

ICTACADEMY

NAALAIYA THIRAN PROJECT - 2022
19EC101-PROFESSIONAL READINESS FOR
INNOVATION, EMPLOYABILITY AND
ENTREPRENEURSHIP

SMART LENDER - APPLICANT CREDIBILITY PREDICTION FOR LOAN
APPROVAL

A PROJECT REPORT

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LIST OF TABLES

Title	Page no
1.1 Introduction	1
2.1 Literature Survey	3

LIST OF TABLES

Title	Page NO
1.1 Introduction	1
2.1 Literature Survey	3
3.1 Proposed solution	7
4.1 Functional requirements	9
4.2 Non- functional requirements	10
5.1 Components used	
5.2 Characteristics of the technology used	14
5.3 User stories	17
6.1 Sprint delivery schedule	18

6.2	Sprint planning and estimation	20
7.1	Dataset	26

FIGURE No.	TITLE	PAGE No.
2.1	Problem statement definition	2
3.1	Empathy map canvas	3
3.2	Problem statement	4
3.3	Brainstorming	5
3.4	Problem solution fit	8
5.1	Data flow diagram	12
5.2	Solution architecture	13
5.3	Technical architecture	13
6.1	Burndown chart of Sprint 1	21
6.2	Burndown chart of Sprint 2	21
6.3	Burndown chart of Sprint 3	22
6.4	Burndown chart of Sprint 4	22
6.5	Roadmap	23
7.1	Libraries imported	25
7.2	Dataset	26
7.3	Classifier algorithm	27

7.4	Code for Homepage	30
7.5	Homepage	31
7.6	Code for About us	33
7.7	Output for About us	34
7.8	Code for view procedure	36
7.9	Output for view procedure	36
7.10	Code for login page	39
7.11	Login page	39
7.12	Code for application rejection	43
7.13	Application rejection	44
7.14	Code for application approval	47
7.15	Output for Loan approval	48
7.16	Code for terms and condition	48
7.17	Output for terms and conditions	49
8.1	Testing	50
8.2	Test cases accuracy	51
8.3	Results	52
9.1	Classifier accuracy	54

ABSTRACT

In today's increasingly competitive market, estimating the risk involved in a loan application is one of the most crucial challenges for banks' survival and profitability. The banks receive many loan applications from their customers and other individuals daily. Not every applicant is accepted. Most banks employ their credit scoring and risk assessment procedures to examine loan applications and make credit approval decisions. Despite this, many incidents of people failing to repay loans or defaulting on them occur every year, causing financial institutions to lose a significant amount of money. So, among the available ML algorithms, a comparative analysis is performed to determine which one proves to be the best with the highest accuracy. This project essentially provides the assumption or probability of approval or denial of any candidate's personal loan application. As soon as the customer enters his or her information and all required domains. Various models are used to determine whether the customer's provided information is sufficient to grant a loan. If yes, it displays the message "loan approved, " and further functionality is available. Otherwise, it displays the message "Loan denied. "

CHAPTER 1 INTRODUCTION

1.1 PROJECT OVERVIEW

One of the difficult challenges for every bank is the prediction of credit defaulters. By predicting loan defaulters, banks can significantly cut their loss by reducing their non-profit assets, allowing for the loss-free recovery of approved loans. Consequently, the project's aim is to predict the loan defaulters in the future by using a machine learning algorithm system that can forecast defaulters by extracting patterns from a common dataset of loans that have been granted. The forecasting study will be conducted using previous data from customers, including their age, income, loan amount, and employment, to determine whether or not the applicant is suitable for loan approval.

1.2 PURPOSE OF THE PROJECT

For banking organizations, loan approval and risk assessment are very complex and significant process which needs a high effort for relevant employee or manager to take a decision, because of manual or traditional methods that used in banks. The banking industry still needs a more precise method of predictive modelling for several problems. In general, for financial institutions and especially for banks forecasting credit defaulters is a hard challenge. The primary role of the current systems is to accept, or sending loan application to a specific level of approval to be studied and it is very difficult

CHAPTER

to foresee the probability of the borrower for paying the dues amount without using methods to predict which results in the rise for this project.

2 LITERATURE SURVEY

2.1 EXISTING PROBLEM

Estimating the risk associated with a loan application is one of the most important difficulties for banks' survival and profitability in today's fiercely competitive market. Every day, numerous loan applications are submitted to the banks by customers and other people. But not all applicants are approved. Most banks review loan applications and decide whether to approve them using their credit score and risk assessment processes. Despite this, numerous instances of people not paying back loans or defaulting on them happen annually, costing financial institutions a sizable sum of money.

2.2 PROBLEM STATEMENT DEFINITION

I am	I'm trying to	But	Because	Which makes me feel
Bank or Microfinancing bank	Fasten my loan process and wants to know who are the loan defaulters	Unable to find the correct technology	The accuracy of the technology is very low and unpredictable	Hopeless and insecure due the incurring loss by defaulters.

Fig 2.1 Problem statement definition

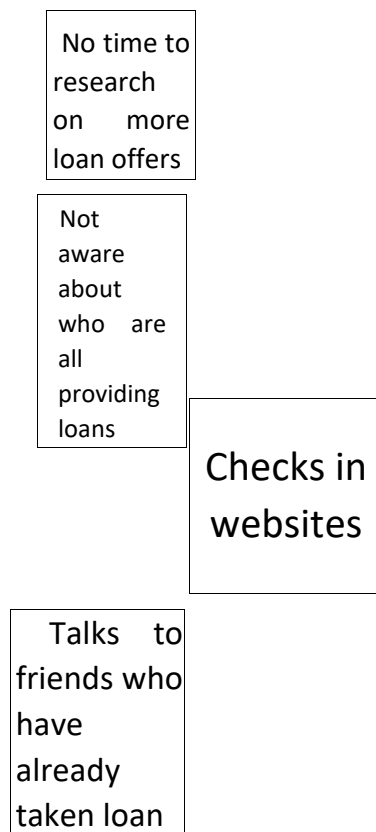
3

IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

CHAPTER

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



CHAPTER

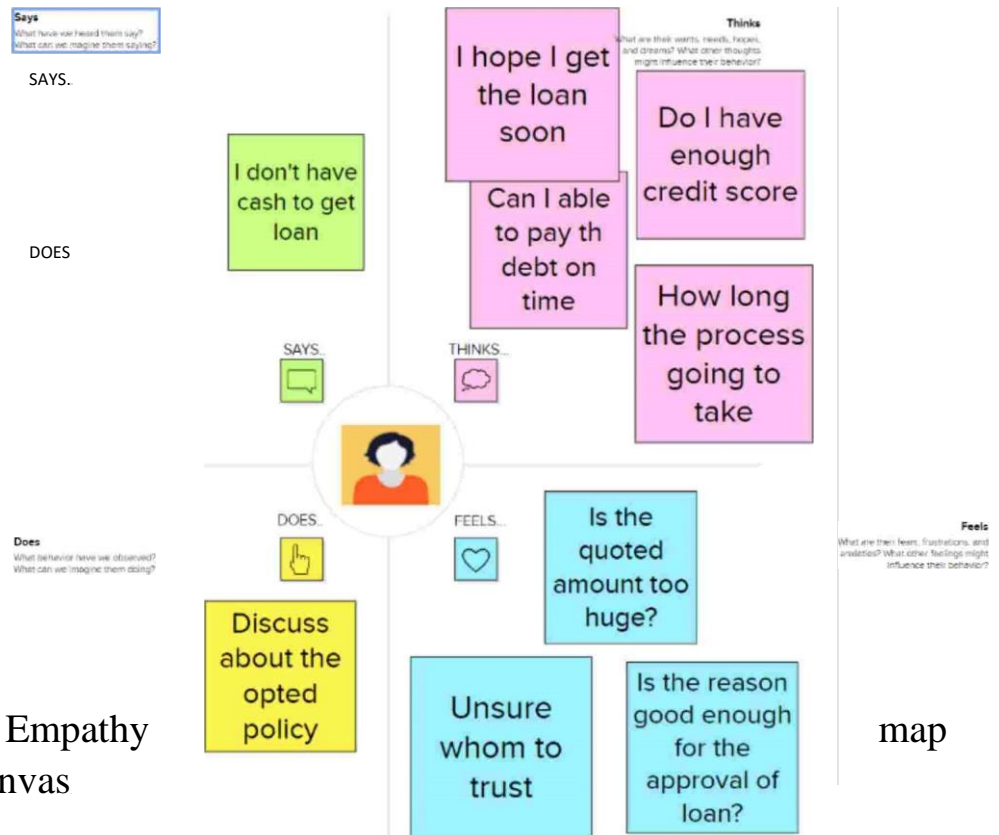


Fig 3.1 Empathy canvas

3.2IDEATION AND BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

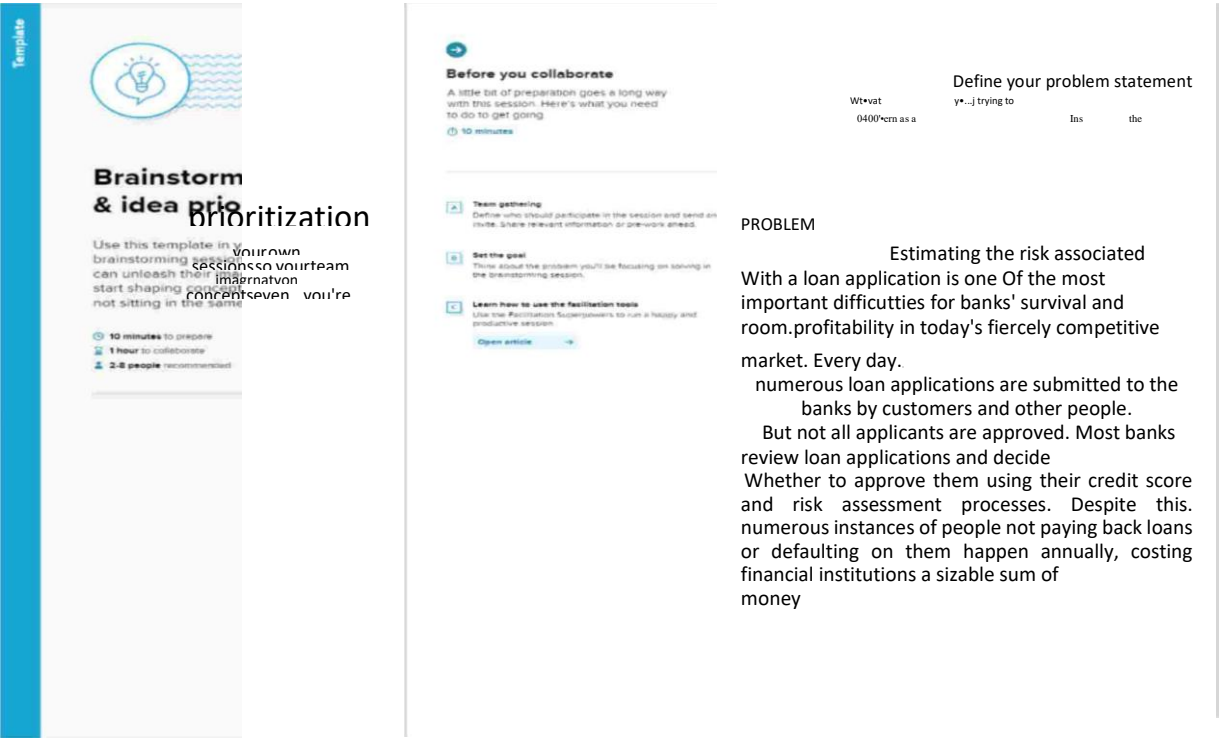


Fig 3.2 Problem statement

O

Mirra MShir	Shenmupm	Based on	Feature Engineering	Impact of attribute	Combining the
Based on	Based on	how	Salary of a	Accuracy of	applicant
previous	customer's	the	has	Combining the features	person is family
each algorithm					
loans history	age	Income	sue	applicant and	directly background of
			can	cc-applicant income	proportional to the person
Based on			in	easier analysis	the loan applying for
					Checking the model
					ana

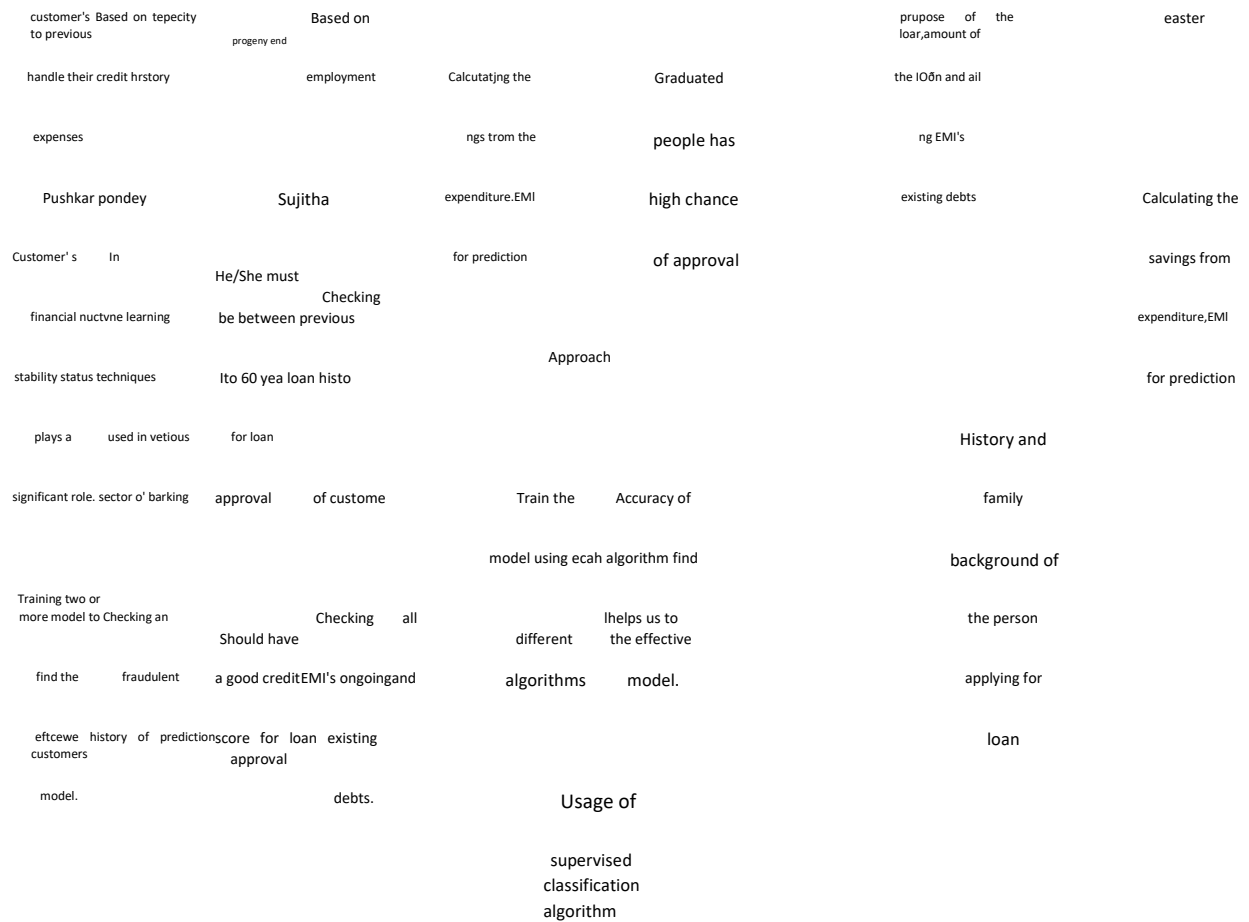


Fig 3.3 Brainstorming

3.3 PROPOSED SOLUTION

S.NO.	Parameter	Description
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1.	Problem Statement (Problem to be solved)	<p>Estimating the risk associated with a loan application is one of the most important difficulties for banks' survival and profitability in today's fiercely competitive market. Every day, numerous loan applications are submitted to the banks by customers and other people. But not all applicants are approved. Most banks review loan applications and decide whether to approve them using their credit score and risk assessment processes. Despite this, numerous instances of people not paying back loans or defaulting on them</p>
		<p>happen annually, costing financial institutions a sizable sum of money.</p>

2.	Idea/ Solution description	This solution uses Machine Learning techniques which can be used to perform such classifications of the credit defaulters as they are very crucial and useful in the prediction of these types of data. Classification algorithms such as Decision tree, SVM will be used. The data is trained and tested with these algorithms and finally, the best model is selected and saved in pkl format. Then, flask integration and IBM deployment will be done.
3.	Novelty / Uniqueness	The solution tries to use the best model from the mentioned five models and classify the applicants with least error.
4.	Social Impact / Customer Satisfaction	This application will help the bank employees to classify the credit defaulters accurately with minimum error. So, the non profit losses of the banks have been reduced. Thus, they may recover the approved loans with minimum losses
5.	Business Model (Revenue Model)	The model can be implemented as a pay per month use model. The bank employees can pay the monthly or yearly subscription. Another option is to sell the model to the bank

		that pays the amount which is most profitable to developers.
6	Scalability of the Solution	The front end of the application is modular. Python Web Framework is used to do so. The bank end uses the flask integration. Therefore, different features can be implemented and new pages can be added easily.

Table 3.1 Proposed solution

3.4 PROBLEM SOLUTION FIT

<p>1. CUSTOMER SEGMENT(S)</p> <p>Our target customers are mostly banking firm, small financial firms that lends out loan and credit card companies because of the increasing rate of loan defaulter and also to increase the slow process of the loan approval.</p>	<p>6. CUSTOMER CONSTRAINTS</p> <p>Banks are not to correctly handle the loan request. People within a protected class being clearly treated differently than those of non-protected classes for loan. There is an increasing rate of loan defaults. Banks identify the loan defaulters for much-reduced credit risk as large portions of a bank's assets directly come from the interest earned on loans given.</p>	<p>5. AVAILABLE SOLUTIONS</p> <p>Random forest, Logistic regression, Decision tree and Naive bayes algorithm are used</p> <ul style="list-style-type: none"> • Using data pre-processing data mining and data filtering • Algorithms such as na'Ve bayes, k-nearest neighbors are used.
<p>2. JOBS-TO-BE-DONE / PROBLEMS</p> <p>Needs to Support genuine Entrepreneur. That the process should be easier a time saving. To find an applicant which can give best interest. Needs to find a loan applicant with good credit score</p>	<p>9. PROBLEM ROOT CAUSE</p> <p>The root cause of this problem is the banks identify the loan defaulters for much-reduced credit risk as large portions of a bank's assets directly come from the interest earned on loans given. . People within a protected class being clearly treated differently than those of non-protected classes for loan.</p>	<p>7. BEHAVIOUR</p> <p>Directly related: The customers who lends the loan and the banks that checks the credibility seek to do the process faster.</p> <p>Indirectly associated: The small finance sector that deals with middle class and poor class people seek to find the credibility.</p>

<p>3. TRIGGERS</p> <p>The slow and complex process of loan approval is affecting the business of our customer and it also decline the revenue of our customers. Due to the sudden surge in the number of loan defaulters our customers business is highly affected.</p>	<p>10. YOUR SOLUTION</p> <p>■ There is an increasing rate of loan defaulters and banks are not able to correctly handle the loan request. To avoid this problem a machine learning algorithm is developed ■</p>	<p>loan and it will of loan approval accurately identify banks to identify credit risk.</p>	<p>improve the speed, efficacy, and accuracy processes. ■ This help the user(Lender) to whom to lend the loan and also help the the loan defaulter for much-reduced</p>
<p>4. EMOTIONS: BEFORE / AFTER</p> <p>Before:</p> <p>Needs to Support genuine Entrepreneur. To Ind an applicant which can give best interest. Needs to ind a loan applicant with good credit score.</p> <p>After:</p> <p>After implementing this project people can be ble to face all these above-mentioned problems asily</p>	<p>8. CHANNELS OF</p> <p>The customers in an online mode.</p> <p>OFFLINE</p> <p>The customer need algorithm in their</p>	<p>BEHAVIOUR CH ONLINE:</p> <p>needs to check the credibility f the client</p> <p>to install the Machine Learning system to work efficiently.</p>	

Fig 3.4 Problem solution fit

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily incorporated into the system as a part of the contract. These are represented or stated in the form of input to be given to the system, the operation performed and the output expected. They are basically the requirements stated by the user which one can see directly in the final product, unlike the non-functional requirements.

No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Home Page	<ul style="list-style-type: none">• Smart Lender Applicant Credibility description• Information about Credibility details required for loan approval• if new user , REGISTER• if already exists, SIGN IN
FR-2	User Registration	Enter Mail Id and other personal details required for Registering
FR-3	User login	User Mail Id and Password for Login
FR-4	Loan Approval form	Credibility details should be entered for prediction
FR-5	Result	if Approved - It display the information about what is done to be next. if Not Approved - It display the information about what rejection criteria you are not eligible for the loan.

Table 4.1 Functional requirements

4.2 NON - FUNCTIONAL REQUIREMENT

These are basically the quality constraints that the system must satisfy according to the project contract. The priority or extent to which these factors are implemented varies from one project to other. They are also called non -

behavioral requirements. They basically deal with issues like Portability, Security, Maintainability, Reliability, Scalability, Performance, Reusability, Flexibility.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	If the customer is eligible, he/she should be able to receive the acknowledgement receipt for loan application within 7 days from the bank. If not, then he/she should be intimated with the reason for rejection.
NFR-2	Security	Check if the customer has any fraudulent history.
NFR-3	Reliability	Customer's financial status plays a crucial role. So the customer should have a good credit score.
NFR-4	Performance	By training the model using different ML algorithms the performance of the system can be increased.
NFR-5	Availability	The loan will be available easily to those persons who have high income and to those who assure to repay the high sum within short period of time.
NFR-6	Scalability	The customer should be between 21 to 60 age. And based on customer's capacity to handle their expenses.

Table 4.2 Non-functional requirements

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. It shows how data enters and leaves the system, what changes the information, and where data is stored.

- 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 go to approval process.
- Finally they will get loan closure certificate.

A data flow diagram (DFD) maps out the flow of information for any process or system. It uses defined symbols like rectangles, circles and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination. Data flowcharts can range from simple, even hand-drawn process overviews, to in-depth, multi-level DFDs that dig progressively deeper into how the data is handled. They can be used to analyze an existing system or model a new one. Like all the best diagrams and charts, a DFD can often visually "say" things that would be hard to explain in words, and they work for both technical and nontechnical audiences, from developer to CEO. That's why DFDs remain so popular after all these years. While they work well for data flow software and systems, they are less applicable nowadays to visualizing interactive, real-time or database-oriented software or systems. There are four main elements of a DFD external entity, process, data store, and data flow.

DFD Level 2 (Industry Standard)

DFD - LEVEL 2

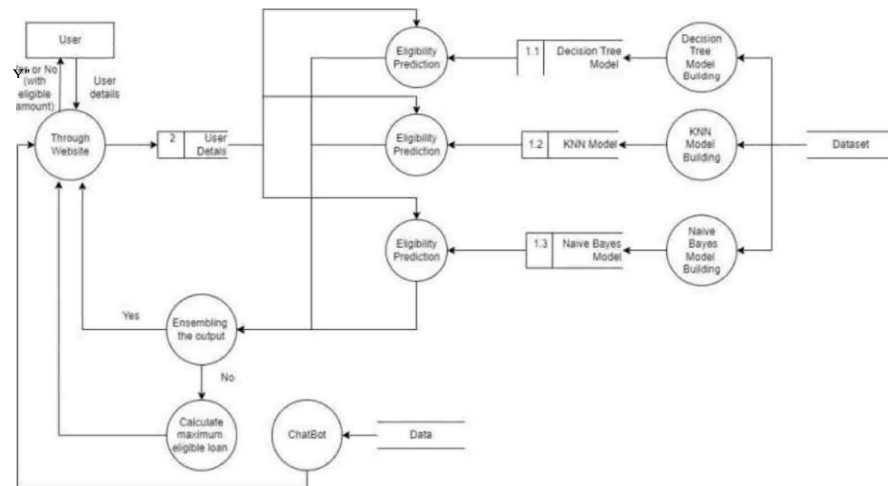


Fig 5.1 Data flow diagram

5.2 SOLUTION ARCHITECTURE

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

- Find the best tech solution to solve existing business problems.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

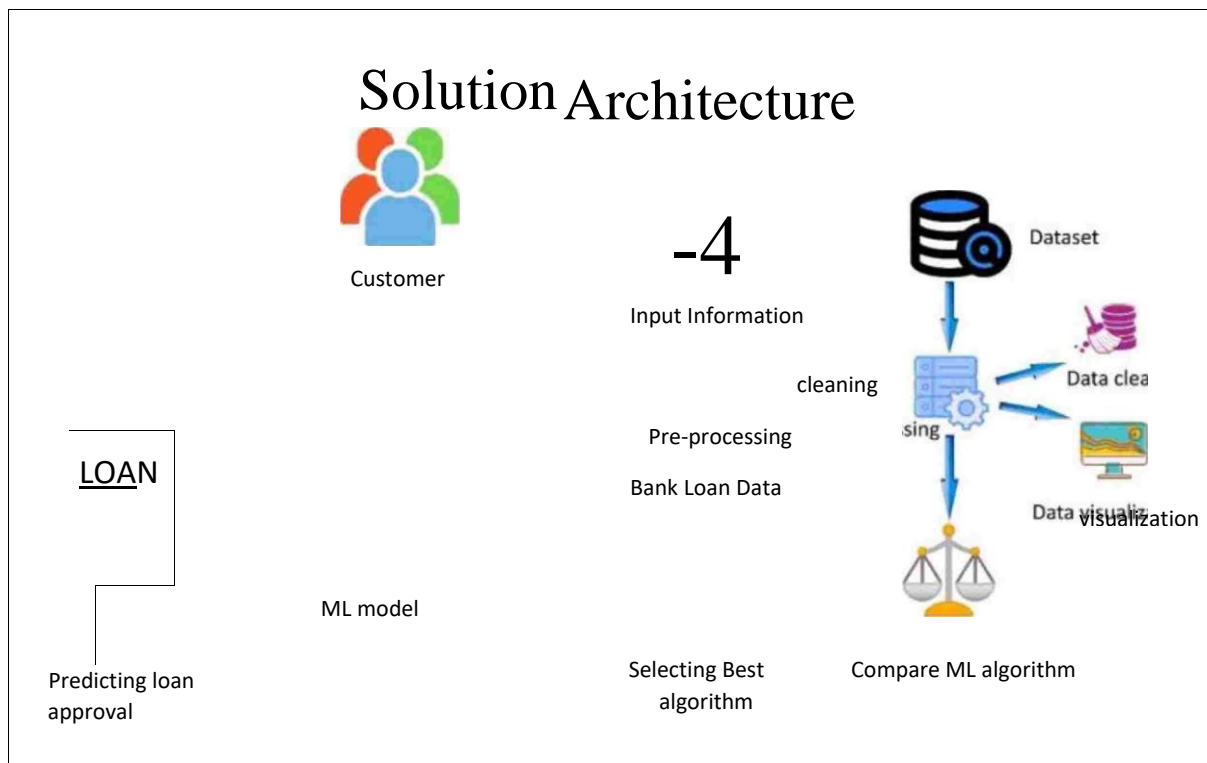


Fig 5.2 Solution architecture

5.3 TECHNICAL ARCHITECTURE

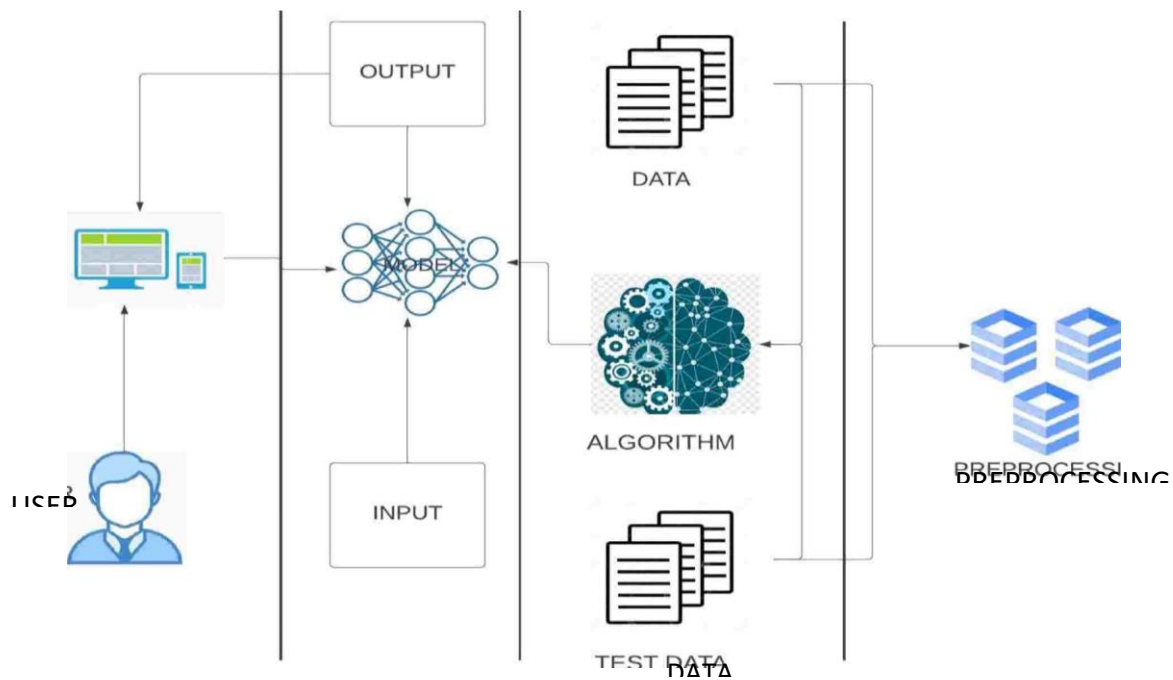


Fig 5.3 Technical architecture

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript
2.	Information window	The user information is obtained using the UI and is feeded into the model for evaluation.	Python Flask
3.	Chatbot	The questions of the users are handled for navigation through the application and evaluation of results.	DialogFlow/Knowlarity etc.
4.	Visualization and analysis of data	Comprehending the data using visualization techniques offered by python libraries.	Python pandas, numpy, matplotlib etc.
5.	Preprocessing Data	Outlier treatment, Categorical values treatment, replacing missing values etc.	Python pandas, Scikitlearn etc.
6.	Database	Storage of user details etc.	MySQL
7.	Cloud Database	Deployment of application in cloud	IBM Cloud
8.	Machine Learning Model	Evaluation and prediction of borrower's eligibility for loan approval	Python, incorporating classification algorithms such as Decision tree, Random Forest, KNN, XG boost etc.

Table 5.1 Components used

<u>SNO</u>	Characteristics	Description	Technology
1.	Open-Source Frameworks	> Flask is used for website hosting. -> Scikit and TensorFlow are python ML frameworks.	Flask, Scikit,
2.	Security Implementations	Definitions and procedures for information accessibili and handover to authorized eo le.	IBM Watson STT
3.	Scalable Architecture	This application's architecture is highly flexible in various ways such as integrating it with a banking app so that more users access it other than just customers of normal cases.	Python, HTML, CSS.
4.	Availability	IBM Cloud uses global load balancing to ensure a redundant, highly available platform for hosting applications.	IBM Cloud
5.	Performance	Efficient UIs are designed in a way that it could withstand processing large amount of data and fastest algorithm is evaluated and selected by comparison.	UE HTML, CSS, JS ML <u>model</u> : Python

Table 5.2 Characteristics

5.4 USER STORIES

User Type	Function Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
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Customer (Mobile u ser)	Registra - tion	USN-I	As a user, I can register for the loan application by entering my email/u ser 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-I
		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 applicati on through Gmail	I can receive themail that you are registered in loan application.	Medium	Sprint-I
		USN-5	Choose the type of loan	Choose the typeof loan	Medium	Sprint 3

	Login	USN-6	As a user, I can log into the application.	I can receive the message that your ID is in login	High	Sprint-I
	Dashboard	USN-7	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-I
Customer (Web user)	Registration	USN-8	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-I
		USN-9	Choose the type of loan	Choose the type of loan	Medium	Sprint 3
Customer Care Executiv	Doubts	USN-IO	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-I

Administ -rator	Holding all Details	USN-II	Giving approval to the particular user ID.	Approval.	High	Sprint-I
	Prediction of loan approval	USN- 12	Checking the eligibility criteria for loan approval	Check for the chances of loan approval.	High	Sprint 4
	Chatbot	USN-13	Clear doubts and issues	Solve the issues and state thereason for disapproval of loan	Medium	Sprint 2

Table 5.3 User stories CHAPTER 6
PROJECT PLANNING AND SCHEDULE

6.1 SPRINT DELIVERY SCHEDULE

	Total Story Points	Duration	Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Release (Actual)
Sprint- 1	5	6 Days	24 Oct 2022	29 Oct 2022	5	01 Oct 2022
Sprint-2	7	6 Days	31 Oct 2022	05 Nov 2022	7	05 Nov 2022
Sprint-3		6 days	07 Nov 2022	2 Nov 2022		Nov 2022
Sprint	9	6 Days	14 Nov 2022	19 Nov 2022	9	19 Nov 2022

Table 6.1 Sprint delivery schedule

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) $\frac{\text{sprint duration}}{\text{velocity}} = \frac{10}{20} = 0.5$

6.2 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-I	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I		USN-2	As a user, I will receive confirmation email once I have registered for the application	3	High	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I		USN-3	As a user, I can register for the application through Facebook	1	Low	PUSHKAR MRIDUL MUTHU
Sprint-I		USN-4	As a user, I can register for the application through Gmail	2	Medium	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	PUSHKAR MRIDUL MUTHU SWITHA
Sprint-I	Dashboard	USN-6	As a user, I should be able to access the dashboard with everything I am allowed to	2	Medium	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I	Registration	USN-7	As a user, I can register for the application by entering my email, password, and confirming my password.	3		PUSHKAR MRIDUL MUTHU SUJITHA

Sprint-I		USN-8	As a user, I will receive confirmation email once I have registered for the application	3	High	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I		USN-9	As a user, I can register for the application through Facebook	1	Low	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I		USN-10	As a user, I can register for the application through Gmail	2	Medium	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I	Login	USN-11	As a user, I can log into the application by entering email & password	3	High	PUSHKAR MRIDUL MUTHU SUJITHA
Sprint-I	Dashboard	USN-12	As a user, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	PUSHKAR MRIDUL MUTHU SUJITHA
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	PUSHKAR MRIDUL MUTHU SUJITHA
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	PUSHKAR MRIDUL MUTHU SUJITHA
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	PUSHKAR MRIDUL MUTHU SUJITHA
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	PUSHKAR MRIDUL MUTHU SUJITHA
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	PUSHKAR MRIDUL MUTHU SUJITHA
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	PUSHKAR MRIDUL MUTHU SUJITHA

Sprint-4	Dashboard	USN-19	As an admin, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	PUSHKAR MRIDUL MUTHU SUJITHA
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Table 6.2 Sprint planning and estimation

6.3 REPORTS FROM JIRA

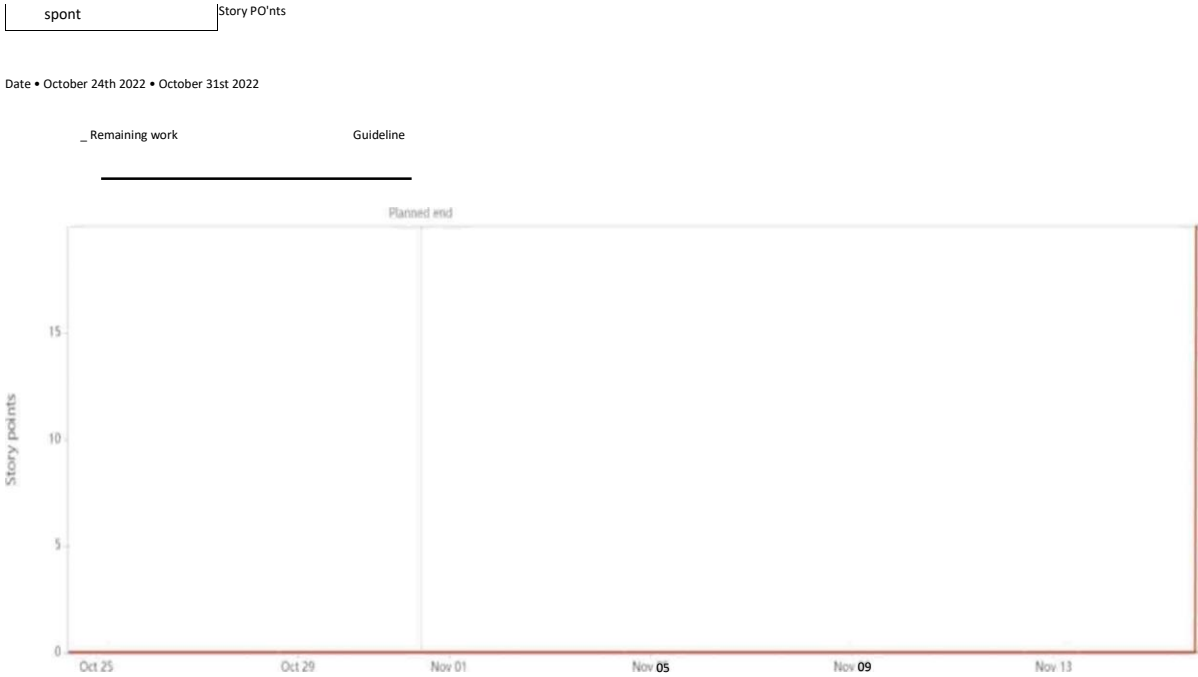


Figure 6.1 Burndown chart of Sprint 1



Figure 6.2 Burndown chart of Sprint 2

23

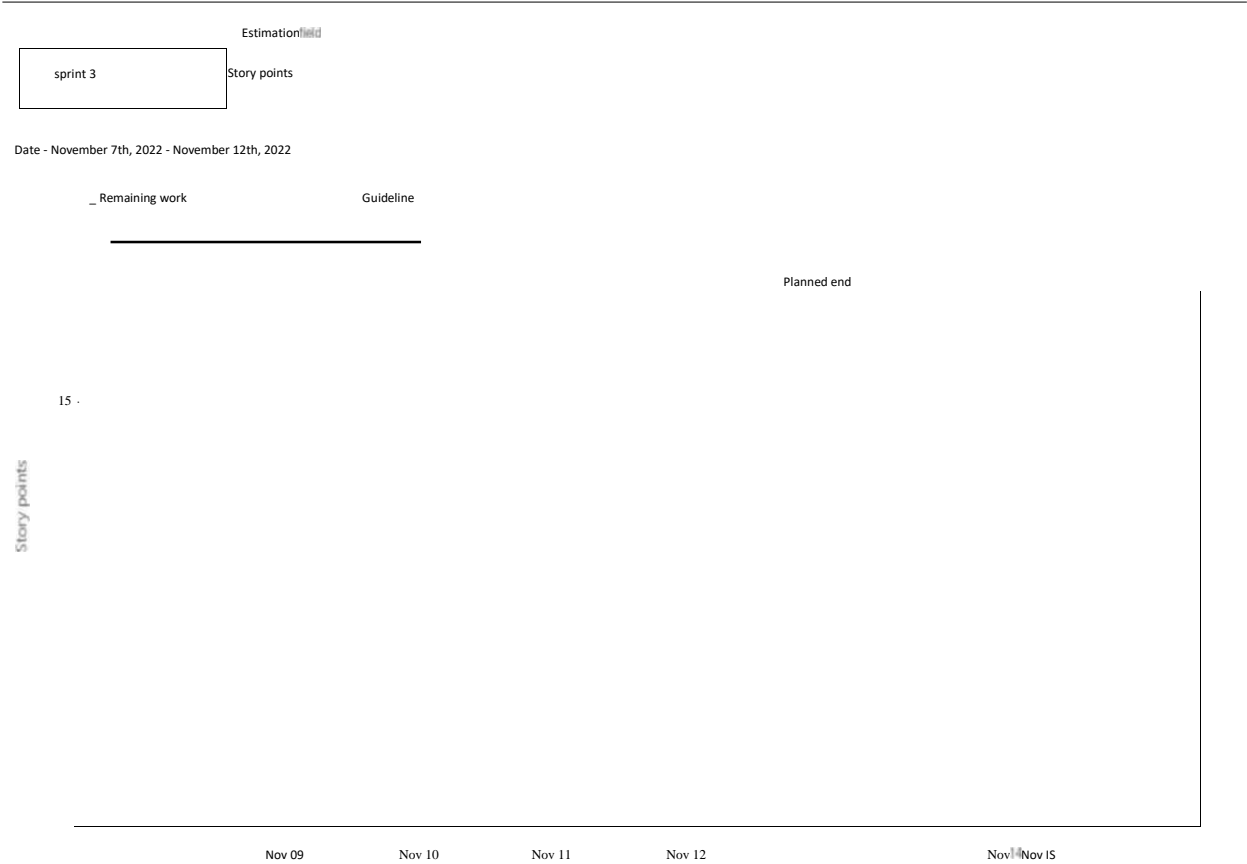
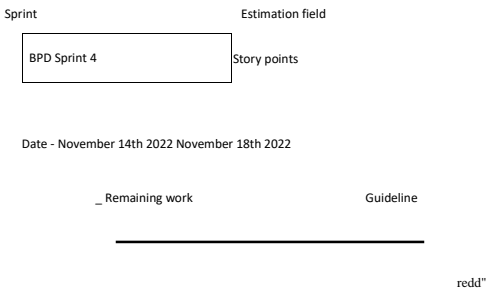


Figure 6.3 Burndown chart of Sprint 3



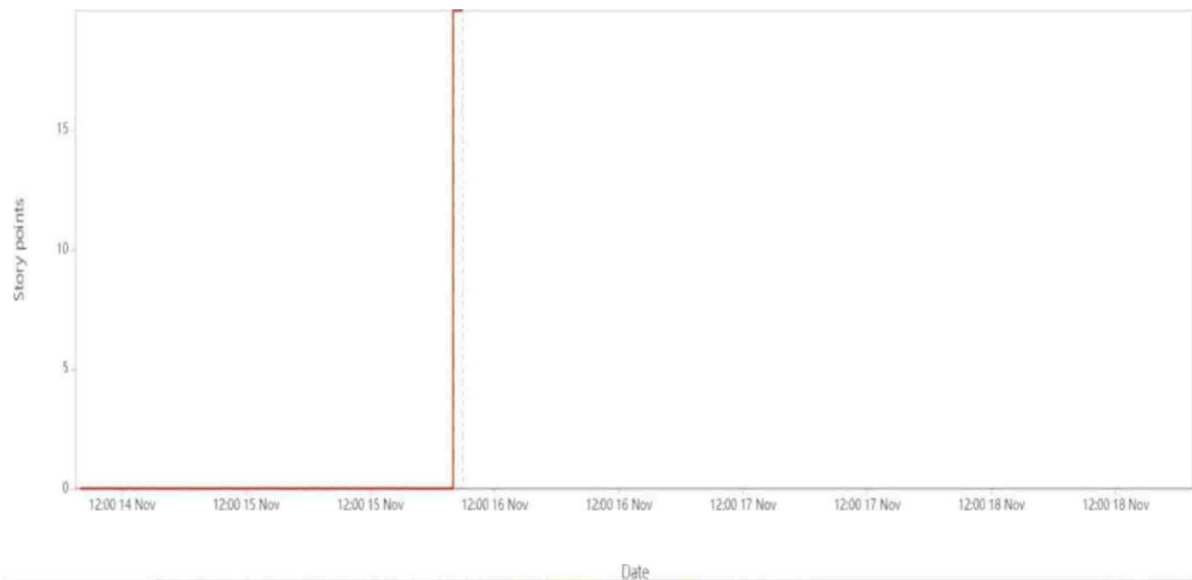


Figure 6.4 Burndown chart of Sprint 4

ROAD MAP

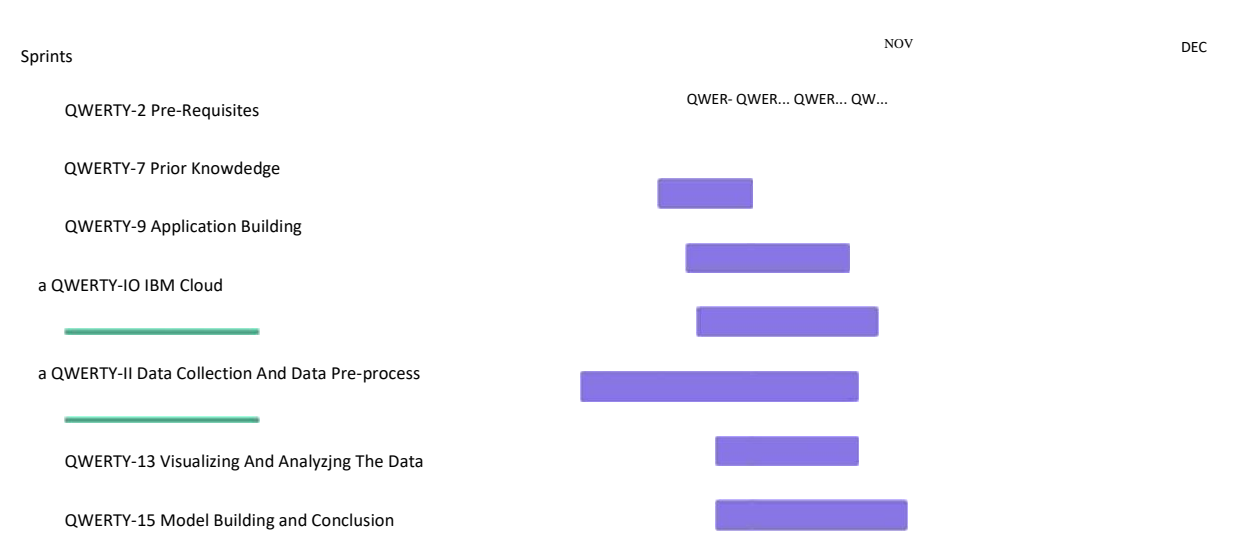


Fig 6.5 Road map

CHAPTER 7

CODING AND SOLUTIONING

7.1 FEATURE 1

LIBRARIES IMPORTED

NUMPY

NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform, and matrices. NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely. NumPy stands for Numerical Python

SEABORN

Seaborn is an amazing visualization library for statistical graphics plotting in Python. It provides beautiful default styles and color palettes to make statistical plots more attractive. It is built on the top of matplotlib library and also closely integrated to the data structures from pandas. Seaborn aims to make visualization the central part of exploring and understanding data. It provides dataset -oriented APIs, so that we can switch between different visual representations for same variables for better understanding of dataset.

PICKLE

Python pickle module is used for serializing and de-serializing a Python object structure. Any object in Python can be pickled so that it can be saved on disk. What pickle does is that it "serializes" the object first before writing it to file. Pickling is a way to convert a python object (list, dict, etc.) into a character stream. The idea is that this character stream contains all the information necessary to reconstruct the object in another python script.

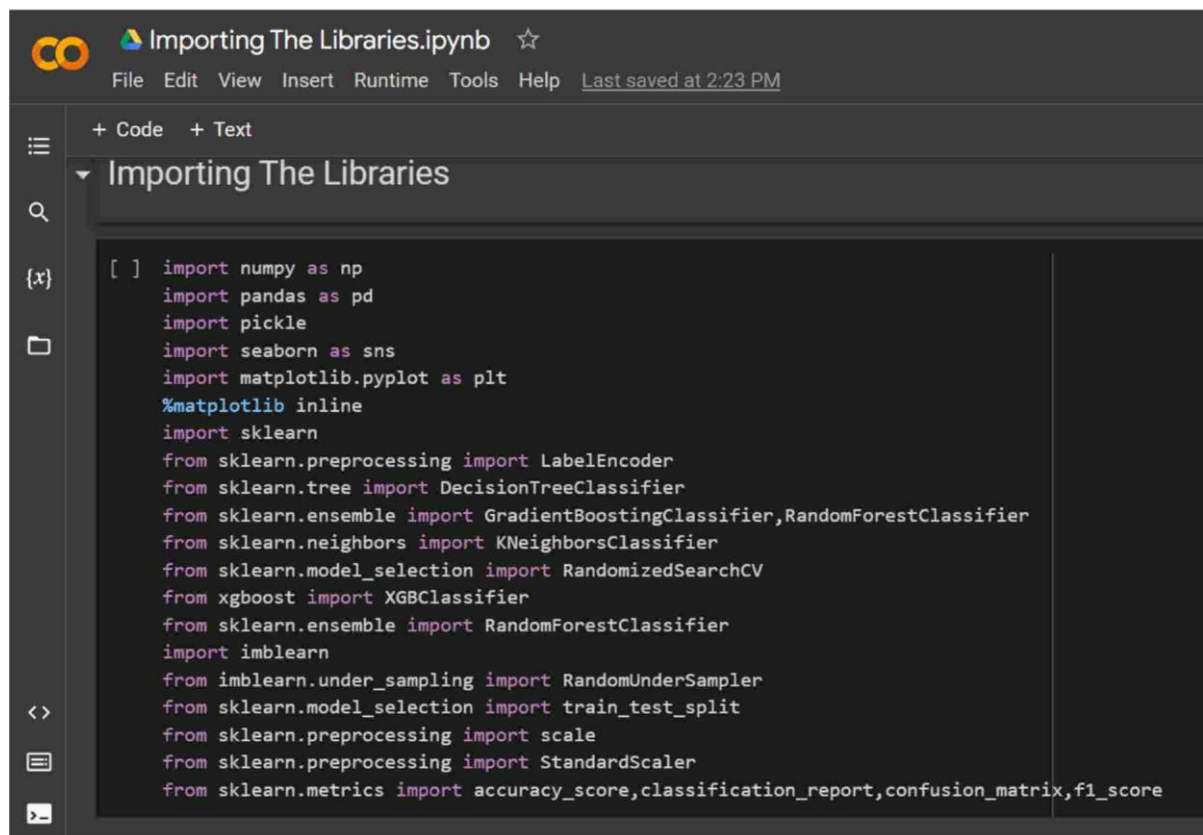
MATPLOTTING

Matplotlib is an amazing visualization library in Python for 2D plots of arrays. Matplotlib is a multi-platform data visualization library built on NumPy arrays and designed to work with the broader SciPy stack. It was introduced by John Hunter in the year 2002. One of the greatest benefits of visualization is that it

allows us visual access to huge amounts of data in easily digestible visuals. Matplotlib consists of several plots like line, bar, scatter, histogram etc.

PANDAS

Pandas is an open source Python package that is most widely used for data science/data analysis and machine learning tasks. It is built on top of another package named Numpy, which provides support for multi-dimensional arrays.



```
[ ] import numpy as np
import pandas as pd
import pickle
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
import sklearn
from sklearn.preprocessing import LabelEncoder
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import GradientBoostingClassifier, RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import RandomizedSearchCV
from xgboost import XGBClassifier
from sklearn.ensemble import RandomForestClassifier
import imblearn
from imblearn.under_sampling import RandomUnderSampler
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import scale
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix, f1_score
```

Fig 7.1 Libraries imported

DATASET

df=pd.read_csv('Loan_train.csv')

df

Loan_ID

Gender

Married

Dependents

0

LP001002

Male

No

0

1

LP001003

Male

Yes

1

2

LP001005

Male

Yes

0

3

LP001006

Male

Yes

0

4

LP001008

Male

No

0

...

...

...

...

...

609

LP002978

Female

No

0

610

LP002979

Male

Yes

3+

611

LP002983

Male

Yes

1

612

LP002984

Male

Yes

2

613

LP002990

Female

No

0

...

...

...

...

...

Education

Self_Employed

ApplicantIncome

CoapplicantIncome

LoanAmount

Loan_Amount_Term

Credit_History

property_area

Loan_Status

Graduate

No

949

0.0

NaN

3600

10

Urban

Y

Graduate

No

15080

1280

3600

1.0

0.0

660

3600

Urban

Y

...

...

...

...

...

...

...

...

...

Graduate

23580

1200

360.0

1.0

Graduate

0.0

141.0

360.0

Urban

Y

Graduate

No

2900

0.0

710

3600

1.0

Rural

Graduate

No

4106

0.0

400

180.0

10

Rural

Graduate

No

7583

0.0

1870

360.0

10

Urban

Y

Graduate

Yes

4583

0.0

1330

3600

00

Semiurban

Fig 7.2 Dataset

The dataset for loan train prediction is a csv file and is loaded using read command. The dataset is viewed using head command.

CLASSIFIER ALGORITHM

1. Decision tree model

A function named decision tree is created and train and test data are passed as the parameters. Inside the function, the DecisionTreeClassifier algorithm is initialized and training data is passed to the model with .fit() function.

Test data is predicted with the .predict() function and saved in the new variable. For evaluating the model, a confusion matrix and classification report are done.

2. Random forest model

A function named randomForest is created and train and test data are passed as the parameters. Inside the function, the RandomForestClassifier algorithm is initialized and training data is passed to the model with .fit() function.

Test data is predicted with `.predict()` function and saved in a new variable. For evaluating the model, a confusion matrix and classification report are done.

3. KNN model

A function named KNN is created and train and test data are passed as the parameters. Inside the function, the `KNeighborsClassifier` algorithm is initialized and training data is passed to the model with `.fit()` function.

Test data is predicted with `.predict()` function and saved in a new variable. For evaluating the model, a confusion matrix and classification report is done.

4. Xgboost model

A function named `xgboost` is created and train and test data are passed as the parameters. Inside the function, the `GradientBoostingClassifier` algorithm is initialized and training data is passed to the model with `.fit()` function. Test data is predicted with `.predict()` function and saved in a new variable. For evaluating the model, a confusion matrix and classification report are done.

Decision Tree Model

[] 44 cells hidden

Random Forest Model

[] 44 cells hidden

KNN Model

[] 44 cells hidden

Xgboost Model

Fig 7.3 Classifier algorithms

CODE

```
<!doctype html>
<html>
<head>
<meta charset="utf-8">
<title>Loan Prediction</title>
  <link rel="stylesheet" href="home.css">
</head>
<body>
  <div class="container">
    <div class="navbar">

      <nav>
        <ul>
          <li><a href="home.html">Home</a></li>
          <li><a href="About.html">About</a></li>
          <li><a href="procedure.html">Procedure</a></li>
        </ul>
      </nav>

    </div>
    <div class="content">

      <h1>Smart Lender - Applicant Credibility Prediction For Loan
Approval </h1>
      <p> Predit your loan eligibility here</p><br><br>
      <a href="prediction.html" class="btn">PREDICT NOW</a>
      <br><br>
      <h2>Team ID -PNT2022TMID52855</h2><br>
      <h3>Team members</h3>
      <p>PUSHKAR PANDEY</p>
      <p>MRIDUL MISHRA</p>
      <p>MUTHU SHANMUGAM</p>
      <p>SUJITHA R</p>
    </div>
  </div>
</body>
</html>
```

```
*{
  margin: 0;
  padding: 0;
}
.container{
  height: 100vh;
  width: 100%;
  background-image: url(background.jpg);
  background-position: center;
  background-size: cover;
  padding-left: 5%;
  padding-right: 5%;
  box-sizing: border-box;
  position: relative;
}
.navbar{
  width: 100%;
```

```

    height: 15vh;
    margin: auto;
    display: flex;
    align-items: center;
}
.logo{
    width: 160px;
    cursor: pointer;
}
.cart{
    width: 40px;
    cursor: pointer;
}
nav{
    flex: 1;
    padding-left: 60px;
}
nav ul li{
    display: inline-block;
    list-style: none;
    margin: 0px 20px;
}
nav ul li a{
    text-decoration: none;
    color: #578;
}
.content h1{
    font-size: 60px;
    font-weight: 100;
    margin-top: 24px;
    margin-bottom: 15px;
    color: #232d60;
}
.content p{
    font-size: 20px;
    color: #6a7199;
}
.content{
    margin-left: 10%;
    margin-top: 10%;
}
.content .btn{
    display: inline-block;
    background: linear-gradient(45deg, #87adfe, #ff77cd);
    border-radius: 6px;
    padding: 10px 20px;
    box-sizing: border-box;
    text-decoration: none;
    box-shadow: 3px 8px 22px rgba(139, 129, 223, 0.15);
    color: rgb(6, 2, 255);
    font-weight: bold;
}
.arrow-icons{
    margin-top: 40px;
    display: flex;
}
.arrow-icons img{
    width: 40px;
    margin-right: 25px;
}

```

```

.feature-img{
    height: 90%;
    position: absolute;
    bottom: 0;
    right: 160px;
}
.social-links{
    transform: rotate(-90deg);
    position: absolute;
    left: -80px;
    bottom: 180px;
}
.social-links a{
    text-decoration: none;
    color: #6a7199;
    padding-right: 20px;
    font-size: 14px;
}
feature-img{
    height: 90%;
    position: absolute;
    bottom: 0;
    right: 160px;
}
.social-links{
    transform: rotate(-90deg);
    position: absolute;
    left: -80px;
    bottom: 180px;
}
.social-links a{
    text-decoration: none;
    color: #6a7199;
    padding-right: 20px;
    font-size: 14px;
}

```

Fig 7.4 Code for Homepage

HOMEPAGE



Fig 7.5 Home page

ABOUT US

```
< ! DOCTYPE html >
< html lang=" en "> it le
>About < / ti t l e> <
head>

    <meta charset="UTF-8
    <meta http-equiv="X-UA-Compatible" content="
    <meta name="viewport" content="width=device-width,
        -web developer</ ti tle>
    < link rel="stylesheet" href="About .css ">
    < link
        href="Font-Awesome/all.min.css" / >
< / head>
<body>
    <a href="home.html"><button ">Back</button></a> <section
        <div class="about-left">
            
        </div>
        <div class="about-right"

            <h1>About Us</h1>
            <p>This project is used to automate the loan eligibility
prediction for the customer as the cost of assets is increasing day by day
and the capital required to purchase an entire asset is very high. So
purchasing it out of your savings is not possible. The easiest way to get
the required funds is to apply for a loan. But taking a loan is a very time
consuming process. The Application has to go through a lot of stages and
```

it 's still not necessary that it will be approved. To decrease the approval time and to decrease the risk associated with the loan we have created this project< /p>

<div class=" address" >

Phone No 89009xxxxx

XYZ @GMATL .
COM

Email ID

Place CO IMBĂTORE

< / di v>

<h3>Our speciality</h3>

1. Quick and convenient loans
that can be availed online wi thout having to go through a rigorous screening process. < / li >

3 . Accurate prediction for loan
eligibi lity / li >

4 . Providing detailed procedure
for loan

5 . Providing easy way to check the
loan eligibi lity</ li >

< /div>

< / section>

< / body>

< / html >

About Section Start From here

```
# about- sect ion { width: 90%;  
height: auto ; di splay: flex;  
justify- content: space -  
between ; align- items:  
center; padding: 4 Opx 5%;
```

```
. about-right {  
width: 57%;
```

```
. about-right ul I i {  
display: flex; al  
ign- items: center;
```

```
. about-right h 1 {  
color: #e74d06;
```

```

    font-size: 37px;
    margin-bottom: 5px;
}
.about-right p{
    color: #444;
    line-height: 26px;
    font-size: 15px;
}
.about-right .address{
    margin: 25px 0;
}
.about-right .address ul li{
    margin-bottom: 5px;
}
.address .address-logo{
    margin-right: 15px;
    color: #e74d06;
}
.address .saprater{
    margin: 0 20px;
}
.about-right .expertise ul{
    width: 80%;
    display: flex;
    align-items: center;
    justify-content: space-between;
}
.expertise h3{
    margin-bottom: 10px;
}
.expertise .expertise-logo{
    font-size: 19px;
    margin-right: 10px;
    color: #e74d06;
}
h3{
    color: #e74d06;
}
.but{
    background-color:#e74d06;
    color: white;
    padding: 5px;
    margin:5px;
    border-radius: 5px;
    width:70px;
    font-weight: bold;
}

```

Fig 7.6 Code for About us ABOUT US

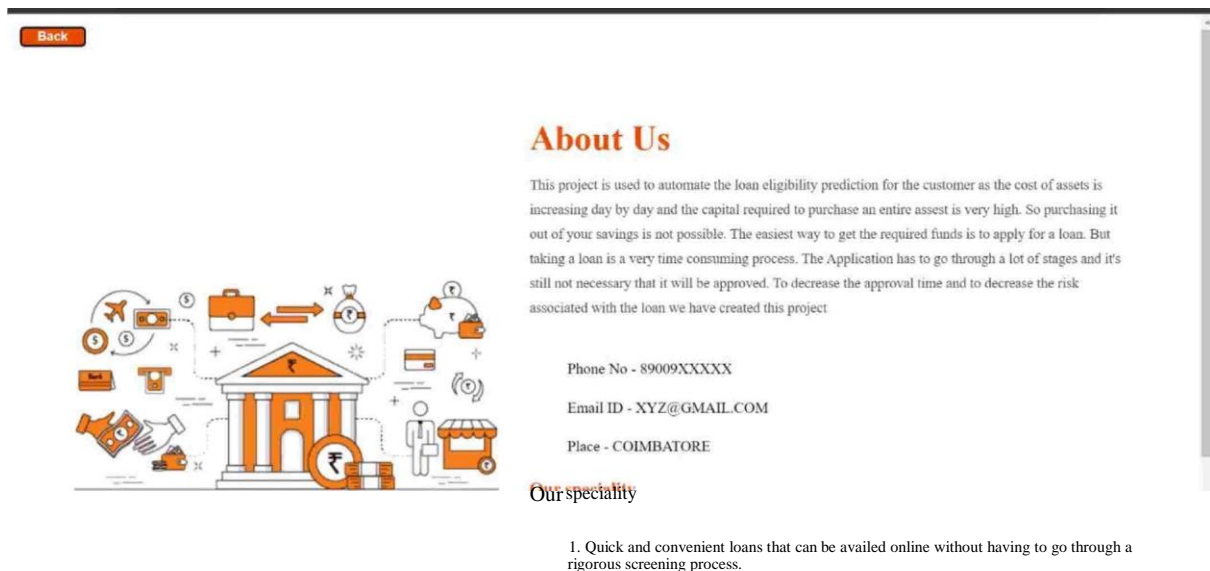


Fig 7.7 Output for About us

PROCEDURE

CODE

```
< !doctype html >
< html >
< head>
<meta charset= "utf-8
< t i t l e r o c e d u r e < / t i t l e>
    < link rel=" stylesheet " href=" procedure . cs s" >
< / h e a d>
<body>

    <div class=" t i t l e" >
    <a href="home. html "><button clas ">Back</button></a> 

        <h2>1 . check the eligibility
        <br><li>Maximum age to apply is 21 Years, not exceeding 65 years
at the time of loan resume</ I i >
        <Ii>You must be Indian resident and citizens</li>
        <Ii>You must have necessary documents required for the personal
loan along with duty filled and signed application form
        <br><h2>2 . check interest rates and other charges</h2>
        <br><li>The interest rates offered by Bank vary based on the
borrow's credit worthiness , amount and tenure of the loan and other factors
. </ l i >

        <br><h2>3 . calculate your EMI</h2>
        <br><li>EMT calculators help to calculate the monthly EMI to
be paid on the loan. This calculation depends on the total loan amount, interest
rate and tenure</

        <br><h2>4 . check required documents</h2>
        <br><Ii>Recent passport-sized photographs</li>
```

```

        <I i>Age proof</li>
        proof</li>
        slips /
        <li>processing fee cheque</li>
        wait for loan approval
        <br><Ii>Bank will process the personal loan application then
a representative will be assigned to you who further take care of the
procedure . <br><br></ I i >

    < / di v>

< / body>
< / html >

margin: 0; padding: 0
; box- si zing: border
-box ;

body { background-col or : rgb (144 ,
    223, 4 8) ; margin-left: 4 0px;

. title { text-align:
    left ; margin-top:
    10 C)px; color: rgb
    (217, 234,

. title h 1 { font-size: 50px;
    color: rgba(245, 3 , 3, 0 .
    607 ) ; line-height: 5px;
    text-align: right; margin-
    top: 10 ()px; padding-bottom
    : 5 0px; padding-le ft: 10
    0px; margin-r ight : 3 00px ;

. title h 2 { font-size: 21px; text-trans
    form: uppercase; background-color
    :rgb (239, 252, 216 ) ; padding: 1
    0px;

. title l i {
    font-size: 18px;
    color: rgb (23, 22,
    22) ; margin-left:
    auto; margin-right:
    auto ;

. img { display:
    block; margin-
    left: auto; marg
    in-right: auto ;
    width: 40%;

. title . cons {

```

```

background-color:rgb(248, 245, 192);
}
.but{
background-color:#22ff43;
color: rgb(255, 255, 255);
padding: 5px;
border-radius: 10px;
font-weight:bold;
}

```

Fig 7.7 Code for Procedure

VIEW PROCEDURE

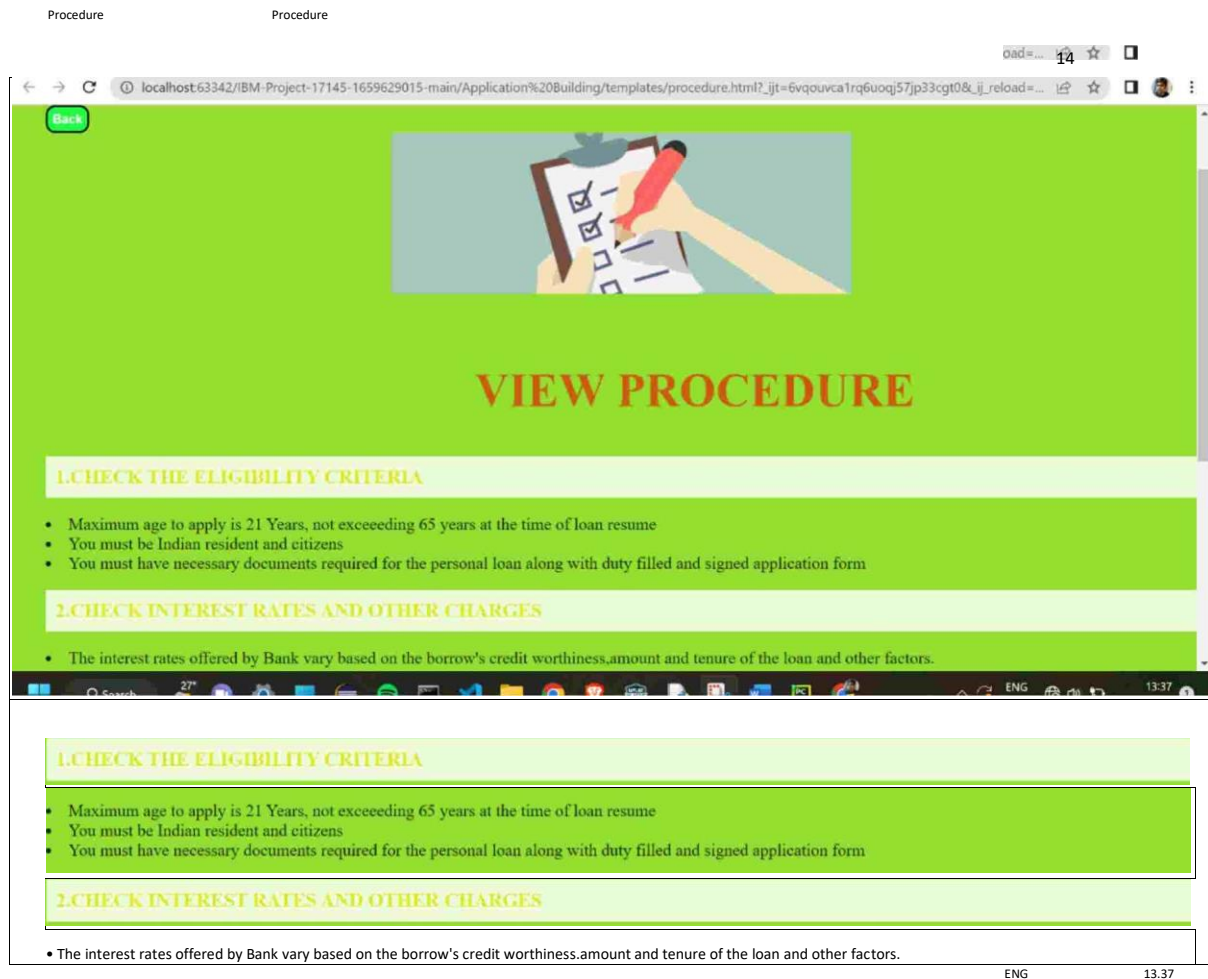


Fig 7.9 View Procedure

7.2FEATURE2 LOGIN

PAGE

CODE

```
< ! DOCTYPE html >
< html >
< head>
  < ti tle>LogIn Page < / title>
  < link rel=" stylesheet" href=" https : / / Cdn. jsde livr .
net/npm/boots trap@4 . 5 . 3 / dis t/ s/ bootstrap. min. css
in tegrity= " sha 38 4-
TX 8t 27 EcRE 3e / ihU7 zmQxVncDAy5 ulKz 4rEkgIXeMe d4 MO j 1 fl DPvg 6u
qK12 xXr2 "
  cros so ri gin=
  "anonymous " > < / he ad>
< s tyle >
  . group { padding- top
    : 100px ;

< / style>

  <div class=" container" >
  <div
    <div 40%; margin: 25px auto; ">
      <div class=" group" >
        <h3 style= "text-align: center; ">Login Page</h3>
        <form action=" loginl .php" method=" POST" >
          <div class="form-group">
            < label>UserName: < / type="text" name= "username" ter
class="form-control" autofocus your username or gmail ID"
required="
            < / div >
            <div clas
              <label>Password: < / type="Password" name="password"
autofocus placeholder=" Password" required=" ">
            < / div >

            < label>Enter Captcha : < / label >
            <div class=" form-row" >
              <div class=" form-group col-md- 6 " >
                <input type= "text" class= form-control 'T readonly id="capt"
required="

              <div class=" form-group col -md- 6" >
                <input type= "text" cla form-control " id=" text input" r equi red
              < / di v>
            < / di

          <div clas >

        < button onclick= "validcap ( ) ' name= " s ave " class="btn btn-lg btn-success
btn- block" tton>
      < / div>
    < / fo
    <h6>Captcha not visible </h6>
```

```

        <p>New Here?<a
                                html ">Register</a> </p>
    </div>
    < / cliv>
< / di
< / di v>
< script type=" text/ j
  avascript" > function cap ( )
  { var alpha

n '                                'w ' y', 'z '

var a    alpha [Math. floor (Math . random (
var b    ) *71) ] ; alpha [Math. floor (Math
var c    . random ( ) *71) ] ; alpha [Math.
var      floor (Math . random( ) *71) ] ;
var      alpha [Math. floor (Math . random (
var      ) ) ; alpha [Math. floor (Math .
          random( ) *71) ] ;
var falph [Math. floor (Math . random( ) *71) ] ;

var final a +b+c +d+e+f ; document.
getElementById (" capt ") . value=final ;

function validcap ( ) { var stg1 = document.
getElementById ( 'capt ' ) . value; var stg2 document.
getElementById ( text input ' ) . value; if
(stg1==stg2) {
  // alert ( "Form is validated Succesfully") •
  return true;

  alert ( "Please enter a valid captcha") ;
  return fal se;

< / script >
< / body>
<script src="https : / / code. jquery.com/j query-3. 5. 1. slim . min . j s"
integrity="sha384-
D fXdz2 ht PH 0l s S S s 5n CTpuj / zy 4C +0Gp amoFVy38 E+ IbbVYU ew+O
rCXaRkfj " cros so ri gi " anonymous "></ sc ript>
< s cr ip t s "https : / / Cdn . j sclcl ivr. net/npm/bootstrap@ 4 . 5 . 3/
di st / j s/ bootstrap . bundle . mi
n. j s" integrity="sha384- ho+j 7j yWK8 fNqe+Ä12Hb 8ÄhRq2 6LrZ
/JpcUGGOn+Y7 RsweNrtN /tE3MoK7 Ze ZDyx " cr os so ri gin= "
anonymous " X/ sc ript>
< / html >

```

```

margin: 0; padding: 0
; box- si zing: border
-box ;

body { background-color : rgb (144 ,
223, 4 8) ; margin-left: 4 0px;

```

```

. title { text-align:
  left ; margin-top:
  10 C)px; color: rgb
  (217, 234,

. title h 1 { font-size: 50px;
  color: rgba(245, 3 , 3, 0 .
  607 ) ; line-height: 5px;
  text-align: right; margin-
  top: 10 ()px; padding-bottom
  : 5 Opx; padding-le ft : 10
  C)px; margin-r ight : 3 00px
  ;

. title h 2 { font-size: 21px; text-trans
  form: uppercase; background-color
  :rgb (239, 252, 216 ) ; padding: 1
  Opx;

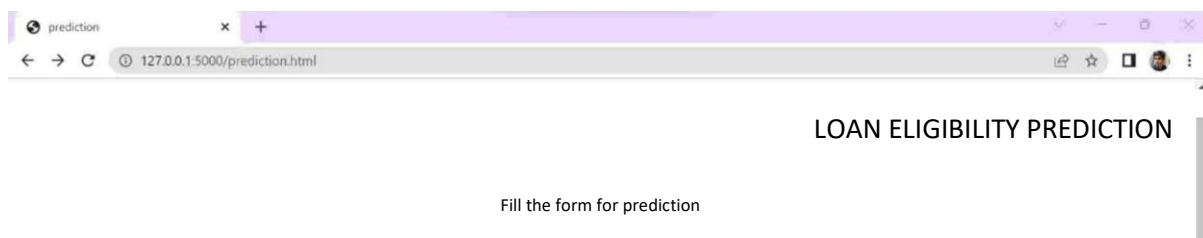
. title l i {

  font-size: 18px;
  color:rgb(23, 22, 22);
  margin-left: auto;
  margin-right: auto;
}
.img{
  display: block;
  margin-left: auto;
  margin-right: auto;
  width: 40%;
}
.title .cons{
  background-color:rgb(248, 245, 192);
}
.but{
  background-color:#22ff43;
  color: rgb(255, 255, 255);
  padding: 5px;
  border-radius: 10px;
  font-weight:bold;
}

```

Fig 7.10 Code for Login page

LOGIN PAGE



Back

Name

muthu

Email ID

123@gmail.com

Mobile Number

1234567891

Gender

Fig 7.11 Login page

APPLICATION REJECTION

CODE

```
< ! DOCTYPE html>
< html lang= 't en ' 'T >
< h ea
  < meta charset="utf-8 ">
  < titIe>Loan approval status</title>
  < link href="rejection.css">
  < link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/css/bootstrap.min.css" />
</head>
<body>
  APPROVAL
  <h2>{ {prediction text} }</h2>
  
  <h3>Please provide your feedback</h3>
  <div class="container">

    <div class="text">
      <div class="text">Thanks for rating us !
      <div class="edit">
    </div>
    <div class="star-widget">
      <input type="radio" name="rate" id="rate-5">
      <div class="star" for="rate-5" class="fas fa-star"></div>
      <input type="radio" name="rate" id="rate-4">
      <div class="star" for="rate-4" class="fas fa-star"></div>
      <input type="radio" name="rate" id="rate-3">
      <div class="star" for="rate-3" class="fas fa-star"></div>
      <input type="radio" name="rate" id="rate-2">
      <div class="star" for="rate-2" class="fas fa-star"></div>
```

```

<input type="radio" name="rate-1" id="rate-1"
      for="rate-class-fa-star-label">
1
<form action="
      ader
    >
  <div class="textarea">
    <textarea cols="30" placeholder="Describe your
experience . . ."/>
  </div>
  <div class="btn">
    <button type="submit">Post</button>
  </div>
</form>

<script> const btn = document.querySelector("button");
const post = document.querySelector("#post");
const widget = document.querySelector("#star-widget");
const editBtn = document.querySelector("#edit");
btn.onclick = () => {
  widget.style.display = "none";
  post.style.display = "block";
  editBtn.onclick = () => {
    widget.style.display = "block";
    post.style.display = "none";
  };
  return false;
};

</script>
</body>
</html> @import url('https://fonts.googleapis.com/css?family=Poppins:400,500,600,700&display=swap');

margin: 0; padding: 0; box-sizing: border-box; font-family: 'Poppins', sans-serif;

html, body {
  display: grid;
  height: 100%;
  place-items: center;
  text-align: center;
  background-color: white;
}

.container {
  position: relative;
  width: 400px;
  background-color: black;
  padding: 20px 30px;
  border: 1px solid #444;
  border-radius: 5px;
  display: flex;
  align-items: center;
  justify-content: center;
  flex-direction: column;
}

.container .post {
  display: none;
}

.container .text {
  font-size: 25px;

```



```

color: #666;
font-weight:
500 ;

. container . edit {
position: absolute
; right: 1 Opx;
top: 5px; font-
size: 16px; color:
#666; font-weight:
500 ; cursor:
pointer;

. container . edit : hover { text-
decoration: underline ;

. con tainer . star -widget
input { di splay: none;

. star-wi_dget label { font-
size: 4 Opx;

padding: 1 Opx; float:
right; transition: all
0.2s ease; input: not ( :
checked) labe I : hover,
input: not ( : checked)
label : hover
Labe I { color: #fd4;

i npu t : checked
color: #fd4;

input#rate-5 : checked Label
{ color: #fe7; text-shadow:
0 0 20px #952;

# rate-I: checked form header: before
{ cont ent : "1 just hate the service"
,

# rate-2: checked form header: before
{ content: "1 don' t like the service

# rate-3: checked form header: before {
content: "Awesome service" ,

# rate-4: checked form header: before { content
: "Satisfied service" ,

# rate-5: checked form header: before
{ content: " Excellent service

. container form{
display: none;

input: checked form {
di splay: block;

form header { width: 100%;
font-size: 25px; color: #
fe7; font-weight: 500 ;
margin: 5px 0 20px 0 ;

```

```

text-align: center ;
transition: all 0.2s ease;

form . textarea {
  height: 100px;
  width: 100%;
  overflow: hidden
;

form . textarea textarea{
  height: 100%; width:
  100%; outline: none;
  color: #eee; border:
  1px solid #333;
  background: #222 ;
  padding: 10px; font-
  size: 17px; resize:
  none ;

. textarea textarea : focus { border-
color: #444;

form . btn{
  height: 45px
; width:
  100%;
  margin: 15px 0;
}
form .btn button{
  height: 100%;
  width: 100%;
  border: 1px solid #444;
  outline: none;
  background: #222;
  color: #999;
  font-size: 17px;
  font-weight: 500;
  text-transform: uppercase;
  cursor: pointer;
  transition: all 0.3s ease;
}
form .btn button:hover{
  background: #1b1b1b;
}
h1{
  background:lightpink;
  width:1500px;
  margin:none;
  color: rgb(99, 22, 23);
  padding-top: 20px;
  height:100px;
  margin-top:none;
  border: solid 5px rgb(99, 22, 23);
}
h2{
  color:rgb(255, 11, 11);
  font-size: 40px;
  font-family: 'Times New Roman', Times, serif;
}
h3{
  font-size:30px;
  color:rgb(246, 187, 11);

```

Fig 7.12 Code for application rejection APPLICATION REJECTION

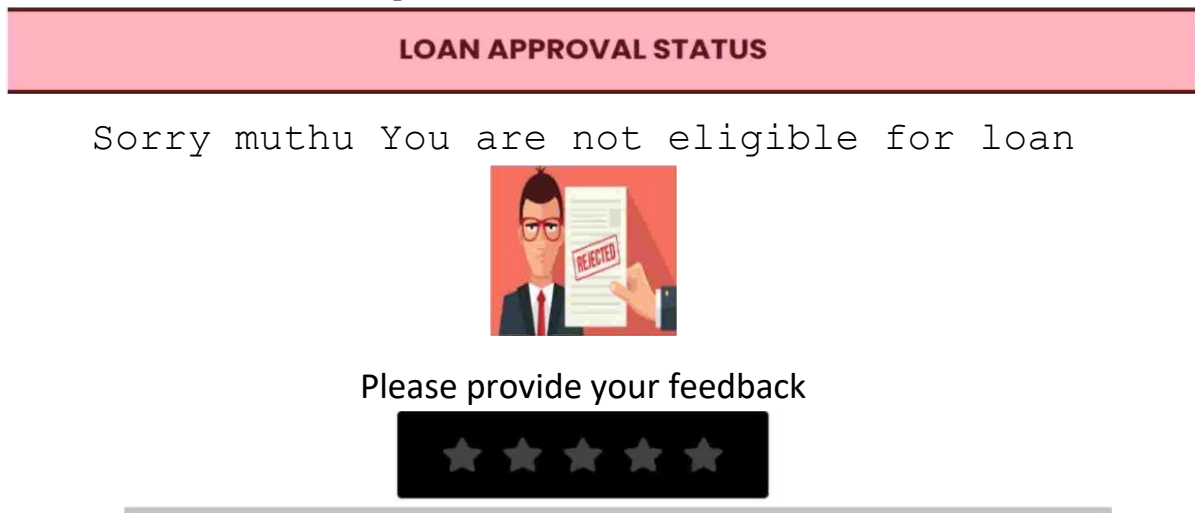


Fig 7.13 Application rejection

APPLICATION APPROVAL

```
< ! DOCTYPE html>
< html lang=" en"
  ead>
  <meta charset= "utf-8
  <title>Loan approva status < / title>
  < link                href="approve .css
  < link href="https : / /cdnjs . cloudflare. com/aj ax/libs/ font- awesome/
5. 15 .3/css / all . min .css " / >
  < / he ad>
  ody>
      APPROVAL
  <h2>{ {prediction text} }</h2>
  
  <h3>Please provide your feedback</h3>
  <div class=" container" >

    <div
      <div class=" text '5 Thanks for rating us !</div>
      <div class=" edit          div>
    < / di v>
    <div class=" star-widget" >
      <input type= "          name=" ra te " id=" ra te -
        radio "          5
      <
        for=" rate-5 cl as fas f a-star    label>
      label "
      <input type= "          name=" rate " id=" ra te-4
        radio "
        for=" ra te- cl as " fas f a- star labe
        4 "
      <input type= 't          name- rate" id=" rate-3
        radio "
      <label for=" rate-3 clas " fas fa- star "></
        "          label >
```

```

        <input type="radio" name="rate" id="rate-2"
            for="rate-class" class="fas fa-star"
            label>
        <input type="radio" name="rate" id="rate-1"
            for="rate-class" class="fas fa-star"
            label>
        <label for="rate-class" class="fas fa-star"></label>
    <form action="">
        <header></header>
        <div class="textarea">
            <textarea cols="30" your experience . . text area>
        <div class="btn">
            <button type="submit">Post</button>
        </div>
    </form>
</div>
</div>
<script> const btn = document.querySelector("button");
const post = document.querySelector("#star-widget");
const editBtn = document.querySelector("#edit");
btn.onclick = function() {
    post.style.display = "block";
    editBtn.style.display = "block";
    post.style.display = "none";
    return false;
};
</script>
</body>
</html>
@import url('https://fonts.googleapis.com/css?family=Poppins:400,500,600,700&display=swap');

margin: 0; padding: 0; box-sizing: border-box; font-family: Poppins, sans-serif;

html, body {
    display: grid;
    height: 100%;
    place-items: center;
    text-align: center;
    background: white;

    .container {
        position: relative;
        width: 400px;
        background: black;
        padding: 20px 30px;
        border: 1px solid #444;
        border-radius: 5px;
        display: flex;
        align-items: center;
        justify-content: center;
        flex-direction: column;

        .container .post {
            display: none;

            .container .text {
                font-size: 25px;
                color:

```

```

    #666;          font-
weight: 500 ;

. container . edit {
position: absolute
; right: 1 Opx;
top: 5px;
font-size: 16px;
color:          #666;
font-weight: 500
;          cursor:
pointer;

. container . edit : hover { text-
decoration: underline ;

. container . star -widget
input { di splay: none;

. star-widget label { font-
size: 4 Opx;

padding: 1 Opx; float:
right; transition: all
0.2s ease;

input: not ( : checked) label : hove r,
input: not ( : checked) label : hover
    labe I { color: #fd4;

inpu t : chec ked label    {
    color: #fd4;

        :checked label {
color: # fe7; text-shadow:
0 0 20px #952;

# rate-I : checked form header: before {
content : just hate the service" ,

        checked form header: before {
content : don' t like the service

#rate-3: checked form header: before {
content: "Awes ome service"

# rate-4: checked form header: before
{ cont ent : " Satisfied service" ;

# rate-5: checked form header: before {
content: "Exce I Lent service

. container form{
di splay: none;

input: checked form {
di splay: block;

form header { width: 100%;
font-size: 25px; color: #
fe7; font-weight: 500 ;
margin: 5px 0 20px 0;

```

```

text-align: center;
transition: all 0.2s ease;

form . text area {
  height: 100px;
  width: 100%;
  overflow: hidden
; form . textarea
textarea{
  height: 100%;
  width: 100%; outline: none; color:
#eee; border: 1px
solid #333;
background: #222
; padding: 10px; font-size:
17px; resize:
none ;

. textarea textarea : focus { border-
color: #444;

form .btn{
  height: 45px;
  width: 100%;
  margin: 15px 0
;

form . btn button { height:
100%; width: 100%; border:
1px solid #444; outline: none; background: #222 ;
color: #999; font-size:
17px; font-weight: 500 ;
text-transform: form:
uppercase; cursor:
pointer; transition: all
0.3s ease;

form . btn button : hover {
  background: #1b1b1b;

  background : lightpink ; width:
150px ; margin : none; color:
rgb (99, 22, 23) ; padding-top: 20px; height : 100px ; margin -top
: none; border: solid 5px rgb (
99, 22, 23 ) ;

color: rgb (42, 117, 7) ; font-
size: 40px;
font-family: Times New Roman' , Times, serif ;

font-size: 30px; color:
rgb (246, 187 , 11 ) ;

```

Fig 7.14 Code Application approval

LOAN APPROVAL

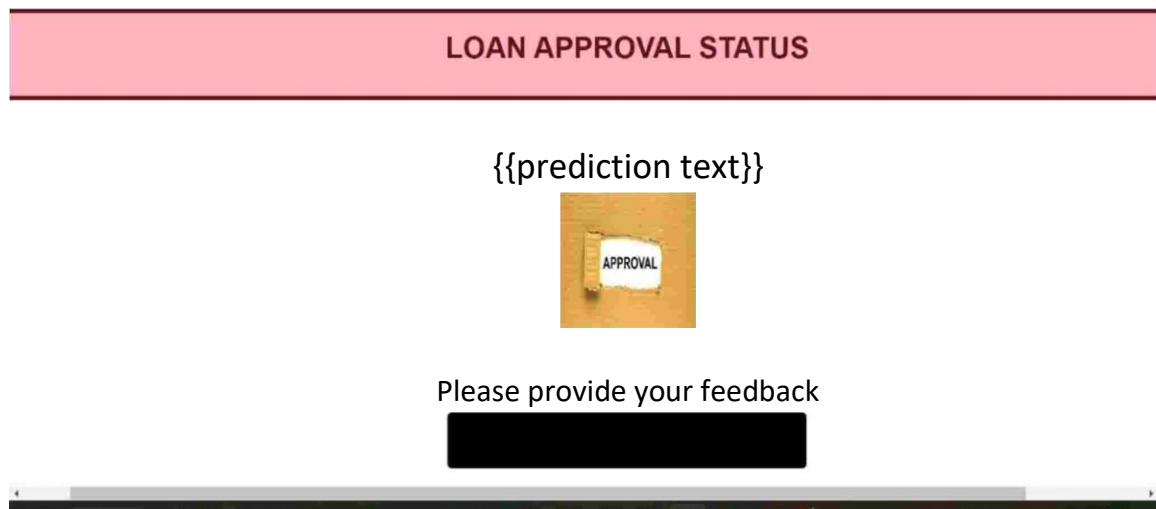


Fig 7.15 Loan approval

TERMS AND CONDITIONS

CODE

```
< ! DOCTYPE html >
< html lang=" en
< head>
  <meta charset= "UTF-8
  <meta http-equiv="X-UA-Compa tible" content="
  <meta
    content="width=device-width, initial-scale=1 . 0

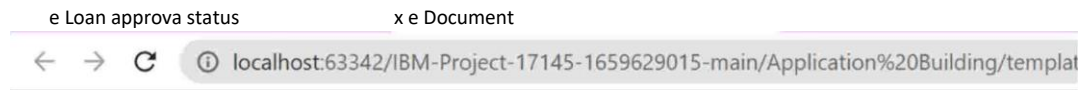
< / he ad>
<body>
  <div class=" term" >
    <h2>Terms and conditions

    are only giving the prediction whether you are eligible for loan
or not</li>
    <li>You should trust the bank and should give all the required deta
    <li>Bank will verify your details and inform you about the
    <li>Up10ad your correct Property document copy</ li >
      't give any false details if it gets known we will not give
you the Ioan</ li >
    <li>Enter your correct income
    <li>Enter your name as per the name in adhar card</li>
    <li>Enter your correct mobile number for contacting you</li> yout
      correct email address</ li >
    <li>Repay the loan amount and interest on time</ I i >
    <li>Your interest rate will be increased if you don't repay the loan
amount on time</ li >

< / body>
< / html >
```

Fig 7.16 Code for Terms and conditions

TERMS AND CONDITIONS



Terms and conditions

1. We are only giving the prediction whether you are eligible for loan or not
2. You should trust the bank and should give all the required details
3. Bank will verify your details and inform you about the loan
4. Upload your correct Property document copy
5. Don't give any false details if it gets known we will not give you the loan
6. Enter your correct Income details
7. Enter your name as per the name in adhar card
8. Enter your correct mobile number for contacting you
9. Enter your correct email address
10. Repay the loan amount and Interest on time
11. Your interest rate will be increased if you don't repay the loan amount on time

Fig 7.17 Terms and conditions

CHAPTER 8

TESTING

8.1 TEST CASES

Testing report of an individual software component or module is termed as Unit Testing. It is typically done by the programmer and not by testers, as it requires detailed knowledge of the internal program design and code



Fig 8.1 Testing

PROJECT TYPE	APPLIED DATA SCIENCE
DEVELOPER	<u>PYTHON,HTML,CSS,JAVA SCRIPT</u>
LANGUAGE	110
TOTAL NUMBER OF TEST CASES	59
NUMBER OF TEST CASES EXCUTED	
TADIGOTLA KRANTHI KUMAR REDDY	
NUMBER OF TEST CASES PASSED	511
NUMBER OF TEST CASES FAILED	3-DUE TO TECHNICAL ISSUES

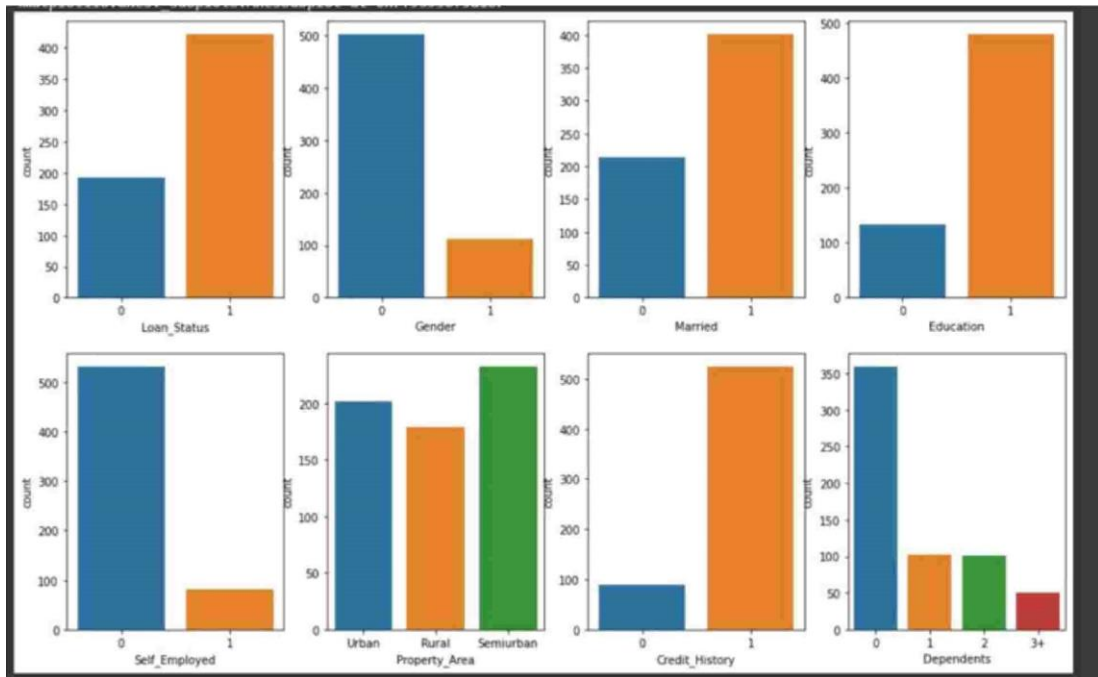


Fig 8.2 Test cases accuracy

8.2 USER ACCEPTANCE AND TESTING

UNIT TESTING

Unit testing is carried out screen-wise, each screen being identified as an object. Attention is diverted to individual modules, independently to one another to locate errors . This has enabled the detection of errors in coding and logic .This is the first level of testing. In this, codes are written such that from one module ,we can move onto the next module according to the choice we enter.

SYSTEM TESTING:

In this, the entire system was tested as a whole with all forms, code, modules and class modules System testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently before live operation commences.It is a series of different tests that verifies that all system

elements have been properly integrated and perform allocated functions. System testing makes logical assumptions that if all parts of the system are correct, the goal will be successfully achieved. Testing is the process of executing the program with the intent of finding errors. Testing cannot show the absence of defects, it can only show that software errors are present.



Fig 8.3 Results

RESULTS

9.1 PERFORMANCE METRICS

ACCURACY

```
[135] print("Decision Tree Model Testing Accuracy")
      print(accuracy_score(ytest,ypredd))
      print("Decision Tree Model Training Accuracy") print
      (accuracy_score(ytrain,ypred2d))
```

Decision Tree Model Testing Accuracy

Decision Tree Model Training Accuracy

e. 8368298368298368

```
print( "Random Forest Model Testing
Accuracy") print(accuracy_score(ytest,ypredR))
print( "Random Forest Model Training
Accuracy")
print(accuracy_score(ytrain,ypred2R))
```

Random Forest Model Testing Accuracy

e. 8972972972972973 Random Forest Model

Training Accuracy

e. 9114219114219114

```
[137] Model Testing Accuracy") print ypredk) )
      print( ' KNN Model Training Accuracy")
      print(accuracy score(ytrain,ypred2k))
```

KNN Model Testing Accuracy

e. 0549549505054 KNN

Model Training Accuracy

e. 6386946386946387

```
[138] print( 'Xgboost Model Testing •Accuracy")
      pri nt ( accuracy_score(ytest, ypredx) )
      print( 'T xgboost Model Training Accuracy")
      pri nt (accuracy_s core (ytrain , y pred2x) )
```

CHAPTER

Xgboost Model Testing Accuracy

xgboost Model Training Accuracy 0.8484848484848485

Fig 9.1 Classifier accuracy

FINAL RESULT FROM PERFORMANCE TESTING

Evaluating Performance Of The Model And Saving The Model

Random Forest Model is Selected

```
/ [09] print("Random Forest Model Testing Accuracy")
      print(accuracy_score(ytest,ypredR) )
      print("Random Forest Model Training
Accuracy") print
      (accuracy_score(ytrain,ypred2R))
```

➡ Random Forest Model Testing Accuracy

0.8972972972972973 Random Forest
Model Training Accuracy
0.9114219114219114

```
/ [14B] f1_score(ypredR,ytest,average='weighted')0
```

0.893315978609323

Fig 9.2 Accuracy of Random forest model

10

ADVANTAGES AND DISADVANTAGES

10.1 ADVANTAGES

There are several advantages associated with pre-approved personal loans. They're given below.

- **Instant approval and disbursal:** An existing customer of a particular financial institution, can get the loan amount disbursed within a day to their account. It can happen so quickly since the bank already has the customer's details.
- **Flexible Loan repayment period:** Getting a pre-approved loan can help the customer get flexible tenure on repayment. Since the banks would trust with credit-worthiness, it results in flexible repayment terms or loan tenure. It can range between 1-4 years. Carefully consider loan tenure so do not default repayment.
- **Low interest rates:** Due to good credit score, can get competitive interest rates on these loans, which is why become eligible for this offer in the first place. Because of clean financial record, the lender would offer low-interest rates on pre- approved loans. It would help to remain punctual with loan payments and not fall into default.
- **Easy documentation:** Pre-approved loans offer paperless documentation. It is only possible for existing. Can apply for this personal loan entirely online. Most of the lenders offer this facility either on their mobile app or website.
- **Several discount:** Since these loans are offered mostly to increase the sales, the lender may attach certain offers along with it.

10.2 DISADVANTAGES

Pre-approved personal loans have multiple pros, but certain cons as well. They're given below.

CHAPTER

- If any mismatch is found in your documents and the loan's requirement, the loan amount will not be credited to your account. just by making an offer, the bank is not bound to offer to the loan to you if such a case arises. Hence, your application can be rejected.
- Pre-approved offer only indicates that you're eligible for the loan. It doesn't mean that you'll get approved for the loan definitely.
- The interest rates may increase for pre-approved customers. Therefore, check the in terest rates with your lender before accepting a loan offer. Although it is not mandatory that the loan interest rate will increase, it is possible.

11 CONCLUSION

For the purpose of predicting the loan approval status of the applied customer, we have chosen the machine learning approach to study the bank dataset. We have applied various machine learning algorithms to decide which one will be the best for applying on the dataset to get the result with the highest accuracy. Following this approach, we found that apart from the logistic regression, the rest of the algorithms performed satisfactory in terms of giving out the accuracy. We also determined the most important features that influence the loan approval status. These most important features are then used on some selected algorithms and their performance accuracy is compared with the instance of using all the features. This model can help the banks in figuring out which factors are important for the loan approval procedure. The comparative study makes us clear about which algorithm will be the best and ignores the rest, based on their accuracy.

CHAPTER

CHAPTER 12

FUTURESCOPE

The proposed work system is a successful working prototype that is used for Applicant Credibility Prediction for Loan Approval. This system will help the bank to find the credibility of loan applicant and make sure it is well protected from defaulters. This system assuredly assists the lenders to know about the applicant based on his occupation, annual salary, bank statement and previous loan history. This assures the early detection and prevention of losses due to the loan defaulters. The following suggestions may be carried out in future implementation of the system the smart lender can be made more user friendly. We need to build a lender login page and subsequently a user login page for the applicants. We need to create a data base consisting all the details about the loan applicants which includes their occupation, annual salary, bank statement, credit score and previous loan history.

APPENDIX

SOURCE CODE

BACKEND

```
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("Rmodel.pkl", 'rb'))

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

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

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

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

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

@app.route('/contact.html')
def contact():
    return render_template('contact.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('/rating.html') def
rat():
    return render_template('rating.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
    elifproparea == 'Rural' :
        proparea  = 0 else:
        proparea  = 1
    features  =
[gender,married,dependents,education,employed,ApplicantIncome,CoapplicantInc
ome,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 ='Con gratulations !
'+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)
```

GITHUB LINK

<https://github.com/1BM-EPBVIBM-Project-9505-1659013990>

PROJECT DEMO LINK

<https://drive.google.com/drive/folders/lbEYdzKq5yIBFESsKoXBdkEyvKwgR1jU>

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