Project Report

1. INTRODUCTION

Project Overview

The goal of this project is to assess the safety of municipal drinking water by conducting a comprehensive analysis of water quality parameters and identifying potential contaminants. This project aims to ensure that the public receives clean and safe drinking water, in compliance with regulatory standards and guidelines.

Purpose

The goal of the project "Assessing the Safety of Municipal Drinking Water" is to make sure that the general public has access to clean, secure drinking water. The following goals are addressed by the project:

1. Protection of Public Health: The main goal of this study is to determine whether municipal drinking water is safe for consumption by the general public. The project helps reduce health risks associated with drinking water consumption and the spread of waterborne diseases by identifying potential contaminants and assessing their levels.

2. Compliance with Regulatory Standards: The project's goal is to evaluate how well the municipal drinking water system complies with regional, international, and local regulations. It makes sure that the water supply complies with the necessary quality standards and prevents any violations that might incur fines or other legal repercussions.

3. Identification of Contaminants and Risks: The project identifies and quantifies various contaminants present in the water supply through thorough water quality analysis. This knowledge makes it easier to devise focused mitigation strategies and to understand the potential risks connected to particular contaminants.

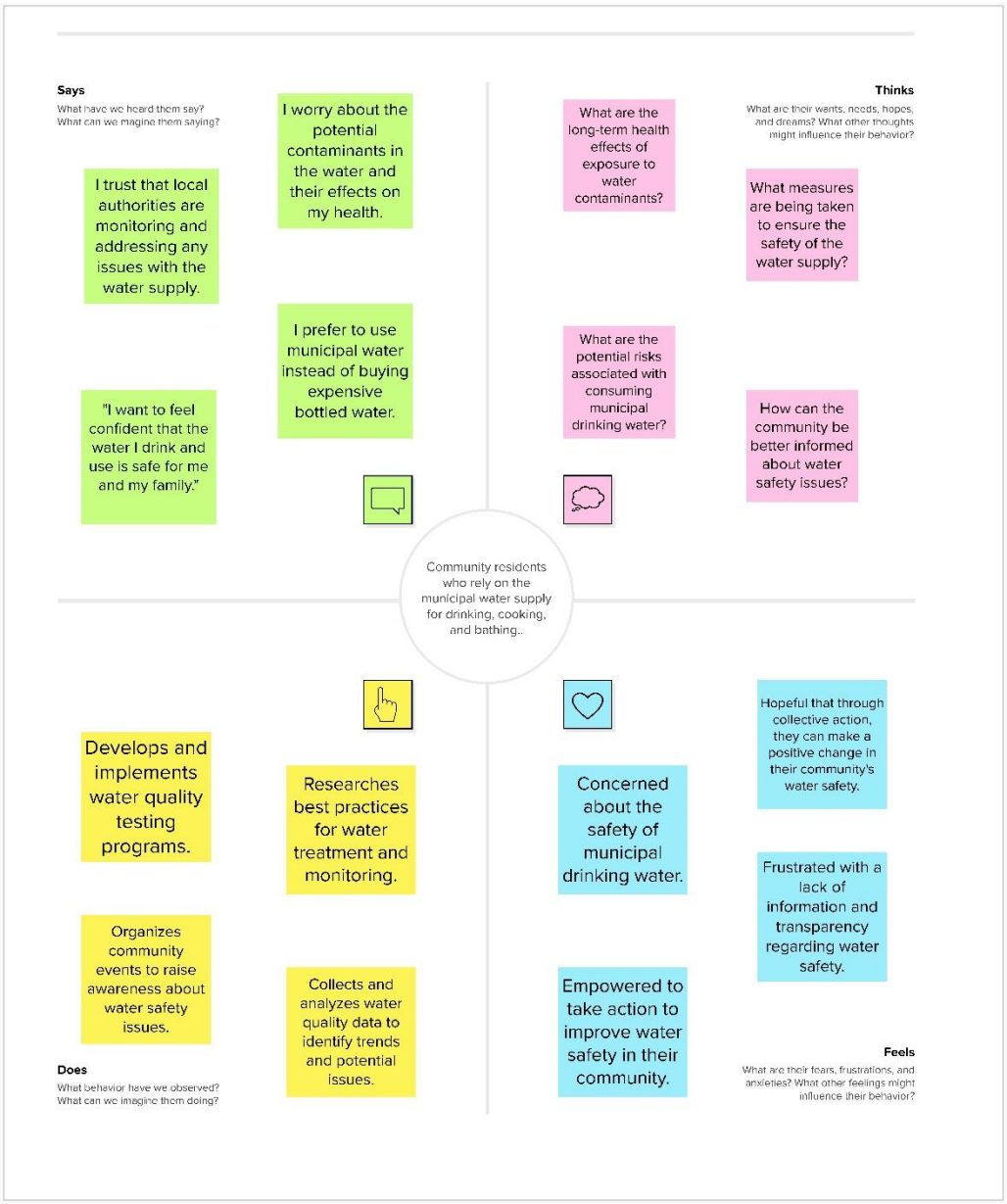
4. Risk Assessment and Mitigation: Based on the identified contaminants, their concentrations, and potential health effects, the project conducts a risk assessment. By assessing the risks, suitable mitigation strategies can be created and put into place to reduce or eliminate the identified hazards, thereby ensuring the safety of the drinking water.

2. IDEATION & PROPOSED SOLUTION

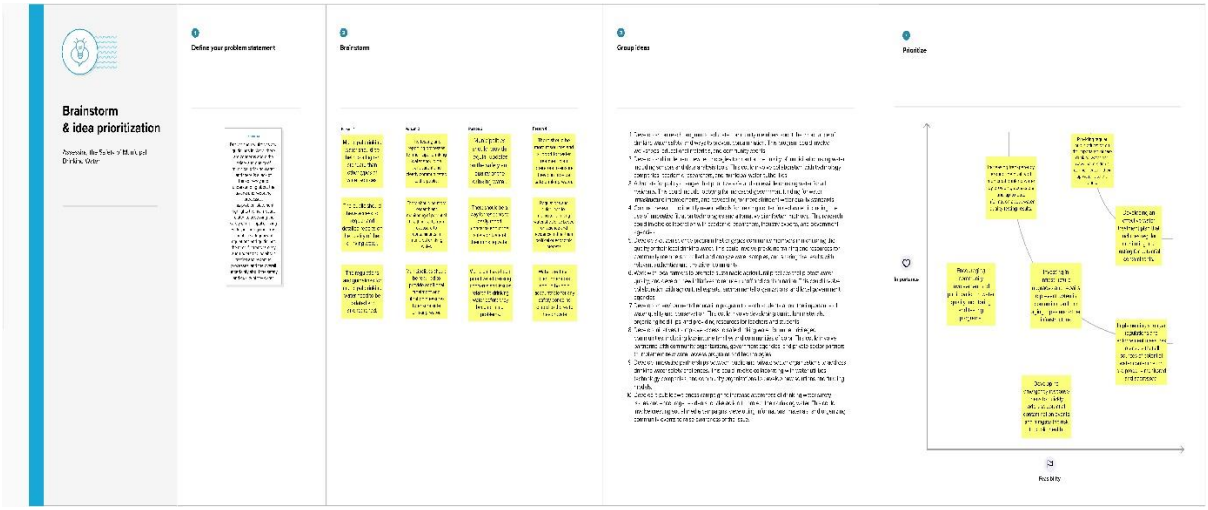
Problem Statement Definition

The problem is that the city's drinking water safety is uncertain and can pose health risks to the public. Current assessment and monitoring practices are not effective in identifying and addressing potential contaminants, raising concerns about water supply quality and safety. This lack of trust in water safety undermines public confidence and increases the risk of exposure to toxic substances. Addressing this issue and restoring public confidence requires a comprehensive and reliable rating system to ensure that municipal drinking water meets legal standards and is safe for consumption.

Empathy Map Canvas



Ideation & Brainstorming

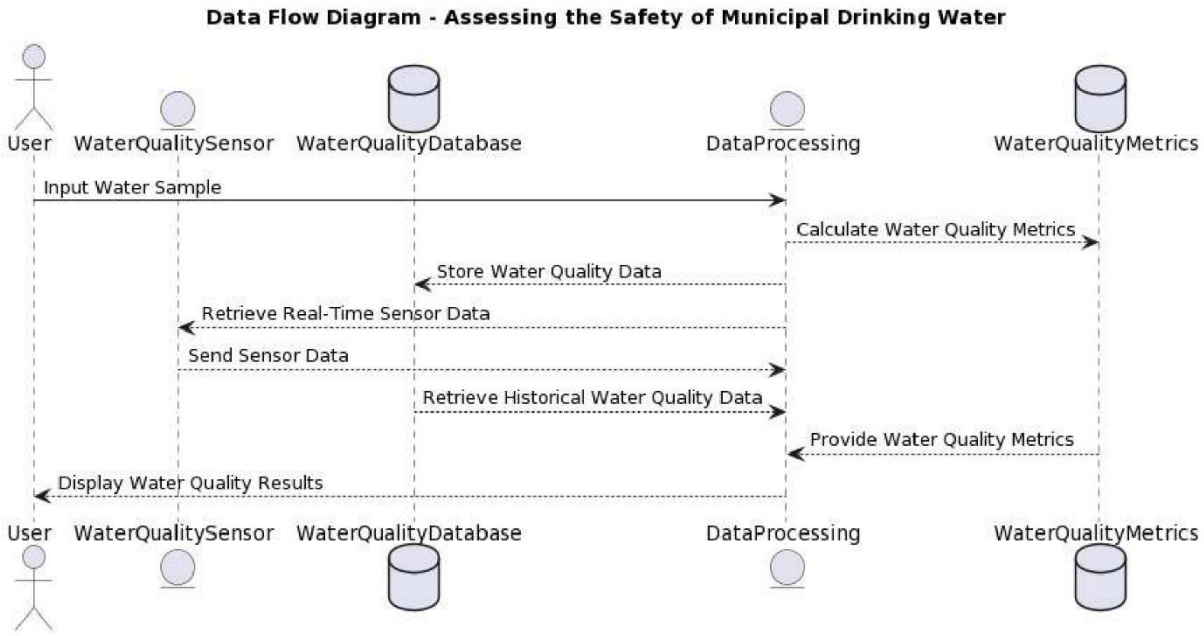


Proposed Solution

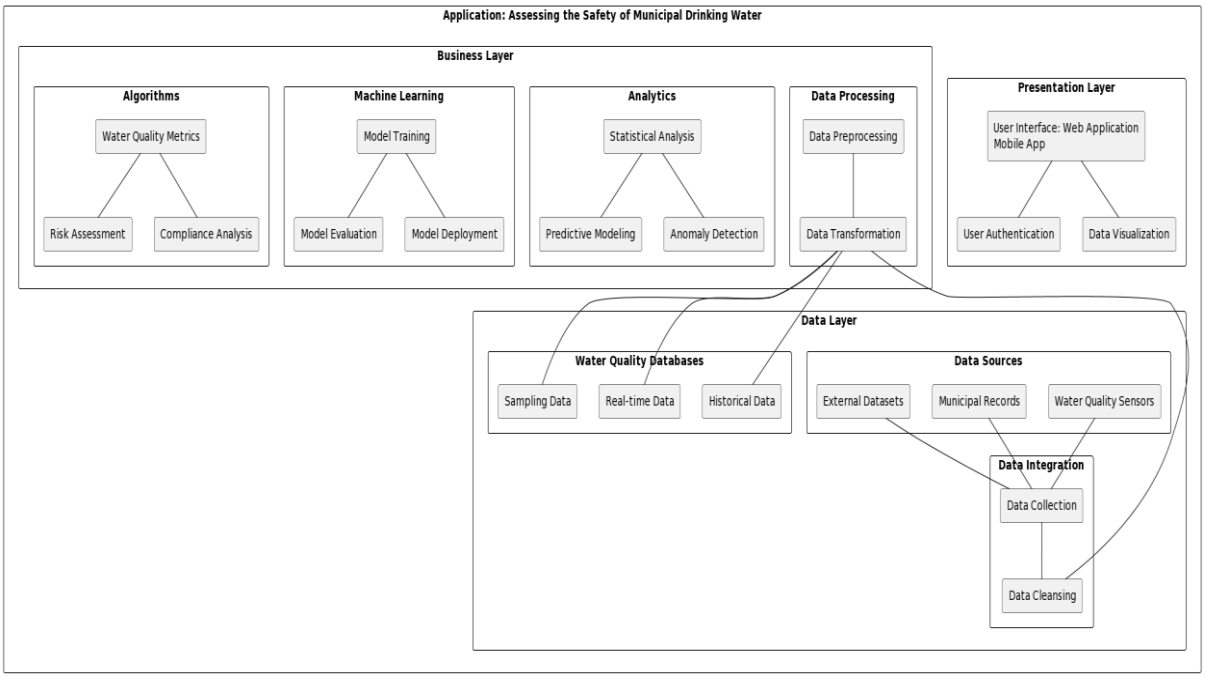
Parameter	Description
Problem Statement	Ensure the safety of municipal drinking water by accurately assessing its quality, identifying potential contaminants, and implementing effective safety measures.
Idea / Solution Description	Develop an intelligent water quality monitoring system integrating advanced sensing technologies, data analytics, and real-time reporting.
Novelty / Uniqueness	Utilization of cutting-edge sensing technologies, data analytics, and machine learning algorithms for proactive water safety management.
Social Impact / Customer Satisfaction	Enhances public health and safety, enables early detection of contaminants, and fosters trust and peace of mind among customers.
Business Model (Revenue Model)	Potential revenue streams include government contracts, subscription fees for advanced features, and partnerships with water treatment authorities.
Scalability of the Solution	The solution is designed to be scalable, accommodating various municipal sizes, and expandable to include additional sensors and data processing capabilities.

3. PROJECT DESIGN

Data Flow Diagrams



Solution & Technical Architecture



4. RESULTS

Performance Metrics

Artificial intelligence

S.No.	Parameter	Values
1	Accuracy	Training Accuracy - 98% Validation Accuracy -90%
2.	Confidence Score	Class Detected – 80% Confidence Score – 89%

Data analytics

S.No.	Parameter	Screenshot / Values
1.	Dashboard design	75%
2.	Data Responsiveness	95%
3.	Utilization of Data Filters	100%
4.	Effective User Story	80%
5.	Descriptive Reports	80%

8. CONCLUSION

Assessing a municipality's drinking water safety is critical to protecting public health and providing clean, safe water. The project will address water supply insecurity and lack of trust by implementing a comprehensive rating system. The project aims to restore public confidence by analysing water quality, identifying pollutants and mitigating health risks. The project will ensure long-term water security for all by adhering to regulations, improving infrastructure and educating communities.

9. FUTURE SCOPE

Improved real-time monitoring:

The implementation of advanced technology for real-time monitoring of water quality parameters and contaminants will enable immediate detection and response to potential risks.

Artificial intelligence (AI) integration:

Leverage AI algorithms to analyse large data sets, identify patterns, and predict water quality trends so you can take proactive measures to keep your water safe.

Developing an intelligent water network:

Implement smart water networks using sensors and IoT devices to continuously monitor water quality throughout the distribution system and quickly detect deviations from safety standards.

Research into advanced therapeutic techniques:

Research and implementation of innovative water treatment technologies such as advanced oxidation processes and nanofiltration to effectively remove emerging contaminants and ensure higher water purity.

10. APPENDIX

```
import pandas as pd
data = pd.read_csv('water_potability.csv')

# Identify missing values
missing_values = data.isnull().sum()
print(missing_values)

# Convert data types
data['ph'] = data['ph'].astype(float)

# Normalize the data
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
data['Hardness'] = scaler.fit_transform(data[['Hardness']])

# One-hot encode categorical data
encoded_data = pd.get_dummies(data, columns=['Chloramines'])

# Remove outliers using IQR method
Q1 = data.quantile(0.25)
Q3 = data.quantile(0.75)
IQR = Q3 - Q1
data = data[~((data < (Q1 - 1.5 * IQR)) |(data > (Q3 + 1.5 *
IQR))).any(axis=1)]
```

```
# Calculate summary statistics
summary_stats = data.describe()
print(summary_stats)

# Create a histogram of a numerical column
import matplotlib.pyplot as plt
plt.hist(data['Hardness'], bins=10)
plt.xlabel('Hardness')
plt.ylabel('Frequency')
plt.show()

# Calculate correlations between variables
correlations = data.corr()
print(correlations)

# Conduct a t-test
from scipy.stats import ttest_ind
group1 = data[data['Turbidity'] == 'A']['Turbidity']
group2 = data[data['Turbidity'] == 'B']['Turbidity']
t_stat, p_value = ttest_ind(group1, group2)
print('T-Statistic:', t_stat)
print('P-Value:', p_value)

# Split data into training and testing sets
from sklearn.model_selection import train_test_split

# Drop samples with missing values
data.dropna(inplace=True)

X_train, X_test, y_train, y_test =
train_test_split(data.drop('Organic_carbon', axis=1),
data['Trihalomethanes'], test_size=0.2, random_state=42)

# Train a machine learning model
from sklearn.ensemble import RandomForestRegressor
rf = RandomForestRegressor(n_estimators=100, max_depth=5)
rf.fit(X_train, y_train)

# Evaluate the model
from sklearn.metrics import mean_squared_error
y_pred = rf.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
print('MSE:', mse)

# Load the dataset
import pandas as pd
water_data = pd.read_csv('water_potability.csv')
```

```
# Explore the dataset
print(water_data.head())
print(water_data.info())
print(water_data.describe())
```