SMART LENDER-APPLICANT CREDIBILITY PREDICTION FOR LOAN APPROVAL

A PROJECT REPORT

Submitted by

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in partial fulfillment for the award of degree of

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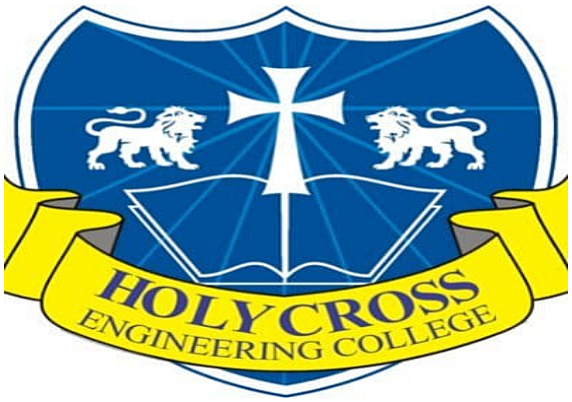
in

COMPUTER SCIENCE AND ENGINEERING

HOLYCROSS ENGINEERING COLLEGE



ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our Faculty Mentor and Industry Mentor for their support and guidance in completing our project on the Smart Fashion Recommender Application We would like to extend our gratitude to the IBM for Nalaiya Thiran project for providing us with all the facility that was required. It was a great learning experience.We would like to take this opportunity to express our gratitude.

DATE:
20/11/2022

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Chapter 1: INTRODUCTION

1.1 Project Overview

The credit system governed by the banks is one of the most important factors which affect our country's economy and financial condition. Also, credit risk is one of the main functions of the banking community. The prediction of credit defaulters is one of the difficult tasks for any bank. This problem occurs when the banks need to provide loans to the customers who are in need of the money. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets.

1.2 Purpose

People who need loan and want to check whether they are eligible for loan or not

Chapter 2: LITERATURE SURVEY

2.1 Existing Problem

Dream Housing Finance company deals in all home loans. They have a presence across all urban, semi-urban and rural areas. Customers first apply for a home loan after that company validates the customer's eligibility for a loan. The company wants to automate the loan eligibility process (real-time) based on customer detail provided while filling out the online application form. These details are Gender, Marital Status, Education, Number of Dependents, Income, Loan Amount, Credit History, and others.

To automate this process, they have given a problem to identify the customer segments, that are eligible for loan amounts so that they can specifically target these customers.

2.2References

Ashwini S. Kadam, Shraddha R Nikam,Ankita A. Aher, Gayatri V. Shelke, Amar S Chandgude (2021)[1]. Our financial framework has a ton of merchandise to offer to banks, yet the principle kind of revenue for all banks is using a loan line. So,you can get the interest in advance. The bank's financing cost or misfortune is exceptionally reliant upon the loan, for instance, regardless of whether the client is reimbursing the advance. By prompting non-moneylenders, banks can lessen non-performing resources. This makes learning these things vital. Momentum research shows that there are numerous ways of concentrating on repayment. In any case, it is essential to concentrate on the construction in a manner that is not quite the same as contrasting, similarly as evident prediction is vital for benefit. Loan Assumptions (I) Data assortment, (ii) Data cleaning, (iii) Basic element examination strategies are utilized to concentrate on execution evaluation issues. Research tests have shown that the Naive Baye s model performs best in loan arranging.

Sivasree M S, Rekha Sunny T (2015)[2]. Used efficient Decision Tree is formulated with Decision Tree Induction Algorithm. It produces a model with the most relevant 6 attributes. A decision is made at each node and the leaf node gives us the final result. That is, if the customer possesses the minimum loan repayment capacity, then the future risks can be avoided. implemented the proposed model in ASP.NET-MVC5. A Decision Tree is developed by performing data mining on an existing bank dataset containing 4520 records and 17 attributes. The accuracy croreis 81.7.

Anuja Kadam, Pragati Namde, Sonal Shirke, Siddhesh Nandgaonkar, Dr.D.RIngle (2021)[3]. Data mining algorithms are used to study the loan-approved data andexact patterns, which would help in predicting the reasonable defaulters, thereby helping the banks for making better choices in the future. Data Mining is the process of examining

underlying and potentially useful patterns in big chunks of source data. For the packages of three algorithms (Logistic regression, Decision tree and Random Forest) were imported. The model was then defined and the accuracy score was evaluated. Logistic Regression was the best fit with the highest accuracy score 81.12%.

Pidikiti Supriya , Myneedi Pavani , Nagarapu Saisushma , Namburi Vimala Kumari , K Vikas (2019)[4]. This Problem is done by mining the Big Data of the previous records of the people to whom the loan was granted before and on the basis of these records/experiences the machine was trained using the machine learning model which gives the most accurate result. The dataset collected for predicting loan default customers is predicted into a Training set and testing set.Generally, an 80:20 ratio is applied to split the training set and testing set. For predicting the loan defaulter and non-defaulter's problem, a Decision tree algorithm is used. The best accuracy on a public test set is 81.1%.

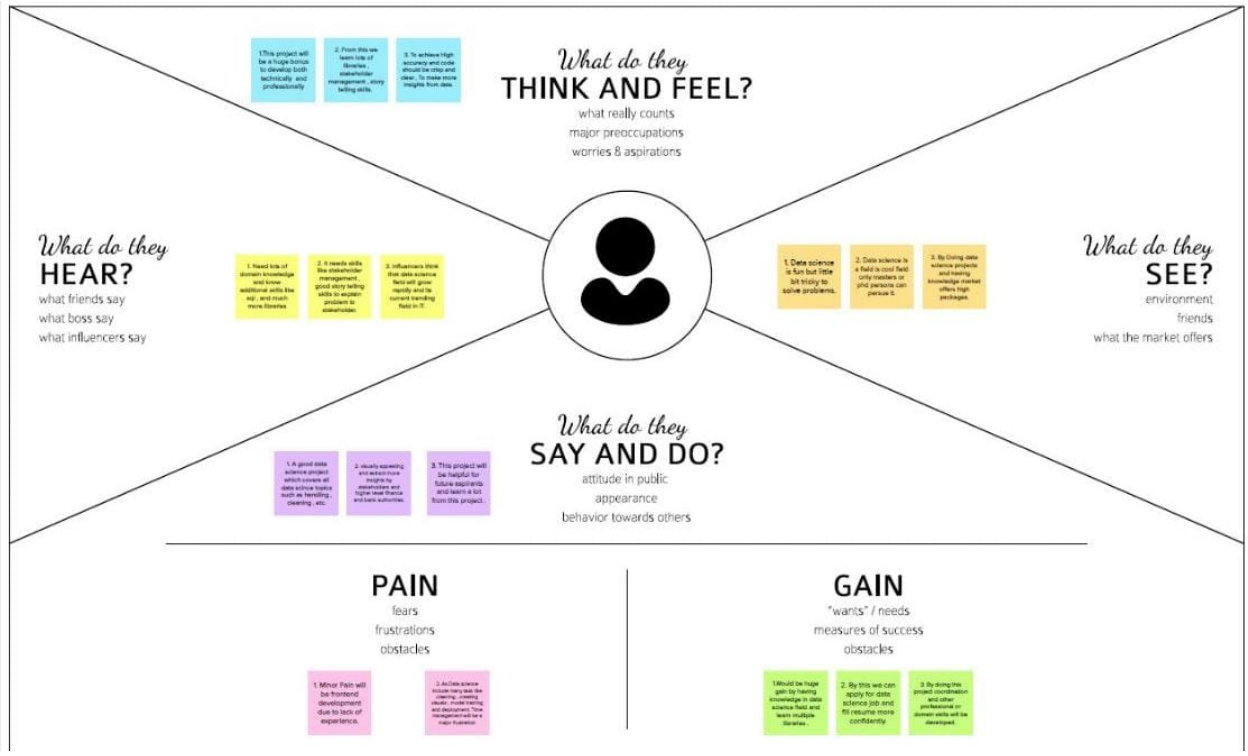
1. Ashwini S. Kadam, Shraddha R Nikam, Ankita A. Aher, Gayatri V. Shelke, Amar S. Chandgude, 2021, "Prediction for Loan Approval using Machine Learning Algorithm", No "Apr" / "2021".
2. Sivasree M S, Rekha Sunny T, (2015), "Loan Credibility Prediction System Based on Decision Tree Algorithm", No "September" / "2015".
3. Anuja Kadam, Pragati Namde, Sonal Shirke, Siddhesh Nandgaonkar, Dr.D.R
Ingle, 2021, "Loan Credibility Prediction System using Data Mining Techniques" No "May" / "2021".
4. Pidikiti Supriya , Myneedi Pavani , Nagarapu Saisushma , Namburi Vimala Kumari , K Vikas, 2019, "Loan Prediction by using Machine Learning Models",
No "April" / "2019".
5. https://medium.com/swlh/lending-club-data-web-app-ada56ff64cee
6. https://github.com/smartinternz02/SI-GuidedProject-48927-1652694502
7.
https://www.academia.edu/77162007/BANK_LOAN_PREDICTION_USING

_M
ACHINE_LEARNING
2.3 Problem statement definition

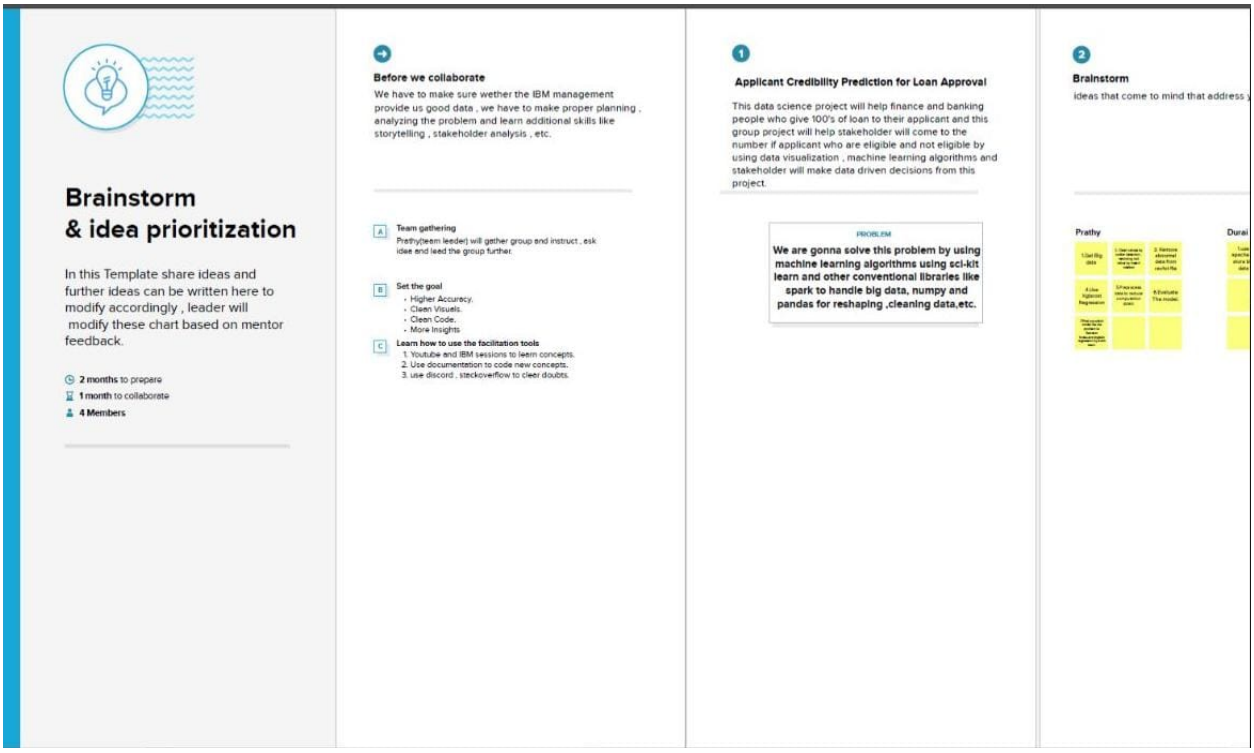
• Company wants to automate the loan eligibility process (real time) based on customer detail provided while filling online application form.
• These details are Gender, Marital Status, Education, Number of Dependents, Income, Loan Amount, Credit History and others.
• To automate this process, they have given a problem to identify the customers segments, those are eligible for loan amount so that they can specifically target these customers.
• It is a classification problem where we have to predict whether a loan would be approved or not.

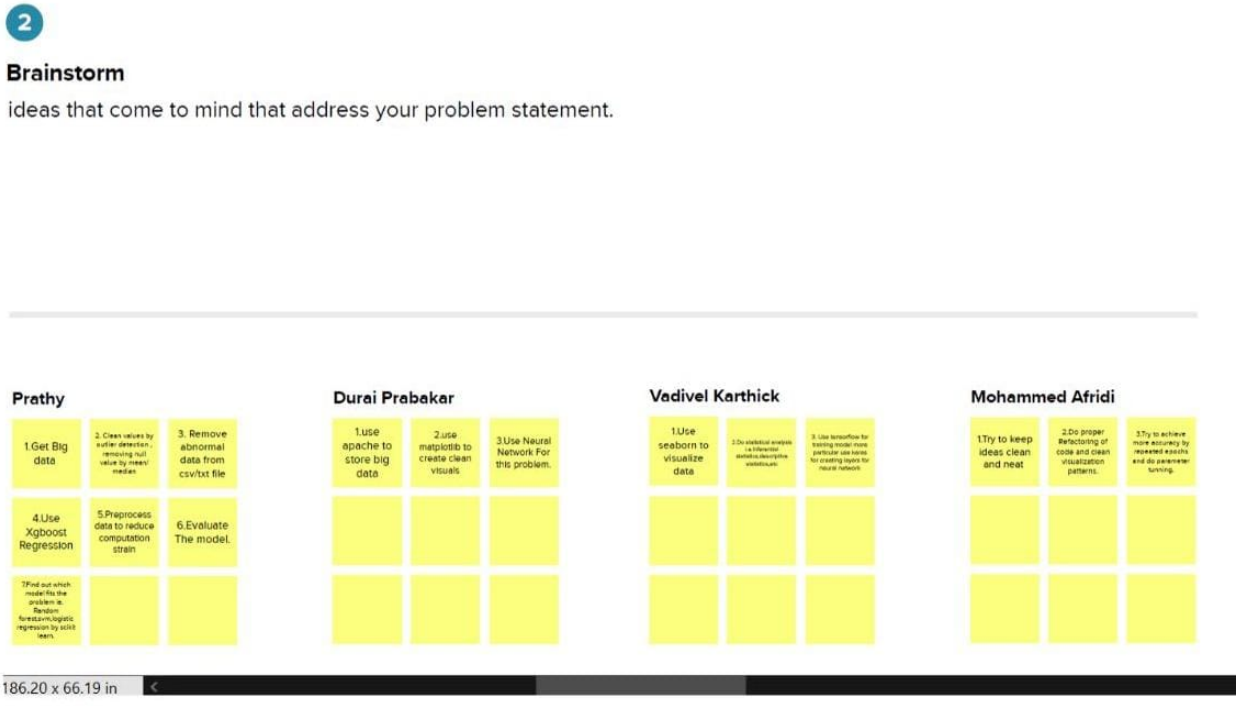
3.IDEATION & PROPOSED SOLUTION

3.1 Empathy map canvas



3.2 Ideation & Brainstorming





Prathy

Use Numpy , pandas , plotly

Dural

Use Matplotlib

Vadivel Karthick

Use seaborn for clean visualization , use testing techniques if possible.

Mohammed Afridi

Refactor code if possible , use clean visuals and use required libraires to reduce complexity

Prathy

Use Apache spark to store big data

Dural

Use Numpy , pandas , Matplotlib

Prathy

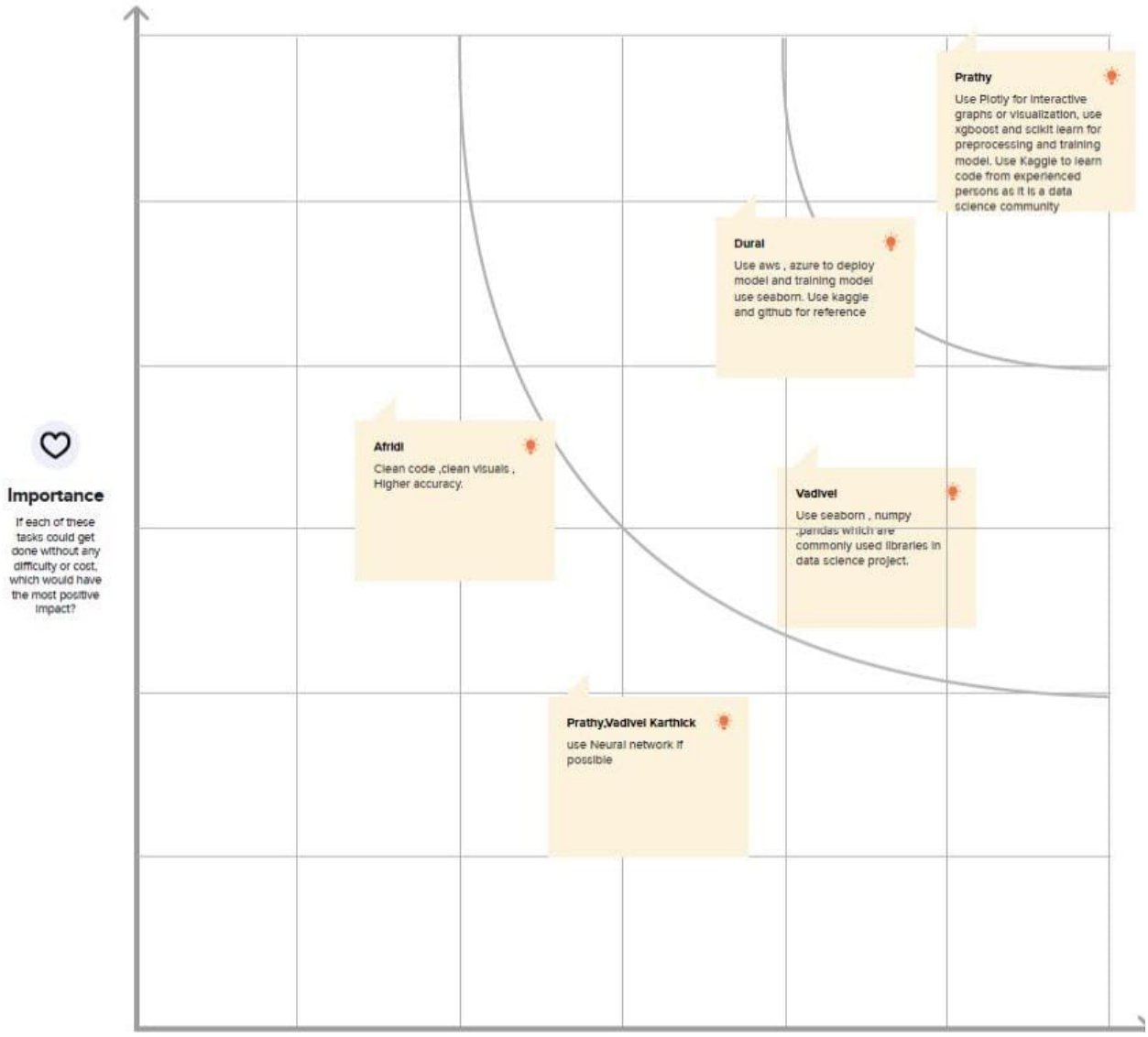
Use Xgboost for regression

Dural

Use charts like barchart , piechart , ribbon chart based on data provided

Prathy

Use aws or azure for model training and deploying model.


Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Prathy
Use Plotly for interactive graphs or visualization, use xgboost and scikit learn for preprocessing and training model. Use Kaggle to learn code from experienced persons as it is a data science community
Dural
Use aws , azure to deploy model and training model use seaborn. Use kaggle and github for reference
Afridi
Clean code ,clean visuals , Higher accuracy.
Vadivel
Use seaborn , numpy ,pandas which are commonly used libraries in data science project.
Prathy,Vadivel Karthick
use Neural network if possible

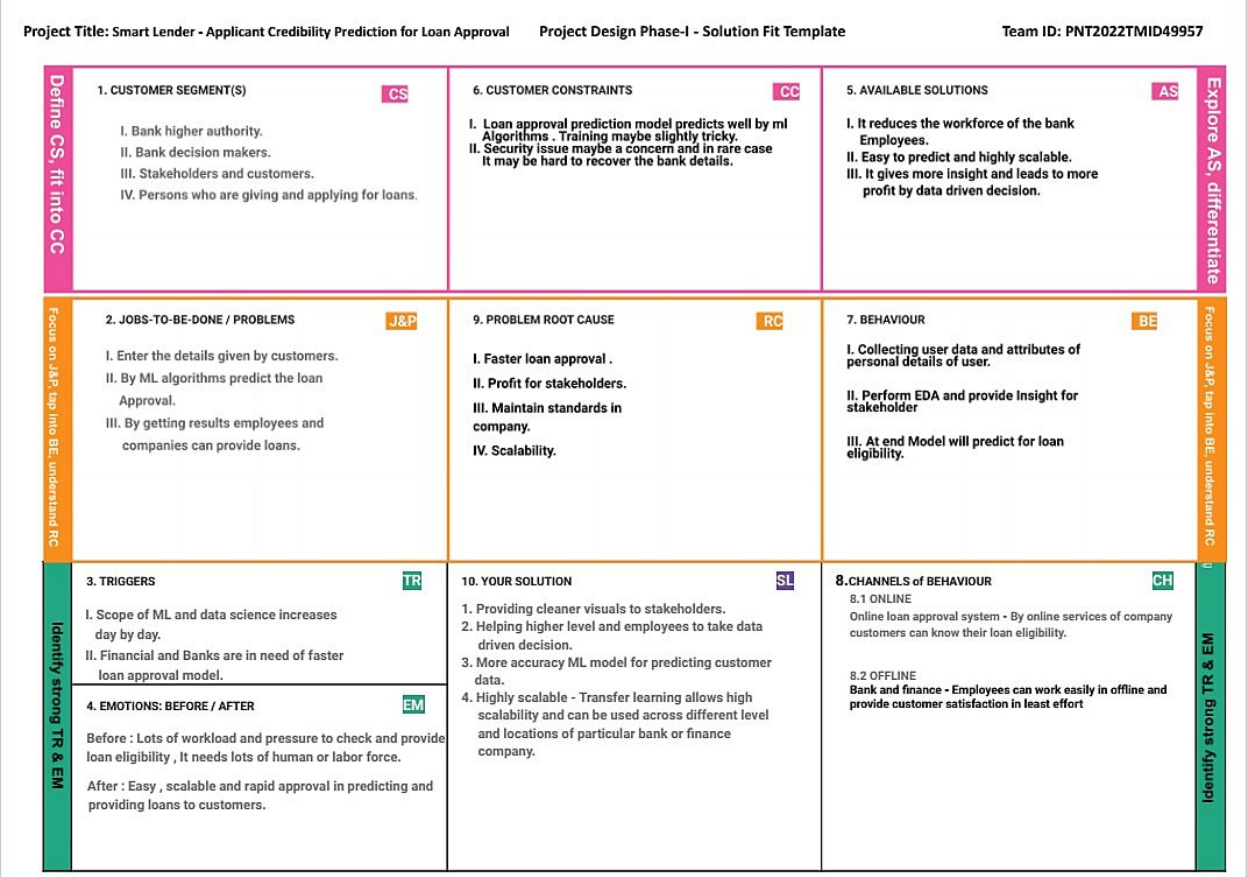
3.3Proposed solution

Proposed Solution :

These solution template relates the current situation to a desired result of this project and also describe the benefits acquire when desired result is achieved.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Tracking or checking the status is difficult. • Prone to human errors. • Time consumption is high. • Lot of paper works. • Poor customer service due to lack of manpower.
2.	Idea / Solution description	• Tracking or checking the status becomes easy. • Reduce the potential for human error. • Time consumption of the process will be reduced. • Reduces the paperwork to paperless. • Improve the effectiveness of customer service teams. • Fair eligibility prediction. • Highly scalable and provide data driven decisions to stakeholder and higher authority. We will be using classification algorithms such as Decision tree, Random Forest, KNN, and xgboost to achieve higher accuracy in predicting the model. We will train and test the data with these algorithms, tune by hyperparameter tunning. From this the above ideas are implemented.
3.	Novelty / Uniqueness	As soon as the essential data are provided, the model will predict whether to approve the loan or not - By use of transfer learning.
4.	Social Impact / Customer Satisfaction	One of the most important factors which affect our country's economy and financial condition is the credit system governed by the banks. As we know credit risk evaluation is very crucial, there is a variety of techniques are used for risk level calculation. In addition, credit risk is one of the main functions of the banking community.
5.	Business Model (Revenue Model)	This model can be developed by minimum cost at the same time it will provide the peak performance, higher accuracy and the result will be more effective than traditional techniques.
6.	Scalability of the Solution	Banks need not to go through the background verification process of the applicant by using this model. The model will predict the customers data and their attributes like salary , credit score,etc.

3.4Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

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 Bank Website Registration through Gmail Registration through mobile Application
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Loan type	Personal Loan Education Loan
FR-4	User Details	Name, Address, Income, Occupation.
FR-5	Assets Proof	Agricultural land, Gold
FR-6	Verification	Verification of user Details which are provided above

4.2 Non-Functional requirements

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy to access
NFR-2	**Security**	User proofs
NFR-3	**Reliability**	Based on the customer Income
NFR-4	**Performance**	Previous history of the user bank account
NFR-5	**Availability**	Based on the customer Address
NFR-6	**Scalability**	Based on the customer Assets proofs

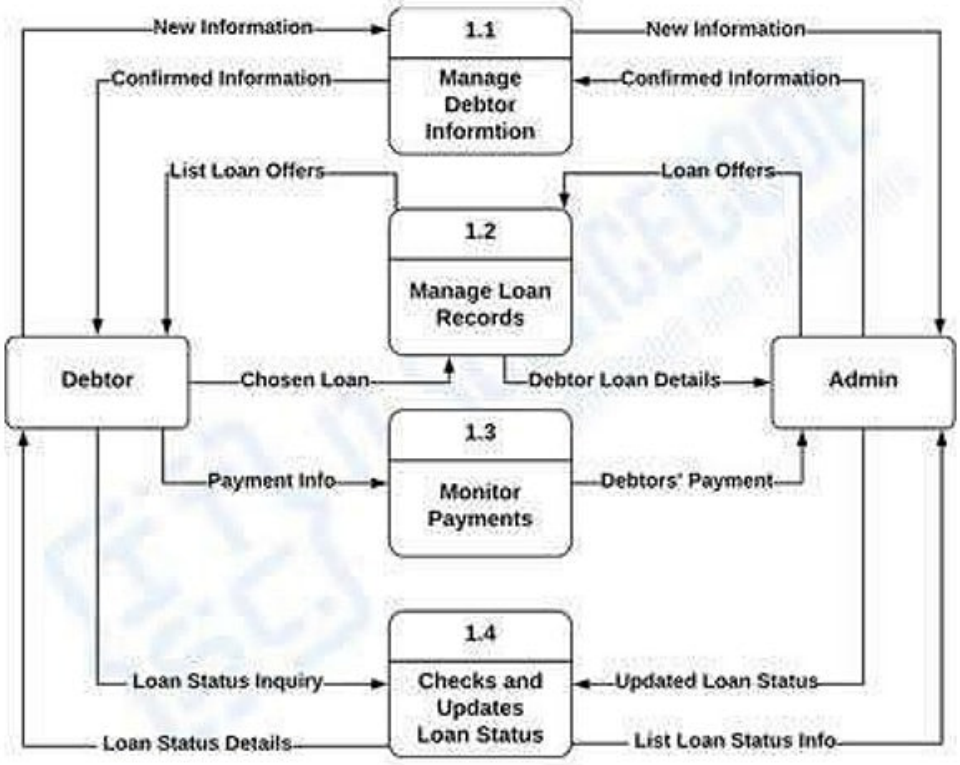
5. PROJECT DESIGN

5.1 Data Flow Diagrams

Flow: (Simplified)

- **The user can register in website by using Email and Mobile number.**
- **The user can Login by using Email and password as Registered in the respective website.**
- **The user will provide personal and financial details.**
- **User should upload the scanned documents.**
- **Then it will goes to approval process.**
- **Finally they will get loan closure certificate.**

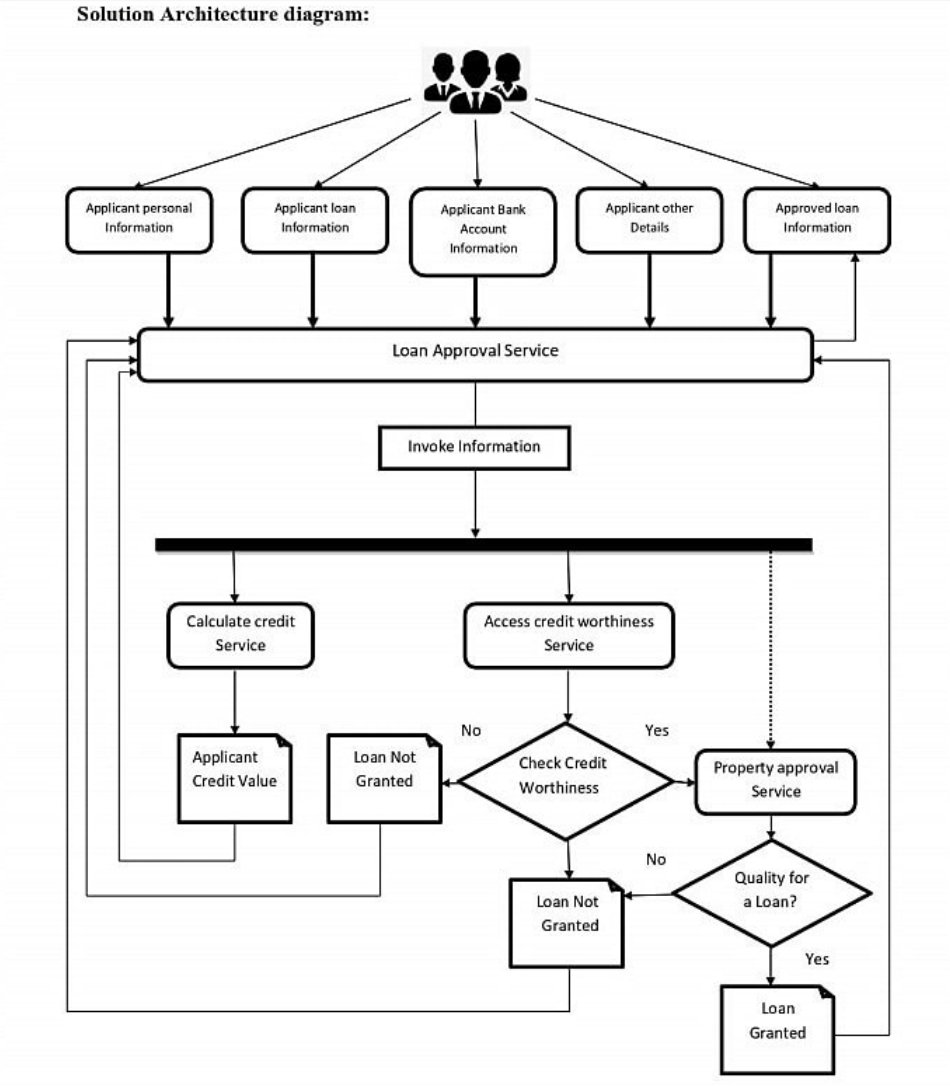
LOAN MANAGEMENT SYSTEM



DATA FLOW DIAGRAM LEVEL 1

5.2 Solution & Technical Architecture

Solution architecture



Technical architecture

Guidelines:

1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services
5. Indicate interface to machine learning models (if applicable)

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	Python with applied Data science
2.	Application Logic-1	Logic for a process in the application	Python with applied Data science
3.	Application Logic-2	Logic for a process in the application	Python with applied Data science
4.	Application Logic-3	Logic for a process in the application	Python with applied Data science
5.	Database	Data Type, Configurations etc.	Python
6.	Cloud Database	Database Service on Cloud	IBM DB2.
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 Bank 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	Data science
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
S.No	**Characteristics**	**Description**	**Technology**
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache) etc.	Technology used

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the loan application by entering my email/user number, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the loan application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the loan application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can receive the mail that you are registered in loan application.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can receive the message that your ID is get loin.	High	Sprint-1
	Dashboard	USN-6	As a user, I can use the dashboard it will Display the summary of the total loan process.	I can access my dashboard to view entire summary of the loan application.	medium	Sprint-1
Customer (Web user)	Registration	USN-7	As a User, I can register for loan website by entering my email, password, and confirming my password.	I can receive my acceptance mail	high	Sprint-1
Customer Care Executive	Doubts	USN-8	As a new user how can I create my account. As a old user how can I resolve the issues.	Clarification doubts through phone call or by Gmail.	Medium	Sprint-1
Administrator	Holding all Details	USN-9	Giving approval to the particular user ID.	Approval.	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)
Use the below template to create product backlog and sprint schedule

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.	3	High	Prathy P Durai M Vadivel M Afridi S
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	3	High	Prathy P Durai M Vadivel M Afridi S
Sprint-1		USN-3	As a user, I can register for the application through Facebook	1	Low	Prathy P Durai M Vadivel M Afridi S
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Prathy P Durai M Vadivel M Afridi S

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	Prathy P Durai M Vadivel M Afridi S
Sprint-1	Dashboard	USN-6	As a user, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	Prathy P Durai M Vadivel M Afridi S
Sprint-1	Registration	USN-7	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	Prathy P Durai M Vadivel M Afridi S
Sprint-1		USN-8	As a user, I will receive confirmation email once I have registered for the application	3	High	Prathy P Durai M Vadivel M Afridi S
Sprint-1		USN-9	As a user, I can register for the application through Facebook	1	Low	Prathy P Durai M Vadivel M Afridi S
Sprint-1		USN-10	As a user, I can register for the application through Gmail	2	Medium	Prathy P Durai M Vadivel M Afridi S
Sprint-2	Register	USN-13	As a loan approval officer, I should be able to register myself as one using a unique email and password.	5	Medium	Prathy P Durai M Vadivel M Afridi S
Sprint-2	Login	USN-14	As a loan approval officer I should be able to login myself as one using a unique email and password.	5	Medium	Prathy P Durai M Vadivel M Afridi S
Sprint-3	Automated analysis of credit history	USN-15	As a loan approval officer, I can access the dashboard where I feed applications for loan prediction.	10	High	Prathy P Durai M Vadivel M Afridi S
Sprint-3		USN-16	As a loan approval officer, I can get a decision followed by some details for the decision when I feed an application for loan prediction.	15	High	Prathy P Durai M Vadivel M Afridi S
Sprint-4	Register	USN-17	As an admin, I should be able to register myself as one using a unique email and password.	2	Medium	Prathy P Durai M Vadivel M Afridi S
Sprint-4	Login	USN-18	As an admin I should be able to login myself as one using a unique email and password.	2	Medium	Prathy P Durai M Vadivel M Afridi S

6.2 Sprint Delivery Schedule

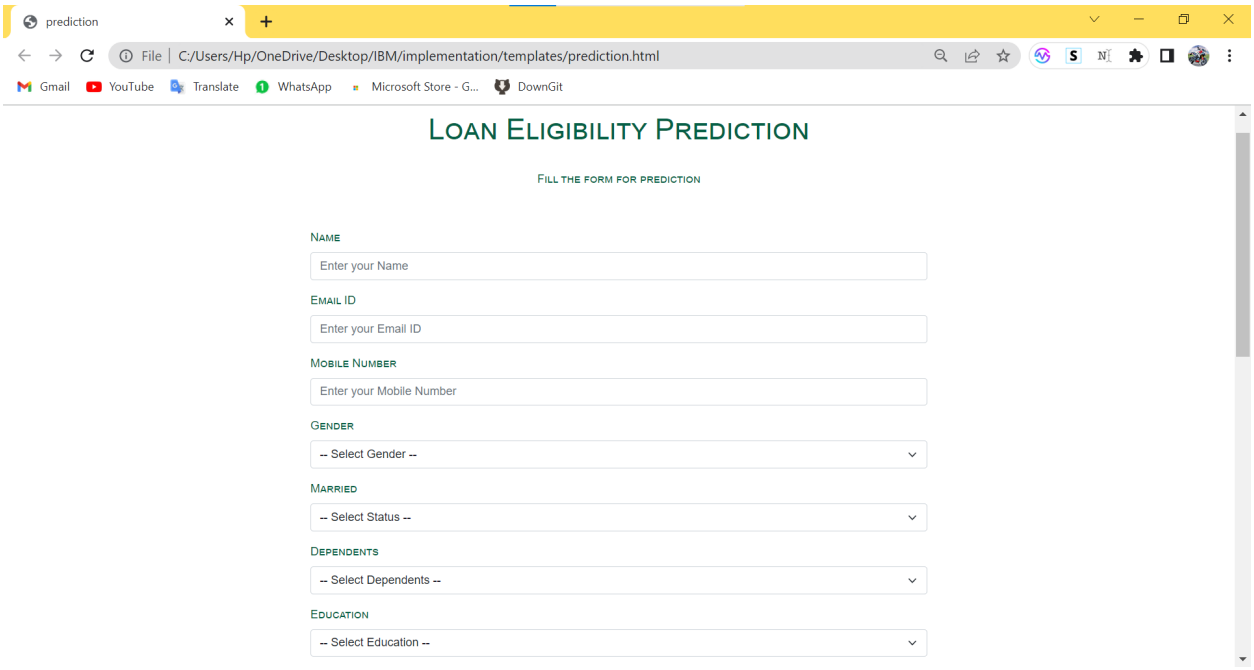
Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	28	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	25	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	6	19 Nov 2022

6.3 Reports from JIRA

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1



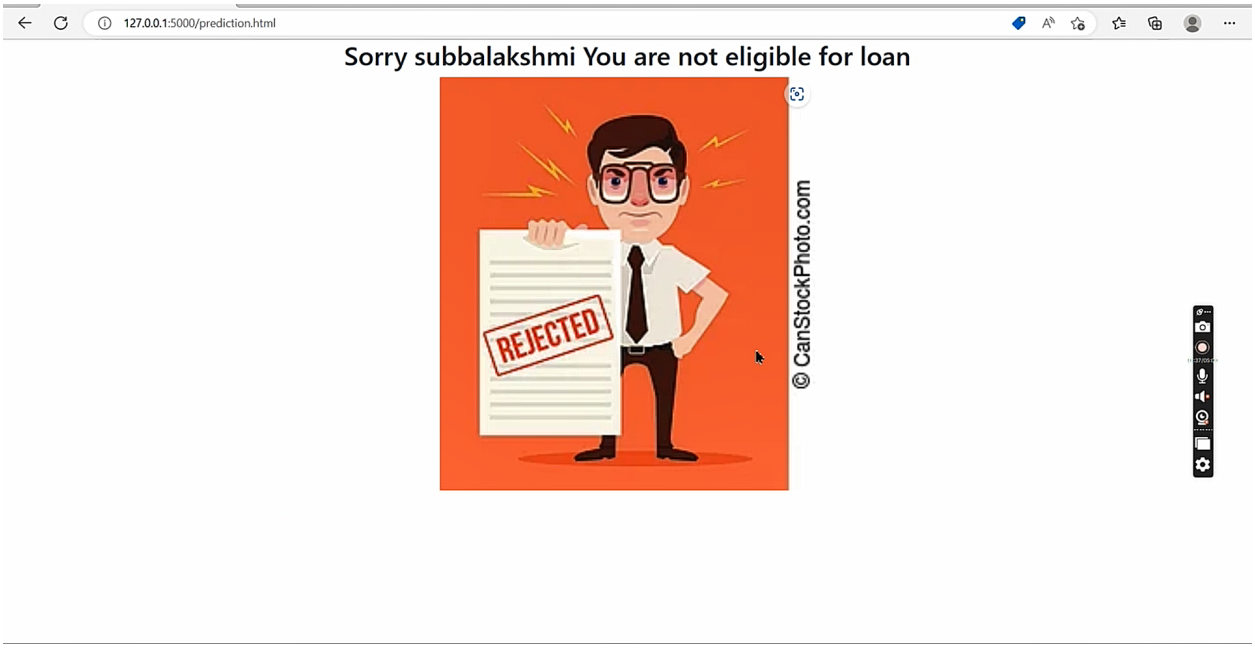

```
from flask import render_template, Flask, request
import numpy as np
import pickle
from sklearn.preprocessing import scale
app = Flask(__name__, template_folder='templates')

model = pickle.load(open("C:\\Users\\subba\\Downloads\\IBM-Project-10223-1659114439-main\\IBM-Project-10223-1659114439-main\\Final Deliverables\\implementation\\model.pkl", 'rb'))


@app.route('/')
def home():
    return render_template('home.html')


@app.route('/login.html')
@app.route('/home.html')
```

```
def home1():
    return render_template('home.html')


@app.route('/prediction.html')
def formpg():
    return render_template('prediction.html')


@app.route('/prediction.html', methods=['POST'])
def predict():
    if request.method == 'POST':
        name = request.form['Name']
        gender = request.form['gender']
        married = request.form['married']
        dependents = request.form['dependents']
        education = request.form['education']
        employed = request.form['employed']
        credit = request.form['credit']
        proparea = request.form['proparea']
        ApplicantIncome = float(request.form['ApplicantIncome'])
        CoapplicantIncome = float(request.form['CoapplicantIncome'])
        LoanAmount = float(request.form['LoanAmount'])
        Loan_Amount_Term = float(request.form['Loan_Amount_Term'])
    if gender == 'Male':
        gender = 1
    else:
        gender = 0

    if married == 'Yes':
        married = 1
    else:
```

```
        married = 0

    if education == 'Graduate':
        education = 0
    else:
        education = 1

    if employed == 'Yes':
        employed = 1
    else:
        employed = 0

    if dependents == '3+':
        dependents = 3
    if credit == 'Yes':
        credit = 1
    else:
        credit = 0
    if proparea == 'Urban':
        proparea = 2
    elif proparea == 'Rural':
        proparea = 0
    else:
        proparea = 1

    features = [gender, married, dependents, education, employed,
ApplicantIncome,
                CoapplicantIncome, LoanAmount, Loan_Amount_Term, credit,
proparea]

    con_features = [np.array(features)]
```

```
    prediction = model.predict(con_features)
    print(prediction)
    if prediction == 1:
        return render_template('approve.html',
prediction_text='Congratulations! '+name+' You are eligible for loan')
    else:
        return render_template('reject.html', prediction_text='Sorry '+name+'
You are not eligible for loan')


if __name__ == "__main__":
    app.run(debug=True)
```

7.2 Feature 2



```
<!doctype html>
<html lang="en">

<head>
  <!-- Required meta tags -->
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">

  <!-- Bootstrap CSS -->
  <link rel="stylesheet" href="{{url_for('static', filename='/prediction.css')}}">
  <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.0-
beta3/dist/css/bootstrap.min.css" rel="stylesheet"
    integrity="sha384-
eOJMYsd53ii+scO/bJGFsiCZc+5NDVN2yr8+0RDqr0Ql0h+rP48ckxlpbzKgwr
a6" crossorigin="anonymous">
  <link href="https://unpkg.com/tailwindcss@^2/dist/tailwind.min.css"
rel="stylesheet">
  <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/bootstrap@4.0.0/dist/css/bootstrap.min
.css"
    integrity="sha384-
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiGgFAW/d
AiS6JXm" crossorigin="anonymous">
  <title>prediction</title>
</head>

<body>
  <script>
    function valid() {
      var Ai = document.getElementById("ApplicantIncome").value;
      var Co = document.getElementById("CoapplicantIncome").value;
      var LA = document.getElementById("LoanAmount").value;
```

```
var LT = document.getElementById("Loan_Amount_Term").value;
if (Ai > 10000000000000000000000000000000000000) {
  alert("Applicant income is too large enter a valid number")
  return false;
}
if (Co > 10000000000000000000000000000000000000) {
  alert("Coapplicant income is too large enter a valid number")
  return false;
}
if (LA > 10000000000000000000000000000000000000) {
  alert("Loan Amount is too large enter a valid number")
  return false;
}
if (LT > 10000000000000000000000000000000000000) {
  alert("loan amount term is too large enter a valid number")
  return false;
}
var name = document.getElementById("Name").value;
var letters = /^[a-zA-Z]*$/;
if (!name.match(letters)) {
  alert("Name must contain only alphabets")
  return false;
}
var num = /^[0-9]+$/;
if (!Ai.match(num)) {
  alert("Enter only valid numbers alphabets are not allowed  ")
  return false;
}
if (!Co.match(num)) {
  alert("Enter only valid numbers alphabets are not allowed  ")
  return false;
}
```

```
    if (!LA.match(num)) {
      alert("Enter only valid numbers alphabets are not allowed  ")
      return false;
    }
    if (!LT.match(num)) {
      alert("Enter only valid numbers alphabets are not allowed  ")
      return false;
    }
    var mo = document.getElementById("mon").value;
    var mn = /^[0-9]{10}$/;
    if (!mo.match(mn)) {
      alert("Please enter only 10 digit mobile number")
      return false;
    }

  }
 </script>
 <section class="text-green-800 body-font">
  <div class="container px-1 py-12 mx-auto">
    <div class="flex flex-col text-center mb-10">

      <h1 class="Heading">Loan Eligibility Prediction</h1><br>
      <p class="fill">Fill the form for prediction</p>
    </div>
    <div>
    </div>



    <form action='/prediction.html' method="post" onsubmit="return valid()"
class="px-24 mx-12">
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-
```

```
label">Name</label>
        <input type="text" class="form-control" id="Name" name="Name"
placeholder="Enter your Name" required>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-label">Email
ID</label>
        <input type="email" class="form-control" id="email" name="email"
placeholder="Enter your Email ID" required>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-label">Mobile
Number</label>
        <input type="text" class="form-control" id="mon" name="mon"
placeholder="Enter your Mobile Number" required>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-
label">Gender</label>
        <select class="form-select" id="gender" name="gender" aria-
label="Default select example" required>
          <option selected>-- Select Gender --</option>
          <option value="Male">Male</option>
          <option value="Female">Female</option>
        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-
label">Married</label>
        <select class="form-select" id="married" name="married" aria-
label="Default select example" required>
          <option selected>-- Select Status --</option>
```

```
          <option value="Yes">Yes</option>
          <option value="No">No</option>
        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-
label">Dependents</label>
        <select class="form-select" id="dependents" name="dependents" aria-
label="Default select example" required>
          <option selected>-- Select Dependents --</option>
          <option value="0">0</option>
          <option value="1">1</option>
          <option value="2">2</option>
          <option value="3+">3+</option>
        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-
label">Education</label>
        <select class="form-select" id="education" name="education" aria-
label="Default select example" required>
          <option selected>-- Select Education --</option>
          <option value="Graduate">Graduate</option>
          <option value="Not Graduate">Not Graduate</option>
        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-label">Self
Employed</label>
        <select class="form-select" id="employed" name="employed" aria-
label="Default select example" required>
          <option selected>-- select Self Employed --</option>
```

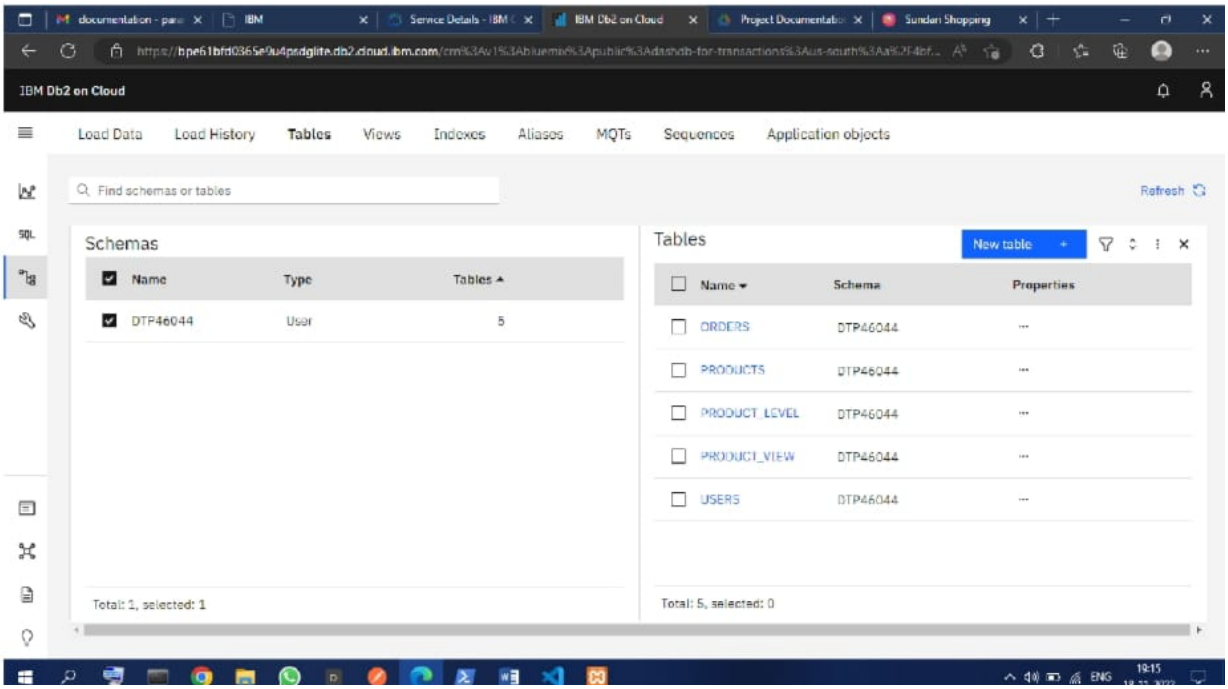
```
          <option value="Yes">Yes</option>
          <option value="No">No</option>
        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-label">Credit
History</label>
        <select class="form-select" id="credit" name="credit" aria-
label="Default select example" required>
          <option selected>-- select Credit History --</option>
          <option value="Yes">Yes</option>
          <option value="No">No</option>

        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-label">Property
Location</label>
        <select class="form-select" id="proparea" name="proparea" aria-
label="Default select example" required>
          <option selected>-- select Property Location --</option>
          <option value="Semiurban">Semiurban</option>
          <option value="Urban">Urban</option>
          <option value="Rural">Rural</option>
        </select>
      </div>
      <div class="mb-3">
        <label for="exampleFormControlInput1" class="form-label">Enter
Applicant Income</label>
        <input type="text" class="form-control" id="ApplicantIncome"
name="ApplicantIncome"
          placeholder="Applicant Income" required>
```

```
    </div>
    <div class="mb-3">
      <label for="exampleFormControlInput1" class="form-label">Enter Co-applicant Income</label>
      <input type="text" class="form-control" id="CoapplicantIncome" name="CoapplicantIncome"
        placeholder="Co-applicant Income" required>
    </div>
    <div class="mb-3">
      <label for="exampleFormControlInput1" class="form-label">Purpose of loan</label>
      <select class="form-select" id="pur" name="pur" aria-label="Default select example" required>
        <option selected>-- select the purpose of loan --</option>
        <option value="person">Personal Loan</option>
        <option value="Bussiness">Business Loan</option>
        <option value="Education">Education Loan</option>
        <option value="Home">Home Loan</option>
        <option value="Other">Other</option>
      </select>
    </div>
    <div class="mb-3">
      <label for="exampleFormControlInput1" class="form-label">Enter Loan Amount</label>
      <input type="text" class="form-control" id="LoanAmount" name="LoanAmount" placeholder="Loan Amount" required>
    </div>
    <div class="mb-3">
      <label for="exampleFormControlInput1" class="form-label">Enter Loan Amount Term</label>
      <input type="text" class="form-control" id="Loan_Amount_Term"
```

```
name="Loan_Amount_Term"
          placeholder="Loan Amount Term" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter
Aadhar Number</label>
          <input type="text" class="form-control" id="Adhar" name="Adhar"
placeholder="Aadhar Number" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter PAN
Card ID</label>
          <input type="text" class="form-control" id="PAN " name="PAN "
placeholder="PAN Card ID" required>
        </div>



        <br><br>
        <div class="mb-3">
          <button type="submit" value="PREDICT" class="btn btn-
dark">Predict</button>
        </div>
      </form>



    </div>
  </section>
  <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.0.0-
beta3/dist/js/bootstrap.bundle.min.js"
    integrity="sha384-
JEW9xMcG8R+pH31jmWH6WWP0WintQrMb4s7ZOdauHnUtxwoG2vI5DkLt
S3qm9Ekf"
```

```
    crossorigin="anonymous"></script>

</body>
<style>
  body{
    font-family: Arial, Helvetica, sans-serif;
    font-variant: small-caps;
}
</style>
</html>
```

7.3 Database Schema (if Applicable)



8. TESTING

8.1 Test Cases

Project Planning 2

TEST CASES

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup page when user clicked on Sign up button	1.Enter URL and click go 2.Scroll down 3.Verify login/Singup popup displayed or not	http://169.51.204.215:30106/	Login/Signup popup should display	Working as expected	PASS	Successful			Manju T Jasmine Mary
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Sign in/Signup popup	1.Enter URL and click go 2.Click on Signup button for User 3.Verify login/Singup popup with below UI elements: a.id text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	http://169.51.204.215:30106/	Application should show below UI elements: a.email text box b. password text box c.Login button d.New customer? Create account link	Working as expected	PASS	Successful			Manju T
LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials	1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter Valid ID in ID text box 4.Enter valid password in password text box 5.Click on login button	ID: 5342 password: Testing123	User should navigate to user account homepage	Working as expected	PASS	Successful			Manju T Jasmine Mary

Test Case (SPRINT 01) 3

LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter the url and click go 2.Click on My Account button 3.Enter InValid ID in ID text box 4.Enter valid password in password text box 5.Click on login button	ID: 5342 password: Testing123	Application should show 'Incorrect email or password ' validation message.	Working as expected	PASS	Successful			Manju T
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter URL and click go 2.Click on My Account button 3.Enter Valid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button	ID: 5342 password: Testing1236 7868 6786876876	Application should show 'Incorrect email or password ' validation message.	Working as expected	PASS	Successful			Manju T
LoginPage_TC_OO6	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button	ID: 5342 password: Testing123	Application should show 'Incorrect email or password ' validation message.	Working as expected	PASS	Successful			Manju T

Test Case (SPRINT 01) 4

LoginPage_TC_OO7	Functional	Login page	Verify User is able to log into application with Valid Credentials	1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login	ID: 5434 password: Testing123	Application should show 'correct email or password ' validation message.	Working as expected	PASS	Successful			Manju T Jasmine Mary

Test Case (SPRINT 01) 4

LoginPage_ TC_ OO7	Functional	Login page	Verify User is able to log into application with Valid Credentials	1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button	ID: 5434 password: Testing123	Application should show 'correct email or password ' validation message.	Working as expected	PASS	Successful			Manju T Jasmine Mary
LoginPage_ TC_ OO8	Functional	Login page for ADMIN	Verify User is able to log into application with Valid Credentials	1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter Valid ID in ID text box 4.Enter valid password in password text box 5.Click on login button	ID: 1111 password: 5678	Application should show 'correct email or password ' validation message.	Working as expected	PASS	Successful			Manju T Jasmine Mary
LoginPage_ TC_ OO9	UI	ADMIN PAGE	Verify all the Customer database is visible	1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button	http://169.51.204. 218:30106/	Customer database is visible	Working as expected	PASS	Successful			Manju T

Test Case (SPRINT 01) 5

LoginPage_ TC_ OI0	Functional	USER REGISTER	Verify Id sent to customer email address	1.Enter URL and click go 1.Register the account by giving credentials 2. Click on button Submit	http://169.51.204 .218:3 0106/	Email sent successfull ly	Working as expected	PASS	Successful			Manju T
LoginPage_ TC_ OI1	Functional	AGENT REGISTER	Verify AGENT is able to log into application with Valid Credentials	1.Enter URL(http://169.51.20 4.21 5:30106/) and click go 2.Click on My Account dropdown button 3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button	ID: 5342 password: Testing@123	ID sent successfully	Application should show a 'correct email or password ' validation message.	PASS	Successful			Manju T
LoginPage_ TC_ OI2	Functional	Login page for ADMIN	Verify User is able to log into application with InValid Credentials	1.Enter URL and click go 2.Click on account button 3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button	ID: 1111 password: 5678	Applicatio n should show 'Incorrect ID or password ' validation message.	Working as expected	PASS	Successful			Manju T P.Jasmine Mary
LoginPage_ TC_ OI3	UI	Home page for Agent	Verify user is able to see the agent home page when user finish on submitting Credentials	1.Enter URLand click go 2. To the Agent Login page and submit Your Credentials	ID: 1111 password: 5678	AGENT Home Page popup should display	Working as expected	PASS	Successful			Manju T

				3.Enter InValid ID in ID text box 4.Enter Invalid password in password text box 5.Click on login button		ID or password ' validation message.						
LoginPage_ TC_ O13	UI	Home page for Agent	Verify user is able to see the agent home page when user finish on submitting Credentials	1.Enter URLand click go 2. To the Agent Login page and submit Your Credentials	ID: 1111 password: 5678	AGENT Home Page popup should display	Working as expected	PASS	Successful			Manju T

Test Case (SPRINT 01) 6

LoginPage_ TC_ O14	UI	Home page for USER	Verify user is able to see the User home page when user finish on submitting Credentials	1.Enter UR and click go 2. To the User Login page and submit Your Credentials	http://169.5 1.20 4.215:3010 6/	USER Home Page popup should display	Working as expected	PASS	Successful			Manju T P.Jasmine Mary
LoginPage_ TC_ O15	UI	Home page for ADMIN	Verify user is able to see the ADMIN home page when user finish on submitting Credentials	1.Enter URL and click go 2. To the User Login page and submit Your Credentials	http://169.5 1.20 4.215:3010 6/	ADMIN Home Page popup should display	Working as expected	PASS	Successful			Manju T
LoginPage_ TC_ O16	Functional	AGENT PAGE	On delete Button the user Credentials will be detected	1.Enter URL and click go 2. To the Admin Page and detect the User Credentials	http://169.5 1.20 4.215:3010 6/	ADMIN Home Page popup should display	Working as expected	PASS	Successful			Manju T

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [CUSTOMER CARE REGISTRY] project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	3	1	2	17
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	40
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8

Totals 24 13 12 25 78

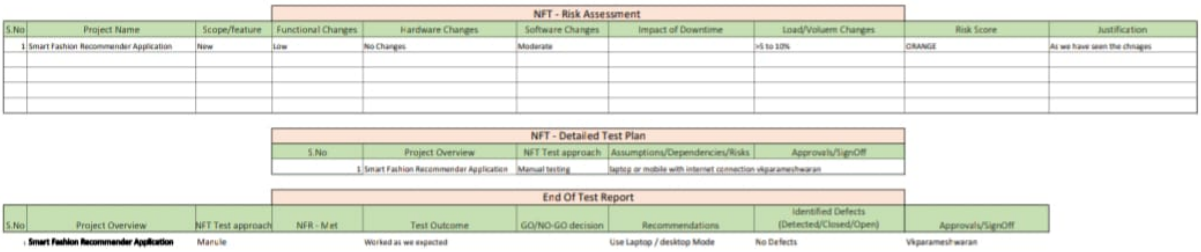
3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	10	0	0	10
Client Application	50	0	0	50
Security	1	0	0	1
Outsource Shipping	3	0	0	3
Exception Reporting	8	0	0	8
Final Report Output	4	0	0	4

9. RESULTS

9.1 Performance Metrics



NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
1	Smart Fashion Recommender Application	New	Low	No Changes	Moderate		>5 to 10%	ORANGE	As we have seen the chnages

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff
1	Smart Fashion Recommender Application	Manual testing	laptop or mobile with internet connection vkparameshwaran	

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	Smart Fashion Recommender Application	Manule		Worked as we expected		Use Laptop / desktop Mode	No Defects	Vkparameshwaran

10. ADVANTAGES & DISADVANTAGES

Advantages:

Keep Control of the Company

A bank loans money to a business based on the value of the business and its perceived ability to service the loan by making payments on time and in full. Unlike with equity finance where the business issues shares, banks do not take any ownership position in businesses. Bank personnel also do not get involved in any aspect of running a business to which a bank grants a loan. This means you ghet to retain full management and control of your business with no external interference.

Bank Loan is Temporary

Once a business borrower has paid off a loan, there is no more obligation to or involvement with the bank lender unless the borrower wishes to take out a subsequent loan. Compare this with equity finance, where the company may be paying out dividends to shareholders for as along as the business exists.Interest is Tax DeductibleThe interest on business bank loans is tax-deductible. In addition, especially with fixed-rate loans, in which the interest rate does not change during the course of a loan, loan servicing payments remain the same throughout the life of the loan. This makes it easy for businesses to budget and plan for monthly loan payments. Even if the loan is an adjustable-rate loan, business owners can use a simple spreadsheet to compute future payments in the event of a change in rates

Disadvantages:

Tough to Qualify

One of the greatest disadvantages to bank loans is that they are very difficult to obtain unless a small business has a substantial track record or valuable collateral such as real estate. Banks are careful to lend only to businesses that can clearly repay their loans, and they also make sure thatthey are able to cover losses in the event of default. Business borrowers can be required to provide personal guarantees, which means the borrower's personal assets can be seized in the event the business fails and is unable to repay all or part of a loan.

High Interest Rates

Interest rates for small-business loans from banks can be quite high, and the amount of bank funding for which a business qualifies is often not sufficient to completely meet its needs. The high interest rate for the funding a business does receive often stunts its expansion, because the business needs to not only service the loan but also deal with additional funding to cover funds not provided by the bank. Loans guaranteed by the U.S. Small Business Administration offer better terms than other loans, but the requirements to qualify for these subsidized bank loans are very strict.

11. CONCLUSION

The analysis starts from data cleaning and processing missing value, exploratory analysis and finally model building and evaluation of the model. The best accuracy on public test set is when we get higher accuracy score and other performance metrics which will be found out. This project can help to predict the approval of bank loan or not for a candidate.

12. FUTURE SCOPE

In order to analyse the risk associated for the bank, credit evaluation largely involves gathering information about the customer and examining the project's technical, financial, and economic viability and this process developed a lot.

13. APPENDIX

Source Code

Codeindex.html

```
<form action='/prediction.html' method="post" onsubmit="return valid()"
class="px-24 mx-12">
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Name</label>
<input type="text" class="form-control" id="Name" name="Name"
placeholder="Enter your
Name" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Email
ID</label>
<input type="email" class="form-control" id="email" name="email"
placeholder="Enter your
Email ID" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Mobile
Number</label>
<input type="text" class="form-control" id="mon" name="mon"
placeholder="Enter your
Mobile Number" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Gender</label>
<select class="form-select" id="gender" name="gender" aria-label="Default
select example"
required>
<option selected>-- Select Gender --</option>
<option value="Male">Male</option>
<option value="Female">Female</option>
```

```
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Married</label>
<select class="form-select" id="married" name="married" aria-label="Default
select example"
required>
<option selected>-- Select Status --</option>
<option value="Yes">Yes</option>
<option value="No">No</option>
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-
label">Dependents</label>
<select class="form-select" id="dependents" name="dependents" aria-
label="Default select
example" required>
<option selected>-- Select Dependents --</option>
<option value="0">0</option>
<option value="1">1</option>
<option value="2">2</option>
<option value="3+">3+</option>
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-
label">Education</label>
<select class="form-select" id="education" name="education" aria-
label="Default select
example" required>
<option selected>-- Select Education --</option>
```

```
<option value="Graduate">Graduate</option>
<option value="Not Graduate">Not Graduate</option>
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Self
Employed</label>
<select class="form-select" id="employed" name="employed" aria-
label="Default select
example" required>
<option selected>-- select Self Employed --</option>
<option value="Yes">Yes</option>
<option value="No">No</option>
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Credit
History</label>
<select class="form-select" id="credit" name="credit" aria-label="Default
select example"
required>
<option selected>-- select Credit History --</option>
<option value="Yes">Yes</option>
<option value="No">No</option>
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Property
Location</label>
<select class="form-select" id="proparea" name="proparea" aria-
label="Default select example" required>
<option selected>-- select Property Location --</option>
```

```
<option value="Semiurban">Semiurban</option>
<option value="Urban">Urban</option>
<option value="Rural">Rural</option>
</select>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Enter Applicant
Income</label>
<input type="text" class="form-control" id="ApplicantIncome"
name="ApplicantIncome"placeholder="Applicant Income" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Enter Co-
applicant
Income</label>
<input type="text" class="form-control" id="CoapplicantIncome"
name="CoapplicantIncome"
placeholder="Co-applicant Income" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Purpose of
loan</label>
<select class="form-select" id="pur" name="pur" aria-label="Default select
example"
required>
<option selected>-- select the purpose of loan --</option>
<option value="person">Personal Loan</option>
<option value="Bussiness">Business Loan</option>
<option value="Education">Education Loan</option>
<option value="Home">Home Loan</option>
<option value="Other">Other</option>
</select>
```

```
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Enter Loan
Amount</label>
<input type="text" class="form-control" id="LoanAmount"
name="LoanAmount"placeholder="Loan
Amount" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Enter Loan
Amount
Term</label>
<input type="text" class="form-control" id="Loan_Amount_Term"
name="Loan_Amount_Term"
placeholder="Loan Amount Term" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Enter Aadhar
Number</label>
<input type="text" class="form-control" id="Adhar" name="Adhar"
placeholder="Aadhar
Number" required>
</div>
<div class="mb-3">
<label for="exampleFormControlInput1" class="form-label">Enter PAN Card
ID</label>
<input type="text" class="form-control" id="PAN " name="PAN "
placeholder="PAN Card ID" required>
</div>
<br><br>
<div class="mb-3">
<button type="submit" value="PREDICT" class="btn btn-
```

```
dark">Predict</button>
</div>
</form>
app.py
from flask import render_template, Flask, request
import numpy as np
import pickle
from sklearn.preprocessing import scale
app = Flask(_name_, template_folder='templates')
model = pickle.load(open("model.pkl", 'rb'))
@app.route('/')def
home():
return render_template('home.html')
@app.route('/login.html')
@app.route('/home.html')
def home1():
return render_template('home.html')
@app.route('/prediction.html')def
formpg():
return render_template('prediction.html')
@app.route('/prediction.html', methods=['POST']) def
predict():
if request.method == 'POST': name
= request.form['Name'] gender =
request.form['gender']
married = request.form['married']
dependents = request.form['dependents']
education = request.form['education']
employed = request.form['employed'] credit
= request.form['credit']
proparea = request.form['proparea']
ApplicantIncome = float(request.form['ApplicantIncome'])
```

```
CoapplicantIncome = float(request.form['CoapplicantIncome'])
LoanAmount = float(request.form['LoanAmount']) Loan_Amount_Term =
float(request.form['Loan_Amount_Term'])
if gender == 'Male':
gender = 1
else:
gender = 0
if married == 'Yes':
married = 1
else:
married = 0
if education == 'Graduate':
education = 0
else:
education = 1
if employed == 'Yes':
employed = 1
else:
employed = 0
if dependents == '3+':
dependents = 3
if credit == 'Yes':
credit = 1
else:
credit = 0
if proparea == 'Urban':
proparea = 2
elif proparea == 'Rural':
proparea = 0
else:
proparea = 1
features = [gender, married, dependents, education, employed,
```

```
ApplicantIncome, CoapplicantIncome,
LoanAmount, Loan_Amount_Term, credit, proparea]
con_features = [np.array(features)]
prediction = model.predict(con_features)
print(prediction)
if prediction == 1:
return render_template('approve.html', prediction_text='Congratulations!
'+name+' You are
eligible for loan')
else:
return render_template('reject.html', prediction_text='Sorry '+name+' You are
not eligible for
loan')

if _name_ == "_main_":
app.run(debug=True)
```

13.2 GitHub& Project Demo Link

Github Link:

https://github.com/IBM-EPBL/IBM-Project-17145-1659629015

Project Link:

https://youtu.be/OxVXJCaFi9I