman, Sulaiman, & Sabri, 2018). It’s absolutely no wonder the quality of the sea is plummeting.

Design of water management system by F Ntambi, C P Kruger, B J Silva, G P Hancke - 2015 IEEE - where the system consists of 3 wireless sensor sub-system. All communicate with each other wirelessly and send information to gateway connected to a computer which hosts the GUI.
The limitation to that system was that Due to wireless transfer of data sometimes delivery of data is not ensured. There are chances of loss of data.

Smart water management using IoT by Sayali Wadekar, Vinayak Vakare, Ram Ratan Prajapati - 2016 IEEE - Water level sensor will provide the level of water present in the water tank and according to the level of water, water motor will automatically turn ON and OFF. Data is displayed on android application.
The limitation to that system was that No quality monitoring is performed, so even if water is available in tank, without performing quality check, water will be supplied. The application needs to be downloaded and updated from time to time.

The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g., construction activities) and location-dependent (e.g., the traffic chokepoints have much worse air quality than average).

S. Garuglieri, D. Madeo,2019, It states that the implementation of an integrated system is for the purpose of monitoring of the aquatic ecosystems that are absorbed on a set of tools that will recognize the environmental circumstances and it will make a tactical conclusion aimed at the administration of lakes, rivers or coastal areas. The system, called Water Environmental Mobile Observer had been made up of low-cost and standard components as the physical and chemical parameters are on condition that with a segmental collection of sensors are performed a bathymetry. Data analytics utensils had also presented in directive to advance a comprehensive observing ecology awning all the importance of data gathering, repository and examination.

CHAPTER 3

PLANNING AND FORMULATION

3. PLANNING AND FORMULATION

3.1 FEASIBILITY STUDY

Feasibility study is the initial design stage of any project, which brings together the elements of knowledge that indicate if a project is possible or not.

A feasibility study includes an estimate of the level of expertise required for a project and who can provide it, quantitative and qualitative assessments of other essential resources, identification of critical points, a general timetable, and a general cost estimate.

3.1.1 Technical

In technical, it checks whether the correct technology exists to support a project. For developing the project, we would be using libraries such as LiquidCrystal_I2C.h, Wire.h, MQ135.h etc. Therefore, there exists all the technology to support our project. Two Arduino nanos (ATmega328) with their sensors.

3.1.2 Operational-Feasibility:

Under operational, they look at how systems can be maintained after being built. The watch will communicate with users by displaying the time and pollution levels on the I2C OLED Display. The Users can use switches connected to the watch to set different parameters. The project will help individuals to explore the nearby environments as per their requirements.

3.1.3 Economic Feasibility:

Under economics, they look at costs and benefits. As for developing the project we use basic python libraries it would be economically feasible. As in the future, this project can be adopted by the common people. The cost of operation limits the cost of Arduino and its components. No extra cost is required.

3.1.4 Legal Feasibility:

Under legal law, they look at any barriers to legal implementation, for instance, privacy issues or safety concerns. Since our project takes care of the user privacy issues and there is legal implementation in our project it maintains the legal component of the feasibility study.

3.1.5 Scheduled

In the schedule, they look at chronology for a project. As in our project for development we would be first collecting the basic requirement and after obtaining the basic requirement we would develop the design and architecture. After the design and architecture, we will develop the prototype and will review it. After reviewing the prototype, we would be starting with the coding phase and after the coding stage we would be testing the model. As shown in the above timeline chart.

3.2 HARDWARE & SOFTWARE REQUIREMENT

- Arduino micro-controller
- Bluetooth (HC-06)
- OLED Display
- Battery
- PH Sensor
- Turbidity Sensor
- Air Quality Sensor
- Gas Sensor
- PCB Board
- Resistors
- Capacitors
- Transistors
- Cables and Connect
- Android Studio
- Arduino IDE
- C

3.3 PROJECT MODEL

3.3.1 Agile Methodology:

The Agile methodology promotes the continuous interaction of the development and testing during the SDLC process of any project. Unlike the waterfall model, the development and testing activities in the agile model are simultaneous. Agile methodology allows much communication between the customers, developers, testers, and managers. In the Agile method, the entire project is divided into small incremental builds. All these builds are provided in iterations, and each iteration lasts from one to three weeks. Agile development methodology and testing practices have worked wonders for several organizations with positive aspects. The positive aspects of agile are not hidden. They are very visible in organizations.

3.3.2 Why Agile Methodology?

Agile focuses on customer feedback, collaboration, small and rapid releases. Its purpose is to manage complex projects. Agile produces better application suites with the desired requirements. Moreover, it can quickly adapt according to the changes made on time during the project life. It has a small team size. Therefore, fewer people work on it so that they can move faster. The agile model is not a suitable model for small projects. The expenses of developing the small projects using agile are more than compared to other models. In agile methodology, the interaction of customers is very high, as after each iteration an incremental model is deployed to customers.

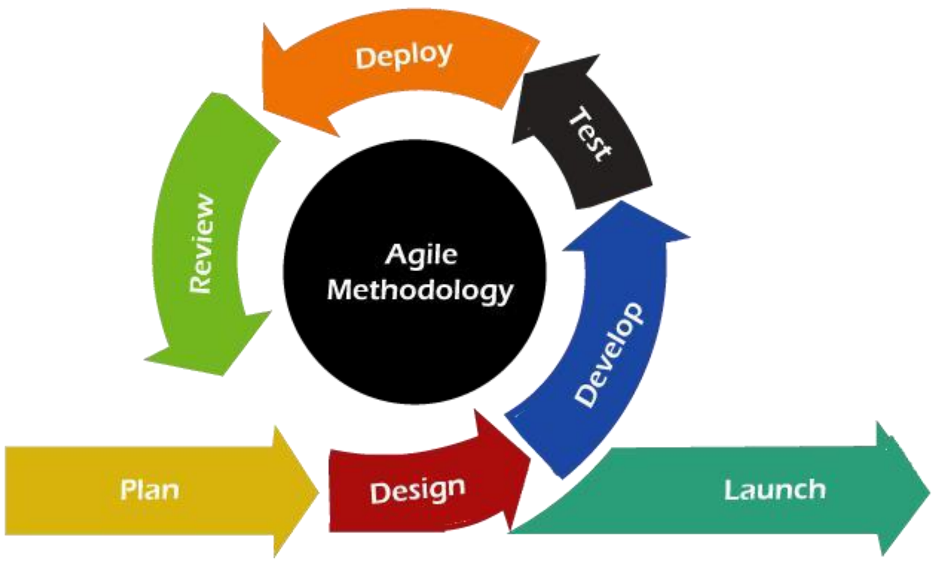

Fig 3.3.2.1 Agile methodology

3.3.3 Advantage of Agile Methodology

- Customer satisfaction with rapid, continuous delivery of useful software.
- People and interactions are emphasized rather than processes and tools. Customers, developers and testers constantly interact with each other.
- Working software is delivered frequently (weeks rather than months).
- Face-to-face conversation is the best form of communication.
- Close, daily cooperation between businesspeople and developers.
- Continuous attention to technical excellence and good design.
- Regular adaptation to changing circumstances.
- Even late changes in requirements are welcomed.

3.3.4 Disadvantage of Agile Methodology

- In the case of some software deliverables, especially the large ones, it is difficult to assess the effort required at the beginning of the software development life cycle.
- There is lack of emphasis on necessary designing and documentation.
- The project can easily get taken off track if the customer representative is not clear what final outcome that they want.
- Only senior programmers are capable of taking the kind of decisions required during the development process. Hence it has no place for newbie programmers, unless combined with experienced resources.

3.4 Project Plan

A timeline chart is an effective way to visualize a process using chronological order. It functions as a sort of calendar of events within a specific period.

- The very first step is to collect the requirements which was done in the first three weeks of August month as shown in the figure above.
- Then next was feasibility study which was begin in the fourth week of August and completed in first week of September.
- Further we had a Design phase which was completed within 3 weeks of September (from 2nd week to 4th week).
- Next, we worked on Architecture which took two weeks to get completed (1st and 2nd week of October).
- Next, we worked on Architecture which took two weeks to get completed (1st and 2nd week of October).
- Then next we worked on Implementing which took 3 weeks to get completed (from 2nd week to 4th week of December).

Tasks	August				September				October			
	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
Presentation Topic Selection												
Requirement Gathering												
Analysis												
Creating IPD												
Complete Planning												
Architecture												
System and hardware design												
GUI planning												
Creating Survey paper												
Project Presentation												

Table 3.4: Project Plan

Tasks	January				February				March				April			
	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
System and Hardware Design																
Algorithm Design																
Algorithm Construction																
Coding																
Creating Research Paper																
Project Presentation																

Table 3.5: Project Plan (Continued)

CHAPTER 4

SYSTEM ANALYSYS

4. SYSTEM ANALYSYS

4.1 DATA ANALYSIS

Classification of PH Values

Type of water	pH level
Tap water	Varies; typically about 7.5
Distilled reverse osmosis water	5 to 7
Common bottled waters	6.5 to 7.5
Bottled waters labeled as alkaline	8 to 9
Ocean water	About 8
Acid rain	5 to 5.5

Table 4.1.1: Classification of PH Values

pH is a measurement of electrically charged particles in a substance. It indicates how acidic or alkaline (basic) that substance is. The pH scale ranges from 0 to 14:

- Acidic water has a pH lower than 7. Strongly acidic substances can have a pH of 0. Battery acid falls into this category.
- Alkaline water has a pH of 8 or above. Strongly alkaline substances, such as lye, can have a pH of 14.
- Pure water has a pH of 7 and is considered “neutral” because it has neither acidic nor basic qualities.

What pH is safe for drinking water?

pH isn’t a quality that falls under EPA regulation because it’s considered an aesthetic quality of water. However, the agency recommends that municipal drinking water suppliers keep their water supply at a pH of 6.5 to 8.5.

Classification of Turbidity Values

Turbidity is the degree or level of cloudiness or haziness of a liquid. This happens due to the presence of large numbers of invisible particles (with the naked eye) similar to white smoke in the air. When light passes through liquids, light waves get scattered Due to the presence of these tiny particles. The turbidity of a liquid is directly proportional to the free suspended particles, that is if the number of particles increases turbidity will also increase.

No	Turbidity level	TSM (NTU)
1	Fairly turbid	15 – 25
2	Rather turbid	25 – 35
3	Turbid	35 – 50
4	Very turbid	> 50

Table 4.1.2 : Classification of Turbidity Values

turbidity happens due to the scattering of light waves, in order to measure the turbidity, we should measure the scattering of light. Turbidity is usually measured in nephelometric turbidity units (NTU) or Jackson turbidity units (JTLJ), depending on the method used for measurement. The two units are roughly equal. turbidity sensor has two parts, transmitter and Receiver. The transmitter consists of a light source typically a led and a driver circuit. In the receiver end, there is a light detector like a photodiode or an LDR. We place the solution in between the transmitter and receiver.

4.2 FUNCTIONAL ANALYSIS

In software engineering, a functional requirement defines a function of software system or its component. A function is described as a set of inputs, the behavior, and outputs. Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses functional requirements are captured in use cases. Functional requirements are supported by non-functional requirements, which impose constraints on the design or implementation. As defined in requirements specify results of a system. Functional requirements drive the application architecture of a system.

Functional Analysis of Proposed System:

- User will be able to check air pollution level around himself/herself using the gas sensor.
- User will get alerts if any harmful gases are in the surroundings.
- User can check the water pollution level by dipping the PH sensor inside a water body.
- User can check the turbidity level of the water by dipping the turbidity sensor inside a water body.
- All the inputs from the sensors are processed by the system and the output values are displayed on the OLED display.

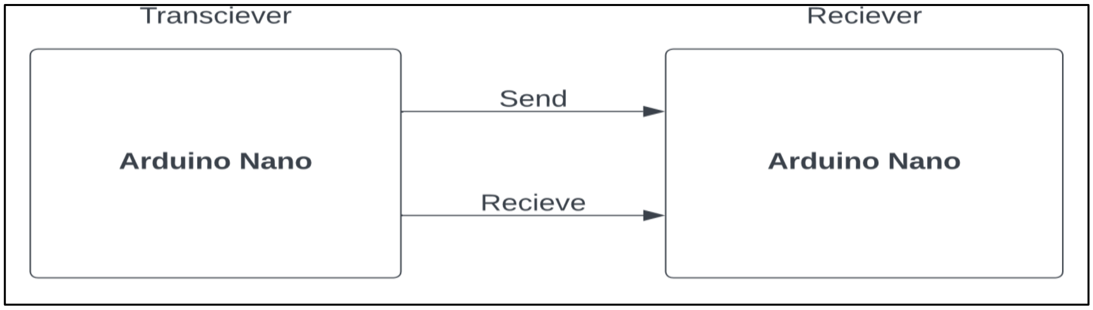

Figure 4.2.1: DFD Level 0

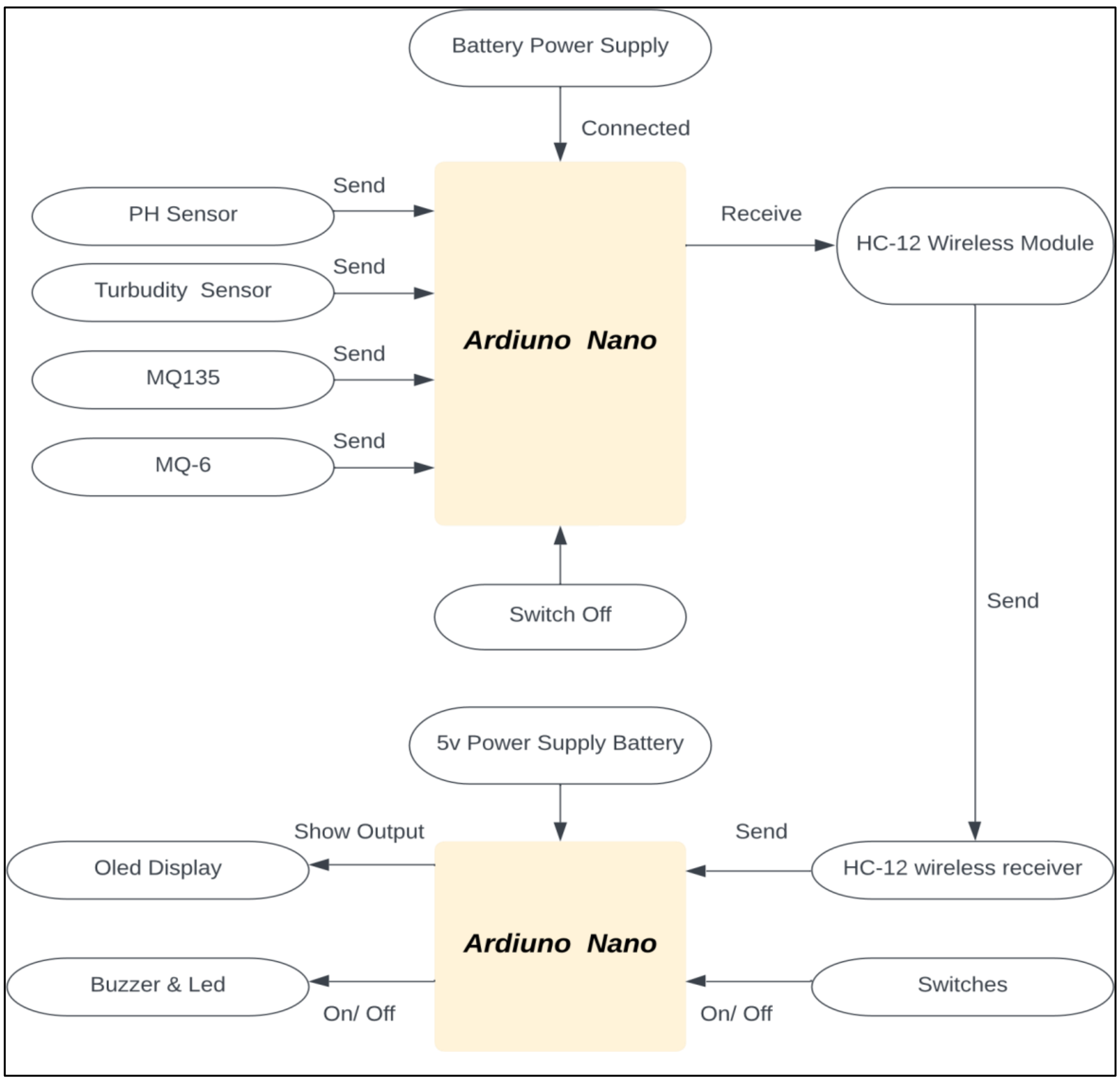

Figure 4.2.2: DFD Level 1

4.3 NON-FUNCTIONAL ANALYSIS

4.3.1 PORTABILITY

Portability determines how the system, or its elements can be launched within one environment or another. The smart watch can be used in almost all environments other than extreme environments (Extremely High/Extremely Low temperatures).

4.3.2 RELIABILITY

Reliability specifies how likely the system, or its element, would run without a failure for a given period under predefined conditions. The current system can perform without failure in 95% of use cases during a month.

4.3.3. MAINTAINABILITY

Maintainability defines the time required for a solution or its component to be fixed, changed to increase performance or other qualities, or adapted to a changing environment. Like reliability, it can be expressed as a probability of repair during some time. As the current system is developed using an Arduino microcontroller, the parts/ components which would be required to be fixed or changed are easily available in the market and the efforts it takes to replace a component is comparatively lower than other smart watches.

4.3.4 AVAILABILITY

Availability describes how likely the system is accessible to a user at a given point in time. As the system is a smart watch which is typically a wearable device, it can be accessed by the user at any given point in time.

CHAPTER 5

PROPOSED SYSTEM

5 PROPOSED SYSTEM

5.1 SYSTEM ARCHITECTURE

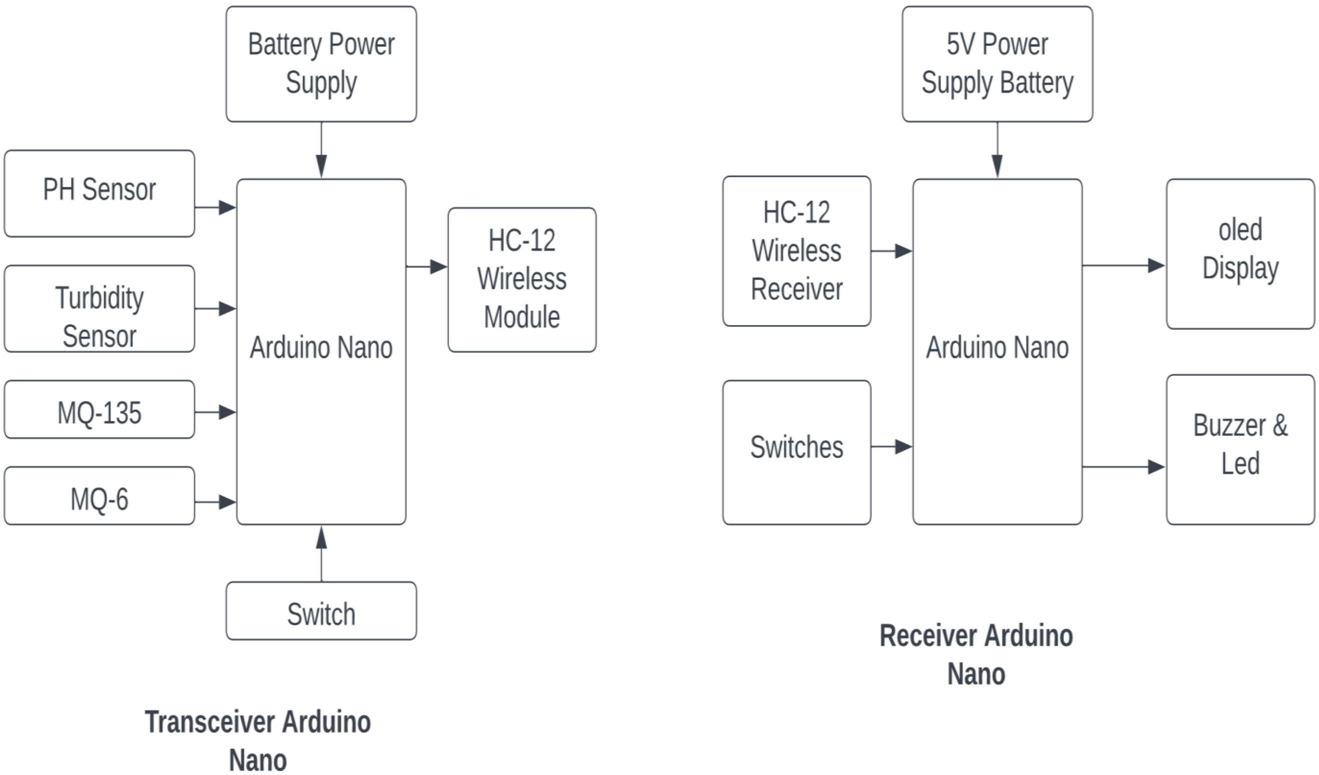

Figure 5.1: System Architecture

The System is divided into 2 Modules. Primary module is the Receiver Module which takes input from the Transceiver module and displays the output on an OLED Display.

The Secondary Module is the Transceiver module which consists of all the sensors which are PH, Turbidity, MQ-135 and MQ-6. This takes in input from the surroundings using the Sensors and Sends that data to the Primary Module.

5.2 SYSTEM DESIGN FLOWCHART

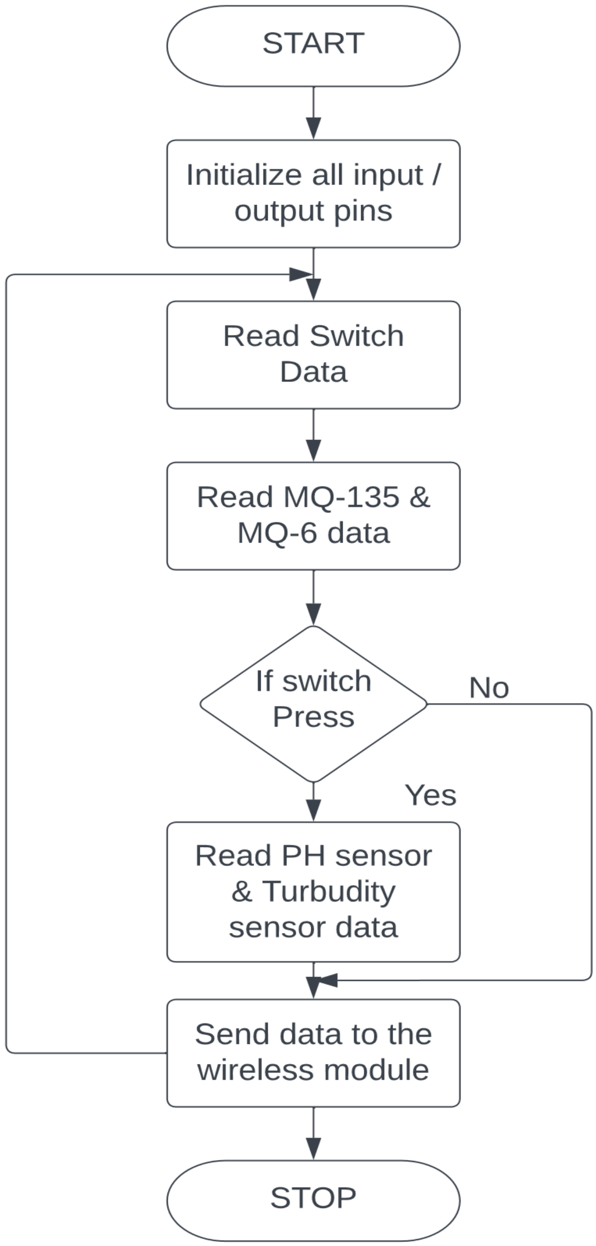

Figure 5.2.1: Transceiver Flowchart

A flowchart is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of algorithm a step-by-step approach to solving a task. The flowchart shows the step of boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields. This flowchart depicts the main modules of the system and each step-by-step process.

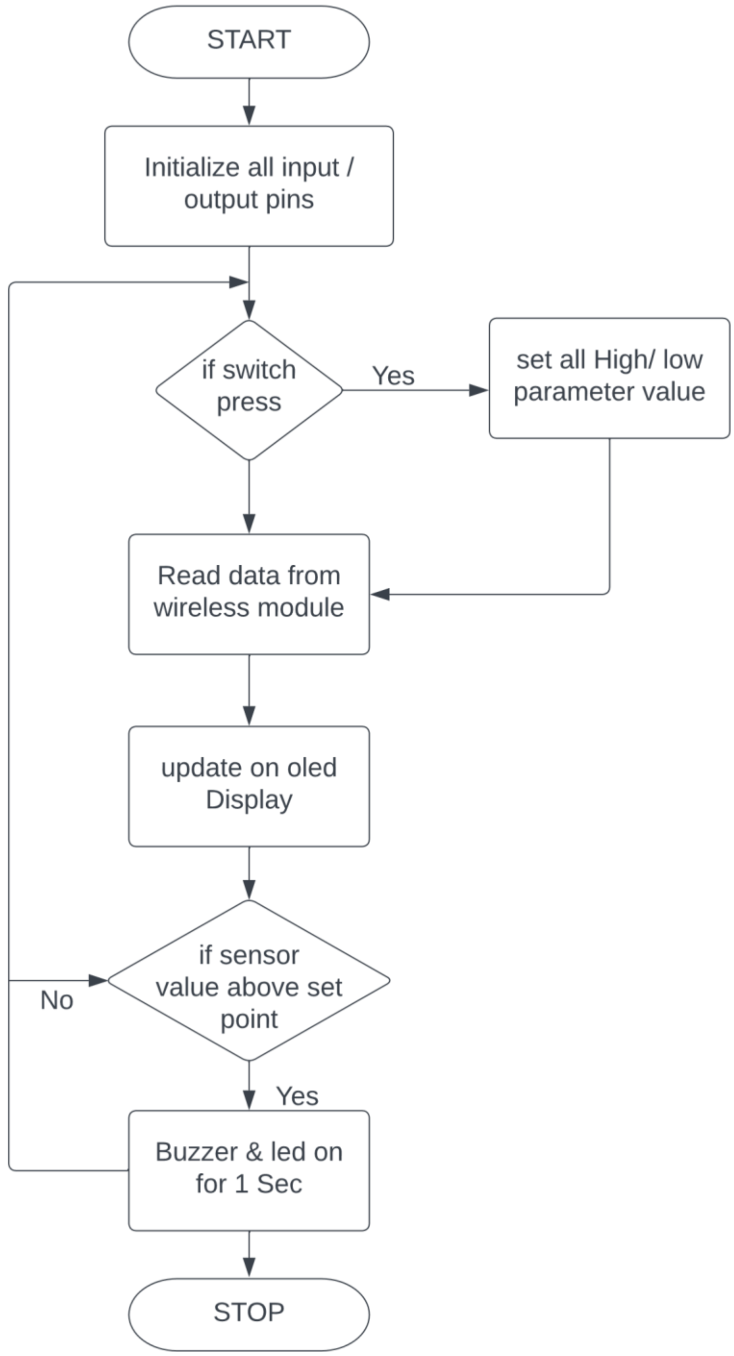

Figure 5.2.2: Receiver Flowchart

5.3 UML DIAGRAMS

5.3.1 USE CASE DIAGRAM

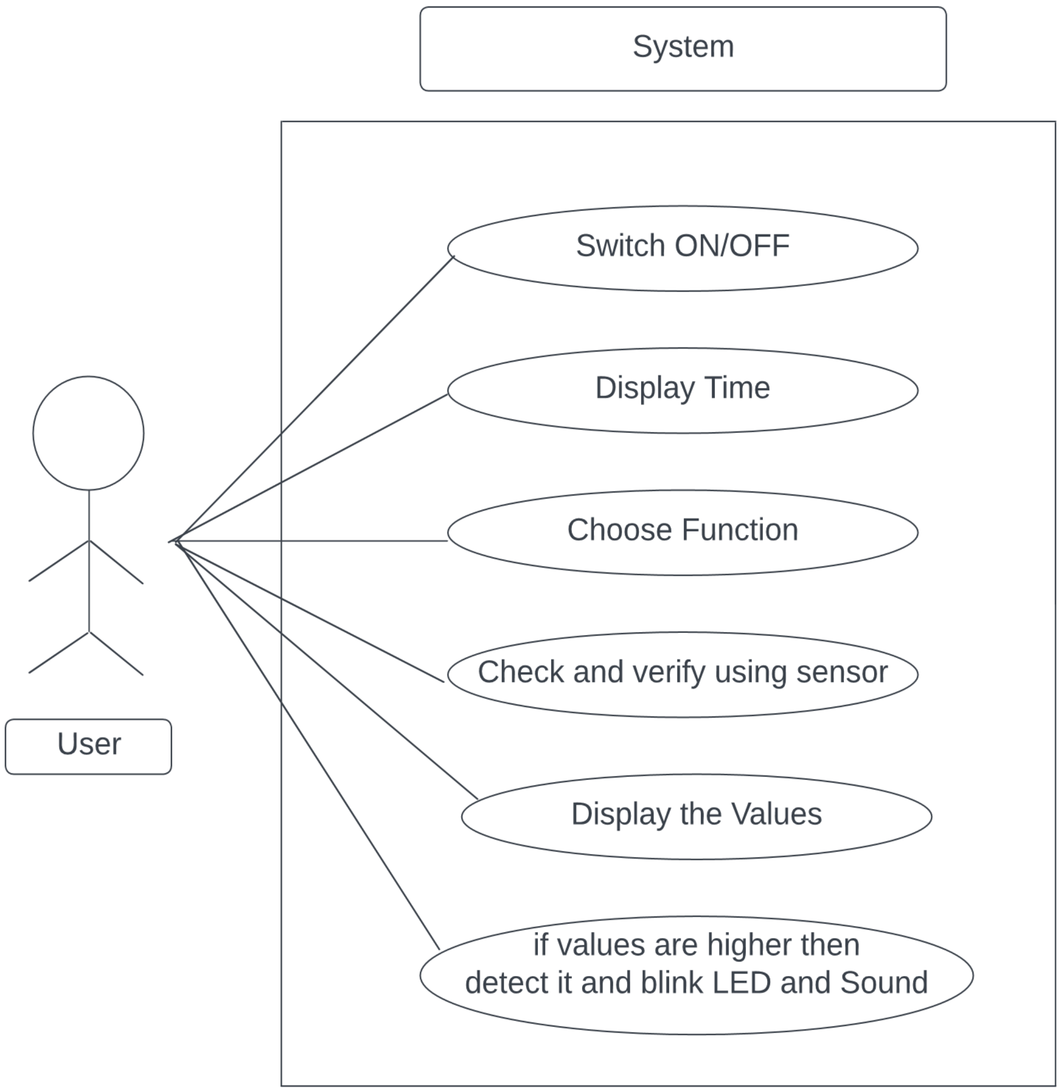

Figure 5.3.1: Use Case Diagram

A use case diagram is a representation of a user's interaction with the system. The above fig. shows the relationship between the user and the watch. In the above use case diagram, there is one actor's named user. There are total of 6 use cases that represent specific functionality of a watch. Each actor interacts with a particular use case.

5.3.2 ACTIVITY DIAGRAM

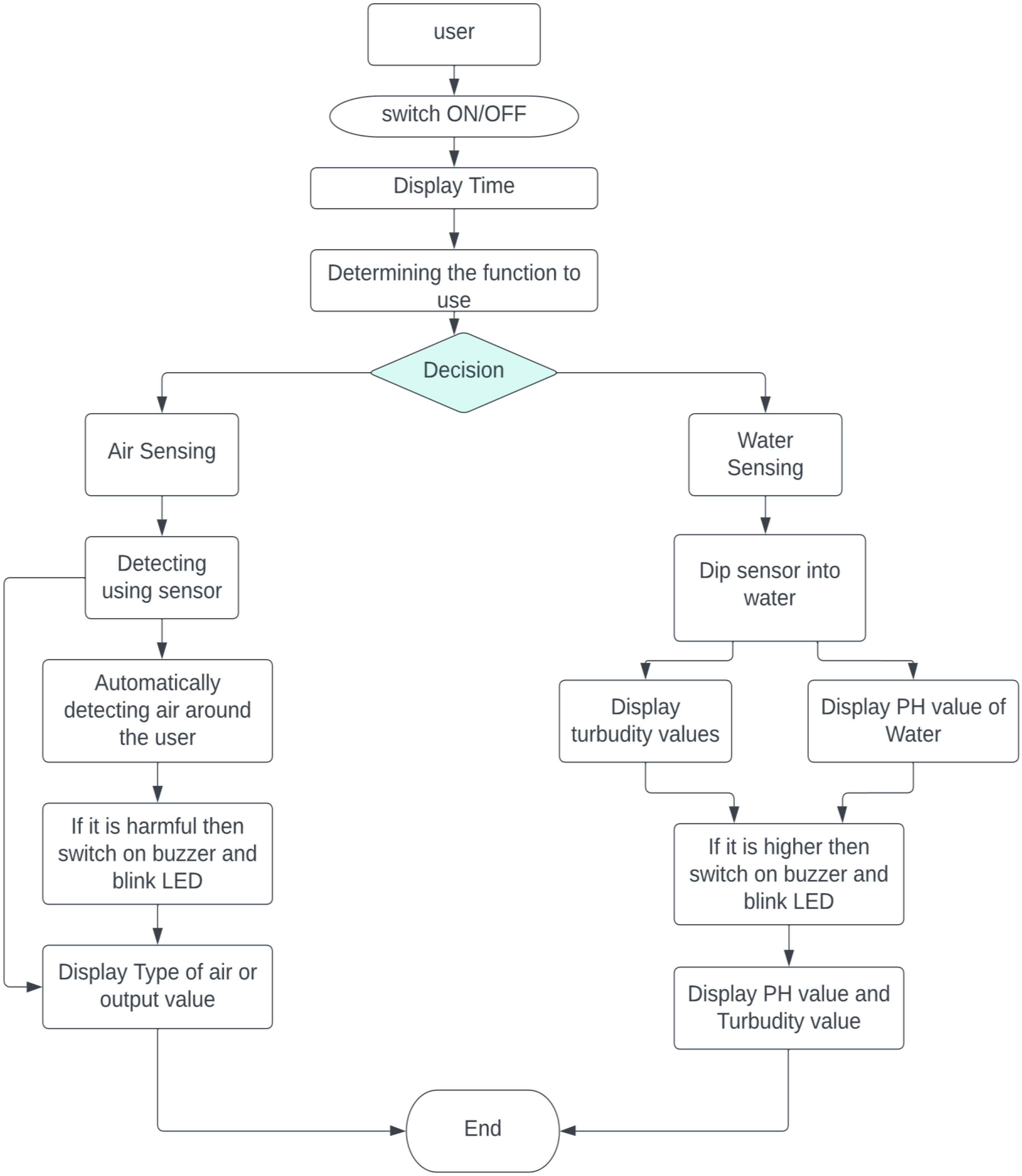

Figure 5.3.2: Activity Diagram

5.3.3 CLASS DIAGRAM

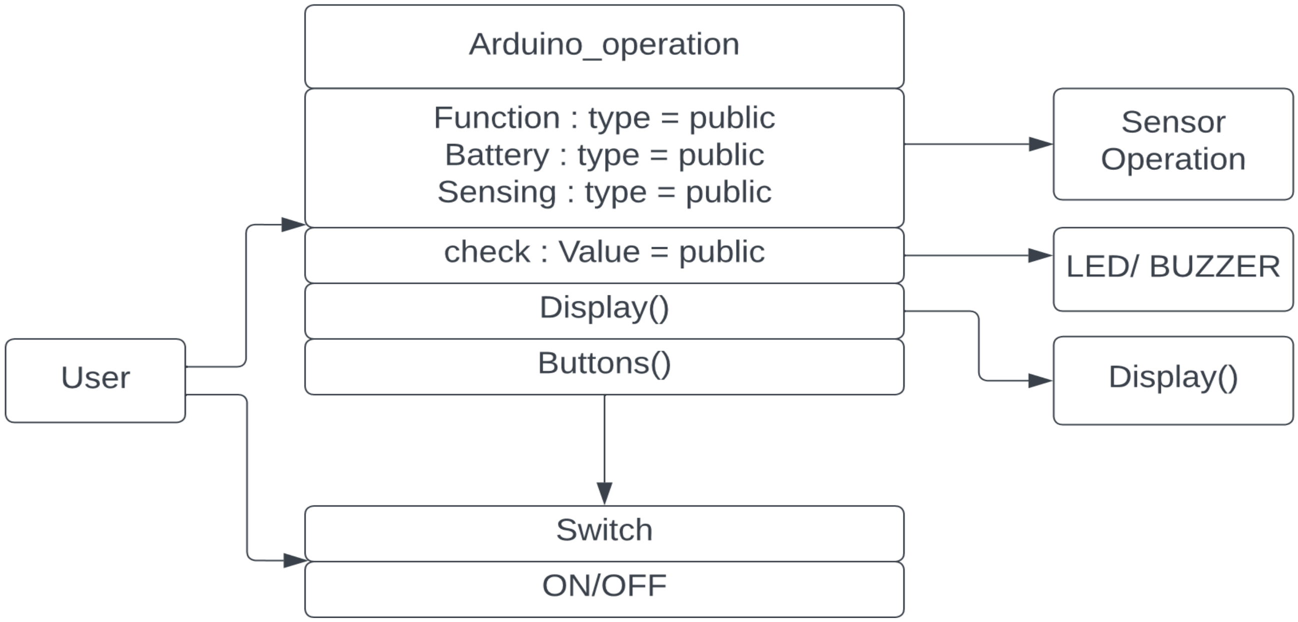

Figure 5.3.3: Class Diagram

Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application.

Class diagram describes the attributes and operations of a class and the constraints imposed on the system. The class diagrams are widely used in the modeling of object-oriented systems because they are the only UML diagrams which can be mapped directly with object-oriented languages.

5.4 GUI DESIGN

Figure 5.4: GUI Design

5.5 HARDWARE DESIGN

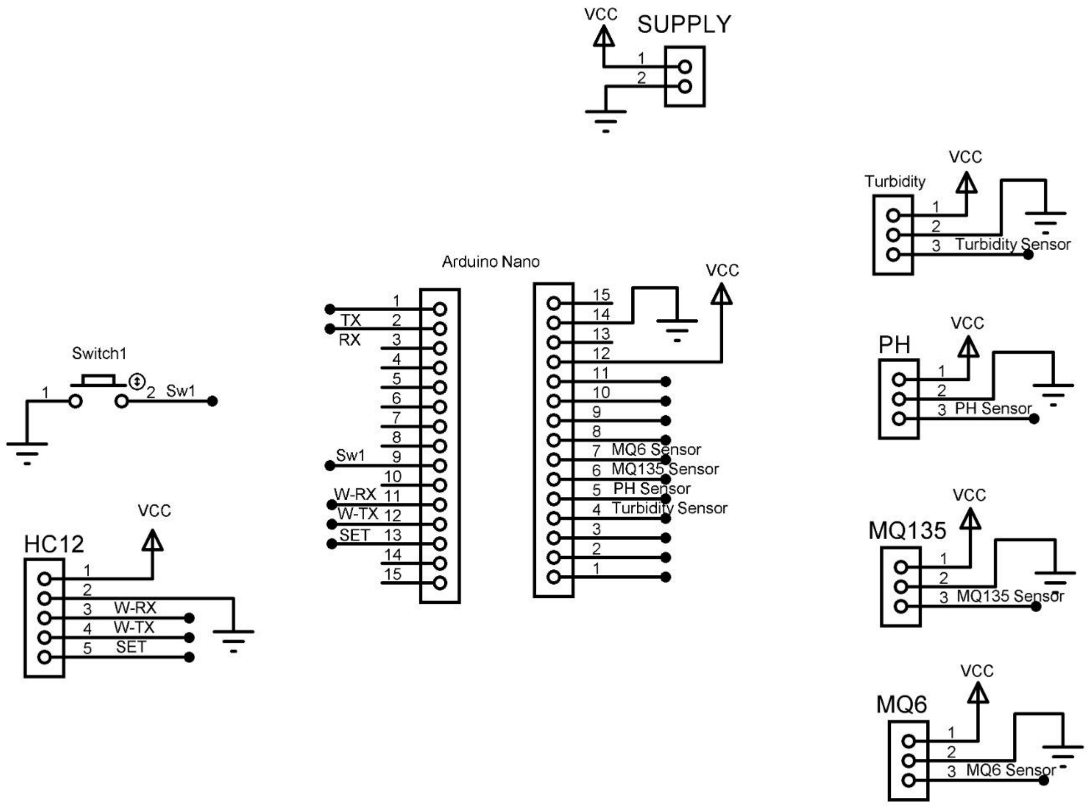

Figure 5.5.1: Transceiver Hardware Design

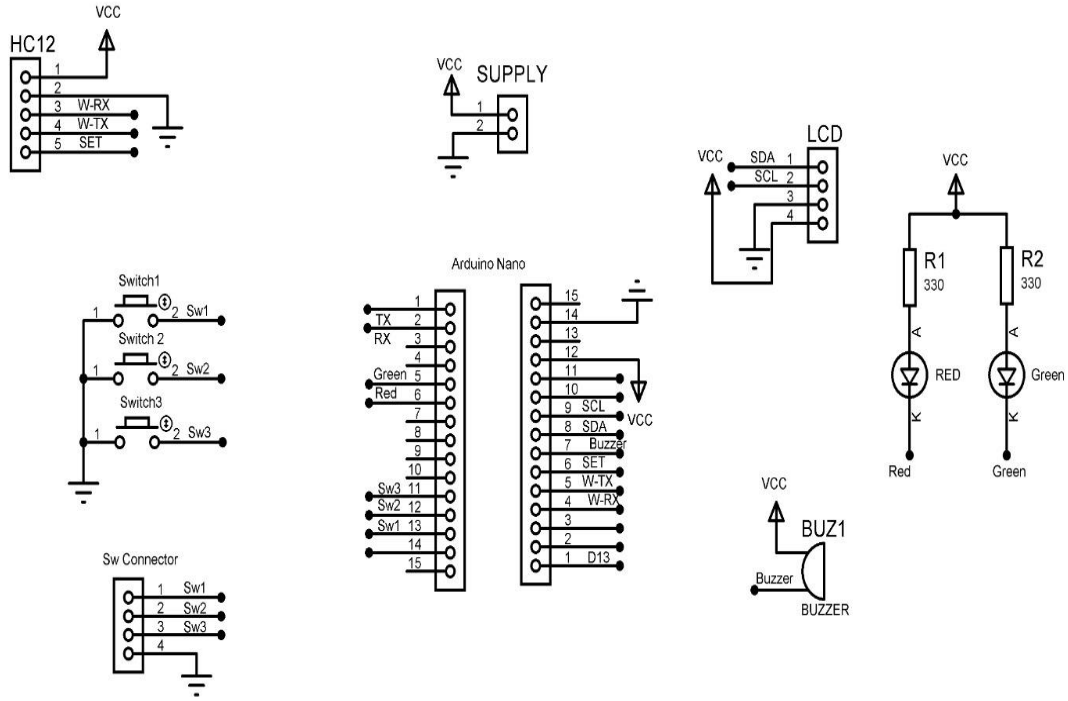

Figure 5.5.2: Receiver Hardware Design

CHAPTER 6

ALGORITHM DEVELOPMENT

6. ALGORITHM DEVELOPMENT

6.1 ALGORITHMS DEVELOPED AND ADOPTED

The system consists of four sensors. Each sensor operates in a different way. The sensors included are PH Sensor, Turbidity Sensor, Air Quality Sensor, Gas Sensor.

PH Sensor Algorithm:

1. Include required libraries which are "LiquidCrystal_I2C.h" library for using I2C interface of an LCD display and "Wire.h" for using I2C functionality on Arduino.
2. Define calibration value for Ph sensor which can be modified as required to get accurate PH value of solutions.
3. Create a setup() function where LCD commands are written for displaying a message on LCD.
4. Create a loop() function which will read 10 sample analog value and store them in an array.
5. Sort the analog values received in ascending order.
6. Calculate the average of 6 centre sample analog values. This average value is converted in actual PH value and printed on an LCD display.

Turbidity Sensor Algorithm:

1. Include required libraries which are "LiquidCrystal_I2C.h" library for using I2C interface of an LCD display and "Wire.h" for using I2C functionality on Arduino.
2. Set integer for sensor input.
3. Define pins in the sensor input integer.
4. Create a loop() function. As the output of the sensor is an analog value, using AnalogRead() function read the output values.
5. Read the minimum and maximum value of the turbidity sensor on the serial monitor using the serial.println function.
6. Convert the maximum and minimum value to 0-100 by using the map() function of Arduino.
7. With the help of IF conditions, setup different output messages and display the values on the LCD display.

Gas Sensor Algorithm:

1. Include required libraries which are “LiquidCrystal_I2C.h” library for using I2C interface of an LCD display and “Wire.h” for using I2C functionality on Arduino.
2. Initialize the code by declaring a macro which would be used for the sensor pin through which we will be reading the data coming out of the sensor.
3. Create a setup() function. Initialize the serial with 9600 baud.
4. Create a loop() function. In the loop function, print analog output as text on the serial monitor window and then call the readSensor() function Inside a Serial.prinln() function.
5. Use the map() function to convert the 10 bit data to 8 bit data .
6. Apply various conditions for checking the gases and setup print messages according to the conditions.
7. Print the data on the LCD.

Air Quality Sensor Algorithm:

1. Include required libraries which are “LiquidCrystal_I2C.h” library for using I2C interface of an LCD display, “Wire.h” for using I2C functionality on Arduino and “MQ135.h” library to get PPM values.
2. Calibrate the sensor and get the RZERO value.
3. Define the libraries and variables for the gas sensor and the LCD.
4. Using the software serial library make any digital pin as TX and RX pin.
5. Define two variables: one for the sensor analog pin and other for storing air quality value.
6. Declare a pin as the output pin where the buzzer is connected.
7. Start the LCD to receive data using the lcd.begin() command and set the cursor to first line and print the ‘circuitdigest’. Then set the cursor on the second line and print ‘sensor warming’.
8. Set the baud rate for the serial communication.
9. Get the input from the sensor using the read() function.
10. Apply various conditions for checking air quality and setup print messages according to the conditions and setup the buzzer control to beep if the pollution level goes beyond 1000 PPM.
11. Print the data on the LCD.

6.2 PERFORMANCE EVALUATION PARAMETERS IDENTIFIED

Evaluation Criteria	**Description**
Ph value	The main criteria for the evaluations of water is PH value. pH is a quantitative measure of the acidity or basicity of aqueous or other liquid solutions. pH is a measure of how acidic or basic a liquid is, ranging from 0 to 14.
Turbidity Value	he turbidity unit is measured in NTU “Nephelometric Turbidity Units” which is global standard. The larger the turbidity is, the cloudy of the sample is.
Air Quality Index	The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 or below represents good air quality, while an AQI value over 300 represents hazardous air quality.
LPG and Butane Values	LPG and Butane gas concentration in the air either at home or in industry is detected using a MQ6 gas sensor. Whenever gas comes into contact with the sensing element, the resistivity of the element changes. The change is then measured to get the concentration of the gases present

Table 6.1: Performance Evaluation Parameters

CHAPTER 7
IMPLEMENTATION

IMPLEMENTATION

Implementing a smart watch involves coding for 2 modules which are Transceiver and Receiver.

Code for Receiver Module:

```
#include <SPI.h>
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

#include <SoftwareSerial.h>
SoftwareSerial HC_12(A1,A0);
int Set_HC_12=A2;


#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 32 // OLED display height, in pixels

#define OLED_RESET     4 // Reset pin # (or -1 if sharing Arduino reset pin)
#define SCREEN_ADDRESS 0x3C ///< See datasheet for Address; 0x3D for 128x64, 0x3C
for 128x32
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, OLED_RESET);

#define NUMFLAKES     0// Number of snowflakes in the animation example

#define LOGO_HEIGHT   16
#define LOGO_WIDTH    16



#define Buzzer A3
#define Red_Led 2
#define Green_Led 3

#define Switch_1 8
#define Switch_2 9
#define Switch_3 10

int Sw_1_State=0;
int Sw_2_State=0;
int Sw_3_State=0;

int Current_PH=0;
int Current_Turbidity=0;
int Current_MQ135=0;
```

```
int Current_MQ6=0;


int Set_PH_High=10;
int Set_PH_Low=3;
int Set_Turbidity=500;
int Set_MQ135=30;
int Set_MQ6=30;

String inputData = "";
bool Data_Received = false;
String SM_ARU="";
int valid_data=0;

void setup()
{
      Serial.begin(9600);

      Serial.println("SM_ARU...");

      pinMode(Buzzer, OUTPUT);
      pinMode(Green_Led, OUTPUT);
      pinMode(Red_Led, OUTPUT);

      digitalWrite(Buzzer, 1);
      digitalWrite(Green_Led, 1);
      digitalWrite(Red_Led, 1);

      pinMode(Switch_1, INPUT);
      pinMode(Switch_2, INPUT);
      pinMode(Switch_3, INPUT);

      digitalWrite(Switch_1, 1);
      digitalWrite(Switch_2, 1);
      digitalWrite(Switch_3, 1);

      if(!display.begin(SSD1306_SWITCHCAPVCC, SCREEN_ADDRESS)) {
      Serial.println(F("SSD1306 allocation failed"));
      for(;;); // Don't proceed, loop forever
      }
      display.clearDisplay();

      display.setTextSize(2);             // Normal 1:1 pixel scale
      display.setTextColor(SSD1306_WHITE);        // Draw white text
      display.setCursor(0,0);             // Start at top-left corner
```

```
      display.println(F(" Smart  "));
      display.setCursor(8,17);              // Start at top-left corner
      display.println(F(" Watch"));
      display.display();
      delay(5000);
      display.clearDisplay();
      display.display();

    HC_12.begin(9600);
    init_HC12();
}

void loop()
{
  update_data();
  display.clearDisplay();
  display.setTextSize(1);
  display.setTextColor(SSD1306_WHITE);
  display.setCursor(10,0);display.print("PH :
");display.print(Current_PH);display.print(" ");
  display.setCursor(70,0);display.print("Tur:
");display.print(Current_Turbidity);display.print(" ");
  display.setCursor(10,10);display.print("Air:
");display.print(Current_MQ135);display.print(" ");
  display.setCursor(70,10);display.print("Gas:
");display.print(Current_MQ6);display.print(" ");


if((Current_PH>=Set_PH_High)|| (Current_PH<=Set_PH_Low) ||
(Current_Turbidity<=Set_Turbidity) || (Current_MQ135>=Set_MQ135) ||
(Current_MQ6>=Set_MQ6))
{
      digitalWrite(Buzzer, 0);
      digitalWrite(Green_Led, 1);
      digitalWrite(Red_Led, 0);delay(500);
      digitalWrite(Buzzer, 1);
      display.setCursor(0,20);display.print("Check > ");
  if((Current_PH>=Set_PH_High)|| (Current_PH<=Set_PH_Low) )display.print("PH");
  if(Current_Turbidity<=Set_Turbidity) display.print(" TR");
  if(Current_MQ135>=Set_MQ135)display.print(" Gas");
  if(Current_MQ6>=Set_MQ6)display.print(" Air");
}
else
{
```

```
      digitalWrite(Buzzer, 1);
      digitalWrite(Green_Led, 0);
      digitalWrite(Red_Led, 1);
      display.setCursor(35,20);display.print(" Normal  ");
}
  display.display();
//    digitalWrite(Green_Led,1);
//    delay(1000);
//    digitalWrite(Green_Led,0);
//    delay(1000);
   Sw_1_State = digitalRead(Switch_1);
   if(Sw_1_State==0)Setting_Mode();
}

void Setting_Mode()
{
    int Exit=0;
    display.clearDisplay();
    display.setTextSize(1);
    display.setTextColor(SSD1306_WHITE);
    display.setCursor(10,0);display.print("Setting Mode ");
    display.display();
    digitalWrite(Red_Led, 0);
    digitalWrite(Green_Led,1);
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);
    Sw_1_State=1;
    /*
      Set_PH_High=0;
int Set_PH_Low=0;
int Set_Turbidity=0;
int Set_MQ135=0;
int Set_MQ6=0;
     */
     Set_PH_High_Val();
     Set_PH_Low_Val();
     Set_Turbidity_Val();
     Set_MQ135_Val();
     Set_MQ6_Val();

    digitalWrite(Red_Led, 1);

    display.clearDisplay();
    display.setTextSize(1);
```

```
    display.setTextColor(SSD1306_WHITE);
    display.setCursor(10,0);display.print("Exit Setting Mode ");
    display.display();
    delay(100);

    digitalWrite(Red_Led, 1);
    digitalWrite(Green_Led,0);
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);

}

void Set_PH_High_Val()
{
  int Exit_Set=0;
  while(Exit_Set==0)
  {
    Sw_1_State = digitalRead(Switch_1);
    Sw_2_State = digitalRead(Switch_2);
    Sw_3_State = digitalRead(Switch_3);
    if(Sw_1_State==0)Set_PH_High++;
    if(Sw_2_State==0)Set_PH_High--;
    if(Sw_3_State==0)Exit_Set=1;


    if(Set_PH_High>14)Set_PH_High=1;
    if(Set_PH_High<0)Set_PH_High=14;
    display.clearDisplay();
    display.setTextSize(1);
    display.setTextColor(SSD1306_WHITE);
    display.setCursor(10,0);display.print("  Setting Mode ");
    display.setCursor(10,10);display.print(" PH High Set Val ");
    display.setCursor(50,20);display.print(Set_PH_High);
    display.display();
    delay(100);
  }
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);
}


void Set_PH_Low_Val()
{
```

```
  int Exit_Set=0;
  while(Exit_Set==0)
  {
    Sw_1_State = digitalRead(Switch_1);
    Sw_2_State = digitalRead(Switch_2);
    Sw_3_State = digitalRead(Switch_3);
    if(Sw_1_State==0)Set_PH_Low++;
    if(Sw_2_State==0)Set_PH_Low--;
    if(Sw_3_State==0)Exit_Set=1;


    if(Set_PH_Low>14)Set_PH_Low=1;
    if(Set_PH_Low<0)Set_PH_Low=14;
    display.clearDisplay();
    display.setTextSize(1);
    display.setTextColor(SSD1306_WHITE);
    display.setCursor(10,0);display.print("  Setting Mode ");
    display.setCursor(10,10);display.print(" PH Low Set Val ");
    display.setCursor(50,20);display.print(Set_PH_Low);
    display.display();
    delay(100);
  }
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);

}
void Set_Turbidity_Val()
{
  int Exit_Set=0;
  while(Exit_Set==0)
  {
    Sw_1_State = digitalRead(Switch_1);
    Sw_2_State = digitalRead(Switch_2);
    Sw_3_State = digitalRead(Switch_3);
    if(Sw_1_State==0)Set_Turbidity++;
    if(Sw_2_State==0)Set_Turbidity--;
    if(Sw_3_State==0)Exit_Set=1;


    if(Set_Turbidity>1000)Set_Turbidity=1;
    if(Set_Turbidity<0)Set_Turbidity=100;
    display.clearDisplay();
    display.setTextSize(1);
    display.setTextColor(SSD1306_WHITE);
```

```
    display.setCursor(10,0); display.print("  Setting Mode ");
    display.setCursor(10,10);display.print("Turbidity Set Val ");
    display.setCursor(50,20);display.print(Set_Turbidity);
    display.display();
    delay(100);
  }
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);

}

void Set_MQ135_Val()
{
  int Exit_Set=0;
  while(Exit_Set==0)
  {
    Sw_1_State = digitalRead(Switch_1);
    Sw_2_State = digitalRead(Switch_2);
    Sw_3_State = digitalRead(Switch_3);
    if(Sw_1_State==0)Set_MQ135++;
    if(Sw_2_State==0)Set_MQ135--;
    if(Sw_3_State==0)Exit_Set=1;


    if(Set_MQ135>100)Set_MQ135=1;
    if(Set_MQ135<0)Set_MQ135=100;
    display.clearDisplay();
    display.setTextSize(1);
    display.setTextColor(SSD1306_WHITE);
    display.setCursor(10,0); display.print("  Setting Mode ");
    display.setCursor(10,10);display.print(" MQ135 Set Val ");
    display.setCursor(50,20);display.print(Set_MQ135);
    display.display();
    delay(100);
  }
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);

}

void Set_MQ6_Val()
{
```

```
  int Exit_Set=0;
  while(Exit_Set==0)
  {
    Sw_1_State = digitalRead(Switch_1);
    Sw_2_State = digitalRead(Switch_2);
    Sw_3_State = digitalRead(Switch_3);
    if(Sw_1_State==0)Set_MQ6++;
    if(Sw_2_State==0)Set_MQ6--;
    if(Sw_3_State==0)Exit_Set=1;


    if(Set_MQ6>100)Set_MQ6=1;
    if(Set_MQ6<1)Set_MQ6=100;
    display.clearDisplay();
    display.setTextSize(1);
    display.setTextColor(SSD1306_WHITE);
    display.setCursor(10,0);display.print("  Setting Mode ");
    display.setCursor(10,10);display.print(" MQ6 Set Val ");
    display.setCursor(50,20);display.print(Set_MQ6);
    display.display();
    delay(100);
  }
    digitalWrite(Buzzer, 0);
    delay(1000);
    digitalWrite(Buzzer, 1);


}


void init_HC12()
{
  pinMode(Set_HC_12,OUTPUT);
  digitalWrite(Set_HC_12,LOW);
  HC_12.print(F("AT+C001"));
  delay(500);
  digitalWrite(Set_HC_12,HIGH);
}

void update_data()
{
 while (HC_12.available())
  {
    char inChar = (char)HC_12.read();
   if(inChar=='*')valid_data=1;
```

```
   Serial.println(inChar);
    if(valid_data==1)SM_ARU += inChar;
    if (inChar == '#')
    {
      Data_Received = true;
    }
  }
 if (Data_Received)
  {
  // *1234#
   Serial.print("Data ");
   Serial.println(SM_ARU);

//

//    Serial.print(SM_ARU[1]);
//    Serial.println(SM_ARU[17]);
    Data_Received_process();
    SM_ARU = "";
    Data_Received=0;
    valid_data=0;
  }

}

void Data_Received_process()
{
  int a,b,c;
  int Temp=0;
  //ph-tur-Air-gas
  // *012-123-123-123#
//   Current_PH=0;
//Current_Turbidity=0;
//Current_MQ135=0;
// Current_MQ6
      digitalWrite(Green_Led, 0);
  if(SM_ARU[0]=='*' && SM_ARU[16]=='#')
  {
      a=(SM_ARU[1]-0x30);
      b=(SM_ARU[2]-0x30);
      c=(SM_ARU[3]-0x30);
      Current_PH=(a*100+b*10+c);

      a=(SM_ARU[5]-0x30);
      b=(SM_ARU[6]-0x30);
```

```
      c=(SM_ARU[7]-0x30);
      Current_Turbidity=(a*100+b*10+c);

      a=(SM_ARU[9]-0x30);
      b=(SM_ARU[10]-0x30);
      c=(SM_ARU[11]-0x30);
      Current_MQ135=(a*100+b*10+c);

      a=(SM_ARU[13]-0x30);
      b=(SM_ARU[14]-0x30);
      c=(SM_ARU[15]-0x30);
      Current_MQ6=(a*100+b*10+c);

      Serial.print("Data Valid");
  }
   a=0;
  while(a<17)
  {
    SM_ARU[a]=0;a++;
  }

  SM_ARU[5]='0';
delay(200);
      digitalWrite(Green_Led,1);
}
```

Code for Transceiver Module:

```
#include <SoftwareSerial.h>
SoftwareSerial HC_12(9, 8);
int Set_HC_12=10;
const int PH_Senor = A1;
const int Turbidity_Senor = A0;
const int MQ135_Senor = A2;
const int MQ6_Senor = A3;

int ADC_Val = 0;

int Current_PH=0;
int Current_Turbidity=0;
int Current_MQ135=0;
int Current_MQ6=0;

void setup()
{
```

```
  Serial.begin(9600);
  delay(100);
  HC_12.begin(9600);
  delay(100);
  init_HC12();
}

void loop()
{

 read_ph_Sensor();
read_Turbudity_Sensor();
//
//
  ADC_Val = analogRead(MQ135_Senor);
  Current_MQ135 = map(ADC_Val, 0, 1023, 0, 100);

  ADC_Val = analogRead(MQ6_Senor);
  Current_MQ6 = map(ADC_Val, 0, 1023, 0, 100);
//
  Serial.print("Current PH= ");
  Serial.print(Current_PH);
  Serial.print("\t Turbidity= ");
  Serial.print(Current_Turbidity);
  Serial.print("\t MQ135= ");
  Serial.print(Current_MQ135);
  Serial.print("\t MQ6= ");
  Serial.println(Current_MQ6);
  HC_12_update();
  delay(3000);
}
void  read_ph_Sensor()
{
// ph  soap 10>440  clean water 7> 380   thinner>270  lemon 2>150


// Current Sensor data
// ph  soap 10>580  clean water 7> 440   thinner>270  lemon 2>140

// 140- 380 - 620
int count_step=0;
int Data_adc=0;
  Current_PH=0;
  while(count_step<10)
  {
```

```
      Current_PH = analogRead(PH_Senor);
    //Serial.println(Current_PH);
      delay(20);
      if(Current_PH>=760)Current_PH=760;
      if(Current_PH<100)Current_PH=100;

      Data_adc=Data_adc+Current_PH;
      count_step++;
  }
  Current_PH=Data_adc/10;
  Current_PH = map(Current_PH, 100, 760, 1, 14);



}
void read_Turbudity_Sensor()
{

// clean water 630  dull 50 NTU
  int count_step=0;
int Data_adc=0;
  Current_Turbidity=0;
  while(count_step<10)
  {
      Current_Turbidity = analogRead(Turbidity_Senor);

      delay(20);

      Data_adc=Data_adc+Current_Turbidity;
      count_step++;
  }
  Current_Turbidity=Data_adc/10;

      if(Current_Turbidity>=850)Current_Turbidity=850;
      if(Current_Turbidity<10)Current_Turbidity=10;
 //Serial.println(Current_Turbidity);
  Current_Turbidity = map(Current_Turbidity, 10, 850, 1, 1000);
  if(Current_Turbidity<=1)Current_Turbidity=1;
  if(Current_Turbidity>=1000)Current_Turbidity=1000;
}
void init_HC12()
{
  pinMode(Set_HC_12,OUTPUT);
  digitalWrite(Set_HC_12,LOW);
  HC_12.print(F("AT+C001"));
```

```
  delay(500);
  digitalWrite(Set_HC_12,HIGH);
}

void HC_12_update()
{
  HC_12.print("*");
  HC_12.print(((Current_PH/100)%10));
  HC_12.print(((Current_PH/10)%10));
  HC_12.print(((Current_PH%10)));
  HC_12.print("-");
  HC_12.print(((Current_Turbidity/100)%10));
  HC_12.print(((Current_Turbidity/10)%10));
  HC_12.print(((Current_Turbidity%10)));
  HC_12.print("-");
  HC_12.print(((Current_MQ135/100)%10));
  HC_12.print(((Current_MQ135/10)%10));
  HC_12.print(((Current_MQ135%10)));
  HC_12.print("-");
  HC_12.print(((Current_MQ6/100)%10));
  HC_12.print(((Current_MQ6/10)%10));
  HC_12.print(((Current_MQ6%10)));
  HC_12.print("#");
  HC_12.write('\n');
}
```

CHAPTER 8

RESULTS ANALYSIS

8. RESULT ANALYSIS

The results of the project are presented in this section, which aims to summarize the findings and outcomes of the research or investigation.

The project's objectives or hypotheses are evaluated based on the results of the data analysis. If the objectives were achieved or the hypotheses were supported, the findings are discussed and interpreted considering previous research in the field. Alternatively, if the objectives were not met or the hypotheses were not supported, the reasons for these outcomes are explored, and suggestions for future research are made.

Overall, the results section should provide a comprehensive and clear summary of the project's outcomes and their significance, enabling readers to understand the project's contributions and implications fully.

8.1 PICTORIAL PRESENTATION OF OUTPUT

Here is the glimpse of final output of our project:

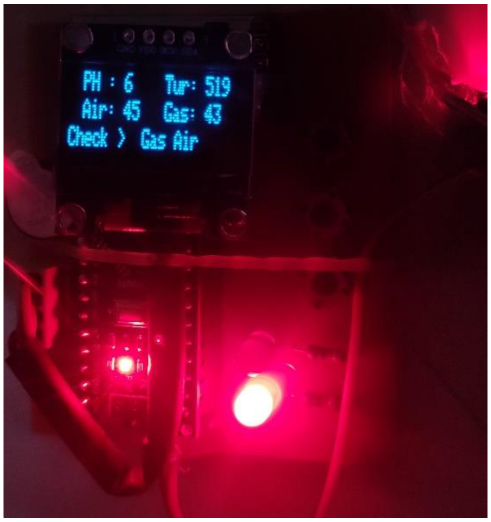

Fig. 8.1: Sensor Output Data

In the above Picture we can have look at the output from the watch. The picture displays Output values from all the Sensors on the LED Display.

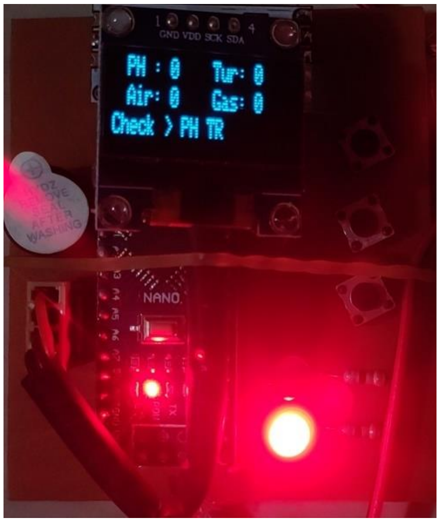

Fig. 8.2: Sensor OFF Output

In the above Picture we can observe that data when Sensors are not connected. The picture displays Output values from all the Sensors on the LED Display. As the Sensors are not connected, all displayed values are 0.

Fig. 8.3: Time Output

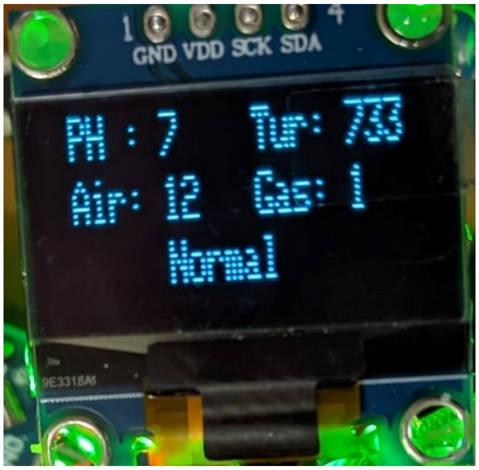

Fig. 8.4: Sensor ON Output

In the above Picture we can observe the output of the watch when all the conditions for the Sensors are satisfied. The picture displays Output values from all the Sensors on the LED Display where PH value is neither less than 6 nor greater than 7, Turbidity values are greater than 500, Air quality values are less than 50 and Gas Sensor values are less than 50.

CHAPTER 9
CONCLUSION

CONCLUSION

9.1 CONCLUSION

Water and Air are part of life and are also a very important source. Awareness in the safeguard and the cleanliness of the water and air should be enhanced among the community at large. Development of tools that can measure the level of index water, this can increase knowledge and awareness in maintaining life. There are various systems developed but very few provides portability and efficient results. Challenge is to develop a system which is portable and easy to setup in all environments. In this paper we have studied various approaches and identified drawbacks. Hence, we can suggest implementing Air and water pollution sensing system on a smart watch using Arduino and its sensors. As technology is getting updated rapidly the base of the systems are getting smaller and portable which is easy to use and more efficient.

9.2 FUTURE SCOPE

The current air and water pollution detection smart watch has a few drawbacks. One of the drawbacks is that it cannot be connected to a smartphone or a computer for computation and storage purposes. In the coming future an app can be developed to work in sync with the watch. Currently the sensors are too big to be directly connected to the watch. Therefore, In the coming future when Arduino based sensor sizes are reduced, the watch can be made even more portable and easier to use. We can add multiple new features such as temperature meter, heart rate monitor and many more.

REFERENCES

1. A.Kumar and N.P. Pathak, Wireless monitoring of volatile organic compounds / Water vapor / gas pressure/temperature using RF transceiver. IEEE Transactions on Instrumentation and Measurement, 67(9), pp. 2223-2234, 2018.

2. S. Garuglieri, D. Madeo, A. Pozzebon, R. Zingone, C. Mocenni and D.Bertoni, An Integrated System for RealTime Water Monitoring Based on Low Cost Unmanned Surface Vehicles. In 2019 IEEE Sensors Applications Symposium, Sophia Antipolis, France, 11-13 March 2019, pp. 1-6.

3. I. Hussain, M. Das, K.U. Ahamad, and P. Nath, Water salinity detection using a smartphone. Sensors and Actuators B: Chemical, 239, pp. 1042-1050, 2017.

4. N Vijaykumar, R Ramya," The real time monitoring of water quality in IoT environment", IEEE pp: 978-1- 47996818,2015.https://www.ijirset.com/upload/2016/march/246_The_new.pdf.

5. W. S. Cain, J. M. Samet, and M. J. Hodgson, "The Quest for negligible health risks from indoor air," ASHRAE Journal, 37, (7), 1995, pp. 38 - 57.

6. D. D. Lee, and D. S. Lee, "Environment gas sensors," IEEE Sensors Journal, 1, (3), 2001, pp. 214-215.

7. G. L. Tang, "Lecture notes on Health and the built environment: Indoor air quality," university of Calgary, Alberta, Canada

8. Jiang, P., & All. (2009). Design of a water environment monitoring system based on wireless sensor networks,", vol. 9, pp. 6411–6434, 2009. Sensors, 9, 6411–6434.

9. Manuel, A.S., Alberto, R.C., Carolina, O., Nora, G. (2002). In- Situ Tests for Water Quality Assessment: A Case Study in Pampean Rivers. Water Research, 36, 4033–4040

ACKNOWLEDGEMENT

No project is ever complete without the guidance of those expert how have already traded this past before and hence become Master of It and as a result, our leader. So, we would like to take this opportunity to take all those individuals how have helped us in visualizing this project. We express our deep gratitude to our **project's internal guide Prof. Dr. K. T. Patil** for providing timely assistance to our query and guidance that she gave owing to her experience in this field for past many years. We are highly indebted to **Dr. Sunil Chavan, Principal**, **Smt. Indira Gandhi College of Engineering** and **Prof. K.T. Patil, Head of the Department, Computer Department** and all the faculty members.

We are thankful to the lord for keeping us energized that every end seems to be a new beginning.

Air Water Pollution Sensing System: Research

[1]Hamza Mulla
[1]2020ce03@sigce.edu.in

[2]Misba Sayyad
[2]2020ce14@sigce.edu.in

[3]Amol Pawar
[3]2020ce10@sigce.edu.in

Dr. K.T Patil

Abstract - Air and water pollution are the one of the causes of global warming. The first step towards stopping pollution is to be able to measure it. People need to know the exact pollution level they are standing in so that they can respond to it. In this age of smart watches, we have watches to track our own health and fitness, but what about environmental health. If environmental health degrades so will the health of all humans and future generations too. With this people will no longer special equipment to measure pollution levels, they can monitor pollution levels anywhere and anytime desired. In this paper, we have presented an in-depth look at current advances in air and water pollution sensing system.

Keywords: Air pollution sensing system, Water pollution sensing system, Smart watch.

1. INTRODUCTION

Air pollution and Water pollution is the biggest problem of every nation, whether it is developed or developing[1]. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants[1].

Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma[3]. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone[3]. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide[3].

IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there are enough harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, LPG and NOx[2]. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily[2].

Drinking water is becoming more harmful and contaminated due to urbanization, industrialization and increase in population[4]. Hence there is need of better methodologies for monitoring the water quality[4]. For examining the water quality manual efforts were required for testing. Such approaches take longer time and no longer to be considered efficien[4].

2. LITERATURE SURVEY

As proposed by A.Kumar and N.P. Pathak [1] The worrying state of the environment has affected the quality of rivers, seas and ponds. The shameless act of disposing trash into the sea has impacted their quality negatively deeply. Smokes from factories rose and soon form acidic rain that will pour on the land and water (Samsudin, Salim, Osman, Sulaiman, & Sabri, 2018). It's absolutely no wonder the quality of the sea is plummeting.

As proposed by N Vijaykumar, R Ramya [4] where the system consists of 3 wireless sensor sub-system. All communicate with each other wirelessly and send information to gateway connected to a computer which hosts the GUI.

As proposed by I. Hussain, M. Das, K.U. Ahamad, and P. Nath [3]The limitation to that system was that Due to wireless transfer of data sometimes delivery of data is not ensured. There are chances of loss of data.

As proposed by Sayali Wadekar, Vinayak Vakare, Ram Ratan Prajapati [10] Water level sensor will provide the level of water present in the water tank and according to the level of water, water motor will automatically turn ON and OFF. Data is displayed on android application.
The limitation to that system was that No quality monitoring is performed, so even if water is available in tank, without performing quality check, water will be supplied. The application needs to be downloaded and updated from time to time.

As proposed by Jiang, P [8] The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g., construction activities) and location-dependent (e.g., the traffic chokepoints have much worse air quality than average).

As proposed by [2] It states that the implementation of an integrated system is for the purpose of monitoring of the aquatic ecosystems that are absorbed on a set of tools that will recognize the environmental circumstances and it will make a tactical conclusion aimed at the administration of lakes, rivers or coastal areas. The system, called Water Environmental Mobile Observer had been made up of low-cost and standard components as the physical and chemical parameters are on condition that with a segmental collection of sensors are performed a bathymetry. Data analytics utensils had also presented in directive to advance a comprehensive observing ecology awning all the importance of data gathering, repository and examination.

3. IMPLEMENTATION

3.1 Basic Working:

Many of the water and air quality monitoring devices and automatic water saving devices are facing a lot of problems. The fresh water can be appraised through the benefit of pH sensor. The system will show the air quality in PPM on the LCD so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system.

LPG gas is detected using MQ6 sensor and MQ135 sensor is used for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately.

These sensors are connected to the microcontroller Arduino Uno board. And this device is made more adaptable, the real time data is collected, processed and stored.

Data are collected through the sensors that are been used and then these data are sent to the watch and displayed on the LCD Screen.

In this project, it can monitor the pollution level from anywhere using your watch. This system can be installed anywhere and can also trigger some alert when pollution goes beyond some level

The air quality sensor is used to detect the amount of air pollution in the air as ppm levels. This data is processed by microcontroller to get the current air quality. The watch also monitors for any flammable gases in the vicinity to detect any flammable gas leakages using flammable gas sensor. This sensor is constantly monitored by controller.

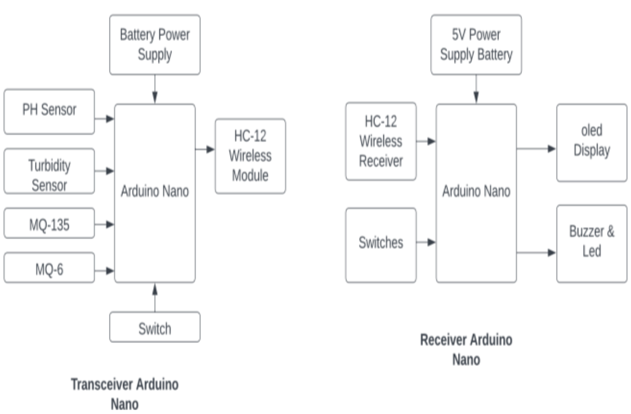

Fig. System Architecture Block Diagram

Now we have a ph sensor that is used to detect the ph level of any water body. The user can just dip the ph sensor on his/her smart watch to get ph level.

The sensor data is processed by controller and displayed on the display module.

Similarly, we here have a turbidity sensor attached to the smart watch as well. The sensor is used to transmit the water turbidity value to controller which is displayed on display.

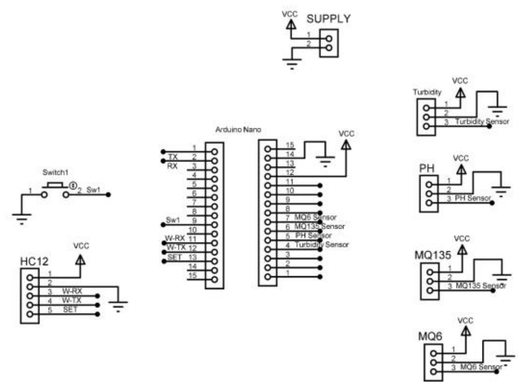

Fig. Transceiver Pin Diagram

Ph and turbidity are used to display water quality of any water body (lake, pond, canal, sea). The smartwatch allows to set high and low acceptance values of each parameter using push buttons. If any of the values scanned shows up higher/lower than set limits it sounds a buzzer alert as well displays the alert message on display to the user.

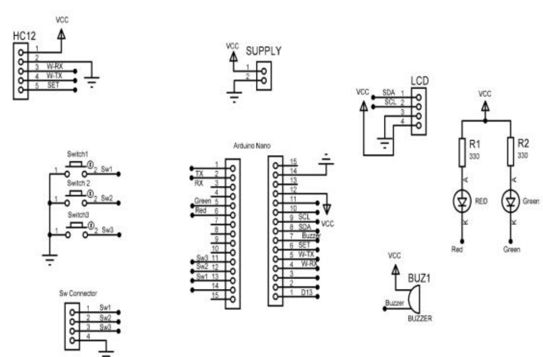

Fig. Receiver Pin Diagram

4. SMART WATCH APPLICATIONS

A smartwatch is a wearable computer in the form of a watch; modern smartwatches provide a local touchscreen interface for daily use, while an associated smartphone app provides for management and telemetry. While early models could perform basic tasks, such as calculations, digital time telling, translations, and game-playing, smartwatches released since 2015 have more general functionality closer to smartphones, including mobile apps, a mobile operating system and Wi-Fi/Bluetooth connectivity.

The Gaia smartwatch:
A smartwatch with strong ecological accents. Since pollution has become a great problem in the world we live in, Gaia proposes that the watch could help you diagnose the levels of contamination on the Planet. while you're doing something outside, the smartwatch will be able to detect the levels of contamination in your environment.

Fitbit Sense:
The Fitbit Sense adds a whole slew of sensors to the Fitbit lineup to track everything from stress to blood oxygen levels, temperature, sleep and even has an FDA-cleared electrocardiogram (ECG or EKG). The Series 6 also measures SpO2 levels at night.

5. RESULTS

Fig. All Ok State

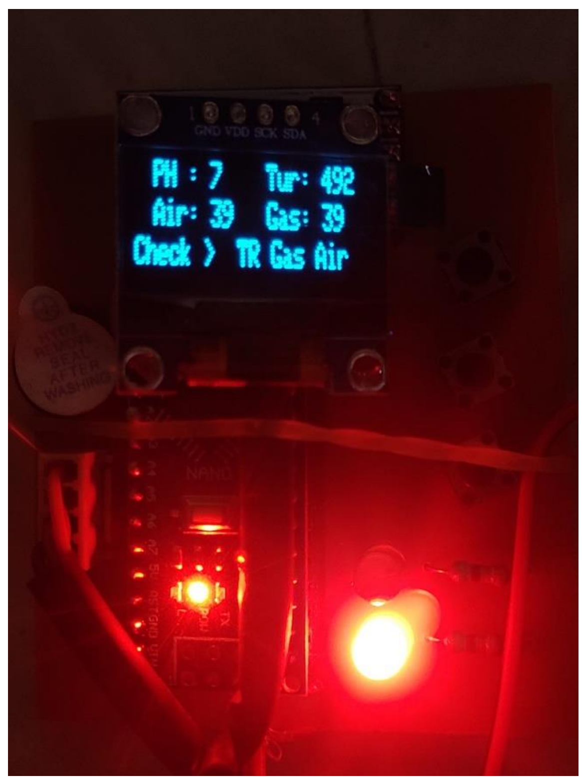

Fig. Environment Checks

6. CONCLUSION

Water and Air are part of life and are also a very important source. Awareness in the safeguard and the cleanliness of the water and air should be enhanced among the community at large. Development of tools that can measure the level of index water, this can increase knowledge and awareness in maintaining life. There are various systems developed but very few provides portability and efficient results. Challenge is to develop a system which is portable and easy to setup in all environments.

In this paper we have studied various approaches and identified drawbacks. Hence, we implemented Air and water pollution sensing system on a smart watch using Arduino and its sensors which is portable, easy to use and efficient.

7. REFRENCES

1. A.Kumar and N.P. Pathak, Wireless monitoring of volatile organic compounds / Water vapor / gas pressure/temperature using RF transceiver. IEEE Transactions on Instrumentation and Measurement, 67(9), pp. 2223-2234, 2018.

2. S. Garuglieri, D. Madeo, A. Pozzebon, R. Zingone, C. Mocenni and D.Bertoni, An Integrated System for RealTime Water Monitoring Based on Low Cost Unmanned Surface Vehicles. In 2019 IEEE Sensors Applications Symposium, Sophia Antipolis, France, 11-13 March 2019, pp. 1-6.

3. I. Hussain, M. Das, K.U. Ahamad, and P. Nath, Water salinity detection using a smartphone. Sensors and Actuators B: Chemical, 239, pp. 1042-1050, 2017.

4. N Vijaykumar, R Ramya," The real time monitoring of water quality in IoT environment", IEEE pp: 978-1-47996818,2015.https://www.ijirset.com/upload/2016/march/246_The_new.pdf.

5. W. S. Cain, J. M. Samet, and M. J. Hodgson, "The Quest for negligible health risks from indoor air," ASHRAE Journal, 37, (7), 1995, pp. 38 - 57.

6. D. D. Lee, and D. S. Lee, "Environment gas sensors," IEEE Sensors Journal, 1, (3), 2001, pp. 214-215.

7. G. L. Tang, "Lecture notes on Health and the built environment: Indoor air quality," university of Calgary, Alberta, Canada

8. Jiang, P., & All. (2009). Design of a water environment monitoring system based on wireless sensor networks,", vol. 9, pp. 6411–6434, 2009. Sensors, 9, 6411–6434.

9. Manuel, A.S., Alberto, R.C., Carolina, O., Nora, G. (2002). In- Situ Tests for Water Quality Assessment: A Case Study in Pampean Rivers. Water Research, 36, 4033–4040

10. Sayali Wadekar, Vinayak Vakare, Ramaratan Prajapati, "Smart water man- agement using IoT",IEEEpp:97815090,2016.http://ieeexplore.ieee.org/document/799342 5/.

ISSN: 2582-3930
Impact Factor: 8.176

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING & MANAGEMENT
An Open Access Scholarly Journal || Index in major Databases & Metadata

CERTIFICATE OF PUBLICATION

International Journal of Scientific Research in Engineering & Management is hereby awarding this certificate to

Hamza Mulla

in recognizaton to the publication of paper titled

Air Water Pollution Sensing System: Research

published in IJSREM Journal on Volume 07 Issue 04 April, 2023

Editor-in-Chief
IJSREM Journal

ISSN: 2582-3930
Impact Factor: 8.176

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING & MANAGEMENT
An Open Access Scholarly Journal || Index in major Databases & Metadata

CERTIFICATE OF PUBLICATION

International Journal of Scientific Research in Engineering & Management is hereby awarding this certificate to

Misba Sayyad

in recognizaton to the publication of paper titled

Air Water Pollution Sensing System: Research

published in IJSREM Journal on Volume 07 Issue 04 April, 2023

Editor-in-Chief
IJSREM Journal

www.ijsrem.com

ijsremjournal@gmail.com

ISSN: 2582-3930
Impact Factor: 8.176

IJSREM
e-Journal
IJSREM

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING & MANAGEMENT
An Open Access Scholarly Journal || Index in major Databases & Metadata

CERTIFICATE OF PUBLICATION

International Journal of Scientific Research in Engineering & Management is hereby awarding this certificate to

Amol Pawar

in recognizaton to the publication of paper titled

Air Water Pollution Sensing System: Research

published in IJSREM Journal on Volume 07 Issue 04 April, 2023

Editor-in-Chief
IJSREM Journal

ISSN: 2582-3930
Impact Factor: 8.176

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING & MANAGEMENT

An Open Access Scholarly Journal || Index in major Databases & Metadata

CERTIFICATE OF PUBLICATION

International Journal of Scientific Research in Engineering & Management is hereby awarding this certificate to

Dr. K.T Patil

in recognizaton to the publication of paper titled

Air Water Pollution Sensing System: Research

published in IJSREM Journal on Volume 07 Issue 04 April, 2023

Editor-in-Chief
IJSREM Journal