



EFFICIENT WATER QUALITY ANALYSIS USING MACHINE LEARNING

NALAIYATHIRAN PROJECT BASED LEARNING

on

**PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND
ENTREPRENEURSHIP**

A PROJECT REPORT

MAHESHWAR M	19106067
KRUTHIK RAJ P	19106062
RAMALINGAM G	19106092
RANJUL R	19106094

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Chapter-1

INTRODUCTION

1.1 Project Overview

The effects of water quality deterioration are far-reaching, impacting health, environment and infrastructure in a very adverse manner. Therefore, it is very crucial to devise novel approaches and methodologies for analyzing water quality and to forecast future water quality trends.

The basic idea of this research is to devise a comprehensive methodology that analyses and predicts water quality of particular regions with the help of certain water quality parameters.

1.2 Purpose

Natural water resources like groundwater and surface water have always been the cheapest and most widely available resources of fresh water. However, these resources are also most likely to become contaminated due to various factors including human, industrial and commercial activities as well as natural processes. In addition to that, poor sanitation infrastructure and lack of awareness also contributes immensely to drinking water contamination.

By proposing a model based on machine learning techniques to forecast the future trends in water quality of a specific area with the aid of existing water quality data, this project seeks to address this issue.

Chapter-2

LITERATURE SURVEY

2.1 Existing Problem

Several researchers have experienced many issues in predicting the quality of water and in devising some new methodologies to analyze and forecast the future trends in water quality. Some of the important research works in water quality evaluation and prediction are reviewed.

A simple method for the evaluation of river water quality based on the distance of a point to the interval in Jiaozuo River L. Hu, et al. [1], has based on Grey Relational Analysis (GRA). Best result was achieved by using GRA and its simple method with best operability and the physical significance.

Tirabassi [2] states that the Blackbox technique uses a mathematical model that is a known input and accurately predicts the output to describe the prediction of river water quality without chemical and physical parameters.

2.2 References

[1] L. Hu, C. Zhang, C. Hu, and G. Jiang, Use of grey system for assessment of drinking water quality: a case study of Jiaozuo city, China,

Advances in Grey Systems Research, Springer Berlin Heidelberg, pp. 469-478, 2010

[2] M. A. Tirabassi, A statistically based mathematical water quality model for a non estuarine river system¹ JAWRA Journal of the American Water Resources Association, Vol. 7, pp. 1221-1237, December 1971

2.3 Problem Statement Definition

Problem Statement	PS1
I am	Public
I'm trying to	Consume water for daily basis in day-to-day life
But	the quality of water is not standard to take it in daily action
Because	the water is been polluted by various factor such as industrial waste, chemical waste dumping, radioactive waste discharge, fertilizer run-off, rapid urban development and also by humans activity.
Which makes me feel	Uncomfortable, and unhealthy if I consumed it. Also it makes me guilty to be part in polluting the water.

Chapter 3

IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation and Brainstorming

1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

How might we predict or reduce the polluting agent in water and make it consumable?

2 Brainstorm

Write down any ideas that come to mind that address your problem statement.

15 minutes

Mareshwar M

No issue in Data Quality

Check water Quality parameter

Comparing the water quality index to WHO Standards

Introducing Artificial Neural Network

Variation in water pollution in urban and rural areas

Awareness to people about the problem

Using pipeline networks for data

Wireless sensors networks for water quality

Ramalingam G

Increase in water pollution, increase in water borne disease

Using traditional method called Time series analysis

Low cost system for every one's use

Hybrid approach by intergrating remote sensing

Continuous check in water quality

Approching based on Real Time data

Using Bayesian regularization for effective in prediction

No disposal of chemical in water

3 Group Ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence like 'what if a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.'

20 minutes

DATA

Approching based on Real Time data

No issue in Data Quality

Using pipeline networks for data

Low cost system for every one's use

PUBLIC

No disposal of chemical in water

Increase in water pollution, increase in water borne disease

Continuous check in water quality

WATER QUALITY

Check water Quality parameter

Comparing the water quality index to WHO Standards

Wireless sensors networks for water quality

ALGORITHM

Introducing Artificial Neural Network

Hybrid approach by intergrating remote sensing

Using Bayesian regularization for effective in prediction

Using traditional method called Time series analysis

AWARENESS

Awareness to people about the problem

Variation in water pollution in urban and rural areas

4 Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

Importance

Feasibility

Regardless of the importance, which note on this board is the most important?

3.3 Proposed Solution

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Water is considered as a vital resource that affects various aspects of human health and lives. The quality of water is a major concern for people living in urban areas and the water is also most likely to become contaminated due to various factors including human, industrial and commercial activities as well as natural processes. In addition to that, poor sanitation infrastructure and lack of awareness also contribute immensely to drinking water contamination.
2.	Idea/Solution description	It is not possible to check the quality of water manually every time. So an automatic real-time monitoring system is implemented based on machine learning technique to forecast the quality of water and to predict the health of water according to its quality parameter level.
3.	Novelty/Uniqueness	<ul style="list-style-type: none">● User Friendly● Determining the reuse and recycle of water

		<ul style="list-style-type: none"> ● Detecting Quality parametric values.
--	--	--

4.	Social Impact / Customer Satisfaction	Customer satisfaction is an important factor to consider in total quality management. In order to achieve this goal, it is important that this project is used by all groups of people in both rural and urban areas.
5.	Business Model (Revenue Model)	First the application is processed with real time data. Later it comes into the picture where everyone can see the networking, conducting various activity and testing to them.
6.	Scalability of the Solution	Helps in getting all required aspects regarding quality of water.

3.4 Problem Solution Fit

<p>1. CUSTOMER SEGMENT</p> <p>The person who wishes to know the quality of the water he uses. Someone who wants to identify the water quality based on the water quality index(WQI) and know it's usage purpose.</p>	<p>2. CUSTOMER CONSTRAINTS</p> <p>The customer thinks that water sample is required to identify it's purpose of usage. Identifying the water quality in laboratories may not be cost efficient which the common people could afford</p>	<p>3. TRIGGERS</p> <p>The curiosity to know the quality of the water which is used in the day to day life of the individual forces him to analyze it's quality.</p> <p>4. EMOTIONS: BEFORE/AFTER</p> <p>The customer is assured to know that the water he uses meets the water quality index standard.</p>
<p>5. BEHAVIOUR</p> <p>The customer searches for free web application which measures the water quality index and suggests ways in which the water can be used. The customer also want the process to be time and cost efficient.</p>	<p>6. CHANNELS of BEHAVIOUR</p> <p>ONLINE The customer make use of free applications available online to measure water quality.</p> <p>OFFLINE The customer try to analyse the water sample in their local laboratories.</p>	<p>7. PROBLEM ROOT CAUSE</p> <p>Water is a vital source for the existence of living organisms. Good quality water nourishes human health thereby ensuring safety from water borne diseases. Trying to know the quality of water used meets the standard suggested by World Health Organization is crucial. Therefore an application which calculates WQI and suggests the ways in which the water can be used assures the customer.</p>
<p>8. JOBS-TO-BE-DONE / PROBLEMS</p> <p>Calculating water quality index based on the user given parameters like pH, Conductivity, temperature, nitrate, and total coliform. Using the calculated WQI the purpose for which the water can be used is suggested to the user.</p>	<p>9. AVAILABLE SOLUTIONS</p> <p>The water can be tested for purity in labs which may be time consuming and required lot of manual work. Water sample is required to check it's quality. Few applications are available which helps the customer to calculate the water quality index.</p>	<p>10. YOUR SOLUTION</p> <p>Developing a web application and integrating it with a model built using machine learning algorithms based on dataset already available help to assist the user to know the purpose for which the water can be used.</p>

Chapter-4

REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement(Epic)	SubRequirement(Story/Sub-Task)
FR-1	UserRegistration	RegistrationthroughForm Registration through GmailRegistration
FR-2	UserConfirmation	ConfirmationviaEmail ConfirmationviaOTP
FR-3	Executiveadministration	Regulation of monitoring the water environment statusand regulatory compliance like pollution eventemergencymanagement, andit includestwo different functions:earlywarning/forecastmonitoring.
FR-4	Datahandling	Filecontainswaterqualitymetricsfordifferentwater bodies.
FR-5	Qualityanalysis	Analyze with the acquired information of the wateracrossvariouswaterquality indicatorlike (PH, Turbidity,TDS,Temperature)usingdifferentmodels.
FR-6	Modelprediction	Confirming based on water quality index and shows themachine learning prediction (Good, Partially Good,Poor)withthe percentageof presenceofvarious parameter.
FR-7	RemoteVisualization	Visualizationthroughchartsbasedonpresentandpast valuesof alltheparameterfor futureforecast.

FR-8	Notificationservices	Confirming through notification of water statuspredictionwith parameterpresencealongwith timestamp.
------	----------------------	---

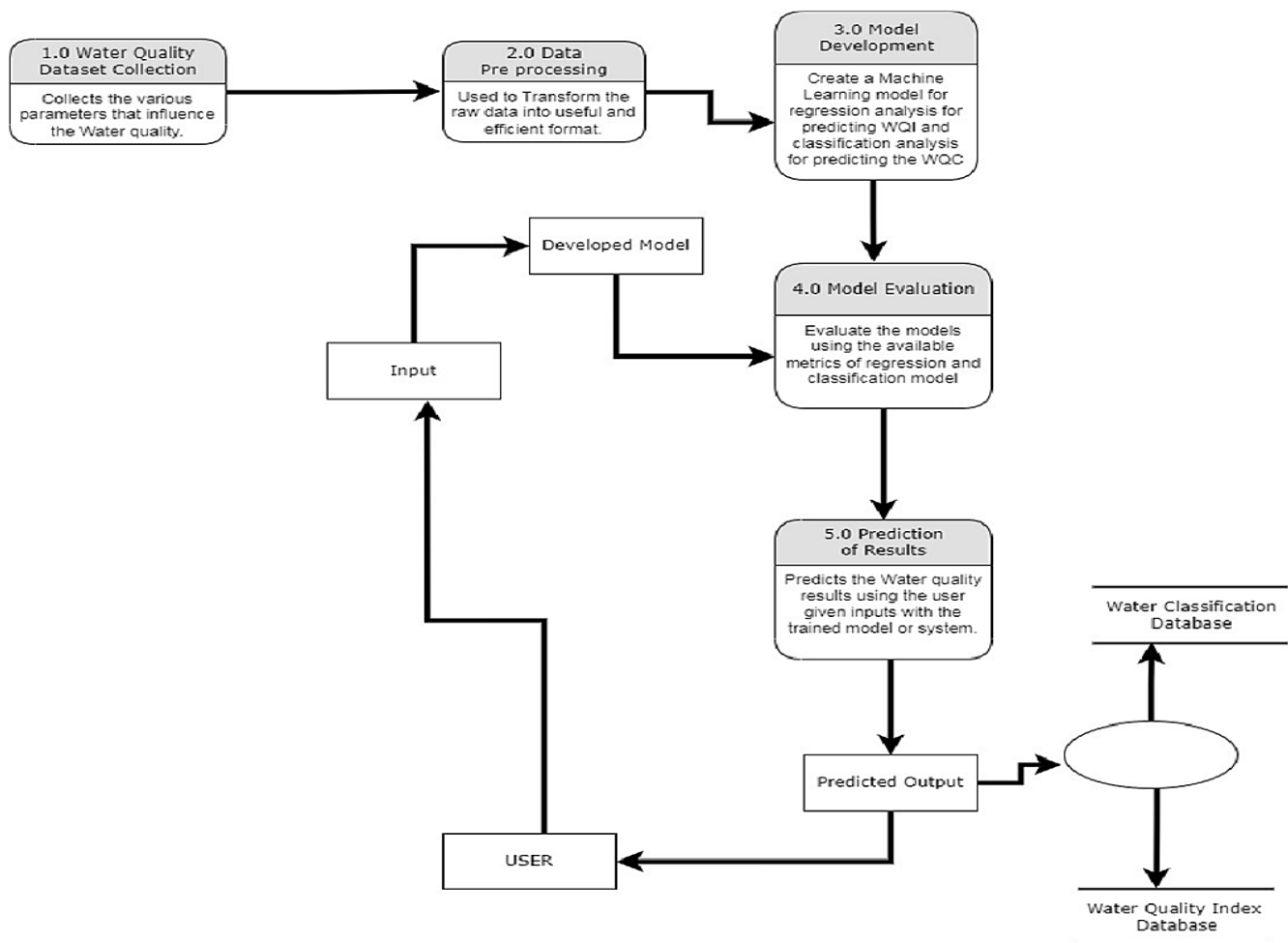
4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The system provides a natural interaction with the users. Accurate water quality prediction with short time analysis and provide prediction safe to drink or not using some parameters and provide a great significance for water environment protection.
NFR-2	Security	The model enables with the high security system as the user's data will not be shared to the other sources. The system is protected with the username and password throughout the process.
NFR-3	Reliability	The system is very reliable as it can last for a long period of time when it is well maintained. The model can be extended in large scale by increasing the datasets.
NFR-4	Performance	Our system should run on 32 bit (x86) or 64 bit (x64) Dual-core 2.66-GHz or faster processor. It should not exceed 2 GB RAM.
NFR-5	Availability	The system should be available for the duration of the user access the system until the user terminates the access. The system response to request of the user in less time and the recovery is done in less time.
NFR-6	Scalability	It provides an efficient outcome and has the ability to increase or decrease the performance of the system based on the datasets.

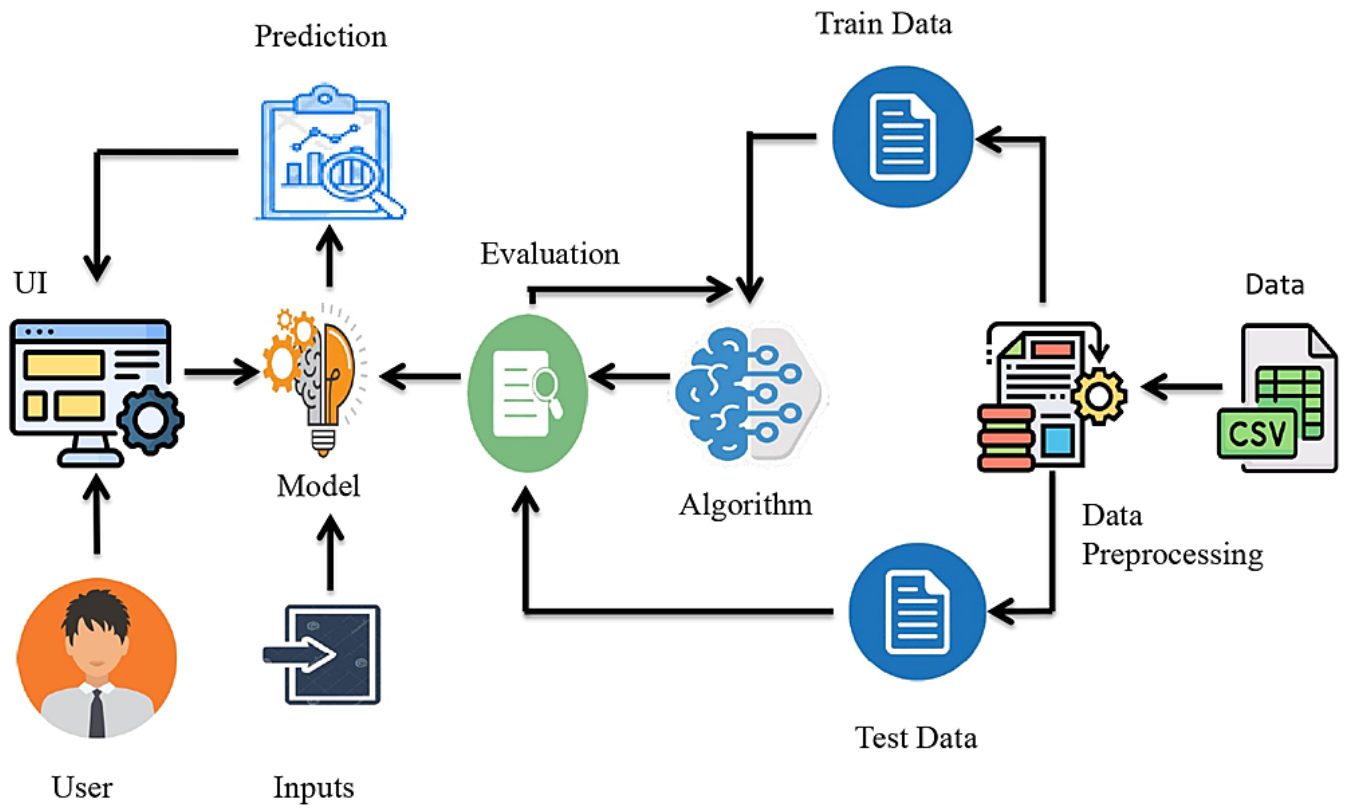
Chapter-5

PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories

UserType	Functional Requirement(Epic)	User Story Number	UserStory/Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can register for the application by entering my email,password, and confirming my password.	I can access my account/dash board.	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint -1
	Login	USN-3	As a user, I can login to the application by entering the registered email id & password	If the registered information matches the given information, accept the login and allow the user to access the functionality	High	Sprint -1

	Dashboard		If you want test the water quality of some samples you have to select "Test sample" option. If you want view the results of already	I can access my dashboard.	High	Sprint2
			predicted results click "Previous Results"option. If you want the purification technique to bere commended for your water sample,click "Check Purification Technique"option.			
WaterQualityTestingAgencies, Private &PublicLaboratories,Restaurantsand Hotels,People who Consume the Water to check the Quality.			Givetheaccesstodisplaytoviewthetesting page so as to give the water qualityparametric values to calculate the Water Quality Index.Give the access to view the Predicted Water Quality Index(WQI) value.	It provides an opportunity for the users to test their water samples.	High	Sprint2

Chapter-6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

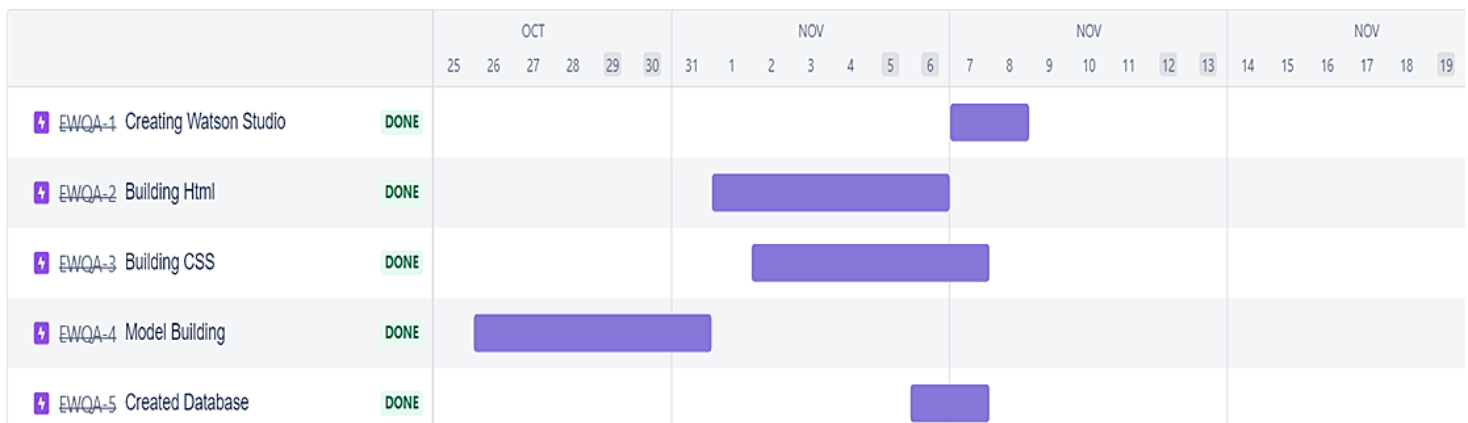
Sprint	Functional Requirement(Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Data Preparation	USN-1	Collecting water dataset and pre-processing it	20	High	Maheshwar M RamalingamG
Sprint-2	Model Building	USN-2	Creating ML model to predict water quality	5	Medium	Ranjul R KruthikrajP
Sprint-2	Model Evaluation	USN-3	Calculate the performance, error rate, and complexity of the ML model and evaluate the data set based on the parameter that the data set consists of.	5	Medium	Ranjul R KruthikrajP
Sprint-2	Model Deployment	USN-4	As a user, I need to deploy the model and need to find the results.	10	Medium	Ranjul R KruthikrajP

Sprint-3	Webpage (Form)	USN-5	As a user, I can use the application by entering the water data set to analyze or predict the results.	20	Medium	Maheshwar M Ramalingam G
Sprint-4	Dashboard	USN-6	As a user, I can predict the water quality by clicking the submit button and the application will show whether the water is efficient for use or not.	20	High	Ranjul R Kruthikraj P

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date	Story Points Completed	Sprint Release Date
Sprint-1	20	6Days	23Oct2022	28Oct2022	20	29Oct2022
Sprint-2	20	7Days	29Oct2022	04Nov2022	20	05Nov2022
Sprint-3	20	7Days	05Nov2022	11Nov2022	20	12Nov2022
Sprint-4	20	8Days	12Nov2022	19Nov2022	20	19Nov2022

6.3 Reports from JIRA



Chapter-7

CODING & SOLUTIONING

7.1 Feature 1

Predict Page:

```
<!DOCTYPE html>
<html>
<head>
<title>Efficient Water Quality Anaysis</title>
<link href="https://fonts.googleapis.com/css?family=Roboto:300,400,500,700" rel="stylesheet">
<link rel="stylesheet" href="https://use.fontawesome.com/releases/v5.5.0/css/all.css"
integrity="sha384-
B4dIYHKNBt8Bc12p+WXckhzcICo0wtJAoU8YZTY5qE0Id1GSseTk6S+L3BlXeVIU"
crossorigin="anonymous">
<link rel="stylesheet" href="css/style.css">
<style>
    html, body {
        min-height: 100%;
background-image:url(img/mahe.jpg);
background-size:cover;
        background-repeat: no-repeat;
    }
    body, div, form, input, select,textarea, p {
        padding: 0;
        margin: 0;
        outline: none;
```

```
font-family: Roboto, Arial, sans-serif;
font-size: 14px;

color: #666;
  line-height: 22px;
}
h1 {
  position: absolute;
  margin: 0;
  font-size: 32px;
  color: #fff;
  z-index: 2;
}
h5 {
  margin: 10px 0;
}
.testbox {
  display: flex;
  justify-content: center;
  align-items: center;

  height: inherit;
  padding: 100px;
  margin: 0% 20%;
}
form {
  width: 100%;
  padding: 20px;
  border-radius: 6px;
  background: #fff;
  box-shadow: 0 0 20px 0 #095484;
}
.banner {
```

```
position: relative;
height: 210px;
background-color: blue;
background-size: cover;
display: flex;
justify-content: center;
align-items: center;
text-align: center;
}
```

```
.banner::after {
  content: "";
  background-color: rgba(0, 0, 0, 0.5);
  position: absolute;
  width: 100%;
```

```
height: 100%;
```

```
}
```

```
input, select, textarea {
  margin-bottom: 10px;
  border: 1px solid #ccc;
  border-radius: 3px;
}
```

```
input {
  width: calc(100% - 10px);
  padding: 5px;
}
```

```
select {
  width: 100%;
  padding: 7px 0;
  background: transparent;
}
```

```
textarea {
  width: calc(100% - 12px);
```

```

padding: 5px;
}
.item:hover p, .item:hovert, .question:hover p, .question label:hover,

input:hover::placeholder, a {
    color: #095484;
}
.iteminput:hover, .item select:hover, .item textarea:hover {
    border: 1px solid transparent;
    box-shadow: 0 0 6px 0 #095484;
    color: #095484;
}
.item {
    position: relative;
    margin: 10px 0;
}
input[type="date"]::-webkit-inner-spin-button {
    display: none;
}
.itemi, input[type="date"]::-webkit-calendar-picker-indicator {
    position: absolute;
    font-size: 20px;
    color: #a9a9a9;
}
.itemi {
    right: 2%;

top: 30px;
    z-index: 1;
}
.question span {
    margin-left: 30px;

```

```

    }
span.required {
    margin-left: 0;
    color: red;
}
.btn-block {
    margin-top: 10px;
    text-align: center;
}
button {
    width: 150px;
    padding: 10px;
    border: none;
    border-radius: 5px;
    background: #095484;
    font-size: 16px;
    color: #fff;
    cursor: pointer;
}
button:hover {

background: #0666a3;
}
@media (min-width: 568px) {
.city-item {
    display: flex;
    flex-wrap: wrap;
    justify-content: space-between;
}
.city-item input {
    width: calc(50% - 20px);
}
.city-item select {

```

```
width: calc(50% - 8px);
}
}
</style>
</head>
<body>

<div class="textbox">
<form action="login" method="post">
<div class="banner">
<h1>Water Quality Analysis</h1>
</div>
<div class="item">
<p>Temperature</p>
<input type="text" name="temp" required/>
</div>
<div class="item">
<p>DO</p>
<input type="text" name="do" id="do" required/>
</div>
<div class="item">
<p>pH</p>
<input type="text" name="ph" id="ph" required/>
</div>
<div class="item">
<p>Conductivity</p>
<input type="text" name="co" id="co" required/>
</div>
<div class="item">
<p>BOD</p>
<input type="text" name="bod" id="bod" required/>
</div>
<div class="item">
```



```

<p>NI</p>
<input type="text" name="na" id="na" required/>

</div>

<div class="item">
<p>Fec_col</p>
<input type="text" name="Fec_col" required/>
</div>
<div class="item">
<p>Tot_col</p>
<input type="text" name="tc" id="tc" required/>
</div>
<div class="item">
<p>year</p>
<input type="text" name="year" id="year" required/>
</div>

<div><h2>{{showcase}}</h2></div>
<div class="btn-block">
<button type="submit" href="login" >SUBMIT</button>
</div>
</form>
</div>
</body>
</html>

```

7.2 Feature 2

CSS:

```
html {
scroll-behavior:smooth;
}
body,
html {
margin: 0;
padding: 0;
background-image:url(../img/mahe.jpg);
background-size:cover;
font-family: 'Poppins',sans-serif;
}
* {
box-sizing: border-box;
}
.d-grid {
display: grid;
}
.d-flex {
display: flex;
display: -webkit-flex;
}
.text-center{
text-align: center;
}
.text-left{
text-align: left;
}
.text-right {
text-align:right;
}
button,
input,
select{
-webkit-appearance: none;
```

```
outline: none;
font-family: 'Poppins',sans-serif;
}
button,
.btn,
select {
cursor: pointer;
}
a {
text-decoration: none;
}
img {
max-width: 100%;
}
ul {
margin: 0;
padding: 0
}
h1,
h2,
h3,
h4,
h5,
h6,
p {
margin: 0;
padding: 0
}
p {
color: #666;
font-size: 16px;
line-height: 25px;
opacity: .6;
}
```

```
.p-relative {  
position:relative;  
}  
.p-absolute {  
position: absolute;  
}  
.p-fixed {  
position: fixed;  
}  
.p-sticky {  
position:sticky;  
}  
.btn,  
button,  
.actionbg,  
input {  
border-radius: 4px;  
-webkit-border-radius: 4px;  
-moz-border-radius: 4px;  
-o-border-radius: 4px;  
-ms-border-radius: 4px;  
}  
.btn:hover,  
button:hover{  
transition: 0.5s ease;  
-webkit-transition: 0.5s ease;  
-o-transition: 0.5s ease;  
-ms-transition: 0.5s ease;  
-moz-transition: 0.5s ease;  
}  
/*-- wrapper start--*/  
.wrapper {  
width: 100%;  
padding-right: 15px;
```

```
padding-left: 15px;
margin-right: auto;
margin-left: auto;
}
@media (min-width: 576px) {
.wrapper{
max-width: 540px;
}
}
@media (min-width: 768px) {
.wrapper{
max-width: 720px;
}
}
@media (min-width: 992px) {
.wrapper{
max-width: 960px;
}
}
@media (min-width: 1200px) {
.wrapper{
max-width: 1140px;
}
}
.wrapper-full{
width: 100%;
padding-right: 15px;
padding-left: 15px;
margin-right: auto;
margin-left: auto;
}
/*--//wrapper start --*/
/*-- form styling --*/
.w3l-mockup-form {
```

```
position: relative;
min-height: 100vh;
z-index: 0;
background: rgba(99, 194, 110, 0.1);
padding: 40px 40px;
}
.container{
max-width: 890px;
margin: 0 auto;
}
.w3l_form {
padding: 0px;
flex-basis: 0%;
-webkit-flex-basis: 60%;
background-image: url(../img/mah.jpg);
background-size:cover;
padding: 10px 20px;
border-top-left-radius: 10px;
border-bottom-left-radius: 8px;
display: flex;
justify-content: center;
align-items: center;
}
.content-wthree {
flex-basis: 60%;
-webkit-flex-basis: 60%;
box-sizing: border-box;
padding: 3em 3.5em;
background: #fff;
box-shadow: 2px 9px 49px -17px rgba(0, 0, 0, 0.1);
border-top-right-radius: 8px;
border-bottom-right-radius: 8px;
}
.w3l-workinghny-form .logo {
```

```
text-align: center;
}
.w3l-mockup-form .main-mockup {
position: relative;
display: -webkit-box;
display: -moz-box;
display: -ms-flexbox;
display: -webkit-flex;
display: flex;
margin: 40px 0;
}
.w3l-mockup-form .alert-close {
cursor: pointer;
height: 35px;
width: 35px;
line-height: 35px;
position: absolute;
right: -5px;
top: -5px;
background: #03cafc;
border-radius: 50px;
color: #fff;
text-align: center;
}
.w3l-mockup-form form {
margin-top: 30px;
margin-bottom: 30px;
}
.social-icons{
text-align: center;
}
.w3l-mockup-form h1 {
text-align: center;
font-size: 40px;
```

```
font-weight: 500;
color: #3b3663;
}
.w3l-mockup-form h2 {
display: inline-block;
font-size: 25px;
line-height: 35px;
margin-bottom: 5px;
font-weight: 600;
color: #3b3663;
}
.w3l-mockup-form input {
outline: none;
margin-bottom: 15px;
font-size: 16px;
color: #999;
text-align: left;
padding: 14px 20px;
width: 100%;
display: inline-block;
box-sizing: border-box;
border: none;
outline: none;
background: transparent;
border: 1px solid #e5e5e5;
transition: 0.3s all ease;
}
.w3l-mockup-form input:focus {
border-color: #00c16e;
}
.w3l-mockup-form button {
font-size: 18px;
color: #fff;
width: 100%;
```



```
background: #03cafc;
border: none;
padding: 14px 15px;
font-weight: 500;
transition: .3s ease;
-webkit-transition: .3s ease;
-moz-transition: .3s ease;
-ms-transition: .3s ease;
-o-transition: .3s ease;
}
.w3l-mockup-form button:hover {
background: #4ca356;
}
.w3l-mockup-form .social-icons ul li {
list-style: none;
display: inline-block;
}
.w3l-mockup-form .social-icons ul li a {
padding: 8px;
}
.w3l-mockup-form .social-icons ul li a:hover {
opacity: 0.8;
transition: 0.5s ease;
-webkit-transition: 0.5s ease;
-o-transition: 0.5s ease;
-ms-transition: 0.5s ease;
-moz-transition: 0.5s ease;
}
.w3l-mockup-form .social-icons ulspan.fa {
color: #696687;
font-size: 18px;
opacity: .8;
}
.w3l-mockup-form .social-icons ul li a.facebook span {
```

```
color: #3b5998;
}
.w3l-mockup-form .social-icons ul li a.twitter span {
color: #1da1f2;
}
.w3l-mockup-form .social-icons ul li a.pinterest span {
color: #e60023;
}
.copyright p {
text-align: center;
font-size: 17px;
line-height: 26px;
color: #607863;
opacity: 1;
}
p.copy-footer-29 a {
color: #517856;
}
p.copy-footer-29 a:hover {
color: #00c16e;
transition: 0.5s ease;
-webkit-transition: 0.5s ease;
-o-transition: 0.5s ease;
-ms-transition: 0.5s ease;
-moz-transition: 0.5s ease;
}
.alert {
padding: 1rem;
border-radius: 5px;
color: white;
margin: 1rem 0;
}
.alert-success{
background-color: #42ba96;
```

```

}
.alert-danger {
background-color: #fc5555;
}
.alert-info {
background-color: #2E9AFE;
}
.alert-warning {
background-color: #ff9966;
}
/*-- responsive design --*/
@media (max-width:736px) {
.w3l-mockup-form .main-mockup {
flex-direction: column;
}
.w3l_form {
order: 2;
padding: 50px;
border-radius: 0;
border-bottom-left-radius: 8px;
border-bottom-right-radius: 8px;
}
.content-wthree {
order: 1;
border-radius: 0;
border-top-left-radius: 8px;
border-top-right-radius: 8px;
}
}
@media (max-width:568px) {
.w3l-mockup-form h1 {
font-size: 30px;
}
.w3l-mockup-form .main-mockup {

```

```
margin: 30px 0;
}
.content-wthree {
padding: 2.5em;
}
}
@media (max-width: 415px) {
.w3l-mockup-form {
padding: 40px 30px;
}
}
@media (max-width:384px) {
.w3l-mockup-form {
padding: 30px 15px;
}
.content-wthree {
padding: 2em;
}
.w3l-mockup-form h1 {
font-size: 28px;
}
.w3l-mockup-form h2 {
font-size: 22px;
line-height: 32px;
}
.copyright p {
font-size: 16px;
}
}
```

7.3 Database Schema

The screenshot shows the phpMyAdmin interface for a database named 'test'. The table 'predict' is selected, and its structure is displayed. The table has 9 columns: Temperature, DO, PH, Conductivity, BOD, NI, FeI_col, ToI_col, and year. The 'year' column is of type 'date'. The interface includes a sidebar with a tree view of the database structure, a top navigation bar with tabs for Browse, Structure, SQL, Search, Insert, Export, Import, Privileges, Operations, Tracking, and Triggers. Below the table structure, there are options to check all, with selected, browse, change, drop, primary, unique, index, fulltext, add to central columns, and remove from central columns. There is also a section for indexes, which is currently empty, and a section for partitions, which is also empty.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	Temperature	float			No	None			Change Drop More
2	DO	float			No	None			Change Drop More
3	PH	float			No	None			Change Drop More
4	Conductivity	float			No	None			Change Drop More
5	BOD	float			No	None			Change Drop More
6	NI	float			No	None			Change Drop More
7	FeI_col	float			No	None			Change Drop More
8	ToI_col	float			No	None			Change Drop More
9	year	date			No	None			Change Drop More

The screenshot shows the phpMyAdmin interface for a database named 'test'. The table 'login' is selected, and its structure is displayed. The table has 2 columns: email and password. The 'email' column is of type 'varchar(50)' and the 'password' column is of type 'varchar(20)'. The interface includes a sidebar with a tree view of the database structure, a top navigation bar with tabs for Browse, Structure, SQL, Search, Insert, Export, Import, Privileges, Operations, Tracking, and Triggers. Below the table structure, there are options to check all, with selected, browse, change, drop, primary, unique, index, fulltext, add to central columns, and remove from central columns. There is also a section for indexes, which is currently empty, and a section for partitions, which is also empty.

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	email	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
2	password	varchar(20)	latin1_swedish_ci		No	None			Change Drop More

localhost / 127.0.0.1 / test / regis x localhost/test/predict.php x Efficient Water Quality Analysis x IBM-Project-36146-1660293206/ x +

localhost/phpmyadmin/tbl_structure.php?db=test&table=registration

IBM IBM-Project-49421-... IBM-Project-36146-...

phpMyAdmin

Recent Favorites

- New
- db
- information_schema
- mysql
- performance_schema
- phpmyadmin
- test
 - New
 - forgot password
 - login
 - predict
 - registration

Server: 127.0.0.1 Database: test Table: registration

Browse Structure SQL Search Insert Export Import Privileges Operations Tracking Triggers

Table structure Relation view

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	name	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
2	email	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
3	password	varchar(20)	latin1_swedish_ci		No	None			Change Drop More

☐ Check all With selected: Browse Change Drop Primary Unique Index Fulltext Add to central columns Remove from central columns

Print Propose table structure Track table Move columns Normalize

Add 1 column(s) after password Go

Indexes

No index defined!

Create an index on 1 columns Go

Partitions

No partitioning defined!

Partition table

Console

Windows taskbar: 16:45 09-11-2022

Chapter-8

TESTING

8.1 Test Cases

```
import numpy as np
from flask import Flask, render_template, request
import pickle
app = Flask(__name__)
model = pickle.load(open('wqi.pkl','rb'))
@app.route('/')
def home():
    return render_template("predict.html",showcase="")
@app.route('/login' ,methods = ['POST'])
def login():
    year = request.form["year"]
    do = request.form["do"]
    ph = request.form["ph"]
    co = request.form["co"]
    bod = request.form["bod"]
    na = request.form["na"]
    tc = request.form["tc"]
    total = [[float (do), float (ph), float (co), float (bod), float (na), float(tc), int(year)]]
    pred = model.predict(total)
    y_pred = pred[[0]]
    if(y_pred>= 95 and y_pred<= 100) :
        return render_template("predict.html", showcase = 'Excellent, The predicted value is '+str(y_pred))
    elif(y_pred>= 89 and y_pred< 95) :
```

```

        return render_template("predict.html", showcase = 'Very good, The predicted value is
'+str(y_pred))
    elif(y_pred>= 80 and y_pred< 89) :
        return render_template("predict.html", showcase = 'Good, The predicted value is
'+str(y_pred))
    elif(y_pred>= 65 and y_pred< 80) :
        return render_template("predict.html", showcase = 'Fair, The predicted value is
'+str(y_pred))
    elif(y_pred>= 45 and y_pred< 65) :
        return render_template("predict.html", showcase = 'Marginal, The predicted value is
'+str(y_pred))
    else :
        return render_template("predict.html", showcase = 'Poor, The predicted value is
'+str(y_pred))
if __name__=='__main__':
    app.run(debug = True,port=8000)

```

8.2 User Acceptance Testing

```

import numpy as np
from flask import Flask, render_template, request
import pickle
import requests

# NOTE: you must manually set API_KEY below using information retrieved from your IBM
Cloud account.
API_KEY = "P-v0uUtXoamzjb6MZFyGXQnh9ql2xObgQaTMWSjkbXJg"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":
    API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}
app = Flask(__name__)

```



```

model = pickle.load(open('wqi.pkl','rb'))
@app.route('/')
def home():
    return render_template("index.html",)
@app.route('/login' ,methods = ['POST'])
def login():
    year = request.form["year"]
    do = request.form["do"]
    ph = request.form["ph"]
    co = request.form["co"]
    bod = request.form["bod"]
    na = request.form["na"]
    tc = request.form["tc"]
    total = [[float (do), float (ph), float (co), float (bod), float (na), float(tc), int(year)]]

    # NOTE: manually define and pass the array(s) of values to be scored in the next line
    payload_scoring = {"input_data": [{"fields": [float (do), float (ph), float (co), float (bod), float
(na), float(tc), int(year)], "values": total}]}

    response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/823bcd15-d246-4027-ae6d-
a984d3e1b053/predictions?version=2022-11-03', json=payload_scoring,
    headers={'Authorization': 'Bearer ' + mltoken})
    print("Scoring response")
    print(response_scoring.json())
    predictions=response_scoring.json()
    predict = int(predictions['predictions'][0]['values'][0][0])
    #print("Final prediction :",predict)

    if(predict >= 95 and predict<= 100) :
        return render_template("index.html", showcase = 'Excellent, The predicted value is
'+str(predict))
    elif(predict >= 89 and predict <= 94) :
        return render_template("index.html", showcase = 'Very good, The predicted value is

```

```
'+str(predict))
elif(predict >= 88 and predict <= 88) :
    return render_template("index.html", showcase = 'Good, The predicted value is
'+str(predict))
elif(predict >= 65 and predict <= 79) :
    return render_template("index.html", showcase = 'Fair, The predicted value is '+str(predict))
elif(predict >= 45 and predict <= 64) :
    return render_template("index.html", showcase = 'Marginal, The predicted value is
'+str(predict))
else :
    return render_template("index.html", showcase = 'Poor, The predicted value is '+str(predict))
if __name__=='__main__':
    app.run(debug = True,port=500)
```

Chapter-9

RESULTS

9.1 Performance Metrics

Temperatu re	D O	p H	Conductivi ty	BOD	NI	Fec_col	Tot_c ol	Year	Predicted value
37	2.2	7 .5	203	0.2	0.1	45.26 52	27	20 17	93.673215 66
234	10	7	100	325 .2	65 .2	97	654.1	23 15	71.398886 82
30.6	6.7	2 .2	10	10	7	97	717	20 22	65.881772 27

Chapter-10

ADVANTAGES

- Predicts the quality and purity of water
- More confident towards drinking water
- Prevent the user from water borne diseases
- Healthy intake of water
- People with weakened immune systems may be especially at risk for illness.

DISADVANTAGES

- Non accessible in rural areas
- Peoples with not trust machines easily
- Senior citizens unable to use
- If the dataset is wrong, then the output prediction is wrong

Chapter-11

CONCLUSION

During the last years, water quality has been threatened by various pollutants. Therefore, modeling and predicting water quality have become very important in **controlling water pollution**. The most important resources for survival is water, and WQI measures the quality of water. Traditionally, one must undergo an expensive and time-consuming lab analysis to test the purity of the water. This study investigated a different machine learning approach to forecast water quality using basic, readily accessible water quality data.

Chapter-12

FUTURE SCOPE

Water quality has a direct impact on public health and the environment. Water is used for various practices, such as drinking, agriculture, and industry. Using water resources such as groundwater and sea water sometimes assisted with problems. Evaluation of water quality is a basic stage for development of agriculture projects in terms of determination of cropping pattern, type of irrigation system, and systems of water purification for industries. As the technology develop, predicting the water quality has to be developed, it is major scope in future because now a days water is not pure. Hence Water can be seen **clear** but not **clean**.

Chapter-13

APPENDIX

Source Code

Register Page:

```
<!DOCTYPE html>
<html lang="zxx">
<head>
<title>Water Quality Analysis</title>
<!-- Meta tag Keywords-->
<meta name="viewport" content="width=device-width, initial-scale=1">
<meta charset="UTF-8" />
<meta name="keywords"
content="Login Form" />
<!-- //Meta tag Keywords-->
<link
href="//fonts.googleapis.com/css2?family=Poppins:wght@300;400;500;600&display=swap"
rel="stylesheet">
<!--/Style-CSS -->
<link rel="stylesheet" href="css/style.css" type="text/css" media="all" />
<!--//Style-CSS -->
<script src="https://kit.fontawesome.com/af562a2a63.js" crossorigin="anonymous"></script>
</head>
<body>
<!-- form section start -->
<section class="w3l-mockup-form">
<div class="container">
```

```

<!--/form -->
<div class="workinghny-form-grid">
<div class="main-mockup">
<div class="alert-close">
<span class="fa fa-close"></span>
</div>
<div class="w3l_form align-self">
<div class="left_grid_info">

<imgsrc="reg1.jpeg" alt="">
</div>
</div>
<div class="content-wthree">
<h2>Register Now</h2>
<form action="register1.php" method="post">
<input type="text" class="name" name="name" placeholder="Enter Your Name"required>
<input type="email" class="email" name="email" placeholder="Enter Your Email"required>
<input type="password" class="password" name="password" placeholder="Enter
Your Password" required>
<input type="password" class="confirm_password" name="confirm_password"
placeholder="Enter Your Confirm Password" required>
<button name="submit" class="btn" type="submit">Register</button>
</form>
<div class="social-icons">
<p>Have an account! <a href="login.html">Login</a>.</p>
</div>
</div>
</div>
</div>
<!-- //form -->
</div>
</section>
<!-- //form section start -->

```



```
<scriptsrc="js/jquery.min.js"></script>
<script>
$(document).ready(function (c) {
$('.alert-close').on('click', function (c) {
$('.main-mockup').fadeOut('slow', function (c) {
$('.main-mockup').remove();
});
});
});
</script>
</body>
</html>
```

Login Page:

```
<!DOCTYPE html>
<html lang="zxx">
<head>
<title>Water Quality Analysis</title>

<!-- Meta tag Keywords-->
<meta name="viewport" content="width=device-width, initial-scale=1">
<meta charset="UTF-8" />
<meta name="keywords"
content="Login Form" />
<!-- //Meta tag Keywords-->
<link
href="//fonts.googleapis.com/css2?family=Poppins:wght@300;400;500;600&display=swap"
rel="stylesheet">
<!--/Style-CSS -->
<!--//Style-CSS -->
<link rel="stylesheet" href="css/style.css">
<script src="https://kit.fontawesome.com/af562a2a63.js" crossorigin="anonymous"></script>
```

```

</head>
<body style="background-image: url(/img/mahe.jpg);">
<!-- form section start -->
<section class="w3l-mockup-form">
<div class="container">
<!-- /form -->
<div class="workinghny-form-grid">
<div class="main-mockup">
<div class="alert-close">
<span class="fa fa-close"></span>
</div>
<div class="w3l_form align-self">
<div class="left_grid_info">
<imgsrc="login1.jpeg" alt="">
</div>
</div>
<div class="content-wthree">
<h2>LoginNow</h2>
<form action="welcome.php" method="post">
<input type="email" class="email" name="email" placeholder="Enter Your Email"
required>
<input type="password" class="password" name="password" placeholder="Enter
Your Password" style="margin-bottom: 2px;" required>
<p><a href="forgotpassword.html" style="margin-bottom: 15px; display: block; text-align:
right;">Forgot Password?</a></p>
<button name="submit" name="submit" class="btn" type="submit">Login</button>
</form>
<div class="social-icons">
<p>Create Account! <a href="register.html">Register</a>.</p>
</div>
</div>
</div>

```

```

</div>
<!-- //form -->
</div>
</section>
<!-- //form section start -->
<scriptsrc="js/jquery.min.js"></script>
<script>
$(document).ready(function (c) {
$('.alert-close').on('click', function (c) {
$('.main-mockup').fadeOut('slow', function (c) {
$('.main-mockup').remove();
});
});
});
</script>
</body>
</html>

```

Forgot Password:

```

!DOCTYPE html
html lang=xxx
head
titleWater Quality Analysistitle
!-- Meta tag Keywords--
meta name=viewport content=width=device-width, initial-scale=1
meta charset=UTF-8
meta name=keywords
content=Login Form
!-- Meta tag Keywords--
link href=fonts.googleapis.comcss?family=Poppinswght@300;400;500;600&display=swap
rel=stylesheet
!--Style-CSS --
link rel=stylesheet href=cssstyle.css type=textcss media=all

```

```

!--Style-CSS --
script src=httpskit.fontawesome.comaf562a2a63.js crossorigin=anonymousscript
head
body
!-- form section start --
section class=w3l-mockup-form
div class=container
!--form --
div class=workinghny-form-grid
div class=main-mockup
div class=alert-close
span class=fa fa-closespan
div
div class=w3l_form align-self
div class=left_grid_info
img src=fog1.jpeg alt=
div
div
div class=content-wthree
h2Forgot Passwordh2
form action=forgot-password.php method=post
input type=email class=email name=email placeholder=Enter Your Email
required
button name=submit class=btn type=submitSend Reset Linkbutton
form
div class=social-icons
pBack to! a href=login.htmlLogina.p
div
div
div
div
!-- form --
div
section

```

```
!-- form section start --
scriptsrc=jquery.min.jsscript
script
$(document).ready(function (c) {
$('.alert-close').on('click', function (c) {
$('.main-mockup').fadeOut('slow', function (c) {
$('.main-mockup').remove();
});
});
});
script
body
html
```

Register php:

```
<?php
$name = $_POST['name'];
$email = $_POST['email'];
$password = $_POST['password'];
// $confirm_password = $_POST['confirm_password'];
$conn = new mysqli('localhost','root','', 'test');
if($conn->connect_error){
die('Connection Failed :'. $conn->connect_error);
}else{
    $stmt = $conn->prepare("insert into registration(name, email, password)values(?, ?, ?)");
    $stmt->bind_param("sss", $name, $email, $password);
    $stmt->execute();
    echo "registration successfull...";
    $stmt->close();
    $conn->close();
}
```

?>

Forgot Password php:

<?php

```
echo "Reset Link has been sent to your registered mail address.";
```

?>

Login php:

<?php

```
$email = $_POST['email'];
```

```
$password = $_POST['password'];
```

```
$conn = new mysqli('localhost','root','','test');
```

```
if($conn->connect_error){
```

```
die('Connection Failed :'. $conn->connect_error);
```

```
}else{
```

```
    $stmt = $conn->prepare("insert into login(email, password)values(?, ?)");
```

```
    $stmt->bind_param("ss", $email, $password);
```

```
    $stmt->execute();
```

```
echo "Login successfully...";
```

```
    $stmt->close();
```

```
    $conn->close();
```

```
}
```

?>

GitHub & Project Demo Link

[github](#)

[Demo video](#)