MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE

Kodambakkam, Chennai-600024.

DEPARTMENT OF INFORMATION TECHNOLOGY

TOPIC: AQUATIC INSIGHTS: COGNOS -POWERED WATER PORTABILITY ANALYSIS

TEAM ID **:** NM2023TMID07251

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ABSTRACT

Water quality assessment and monitoring are vital for ensuring the health and safety of aquatic ecosystems, as well as the well-being of human populations that depend on these water sources. This abstract introduces "Aquatic Insights," a cutting-edge water portability analysis system that leverages IBM Cognos, a powerful business intelligence and data analytics platform. The Aquatic Insights system is designed to provide a comprehensive and real-time assessment of water quality, enabling a deeper understanding of the conditions of aquatic environments, such as lakes, rivers, and reservoirs. The integration of Cognos into this system empowers users with advanced data visualization, predictive analytics, and reporting capabilities, enabling efficient decision-making for water resource management. Key features of the Aquatic Insights system include data collection through various sensors and IoT devices, data storage and management, data preprocessing and cleansing, and a user-friendly dashboard powered by IBM Cognos. The dashboard presents users with intuitive visualizations and customizable reports, enabling them to monitor water quality parameters such as pH, temperature, turbidity, dissolved oxygen, and pollutants in real-time. Additionally, the system incorporates machine learning algorithms to predict water quality trends and identify potential issues. It can generate alerts and recommendations based on historical data, helping water resource managers and environmental agencies proactively address water quality challenges and protect ecosystems. Aquatic Insights is poised to revolutionize the way we analyze and manage water portability, making it an essential tool for environmental scientists, water resource managers, and policymakers. By harnessing the power of Cognos, this system provides an integrated and efficient solution for ensuring the sustainable and safe use of water resources in an era of increasing environmental concerns and challenges. Key features of the Aquatic Insights system encompass data collection via sensors and IoT devices, data storage, data preprocessing, and a user-friendly dashboard driven by IBM Cognos. This dashboard offers intuitive visualizations and customizable reports, facilitating real-time monitoring of critical water quality parameters such as pH levels, temperature, turbidity, dissolved oxygen, and pollutant concentrations. Furthermore, Aquatic Insights incorporates machine learning algorithms to forecast water quality trends and detect potential issues. It can generate alerts and recommendations based on historical data, enabling water resource managers, environmental agencies, and other stakeholders to proactively address water quality challenges and safeguard aquatic ecosystems. Aquatic Insights represents a significant advancement in water portability analysis, providing a pivotal tool for environmental scientists, water resource managers, and policymakers. By harnessing the capabilities of Cognos, this system offers an integrated and efficient solution for ensuring the sustainable and safe utilization of water resources in the face of mounting environmental concerns and challenges.

CONTENT

1. INTRODUCTION

1.1 Project Overview:

"Aquatic Insights is a ground-breaking project that uses IBM Cognos to analyze water portability. Its main goals are to gather, clean, and standardize different types of water quality data from different sources. The project uses Cognos to provide data analytics and reporting with a mobile-friendly interface, robust security features, and an easy-to-use interface. It encourages cooperation, public awareness, and ongoing development. The goal of Aquatic Insights is to promote sustainable management of aquatic ecosystems and advance our knowledge of water resources."

1.2 Purpose:

The project "Aquatic Insights: Cognos-Powered Water Portability Analysis" aims to use IBM Cognos and advanced analytics for several purposes:

- Assess water quality and portability.
- Integrate diverse data sources for a comprehensive view.
- Standardize data to ensure consistency.
- Provide advanced analytics to identify trends and threats.
- Create a user-friendly platform for data interaction.
- Raise public awareness and offer educational resources.

The overarching purpose is to improve understanding and facilitate sustainable management of aquatic ecosystems for the benefit of researchers, policymakers, and the public.

2. LITERATURE SURVEY

2.1 Existing problem:

In the literature survey for the project "Aquatic Insights: Cognos-PoweredWater Portability Analysis," several existing issues are identified:

- Limited data integration from diverse sources.
- Challenges in data standardization and consistency.
- Lack of predictive modeling for water quality trends.
- Poor accessibility and user-friendliness.
- Limited collaboration among stakeholders.
- Insufficient mobile accessibility for on-the-go access.
- Inadequate attention to data security and privacy.
- Limited emphasis on public awareness and education.
- Gaps in regulatory compliance.
- Potential issues with outdated information.

Addressing these problems is crucial for the project's success, ensuring it provides valuable and up-to-date insights into water quality and portability fora wide range of users and stakeholders.

2.2 References:

- Carpenter, S. R., & Cottingham, K. L. (1997). Resilience and water quality. Ecology, 78(3), 899-904.
- Jin, X., Yang, Z., & Han, H. (2019). A review on predicting algal blooms in freshwater lakes using satellite remote sensing.

Environmental Science and Pollution Research, 26(19), 19513- 19530.
• Cognos Analytics Documentation. IBM. [Link to official IBM Cognos documentation for technical reference and usage.]
• Ouyang, W., & Bartholic, J. (2009). Application of the Soil and Water Assessment Tool (SWAT) for water quality research: A review. Journal of Environmental Quality, 38(2), 515-523.

2.3 Problem Statement Definition:

The problem statement for "Aquatic Insights: Cognos-Powered Water Portability Analysis" centers on addressing several key challenges in water quality assessment and management:

- Fragmented data sources and inconsistent data hinder comprehensiveanalysis.
- Current methods lack predictive modeling for anticipating water qualitytrends.
- Inadequate accessibility and user-friendliness limit information dissemination.
- Collaboration among experts and stakeholders needs improvement.
- Mobile accessibility for on-the-go access is lacking.
- Data security and privacy concerns pose risks.
- Public awareness and education about water quality are oftenинsufficient.
- Regulatory compliance gaps and legal issues may arise.
- Environmental conditions change, requiring continuous updates.

The project aims to resolve these issues by creating a user-friendly, data-driven platform for understanding and managing water quality and portability in aquatic ecosystems.

3. IDEATION & PROPOSED SOLUTION

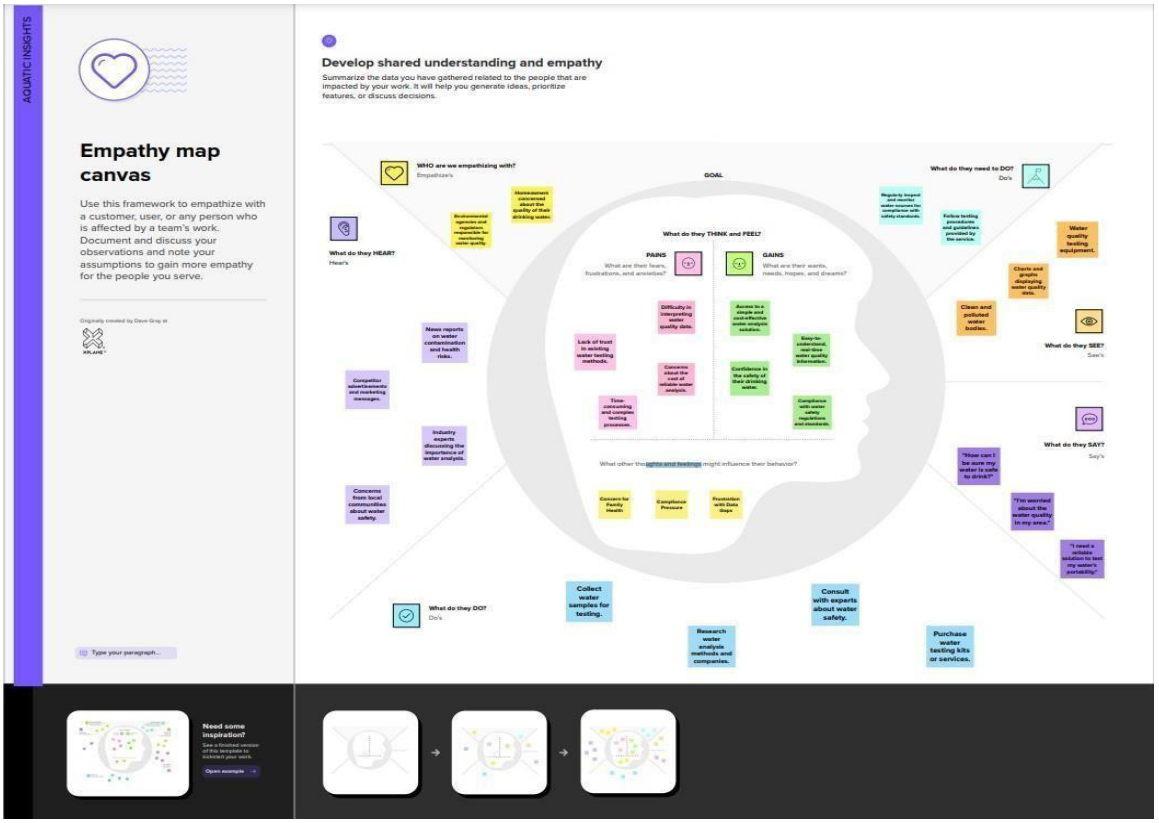
3.1 Empathy Map Canvas:

An empathy map is a straightforward, simple-to-understand graphic that conveys information about the attitudes and behaviors of users.

It's a helpful tool for teams to have a deeper understanding of their users.

Knowing the real issue and the individual suffering it is necessary to develop a workable solution. Participants learn to think about situations from the user's perspective, including goals and problems, through the exercise of constructing the map.

Example:

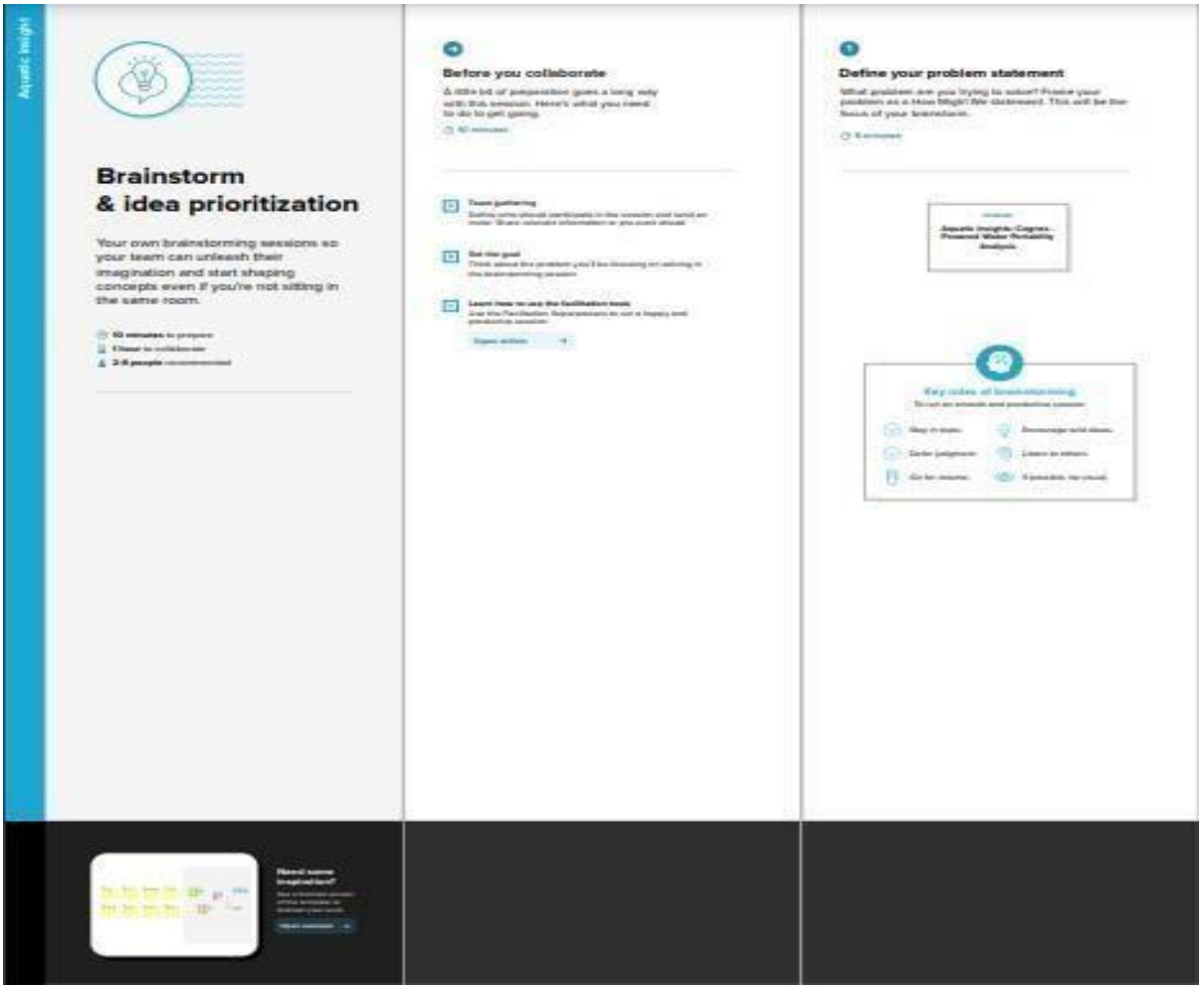


3.2 Ideation & Brainstorming:

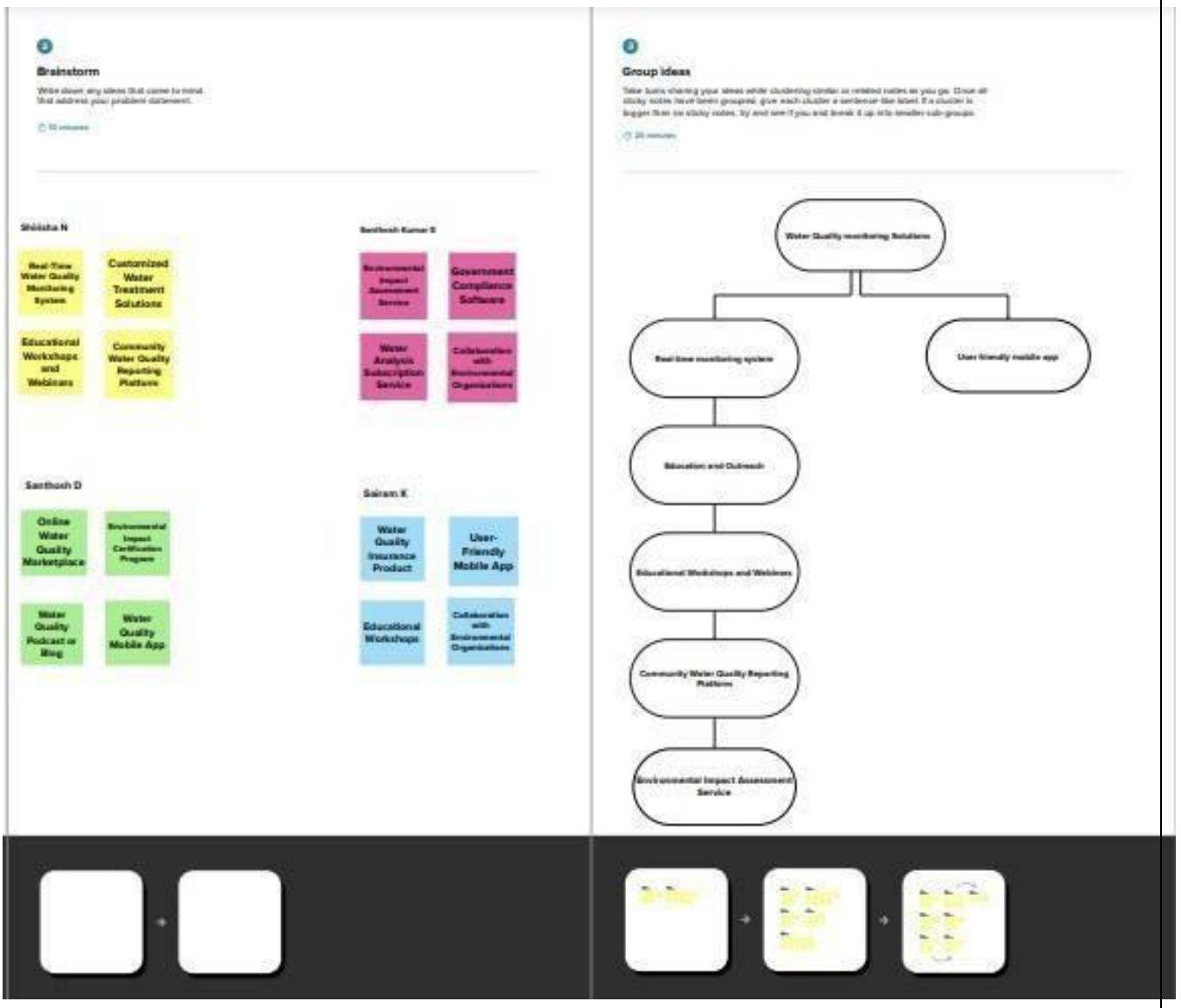
The open, unrestricted environment that brainstorming creates makes it easier for team members to engage in the creative thought process that results in problem solving. Volume is valued more than quality, unconventional ideas are welcomed and expanded upon, and cooperation is encouraged among all participants in order to foster a wealth of creative solutions.

If your team isn't in the same room as you, use this template to let them shape concepts and let their imaginations run wild during brainstorming sessions.

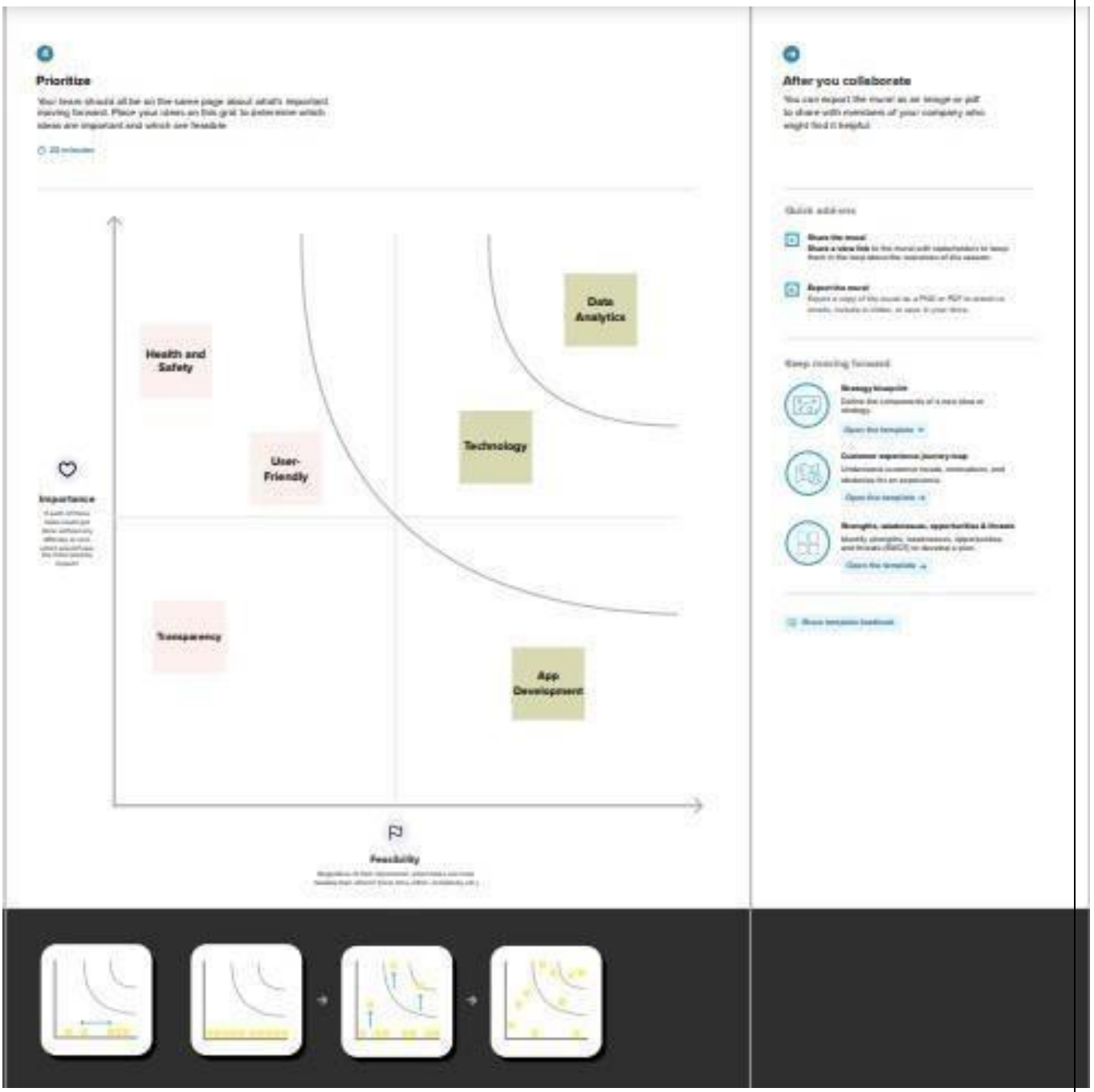
Step-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



Step-3: Idea Prioritization



4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

The functional requirements for "Aquatic Insights: Cognos-Powered Water Portability Analysis" outline the specific features and capabilities the project's platform should possess. These requirements include:

- Data integration and management from various sources.
- Data standardization for consistency.
- Analytics and predictive modeling for water quality assessment.
- Interactive dashboards for data visualization.
- User profiles and access control.
- Development of a mobile application.
- Collaboration tools for experts.
- Strong data privacy and security measures.
- Reporting and alerts for critical events.
- Public engagement and education features.
- Continuous platform improvement.
- Regulatory compliance.
- Scalability and performance for handling large data volumes and users.

These requirements serve as the basis for creating a comprehensive and user-friendly platform for analyzing and managing water quality and portability in aquatic ecosystems.

4.2 Non-Functional requirements:

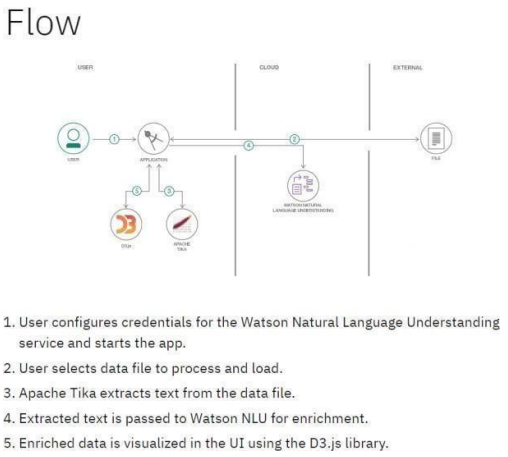
The non-functional requirements for "Aquatic Insights: Cognos-Powered Water Portability Analysis" outline the performance, reliability, usability, security, and compliance standards that the platform should meet. Key points include:

- 4.2.1 Fast performance and scalability to handle growth.
- 4.2.2 High reliability and data protection mechanisms.
- 4.2.3 Intuitive user interface and accessibility for all users.
- 4.2.4 Robust security and data privacy measures.
- 4.2.5 Interoperability with other systems.
- 4.2.6 Easy maintenance and regular updates.
- 4.2.7 Compliance with regulations and standards.
- 4.2.8 Load handling during peak events.
- 4.2.9 Data archiving and user support.

These non-functional requirements ensure the platform's effectiveness, user experience, and adherence to legal and environmental standards.

5. PROJECT DESIGN

5.1 Data Flow Diagrams & User Stories:

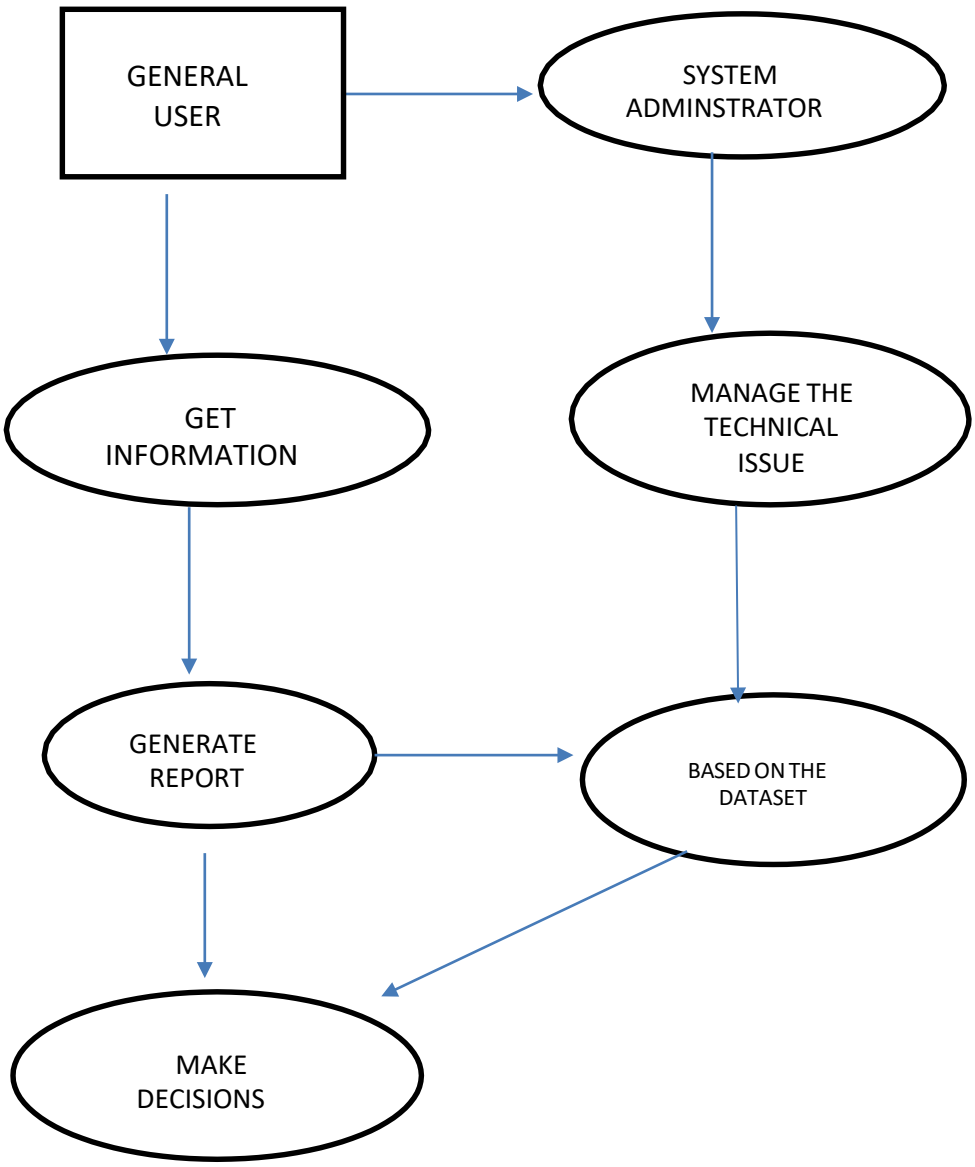


A classic visual depiction of the information flows inside a system is a data flow diagram (DFD).

The correct amount of the system need can be graphically represented in a clean and unambiguous DFD. It displays where data is stored, how data enters and exits the system, and what modifies the information.

Physical diagrams show you the practical process of moving information through a system. It can show how your system's specific software, hardware, files, employees, and customers influence the flow of information.

Flow diagram:



User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
PUBLIC	check water quality information for their area	USN-1	Public users can access the system to check the quality of water in their area. They can view real-time water quality information, including portability status.	I can access my account / dashboard	o/1	
		USN-2	Public users may set preferences to receive real-time alerts and notifications about water quality issues, such as water contamination or safety concerns.		0/1	
		USN-3	They can access historical water quality data to track changes and trends in water quality over time		0/1	
	Dashboard					
System Administrator			Infrastructure Management: Systemadministrators are responsible for managing the technical infrastructure, including servers, databases, and software updates. They ensure that the system is running smoothly and efficiently.			

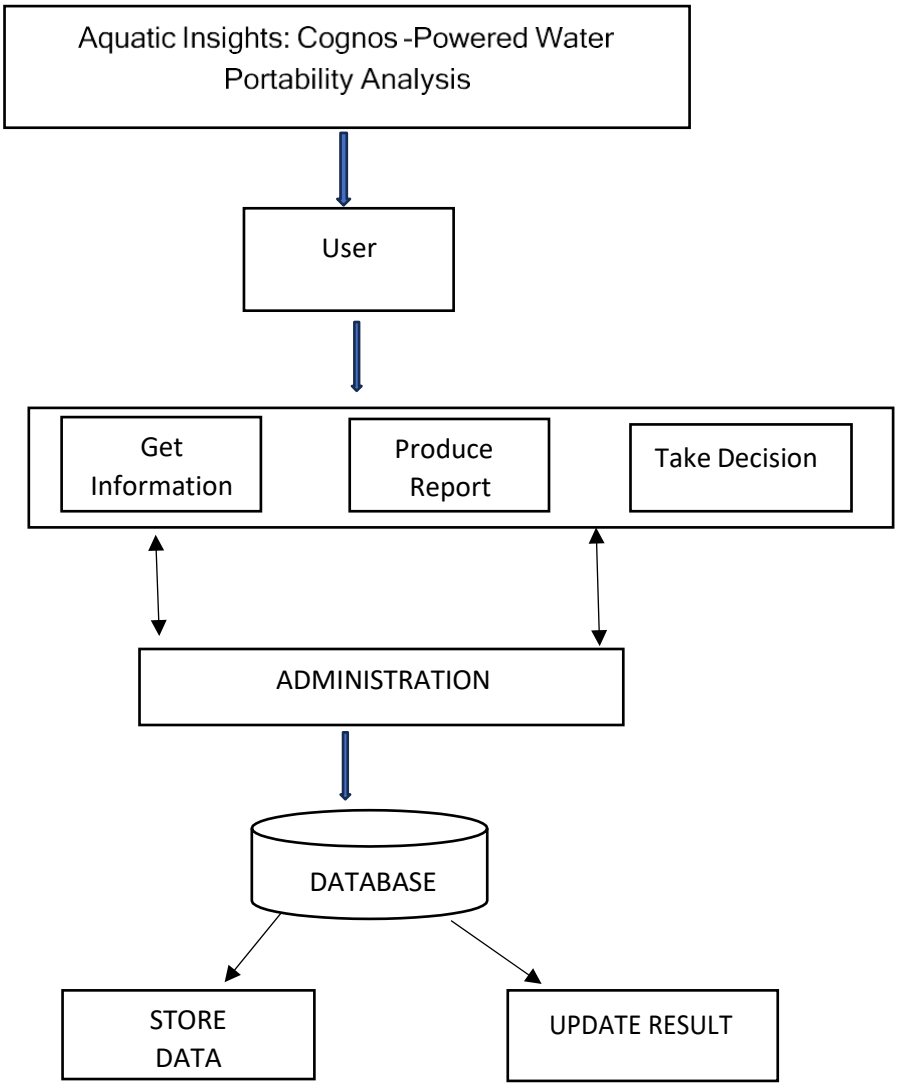
5.2 Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and otheraspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined,managed and delivered.

In solution architecture, the client needs are expanded to business needs that in one way or another are related to technology. These needs usually crystallize through re-assessing existing systems and finding out how they benefit or harm the organization in the long run. Sometimes, these evaluations are run by business analysts who also provide a definition of the problem. In the next step, solution architects take this problem and start crafting a description of solutions that appropriately address this need.

Example - Solution Architecture Diagram**:**

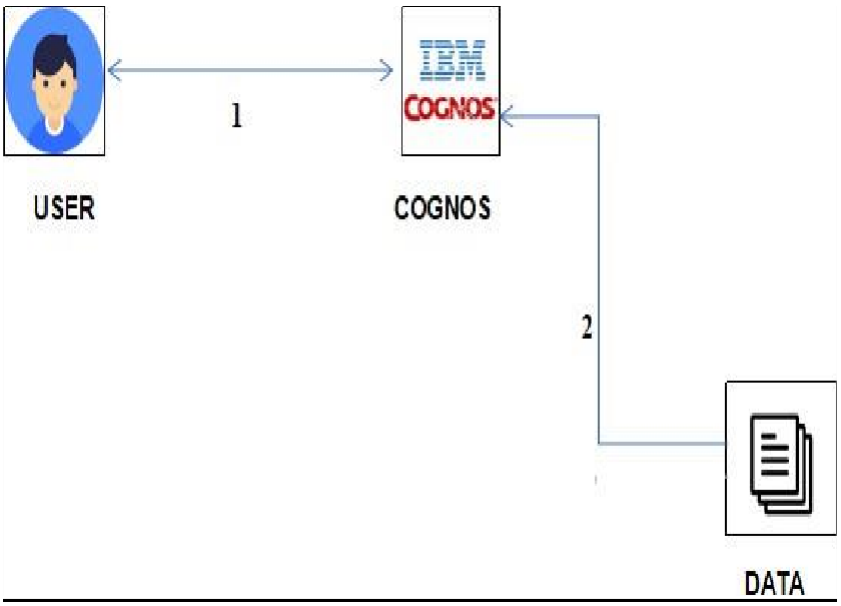


6. PROJECT PLANNING & SCHEDULING

6.1 Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Reference: https://www.kaggle.com/code/khsamaha/potable-water-prediction-0-798- with-caret-rf-r/input



- **Components & Technologies:**

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbotetc.	HTML, CSS, JavaScript / Angular Js / ReactJs etc.
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Cognos Analytics
4.	Application Logic-3	Logic for a process in the application	IBM Cognos Analytics
5.	Database	Data Type, Configurations etc.	Excel

6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

6.2 Sprint Planning & Estimation:

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	
Sprint -1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	
Sprint -2		USN-3	As a user, I can register for the application through SmartInternz	2	Low	
Sprint -1		USN-4	As a user, I can register for the application through smartInternz provided email id.	2	Medium	
Sprint -1	Login	USN-5	As a user, I can log into the applicationby entering email & password	1	High	
	Dashboard					

6.3 Sprint Delivery Schedule:

Sprint	Total StoryPoints	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint ReleaseDate (Actual)
Sprint-1	20	1 Days	16 Oct 2023	16 Oct 2023	16 Oct 2023	16 Oct 2023
Sprint-2	20	1 Days	17 Oct 2023	17 Oct 2023	17 Oct 2023	17 Oct 2023
Sprint-3	20	1 Days	18 Oct 2023	18 Oct 2023	18 Oct 2023	18 Oct 2023
Sprint-4	20	1 Days	19 Oct 2023	19 Oct 2023	19 Oct 2023	19 Oct 2023

7. CODING & SOLUTIONING

7.1 Feature 1:

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=<device-width>, initial-scale=1.0">
<title>NM - Data Analytics</title>
</head>
<body>
<style>
body{
font-style: Arial;
}
h1{
text-align: center;
}
p{
margin-left: 20px;
}
</style>
<h1>AQUATIC INSIGHTS: COGNOS -POWERED WATER PORTABILITY ANALYSIS</h1><br>
<br>
<p>Here is the data analyst regarding the water analysis. We are analysed with the different datas like
Ph values , Hardness , TDS , Chloramines , Sulfate , Conductivity , Organic carbon , Trihalomethanes ,
Turbidity , Potability of  the water samples.</p><br><br><br>
<iframe
rc="https://us3.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.public_folders%2FProject
%2FStory%2Bof%2BWater%2Bpotability&amp;closeWindowOnLastView=true&amp;ui_appbar
=false&am;ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;sceneId=
model0000018b4795eed0_00000000&amp;sceneTime=3350" width="800" height="800"
frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

<h3 style="text-align: center;">STORY BOARD</h3>
<p>Our Analysis are Seperate the Samples as Portable and Non Portable , Average Sulphate content of
portable and non portable , Summerizing cloramines taking their average , Summerizing Organic – Carbon
content taking their average , Average Organic- Corbon content of portable and non-portable water
Chloramines
by Conductivity (Group) colored by Potability and ph by Hardness (Group) colored by Potability. </p>

<iframesrc="https://us3.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.public_folders
%2FProject%2FStory%2Bof%2BWater%2Bpotability&amp;closeWindowOnLastView=true&amp;
ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;
sceneId=model0000018b4795eed0_00000000&amp;sceneTime=3350" width="800" height="800"
frameborder="0" gesture="media" allow=
"encrypted-media" allowfullscreen=""></iframe>
</body>
</html>
```

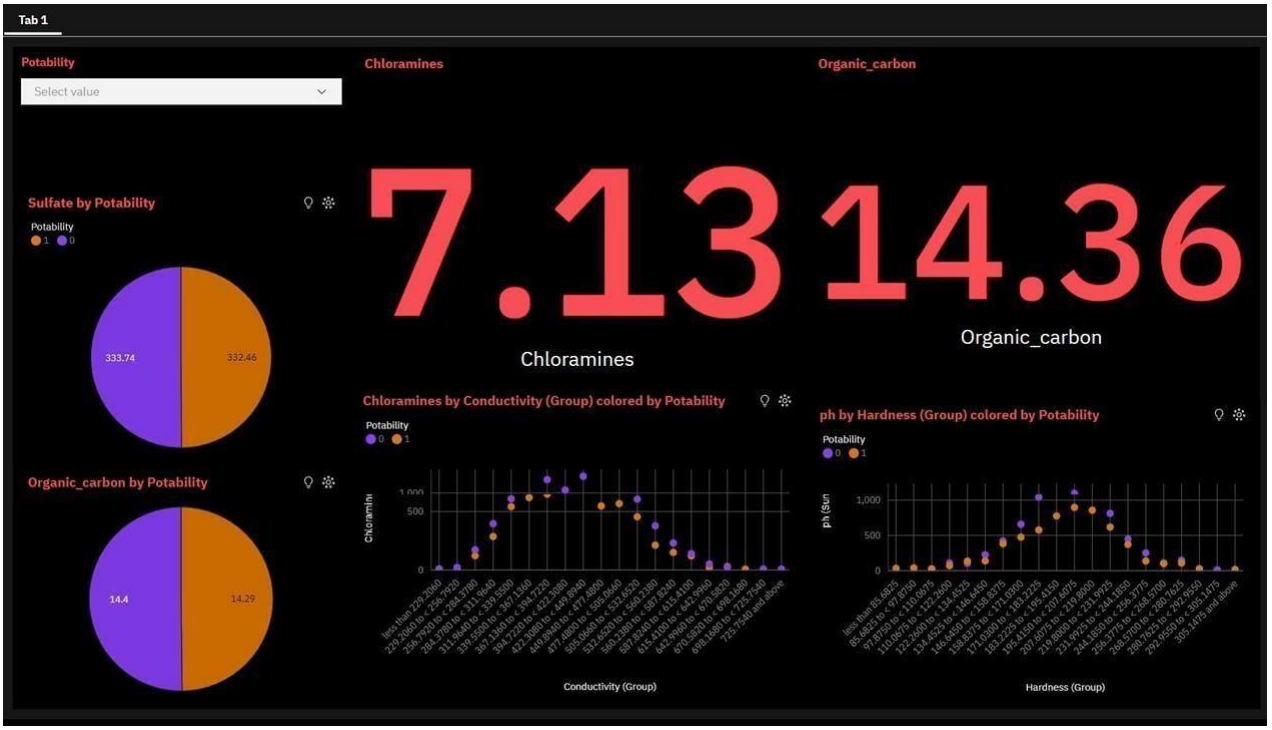
8. PERFORMANCE TESTING

8.1 Performance Metrics:

S.No.	Parameter	Screenshot / Values
1.	Dashboard design	No of Visualizations / Graphs – We have include 4 tabs
2.	Data Responsiveness	The system's ability to efficiently analyze these indicators and provide real-time predictions, ensuring the availability of safe drinking water in regions facing a crisis
3.	Amount Data to Rendered (DB2 Metrics)	The global drinking water crisis by ensuring the availability of safe and potable water in regions facing water quality concerns
4.	Utilization of Data Filters	Employed to narrow down the dataset and focus the analysis such as assess water quality
5.	Effective User Story	No of Scene Added - 4
6.	Descriptive Reports	No of list / Graphs – 1

9. RESULTS

9.1 Output Screenshots:



10. ADVANTAGES & DISADVANTAGES

Advantages:

The project "Aquatic Insights: Cognos-Powered Water Portability Analysis" offers a range of advantages:

- Comprehensive water quality assessment with predictive capabilities.
- User-friendly interface accessible to experts and the public.
- Data integration for a complete view of water quality.
- Facilitation of collaboration and knowledge sharing.
- Promotion of public awareness and regulatory compliance.
- Robust data security and continuous improvements.
- Resource efficiency and environmental sustainability.
- Data-driven decision-making for policymakers and researchers.
- Customization and scalability for future growth.
- Real-time monitoring and international collaboration.

These advantages collectively contribute to improved water qualitymanagement and sustainable ecosystems.

Disadvantages:

The project "Aquatic Insights: Cognos-Powered Water Portability Analysis" comes with several potential disadvantages and challenges:

- Handling complex and diverse data sources.
- Data availability limitations in remote or less-studied areas.
- Technical barriers for some users with limited skills.
- Ongoing maintenance and software update costs.
- Stringent data privacy and security requirements.
- Regulatory compliance complexities.
- Resource-intensive computational and human requirements.
- High initial implementation costs.
- Sustaining user engagement and public awareness.
- Ensuring data consistency across various sources.
- Adaptation to changing environmental conditions.
- Potential public resistance to sharing data.
- Mobile application compatibility challenges.
- Scalability concerns as the project grows.
- Effective communication with diverse stakeholders.

Mitigating these challenges will be vital for the project's success and its ability to deliver comprehensive water quality insights.

11. CONCLUSION

To sum up, "Aquatic Insights: Cognos-Powered Water Portability Analysis" offers a viable way to deal with issues related to managing and assessing water quality.
The project provides important insights into aquatic ecosystems by utilizing modern data analytics, user-friendly interfaces, and collaboration tools.

It provides benefits like enhanced evaluation of water quality and knowledgeable decision-making, supporting environmental sustainability.

The project's objectives are reachable with proper planning and commitment, even in the face of possible obstacles like data complexity and privacy issues.
"Aquatic Insights" may prove to be a useful tool for a range of stakeholders, acting as a spur for improvements in the management of aquatic ecosystems. The project represents a viable route for maintaining natural water supplies and managing water quality sustainably.

12. FUTURE SCOPE

The future scope for "Aquatic Insights: Cognos-Powered Water Portability Analysis" is expansive and promising. It includes:

- Incorporating advanced data sources, AI, and IoT for more comprehensive and real-time water quality analysis.
- Implementing blockchain for enhanced data security and transparency.
- Facilitating global collaboration and data sharing.
- Developing educational resources and influencing water quality policies.
- Addressing climate change and ecosystem health, and expanding the project's focus to include flood monitoring and environmental equity.77
- Promoting sustainable practices and contributing to open data initiatives.

The project has the potential to become a comprehensive and collaborative platform, empowering stakeholders to better understand and manage aquatic ecosystems in an increasingly complex world.

13. APPENDIX

13.1 Source Code:

Index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=<device-width>, initial-scale=1.0">
  <title>NM - Data Analytics</title>
  </head>
  <body>
  <style>
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  Hardness , TDS , Chloramines , Sulfate , Conductivity , Organic carbon , Trihalomethanes , Turbidity ,
  Potability of
  the water samples.</p><br><br><br>

  <iframe src="https://us3.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.public_folders%2
  FProject%2FStory%2Bof%2BWater%2Bpotability&amp;closeWindowOnLastView=true&amp;ui_
  appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;sceneId=
  model0000018b4795eed0_00000000&amp;sceneTime=3350" width="800" height="800" frameborder="0"
  gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>

  <h3 style="text-align: center;">STORY BOARD</h3>
  <p>Our Analysis are Seperate the Samples as Portable and Non Portable , Average Sulphate content of
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  Chloramines by Conductivity (Group) colored by Potability and ph by Hardness (Group) colored by
  Potability. </p>

  <iframe src="https://us3.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.public_folders%2
  FProject%2FStory%2Bof%2BWater%2Bpotability&amp;closeWindowOnLastView=true&amp;ui_appbar
  =false&amp;ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;sceneId=
  model0000018b4795eed0_00000000&amp;sceneTime=3350" width="800" height="800" frameborder="0"
  gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>
  </body>
  </html>
```

App.py

```
from flask import Flask, render_template
app = Flask(_name_)
@app.route("/")
def index():
   return render_template("index.html")if
name_____=="_main_":
   app.run()
```

Github link:

https://github.com/Aswin-Krishna/Naan-Mudhalvan

Project Demo Link:

https://drive.google.com/file/d/1SuXiSDvhplIXQzoNG1XVsLDyKvI2zmw1/view?usp=sharing