# ANNAI VAILANKANNI COLLEGE OF ENGINEERING

## KANYAKUMARI DIST

## PROJECT REPORT

## REAL-TIME RIVER QUALITY MONITORING ANDCONTROL SYSTEM

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## 1.1 PROJECT OVERVIEW

River Water Quality Monitoring System

Water is one of the major compounds that profoundly influence ecosystem. But nowadays it is been exploited heavily due to rapid industrialization, human waste and randomuse of pesticides and chemical fertilizers in agriculture, which leads to water contamination. Thus, a water monitoring system is necessary to observe the water quality in a large area such as lake, river, and aquaculture. As per the current world situation, Internet of Things (IoT) andremote sensing techniques are used in heterogeneous areas of research for supervising, congregate and analyzing data from the remote locations. In this paper, the suggested system is a minimal price real time water quality monitoring system in IoT environment.

This system comprises of numerous sensors for assessing the physical and chemical parameter. The factors of water that can be assessed using these sensors are pH, turbidity, conductivity, dissolved oxygen. Using this system, the real time quality of water bodies can bedetermined and the data uploaded over the Internet are analyzed.

## b. Purpose:

Water quality refers to chemical, physical biological and radio logical characteristics of water. It is a measure of the condition of water relative to the necessities of one or more bio-tic species and or to any human need or purposes. Water quality monitoring is

defined as a sampling and analysis of the water in lake, stream, ocean and river and conditions of the water body. Smart water quality monitoring is a process of real-time monitoring and the analysis of water to identify changes in parameters based on the physical, chemical and biological characteristics. Monitoring water quality is clearly important: in our seas, our rivers, on the surface and in our ports, for both companies and the public. It enables us to assess how they are changing, analyze trends and to inform plans and strategies that improve water quality and ensures that water meets its designated use. There are several indicators determining water quality. These include dissolved oxygen, turbidity, bio indicators, nitrates, pH scale and water temperature. Monitoring water quality helps to identify specific pollutants, a certain chemical, and the source of the pollution. There are many sources of water pollution: wastewater from sewage seeping into the water supply; agricultural practices (e.g., the use of pesticides and fertilizer); oil pollution, river and marine dumping, port, shipping and industrial activity. Monitoring water quality and a water quality assessment regularly provides a source of data identify immediate issues – and their source.

1.Identifying trends, short and long-term, in water quality.
2. Data collected over a period of time will show trends, for example identifying increasing concentrations of nitrogen pollution in a river or an inland waterway. Thetotal data will then help to identify key water quality parameters.

3. Environmental planning methods: water pollution prevention and management.
4. Collecting, interpreting and using data is essential for the development of a sound andeffective water quality strategy. The absence of real-time data will however hamper thedevelopment of strategies and limit the impact on pollution control. Using digital systems and programs for data collection and management is a solution to this challenge.

5. Monitoring water quality is a global issue and concern: on land and at sea. Within the European Union, the European Green Deal sets out goals for restoring biological biodiversity and reducing water pollution, as well as publishing various directives to ensure standards of water quality. Individual nation states, for example France, have also clear regulatory frameworks requiring the effective monitoring of water quality. Inthe United States, the Environmental Protection Agency (EPA) enforces regulations toaddress water pollution in each state. Across the world, countries increasingly understand the importance of effective water quality monitoring parameters and methods.

## 2.LITERATURE SURVEY

### a. Existing Problem:

Due to population growth, urbanization, and climatic change, competition for water resources is expected to increase, with a particular impact on agriculture, river water. Water will be

suitableness to potable water monitoring compound spillage identification done rivers, remote estimation for swimming pools. It holds self-sufficient hubs that unite with the cloud to ongoing water control. The River water needed to be treated before it is used in agriculture fields, hence the parameters affecting the quality of river-water need to be analyzed and to be used for water treatment purpose.

## b.References:


1. **Smart water quality Monitoing System [Author:** Mr. Kumar K**]**
2. **Real Time Water Quality Monitoring and Management [Author:** Deepika gupta**]3.The Monitoring of Water Quality in IOT Environment [Author:** Anuadha T**]**

**4.IOT Based Real time River Water Quality Monitoring System [Author:** Elsevier B.V**] 5.SmartPortable Water Monitoring [Author:** Okoli Chinedu David**]**

**6. IntelligentSystemforMonitoringandDetectingWaterQuality[Author:**JamalMabrouki**]**


## c. Problem Statement:

The reduce the river water pollution and to monitor the parameters of river water and control measures can impact vegetation,health. The Real time analysis of Indicators of River water(Ph,salinity,nutrients,etc..,)

| Problem Statement (PS) | I am (Customer) | I'm trying to | But | Because | Which makes me feel |
|---|---|---|---|---|---|
| PS-1 | A Farmer | use river water for irrigation | i don't know the quality and level of the water | i don't know how to measure the quality of thewater | frustrated |
| PS-2 | An Industrialist | use river water for drinks manufacturing | i don't know the pH level of river water | we can't use water with acidic nature for cool drinks manufacturing | indecisive |

# IDEATION & PROPOSED SOLUTION

## a. Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user'sbehaviours and attitudes. It is a useful tool to helps teams better understand their users.Creatingan effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with

his or her goals and challenges.

## b.Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash theirimagination and start shaping concepts even if you're not sitting in the same room.

## Proposed Solution:

| S.No. | Parameter | Description |
|---|---|---|

| | | |
|---|---|---|
| 1. | Problem Statement (Problem to besolved) | Pollution of water is one of the main threats in recent times as drinking water is getting contaminated and polluted. The polluted water can cause various diseases to humans and animals, which in turn affects the life cycle of the ecosystem. If water pollution is detected in an early stage, suitable measures can be taken and critical situations can be avoided. To make certain the supply of pure water, the quality of the water should be examined in real-time. Smart solutions for monitoring of water pollution are getting more and more significant these days with innovation in sensors, communication, and Internet of Things (IoT) technology. In this paper, a detailed review of the latest works that were implemented in the arena of smart water pollution monitoring systems is presented. The paper proposes a cost effective and efficient IoT based smart water quality monitoring system which monitors the quality parameters uninterruptedly. The developed model is tested with three water samples and the parameters are transmitted to the cloud server for further action. |

| | | |
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| 2. | Idea / Solution description | An assembled Arduino microcontroller is used as the core controller of the system. Once the code is uploaded to the microcontroller, no PC system, keyboard command, monitor is required to operate the system.The system functions automatically and independently according to the code uploaded to the microcontroller. In this system, three sensors are used to measure the essential water parameters. As it was studied from the previous researches, the most essential water parameters needed to be monitored<br>by the average users are water pH level, |

| | | |
|---|---|---|
| | | water turbidity (cloudiness) and water temperature which is a measurement of the amount of the water in a container.Therefore, four essential water parameters which are temperature, pH level and turbidity can be measured by this proposed system. Sensors circuits are connected to the microcontroller and the probes of the turbidity, pH, and temperature sensors placed inside the water.A water proof temperature sensor is used to avoid any damage or electrical shock to the system and the user. An ultrasonic sensor is used to measure the level of the water in thecontainer. The ultrasonic sensor is connected in the system such that it will be placed on the top of the water container.The ultrasonic sensor sends electromagnetic waves to the water surface and receives the wave back after touched the water surface. From the time taken to send and receive the wave by the ultrasonic sensor and the velocity of the electromagnetic waves, the distance which shows the water level in the container is calculated by the microcontroller.All sensors read the water quality parameters and send the data to the microcontroller in the form of electrical signals.The microcontroller is programmed such that is will analyze the result and compare it with the standard ranges which are predetermined in the code. If any water parameter crossed the standard limit, the alarm system will turn on.In case of any abnormality in a water parameter detected by the microcontroller, the buzzer will buzz to indicate that the water is not proper for use. To show the sensor readings (The water parameters) on the device itself, an LCD (Liquid Crystal Display) screen is used. The LCD screen is connected to the microcontroller, and through the wired connection, it receives the sensor |

| | | |
|---|---|---|
| | | |
| 3. | Novelty / Uniqueness | • To measure various chemical and physical properties of water like pH,temperature and particle density of water usingsensors.<br>• Send the data collected to a Raspberry Pi, show the data in display and send it to acloud based Database using Wired/WirelessChannel.<br>• Trigger alarm when any discrepancies are found in the water quality.<br>• Datavisualizationandanalysis using cloud based visualization tools. |

| | | |
|---|---|---|
| 4. | Social Impact / Customer Satisfaction | The main objectives of this research were to assess the level of customer satisfaction on urban water supply services of Southern Region, Ethiopia, and identify major determinants. Quantitative data were collected from 8,413 customers in seventeen towns, using a questionnaire based on the SERVQUAL model. Qualitative data were collected from customers via focus group discussion, and interviews were used with utility employees and officials. The results showed 47% of customers were satisfied with the water supply enterprise services, while 43% were dissatisfied for various reasons. The customer satisfaction score was below the acceptable level for all service quality dimensions, and understanding of customers, communication, and responsiveness were far below the benchmark. The correlation analysis revealed the existence of a monotonic, positive relationship between customers' total satisfaction and service quality dimensions. The proportional odds model indicated that total customer satisfaction was highly dependent on the nine service quality dimensions used in this research. |
| 5. | Business Model (Revenue Model) | • We can sell this technology to theindustries and also to the small scaleand large scale industries to develop their industrial security and wellness. |

| | | |
|---|---|---|
| | | • We can also provide it as a servicebased to earn money out of it.<br>• For example we may offer our services to the company as a contract for a period of time to make revenue. |
| 6. | Scalability of the Solution | The scalability on this model is high as there are involves more demand on safety and security of workers and the companies too.so, the danger the losses caused are get reduced by this system.<br>And we need lesser man power to work with this kind of activities |

1. **REQUIREMENT ANALYSIS**

## a. Functional Requirements:

Following are the functional requirements of the proposed solution.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form<br>Registration through Email<br>Registration through product mobile UI |
| FR-2 | User Confirmation | Confirmation via Email,Confirmation via OTP<br>Confirmation via Message |
| FR-3 | Ph level detection | To monitor the water quality Ph sensor is |

| | | |
|---|---|---|
| | | used andthe signals are send to Ardino. |
| FR-4 | Turbidity detection | Turbidity sensor measures the clarity of element or muddiness utter in the water and the signals are sendto Arduino. |
| FR-5 | Ultrasonic generator | At regular interval times the waves are generatedto clear algae 25%,50%,75%,100% |

b. Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

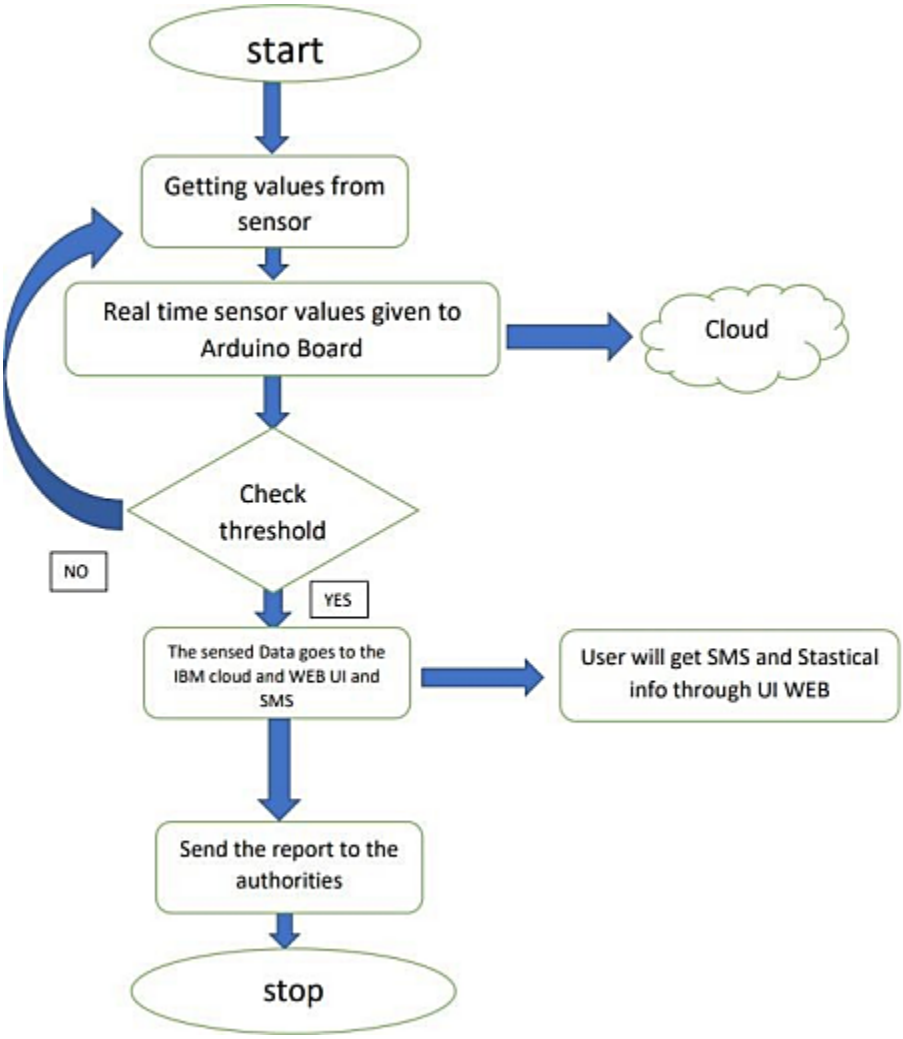
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | It has simple monitoring system and efficient touse. |
| NFR-2 | **Security** | Mobile application is secured with firewallprotection. |
| NFR-3 | **Reliability** | Real time sensor output values with future predicted data storage. 98% efficient monitoring output. It also gives assurance for aquaculture safety. |
| NFR-4 | **Performance** | It has greater performance and environmentallysafe model. |
| NFR-5 | **Availability** | In the form of mobile UI 24 x 7 monitoringsystem. |

5.PROJECTDESIGN

## Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows

within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.




## *a.* SOLUTION AND TECHNICAL ARCHITECTURE

**Summary**

This code pattern explains how to build an IOT based

river water monitoring andcontrolling system with some predefined values.

Flow

i. Feed the data received from the Sensor unit which are placed in the river sides.

ii. The collected data will be displayed in the Web page to the user.

iii. Then the collected data is sent to the data base, where the collected data and thepredefined data are checked and monitored.

iv. If any data exceed the predefined data then the control signal will send to the Admin.

v. The collected data will be stored in the IBM cloud storage. Later thedata will be controlled by the admin via UI.

**Components & Technologies:**

| S.No | Component | Description | Technology |
|---|---|---|---|
| 1. | Sensor Data | The data is collected form the various sensor placed in the river sides. | ESP32Wifimodule Raspberry Pie. |
| 2. | Database for Storage | The data/info need to be stored for accessing it in future | MySQL-Oracle |

| | | | |
|---|---|---|---|
| 3. | File Storage | File storage requirements | IBM Block Storage or Other Storage Service or Local Filesystem |
| 4. | Cloud Database | DatabaseServiceonCloud | IBM cloud |
| 5. | Data Storage | File storage requirements | IBM Block Storage |

**Application Characteristics:**

| S.No | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | PH level Monitoring | The PH level of river watercanbe monitoredviaplacing sensorsin rivers. | PH-sensor |
| 2. | Air Quality Monitoring | The clarity and purity of river water can be monitored | Surface Mount Sensor |
| 3. | Temperature Monitoring | The temperature of riverwater can be monitored | Temperature sensor |

| | | | |
|---|---|---|---|
| 4. | Water Treatment | can be used as both a safety device in the water purification process as carbon dioxide, methane, and carbon monoxide are some of the key gases produced during the treatment process | NDIR gas sensors |

| | | | |
|---|---|---|---|
| 4. | Soil Condition Monitoring | Soil condition monitoringsensors allow farmers to collect data about rainfall,temperature, and other metrics over time to track trends and predict irrigation needs. | Acoustic sensor |

c. User Stories

Use the below template to list all the user stories for the product.

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Registration | USN-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | 2 | High | Akash k |
| Sprint-1 | | USN-2 | As a user, I will receive confirmation email once I have registered for the application | 1 | High | Abimanyu M |
| Sprint-2 | | USN-3 | As a user, I can register for the application through Facebook | 2 | Low | Mohammed Riswan |
| Sprint-1 | | USN-4 | As a user, I can register for the application through Gmail | 2 | Medium | Deepak k |
| Sprint-1 | Login | USN-5 | As a user, I can log into the application by Entering email & password | 1 | High | Akash K |

## SPRINT PLANNING & SCHEDULING

| TITLE | DESCRIPTION | DATE |
|---|---|---|
| **Literatu reSurvey & Information Gathering** | Literature survey on the selected project is done by gathering informationabo ut related details on technicalpapers and web browsing. | 06 OCTOBER 2022 |

| | | |
|---|---|---|
| **Empathy Map** | Prepared Empathy Map Canvas to combine thoughts and pains, gains of the project with all team members . | 08 OCTOBER 2022 |
| **Ideation** | Brainstorming session is conducted with all team members to list out all theideas and prioritise the top3 ideas. | 09 OCTOBER 2022 |
| **Proposed Solution** | Prepared the proposed solution document, which includes the novelty feasibility of idea, business model, social impact scalability of solution, etc. | 28 OCTOBER 2022 |
| **Problem Solution Fit** | Prepared problem solutionfit document. | 30 OCTOBER 2022 |

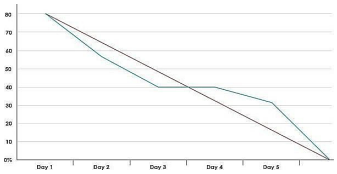
a. **SPRINT DELIVERY SCHEDULE**

**Product Backlog, Sprint Schedule, and Estimate**

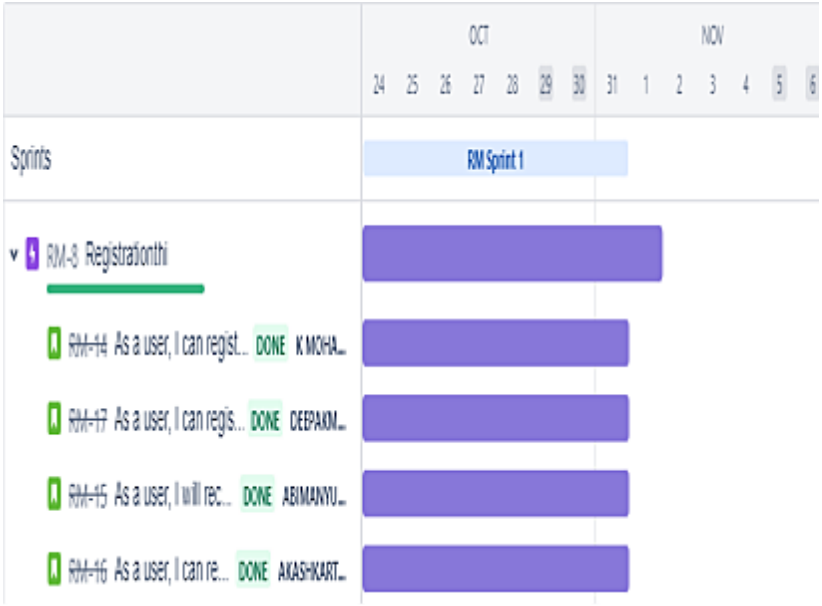
| Sprint | Total Story Points | Duration | Sprint Start Date | Sprint End Date (Planned) | Story Points Completed (as on Planned End Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 20 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 20 | 29 Oct 2022 |
| Sprint-2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 30 | 30 Oct 2022 |
| Sprint-3 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 49 | 06 Nov 2022 |
| Sprint-4 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 50 | 07 Nov 2022 |

## Velocity:

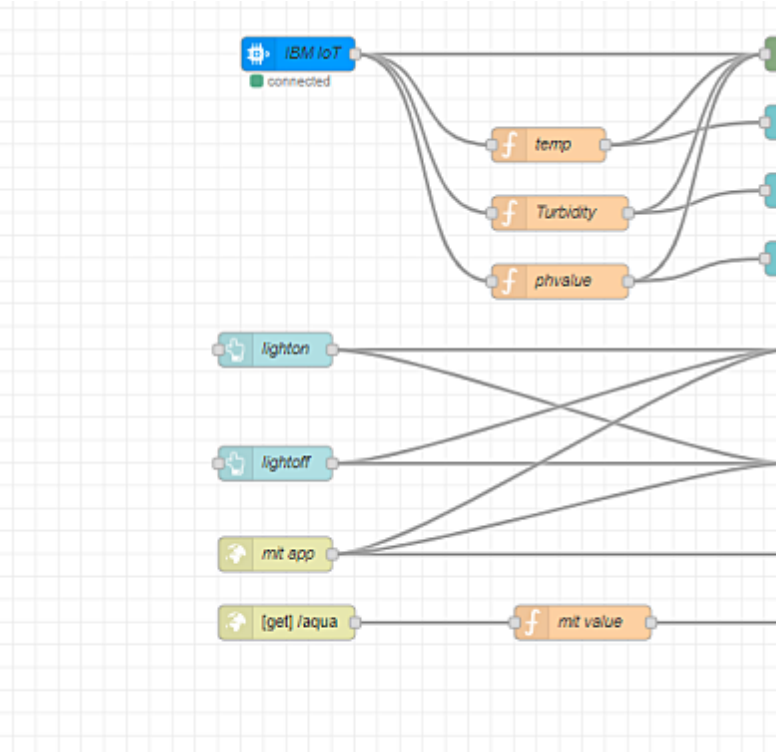
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$




b. REPORT FROM JIRA



## 7 CODING AND SOLUTIONING



# TESTING

## a. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

| Section | Total Cases |
|---|---|
| Print Engine | 15 |
| Client Application | 45 |
| Security | 1 |
| Outsource Shipping | 2 |
| Exception Reporting | 10 |
| Final Report Output | 4 |
| Version Control | 3 |

OUTPUT

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https://drive.google.com/file/d/1utX_1afl55zvs6irrI8Y7

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95g/view?usp=drivesdk

## 7.1 NODE RED SERVICE ASSOCIATED WITH IBM CLOUD: