Smart Lender Applicant Credibility Prediction for Loan Approval

IBM-Project-31088-1660196090

Project Report

Team Members

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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 References

S.NO	TITLE	AUTHOR	ABSTRACT
1.	Modern Approach for Loan Sanctioning in Banks Using Machine Learning	Golak Bihari Rath. Debasish Das. BiswaRanjan Acharya.	As the needs of people are increasing, the demand for loans in banks is also frequently getting higher every day. Usually, banks process the loan of any applicant after the verification and checking of its eligibility which is a tough and time-taking process. In some cases, some applicants default in payment resulting in loss of capital in banks. Machine learning approach would be an ideal solution to reduce human efforts and effective decision making in the loan approval process by implementation of machine learning tools using classification algorithms to predict the deserving

			applicants for loan approval. In this paper, we build a system to construct a model by training the system with records and approval results of the previously applied loan applicants. Model building is done by classification algorithms on the basis of some predictive features that categorize an outcome value as approve or disapprove. We found the logistic regression model has the best performance in comparison with other models and can be used as a predictive model reducing the risk factor in selecting the deserving applicants for loan repayment saving a lot of bank efforts and assets. Further, this model can be implemented in the banking sector allowing faster processing of loans.
2.	Loan Credibility Prediction System using Data Mining Techniques	Anuja Kadam. Pragati Namde. Sonal Shirke. Siddhesh Nandgaonkar. Dr.D.R. Ingle.	As we know that now-a-days there is arapid growth in the banking sector, resulting in lots of people applying for bank loans. Finding out the applicant to whom the loan will be approved is a difficult process. Data mining techniques are becoming very popular nowadays because of the wide availability of huge

			quantities of data and the need for transforming such data into knowledge. Techniques of data mining are implemented in various domains such as retail industry, telecommunication industry, biological data analysis, etc. In this paper, we proposed a model which predicts loan approval/rejection of an applicant using data mining techniques. This canbe done by training the model with the data of the previous records of the people applied for loan.
3.	Loan Prediction using Decision Tree and Random Forest	Kshitiz Gautam. Arun Pratap Singh. Keshav Tyagi. Mr. Suresh Kumar.	In India, the number of people or organizations applying for loans increases every year. The bank employees have to put in a lot of work to analyze or predict whether the customer can pay back the loan amount or not (defaulter or non-defaulter) in the given time. The aim of this paper is to findthe nature or background or credibility of the client that is applying for the loan. We use exploratory data analysis techniques to deal with the problem of approving or rejecting the loan request or in short loan prediction. The main focus of this

			paper is to determine whether the loan given to a particular person or an organization shall be approved or not.
4.	Logistic Regression Based Loan Approval Prediction	Sai Aparna Vangaveeti. Naga Likitha Venna. Prasanna Naga Sri RamyaYajamanam Kidambi. Harika Marneni. Naga Satish Kumar Maganti.	As we know that now-a-days there is arapid growth in the banking sector, resulting in lots of people applying for bank loans. Finding out the applicant to whom the loan will be approved is a difficult process. In this paper, we proposed a model which predicts loan approval/rejection of an applicant using machine learning techniques. This canbe done by training the model with the data of the previous records of the people applied for loan.

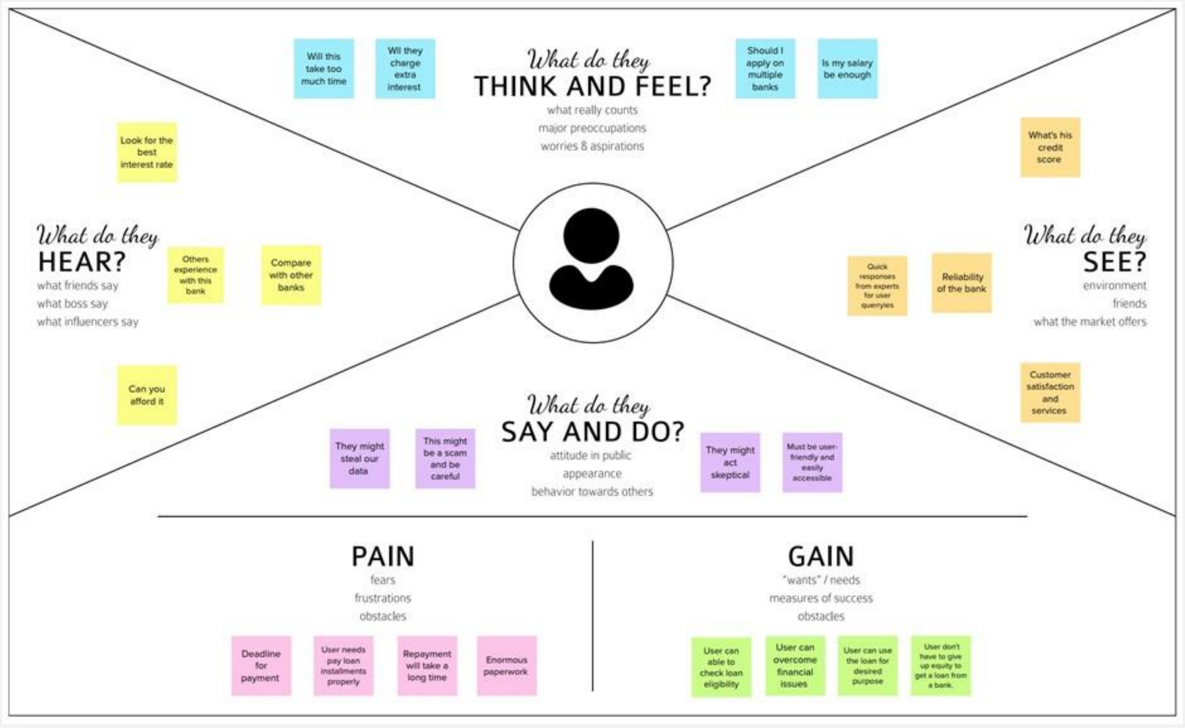
2.2 Problem Statement Definition

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.

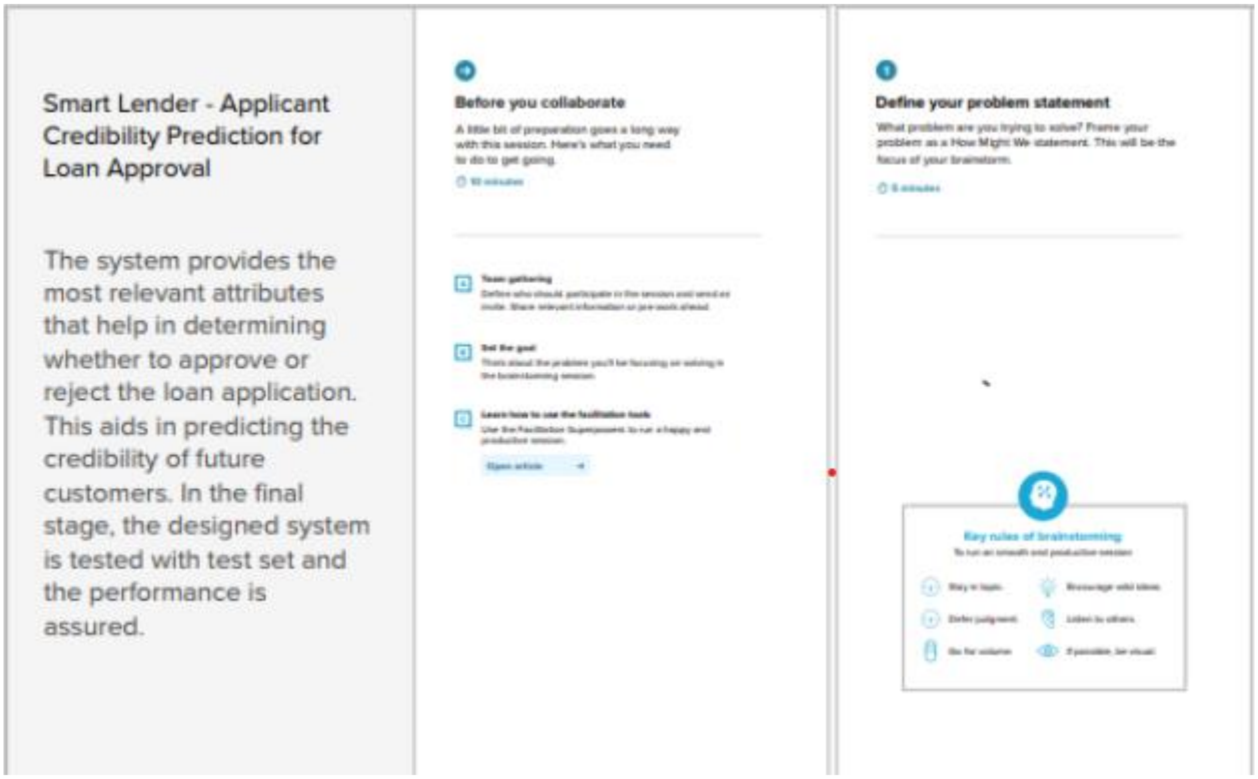
Chapter 3: IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

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


Will this take too much time
Wil they charge extra interest
What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
Should I apply on multiple banks
Is my salary be enough
Look for the best interest rate
What's his credit score
What do they
HEAR?
what friends say
what boss say
what influencers say
Others experience with this bank
Compare with other banks
Quick responses from experts for user querryies
Reliability of the bank
What do they
SEE?
environment
friends
what the market offers
Can you afford it
Customer satisfaction and services
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
They might steal our data
This might be a scam and be careful
They might act skeptical
Must be user-friendly and easily accessible
PAIN
fears
frustrations
obstacles
Deadline for payment
User needs pay loan installments properly
Repayment will take a long time
Enormous paperwork
GAIN
"wants" / needs
measures of success
obstacles
User can able to check loan eligibility
User can overcome financial issues
User can use the loan for desired purpose
User don't have to give up equity to get a loan from a bank.

3.2 Ideation & Brainstorming



Smart Lender - Applicant Credibility Prediction for Loan Approval

The system provides the most relevant attributes that help in determining whether to approve or reject the loan application. This aids in predicting the credibility of future customers. In the final stage, the designed system is tested with test set and the performance is assured.

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

Define your problem statement

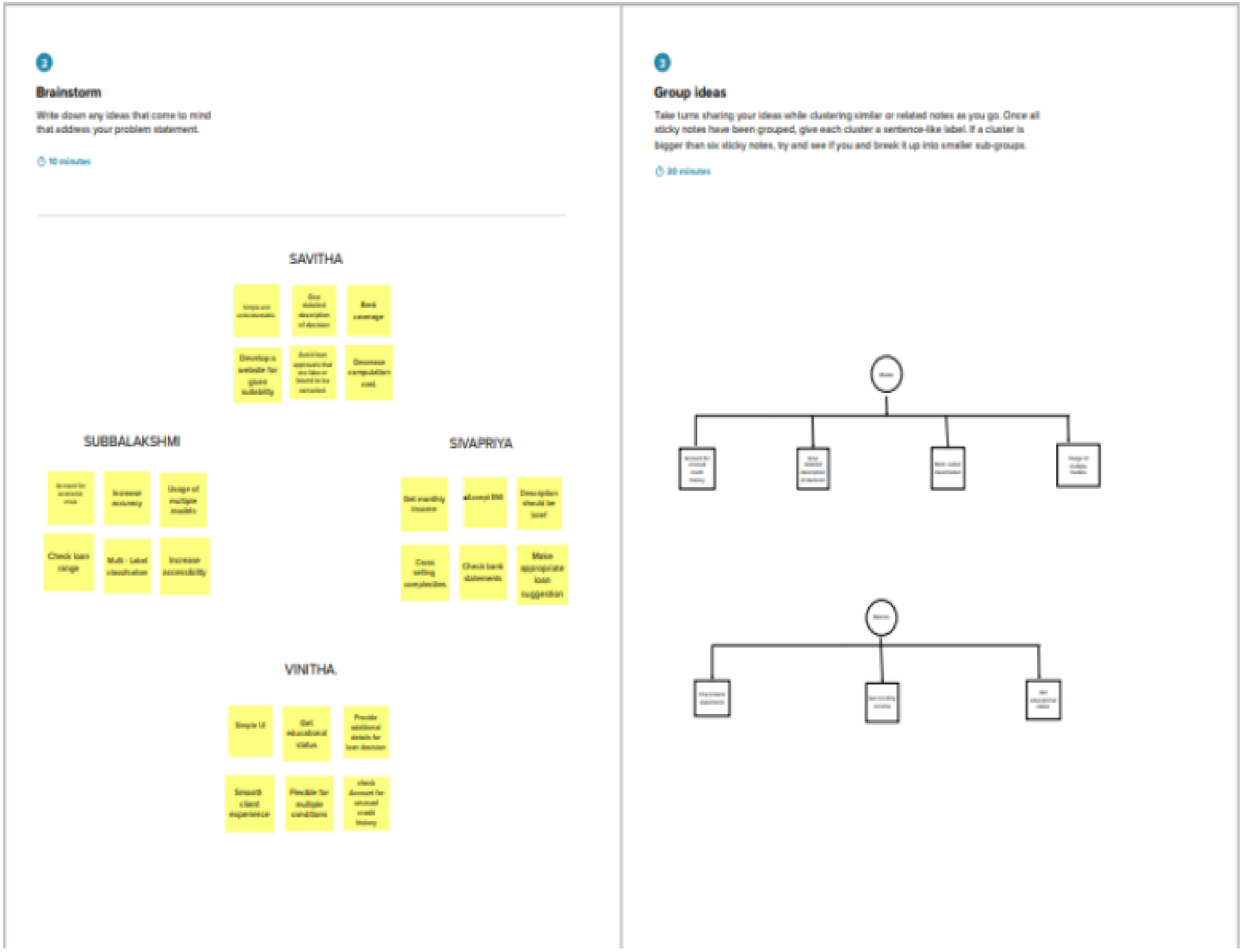
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.



2

Brainstorm

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

10 minutes

SAVITHA

Simple and understandable

Give detailed description of decision

Bank coverage

Develop a website for given suitability

Avoid loan approvals that are fake or bound to be cancelled

Decrease computation cost

SUBBALAKSHMI

Account for economic crisis

Increase accuracy

Usage of multiple models.

Check loan range

Multi - Label classification

Increase accessibility

SIVAPRIYA

Get monthly income

aAccept EMI

Description should be brief

Cross selling complexities

Check bank statements

Make appropriate loan suggestion

VINITHA.

Simple UI

Get educational status

Provide additional details for loan decision

Smooth client experience

Flexible for multiple conditions

check Account for unusual credit history

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 label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Model
Account for unusual credit history
Give detailed description of decision
Multi - Label classification
Usage of multiple models
Metrics
Check bank statements
Get monthly income
Get educational status

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 label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Lenders also typically require minutes and/or resolutions that document Board approval of the loan

Loan applications ask for your annual income, and you can include money earned from part-time work.

If you meet a lender's minimum qualifications and want to see estimated rates and terms, you can pre-qualify for a personal loan.

If you're already a customer with the bank, you may receive an additional APR discount.

Lower APR than other types of personal loan lenders.

Missed payment does not hurt your credit score.

The lender will ask and will require documentation to confirm you have the finances in order to repay the loan.

Understanding credit score One person has one identity.

A credit card is technically a loan that is referred to as a revolving line of credit. Every time you use your card, your card's issuing bank lends you the money to pay for your purchase.

The documents asked by any loan app are basic and minimal. These include your identity proof, address proof, and income proof.

. Depending on your eligibility you can avail a loan amount of your own choice

Such apps provide instant personal loan starting from INR 10,000 to INR 2 lakh. You can get a loan as per your requirement and eligibility

Beware of the high origination fees associated with payday cash advances

Consumers are easily confused about how debt consolidation works because the industry uses interchangeable terms.

Specific guidelines issued by different agencies determine how medical collections appearing on your credit report will affect a mortgage approval and interest rate.

A debt consolidation loan means that one new lender pays off what you owe to multiple old creditors.

The critical approval criteria are a good credit score and sufficient income to cover your monthly payment along with your existing mortgage.

taking out and then repaying an installment loan on time should improve your score in the future, allowing you to borrow money at better rates.

Sometimes if you have a bad credit score, or are currently unemployed, then it can be tricky to get approved for a loan. A great way to help ensure that you are approved is to get a cosigner.

Sometimes if you are getting a loan from a bank or creditor that is different from your own, providing them with a bank statement can help to improve the speed at which you can attain your loan.

One of the best ways to get easily approved for any kind of loan is to have an extremely good credit rating.

People with terrific job security have the best approval odds because the lender can count on your income continuing through the end of the loan term.

Personal loans based on income and not a credit score can help borrowers with weak credentials obtain quick funding for a vacation, or Emergency cash etc...

If you ask the lender to disregard a critical underwriting factor, you must shine in this area.

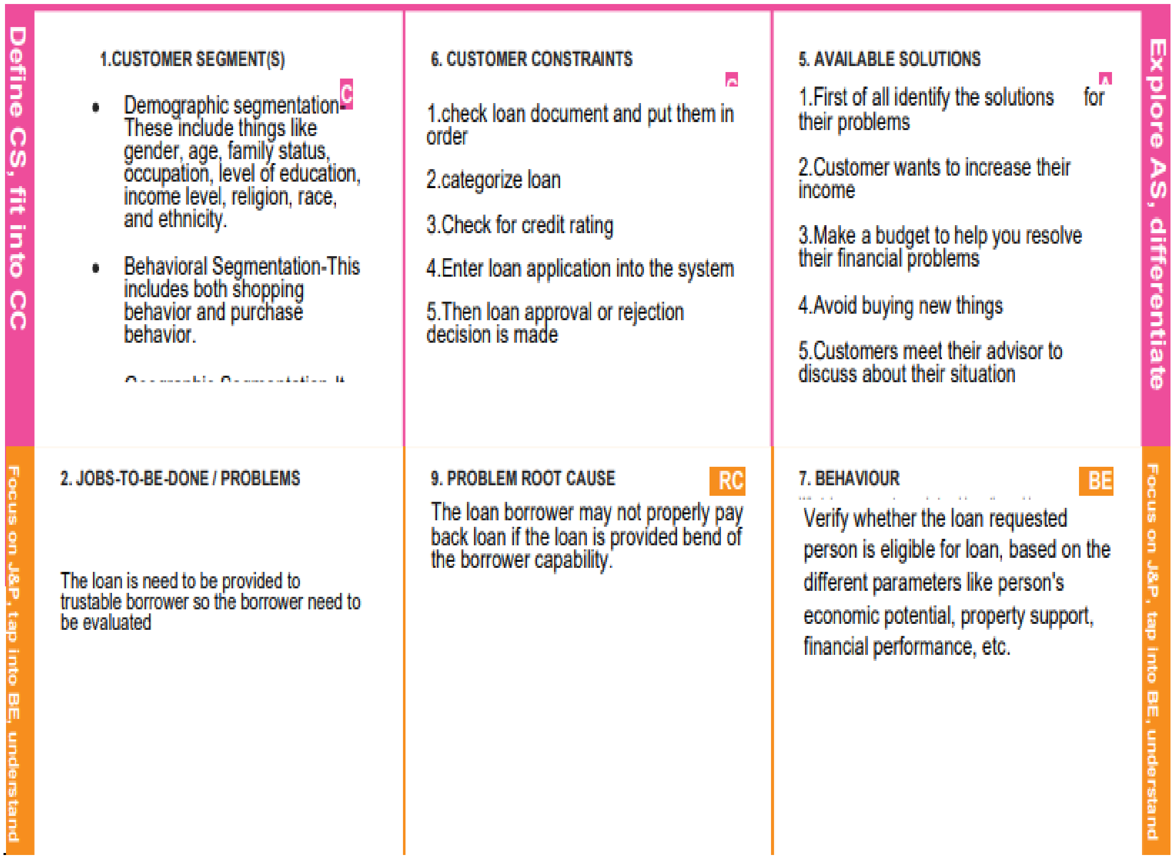
TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

3.3 Proposed Solution

S.No.	Parameter	Description
1	Problem Statement (Problem to be solved)	Insufficient Income . Not having steady source of income.
2.	Idea / Solution description	A steady source of income is the proof for any lender that you are capable of repaying your personal loan.
3.	Novelty / Uniqueness	Banks have set a minimum monthly salary cap.
.4.	Social Impact / Customer Satisfaction	In the absence of a job, ensure that you have other sources of income.
5.	Business Model (Revenue Model)	Avoid applying for a loan when you have just switched jobs.
6.	Scalability of the Solution	Interest payouts or rental income, that will help you make EMI payments.

3.4 Problem Solution fit



Define CS, fit into CC

1.CUSTOMER SEGMENT(S) CS

- Demographic segmentation-These include things like gender, age, family status, occupation, level of education, income level, religion, race, and ethnicity.
- Behavioral Segmentation-This includes both shopping behavior and purchase behavior.

6. CUSTOMER CONSTRAINTS

1.check loan document and put them in order

2.categorize loan

3.Check for credit rating

4.Enter loan application into the system

5.Then loan approval or rejection decision is made

5. AVAILABLE SOLUTIONS

1.First of all identify the solutions for their problems

2.Customer wants to increase their income

3.Make a budget to help you resolve their financial problems

4.Avoid buying new things

5.Customers meet their advisor to discuss about their situation

Explore AS, differentiate

Focus on J&P, tap into BE, understand

2. JOBS-TO-BE-DONE / PROBLEMS

The loan is need to be provided to trustable borrower so the borrower need to be evaluated

9. PROBLEM ROOT CAUSE RC

The loan borrower may not properly pay back loan if the loan is provided bend of the borrower capability.

7. BEHAVIOUR BE

Verify whether the loan requested person is eligible for loan, based on the different parameters like person's economic potential, property support, financial performance, etc.

Focus on J&P, tap into BE, understand

3. TRIGGERS TR The income source for the bank's is the interest of the loan which has been given to the loan requesters. So, the banks are willing to give the loan for trustable borrower.	**10. YOUR SOLUTION** SL 1. Offer consistent companywide messaging 2. Provide instructions for easy adoption 3. Nurture customer relationships 4. Solve for the right customers needs. 5. Build feedback loops into every stage of the process.	**8. CHANNELS of BEHAVIOUR** CH If some customers can take a online action by lending a money through web platforms or mobile apps, utilizing technology for authentication and credit evaluation. If some customers can take a offline action by ofline payments are transaction processed asynchronously, offline payments are made via cash, checks, bank transfer, postal orders etc..
4. EMOTIONS: BEFORE / AFTER EM While evaluating the loan applicant the bankers struggle in deciding how to evaluate the loan applicant, which are the things to be considered and what are the criteria level needed to be checked. If the loan borrowers are not paying back the loan at specified intervals then the banks are not able to generate income which is necessary for maintaining the bank and providing the interest for the depositors. providing the interest for the depositors.		Flexibility for customer to pay through offline payment methods can help extend customers business.

Chapter 4: REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Application	Filling of application Modification of application Verification of application
FR-4	Loan Issuance	Checking status of loan Loan Approval Loan Rejection

4.2 Non-Functional requirements

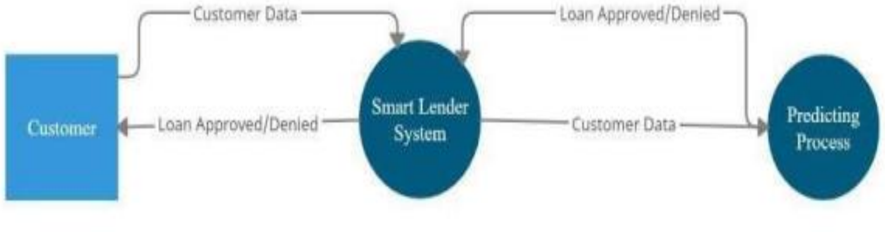
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	● Easy to use and self-explaining website. ● Easy navigation between pages. ● Simple structure for faster access.
NFR-2	**Reliability**	● Ensembling the outputs of various ML models.
NFR-3	**Performance**	● Web Based Application. ● Ability to indicate user inputs of erroneous data types.

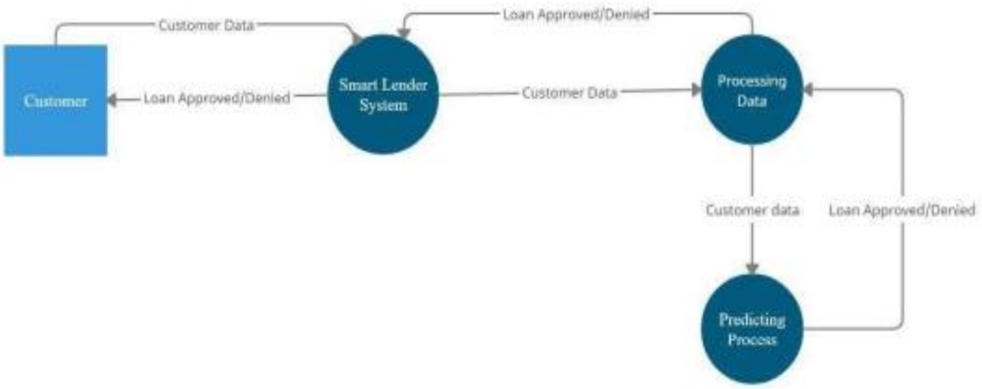
NFR-4	**Availability**	● Application is available 24 / 7 as it is hosted on IBM cloud. ● Simple web browser is enough to access the website.
NFR-5	**Scalability**	● Can be extended for other types of loans. ● Aadhar and PAN verification can also be implemented.

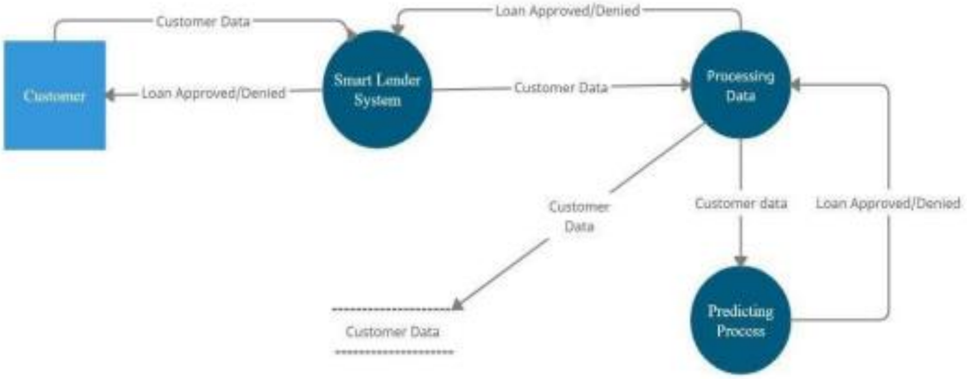
Chapter 5: PROJECT DESIGN

5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.







5.2 Solution & Technical ArchitectureSolution Architecture:

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

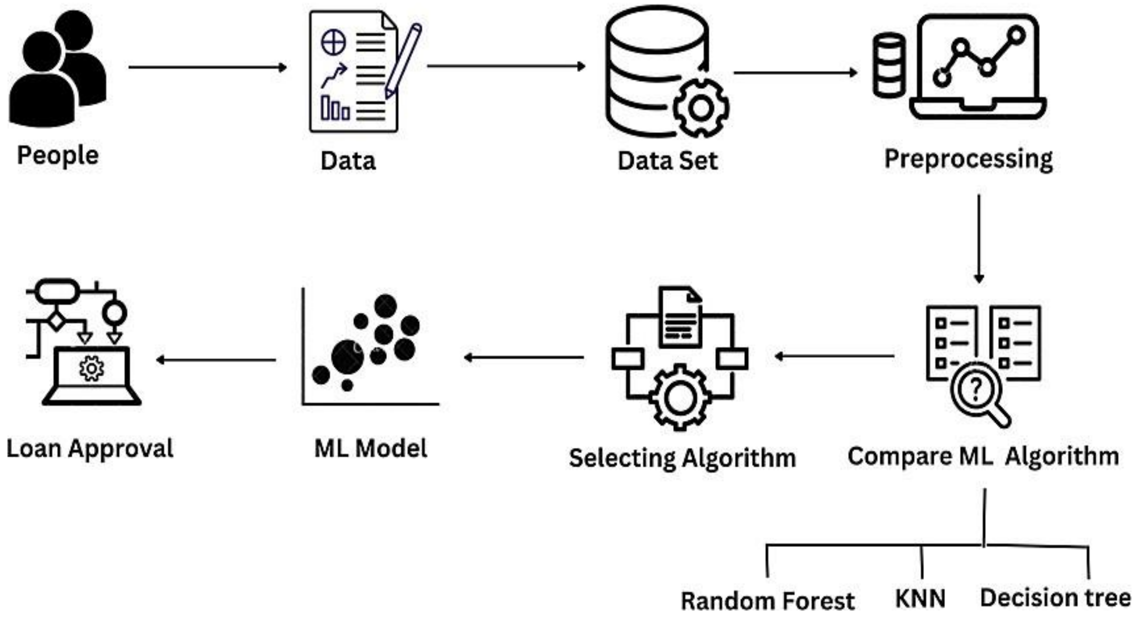
● Find the best tech solution to solve existing business problems

. ● Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders

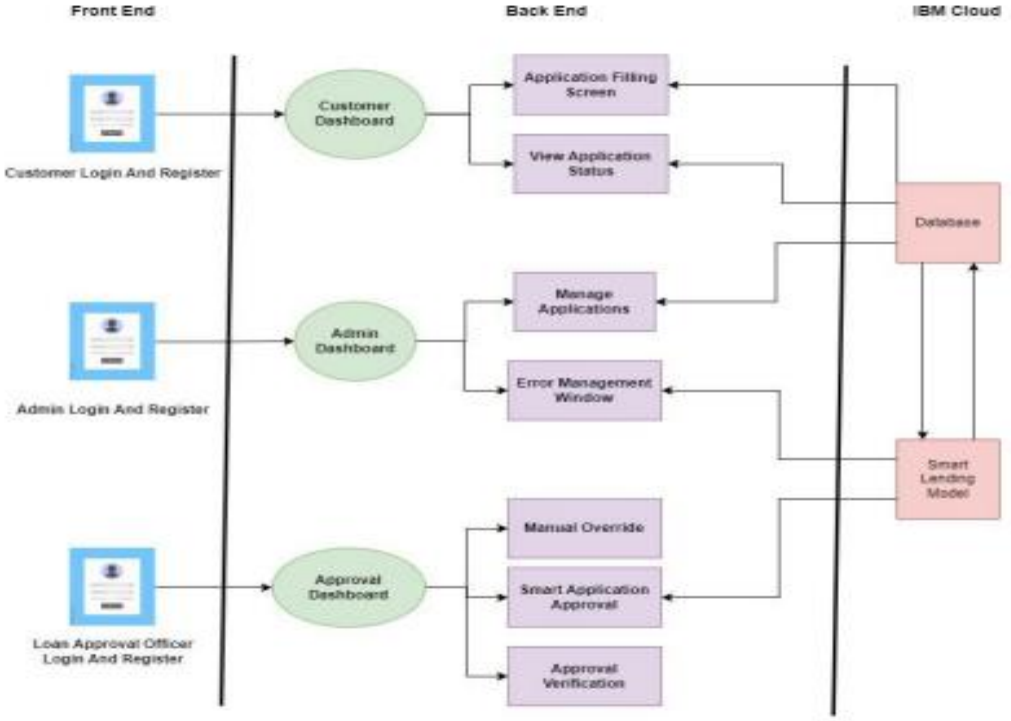
. ● Define features, development phases, and solution requirements

. ● Provide specifications according to which the solution is defined, managed, and delivered.

SOLUTION ARCHITECTURE



Technical Architecture:



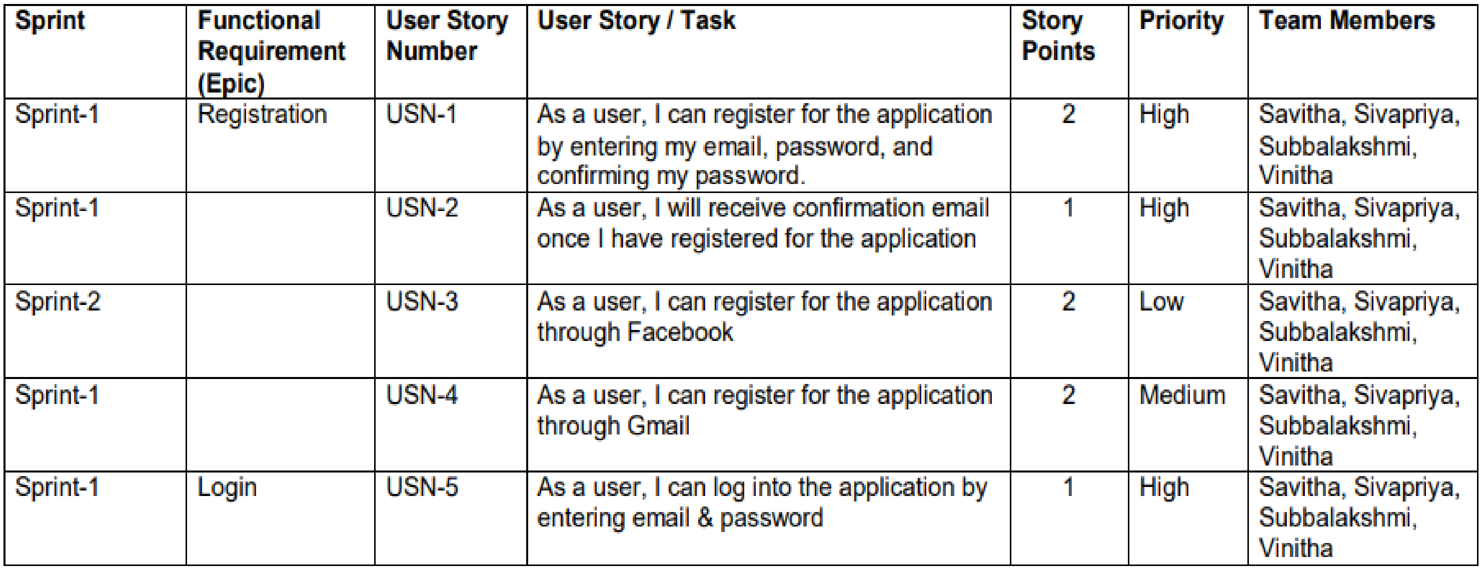
5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Money lender (Web user)	Dashboard	USN-1	As a user, I should be able to access the dashboard.	Access the dashboard	Low	Sprint 3
		USN-2	Select the type of loan	Select the type of loan	Medium	Sprint 3
	Check for loan eligibility	USN-3	Fill the application with the details of the borrower.	Check the eligibility of the borrower.	High	Sprint 4
Borrower	Dashboard	USN-4	Should be able to access the dashboard.	Access the dashboard.	Low	Sprint 3
		USN-5	Choose the type of loan	Choose the type of loan	Medium	Sprint 3

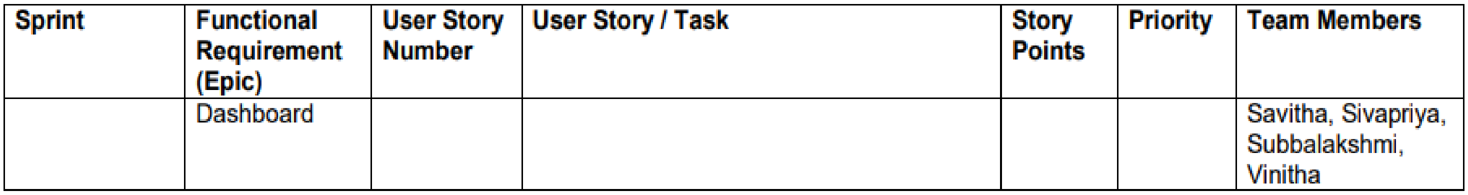
Chapter 6: PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation



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



Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
	Dashboard					Savitha, Sivapriya, Subbalakshmi, Vinitha

6.2 Sprint Delivery Schedule

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

Velocity:

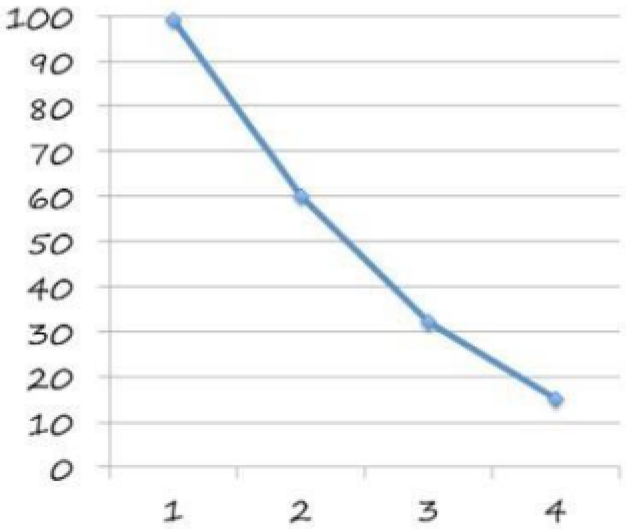
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

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

Our Project velocity

Velocity: Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)

AV = sprint duration/velocity = 20/10 = 2



In our project,there are 4 sprint activities.

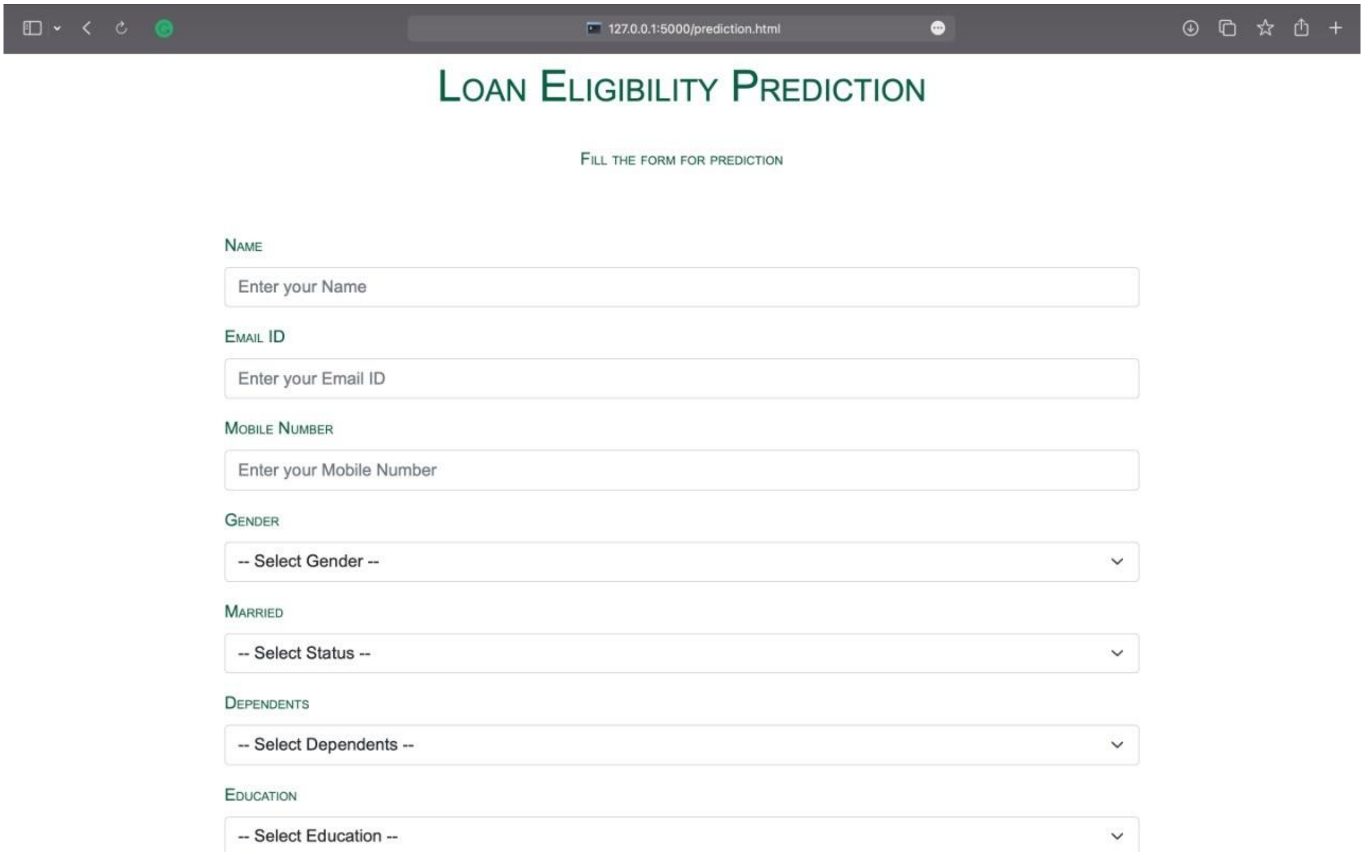
This chart is drawn by taking

X - sprint and

Y - Pending hours.

Chapter 7: CODING & SOLUTIONING

7.1 Feature 1



LOAN ELIGIBILITY PREDICTION

FILL THE FORM FOR PREDICTION

NAME

Enter your Name

EMAIL ID

Enter your Email ID

MOBILE NUMBER

Enter your Mobile Number

GENDER

-- Select Gender --

MARRIED

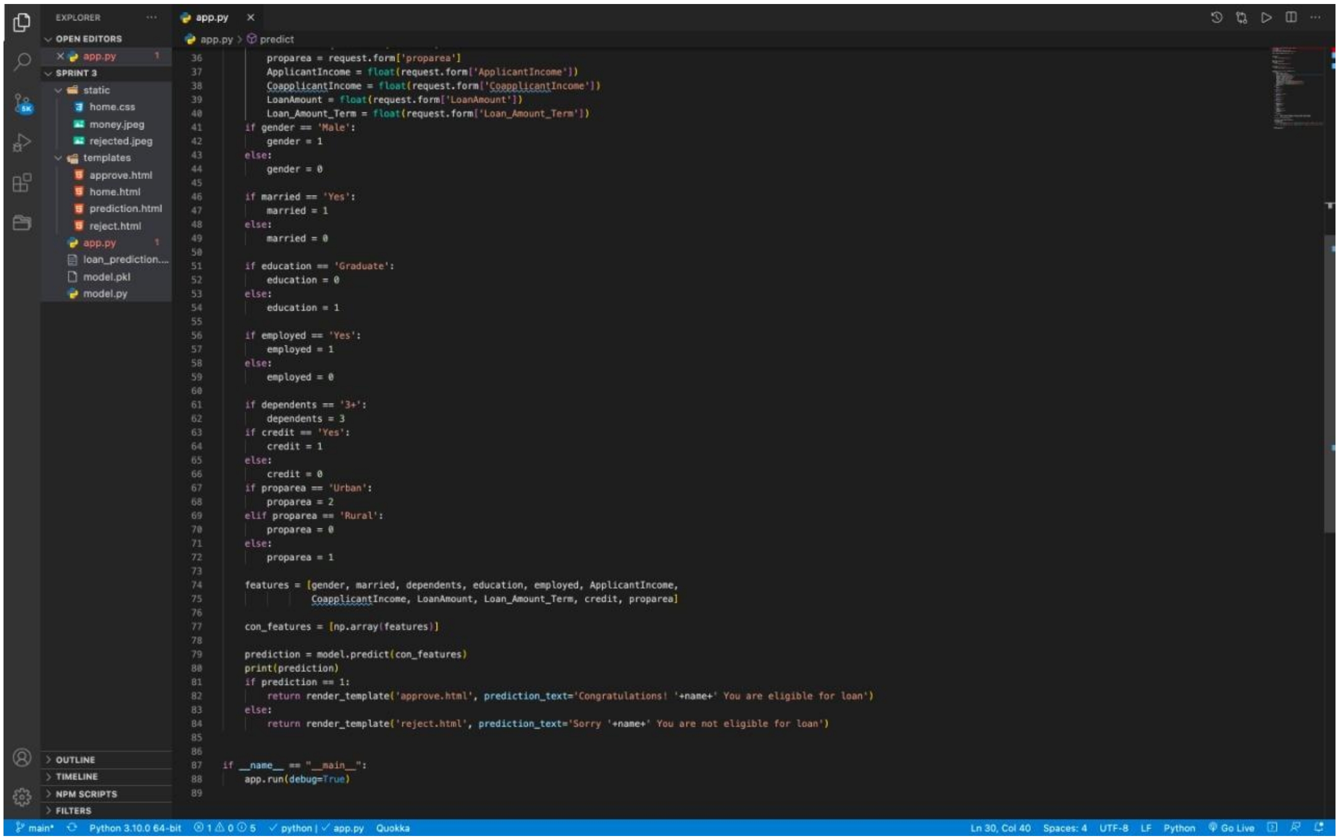
-- Select Status --

DEPENDENTS

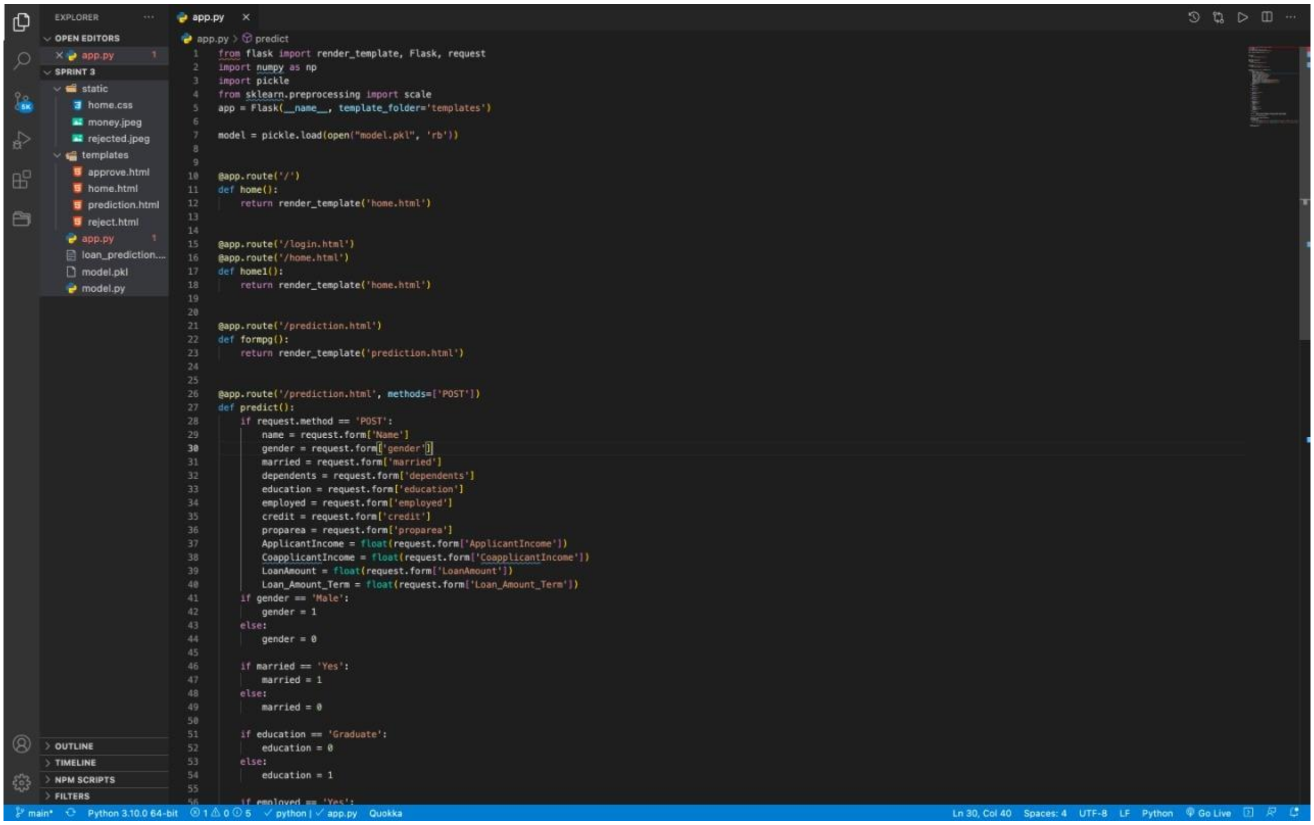
-- Select Dependents --

EDUCATION

-- Select Education --

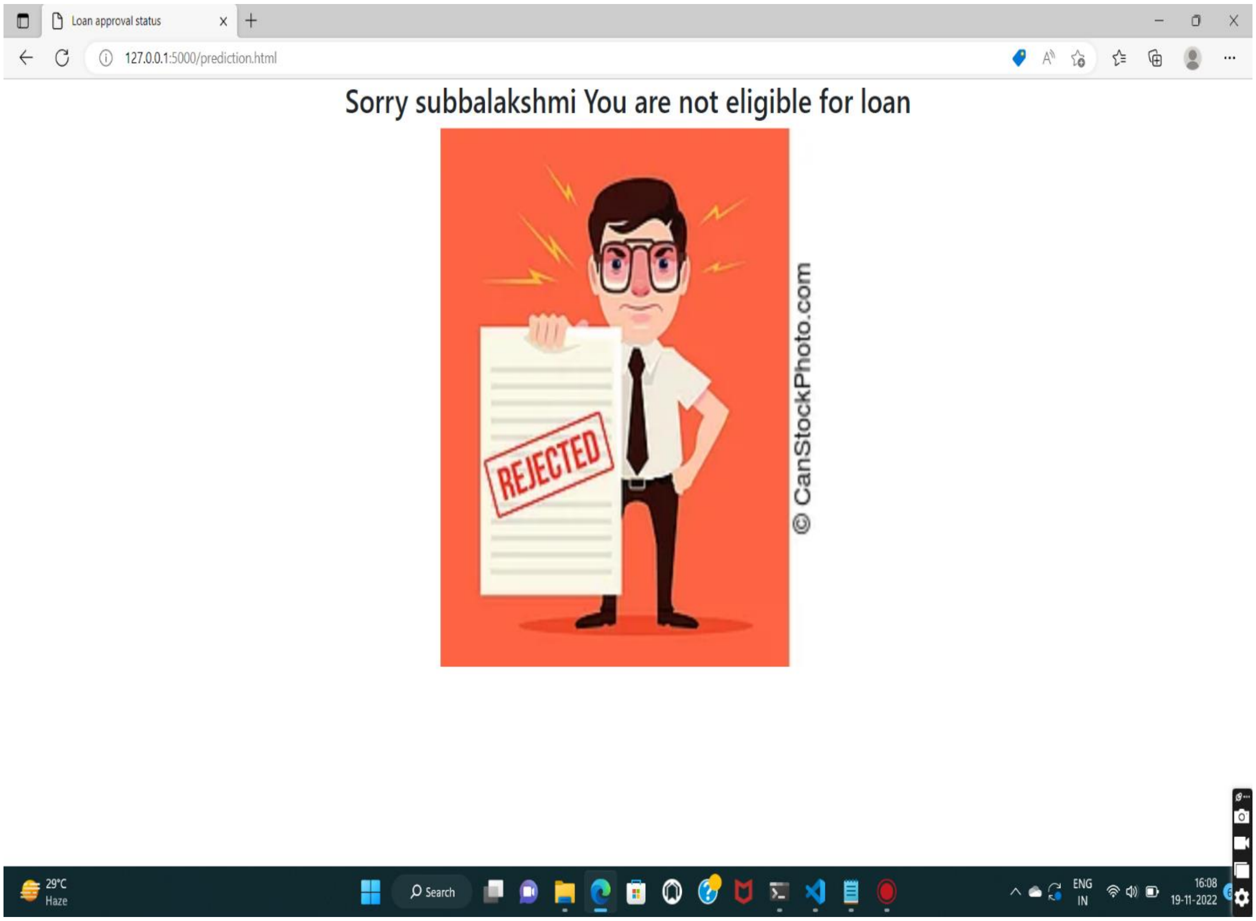


```python
        proparea = request.form['proparea']
        ApplicantIncome = float(request.form['ApplicantIncome'])
        CoapplicantIncome = float(request.form['CoapplicantIncome'])
        LoanAmount = float(request.form['LoanAmount'])
        Loan_Amount_Term = float(request.form['Loan_Amount_Term'])
    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)
```

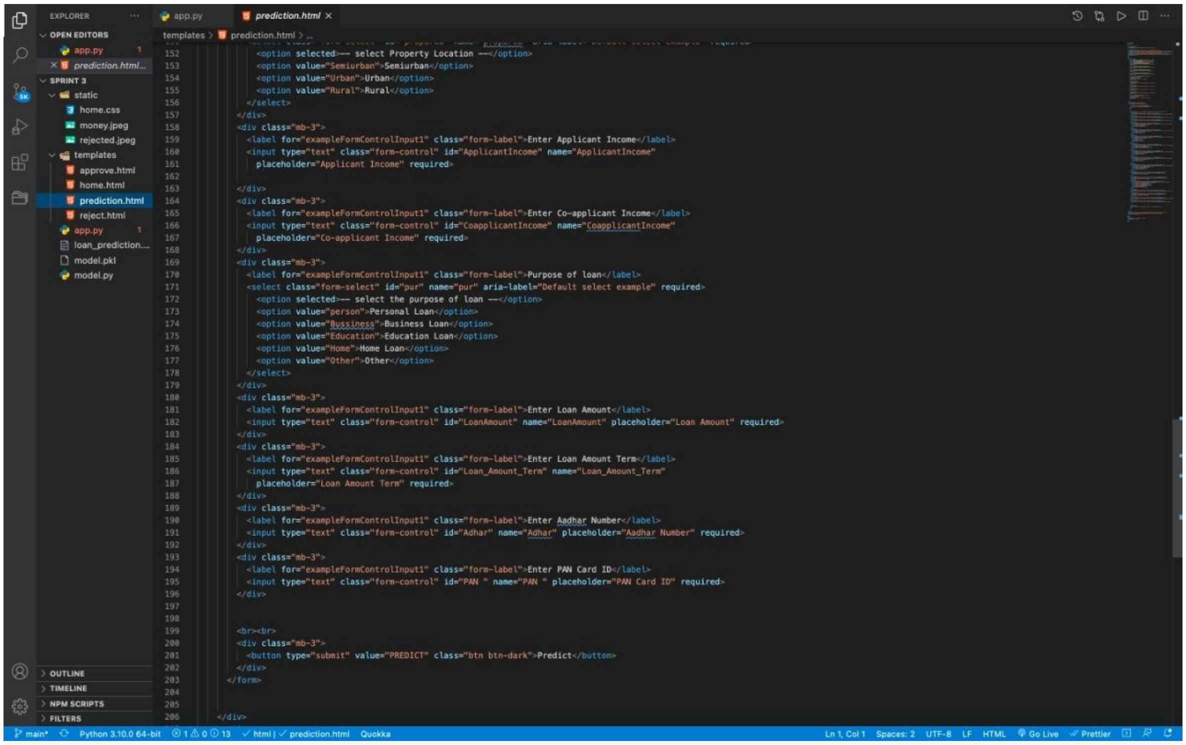


```python
from flask import render_template, Flask, request
import numpy as np
import pickle
from sklearn.preprocessing import scale
app = Flask(__name__, template_folder='templates')

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':
```

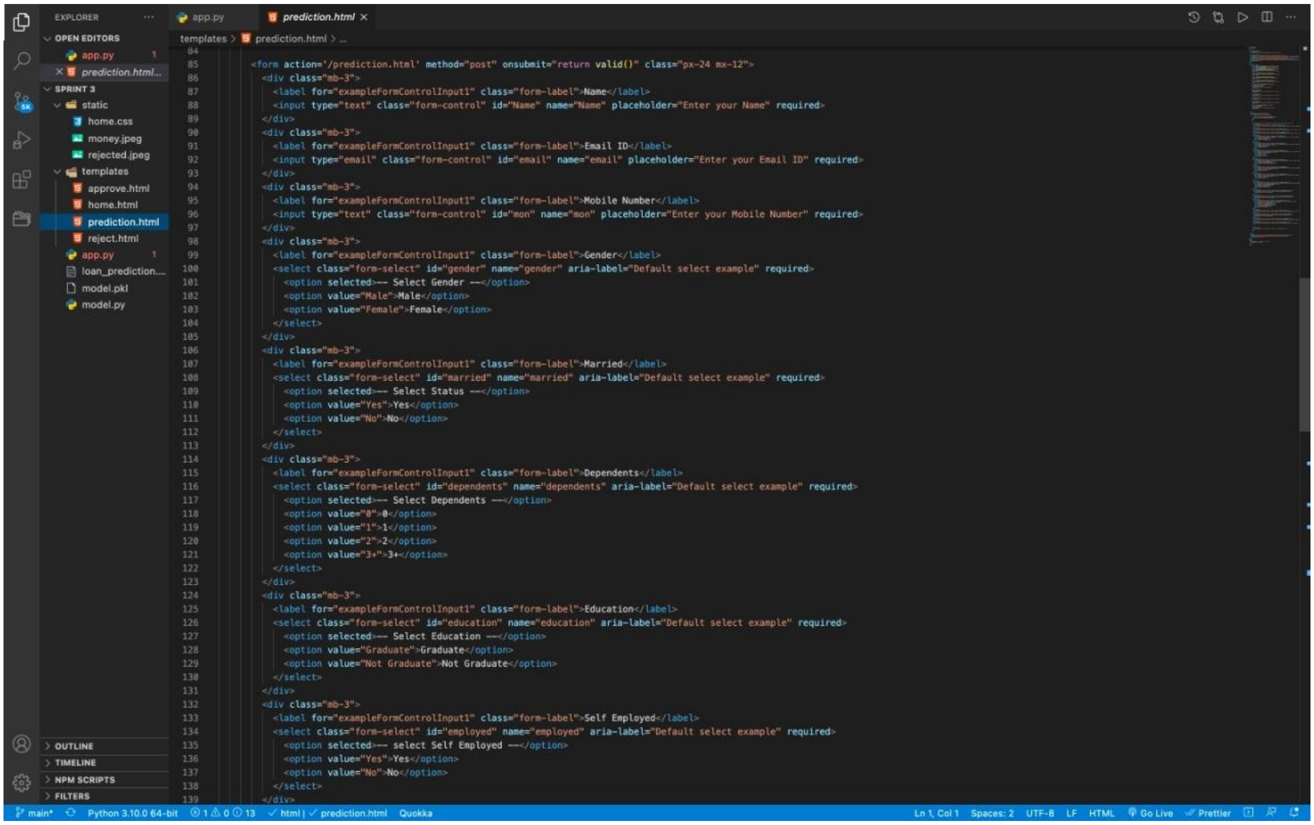
7.2 Feature 2



Sorry subbalakshmi You are not eligible for loan



```
        <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>
```



```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>
```

Chapter 8: TESTING

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
tc01	Functional	e Page	Verify user is able to click on Predict button		1.Enter URL and fill the form 2.Click on Predict button		Loan form should display	Working as expected	Pass				
tc02	Functional	Home Page	The web page is getting refreshed		1.Automatic page reload		Loan form must appear automatically after page reload	Working as expected	Fail	No steps needed	Y	BUG-1234	
tc03	Functional	Home page	Field address validation		1. Double-click on the E-mail address field		User should navigate to E-mail address field	Working as expected	Pass				
tc04	Functional	Output page	Loan Credibility predicted output		1. Click on predict button 2. View the predicted results		User should access the Loan credibility predicted result	Working as expected	Pass				

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 [ProductName] 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 theywere resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	3	1	2	15
Duplicate	0	0	4	0	4
External	1	2	0	0	3
Fixed	10	5	4	21	40
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	20	9	9	23	64

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	5	0	0	5
Client Application	46	0	0	46
Security	4	0	0	4
Outsource Shipping	3	0	0	3
Exception Reporting	7	0	0	7
Final Report Output	4	0	0	4
Version Control	2	0	0	2

Chapter 9: RESULTS

9.1 Performance Metrics

Model Performance Testing:
Project team shall fill the following information in the model performance testing template.

S.No.	Parameter	Screenshot / Values
1	Data Responsiveness	The ML model takes about 0.3 seconds to process the dataset. The credibility result is predicted in approximately 0.9 seconds.
2	Utilisation of Data Filters	Sufficient data filters have been used for ideal model building
3	Effective User Story	No of Scene Added - 15
4	Descriptive Reports	No of Visualisations / Graphs - 13

Chapter 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 Deductible

The 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 that they 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.

Chapter 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.

Chapter 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

Chapter 13: APPENDIX

13.1 Source

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-31088-1660196090

Project Link:

https://photos.app.goo.gl/jQ6HEe2oyerrdaFe9