

# **SMART LENDER – APPLICANT CREDIBILITY PREDICTION FOR LOAN APPROVAL**

**A PROJECT REPORT**

**Submitted by**

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# 1. INTRODUCTION

Today a lot of people/ companies are applying for bank loans. The core business part of every bank is the distribution of loans. The main objective of the banking sector is to give their assets in safe hands. But the banks or the financial companies take a very long time for the verification and validation process and even after going through such a regress process there is no surety that whether the applicant chosen is deserving or not.

Despite the fact that our banking system has many products to sell, the main source of income for a bank is its credit line. So, they can earn from interest on the loans they credit . Commercial loans have always been a big part of the banking industry, and lenders are always aiming to reduce their credit risk . Nowadays in the market economy banks play a very crucial role. The profit or loss of a bank is largely influenced by loans, i.e. Whether the customers repay the loans or default on them The banks need to decide whether he/she is a good(non-defaulter) or bad(defaulter) before giving the loans to the borrowers. Among the most important problems to be addressed in commercial loan lending is the borrowers' creditworthiness.

The credit risk is defined as the likelihood that borrowers will fail to meet their loan obligations .To predict whether the borrower will be good or bad is a very difficult task for any bank or organization. The banking system uses a manual process for checking whether a borrower is a defaulter or not.

The manual method will undoubtedly be more precise and efficient, but it will not be able to handle a high volume of loan applications at once. When a situation like this arises, it will take a very long time to make decisions and a lot of labour will be needed. Both applicants and bank workers will benefit greatly if we can make accurate loan predictions. Therefore, the objective is to determine whether the borrower is good or bad, that is, whether or not the borrower will be able to repay the loans. Machine learning algorithms can aid in achieving this.

## **1.1. Project Overview**

Banks are making major part of profits through loans. Loan approval is a very important process for banking organizations. It is very difficult to predict the possibility of payment of loan by the customers because there is an increasing rate of loan defaults and the banking authorities are finding it more difficult to correctly access loan requests and tackle the risks of people defaulting on loans. Machine learning technique is very useful in predicting outcomes for large amount of data. Henceforth, we develop bank loan prediction system using machine learning technique is to predict whether a candidate will be granted a bank loan or not.

## **1.2. Purpose**

The purpose of Smart Lender- Applicant credibility prediction for loan approval is to predict whether a candidate will be granted a bank loan or not.

## **2.LITERATURE SURVEY**

**PAPER 1: Prediction for Loan Approval using Machine Learning Algorithm Ashwini S. Kadam, Shraddha R Nikam, Ankita A. Aher, Gayatri V. Shelke, Amar S Chandgude (2021)[1].**

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

**PAPER 2: Prediction for Loan Approval using Machine Learning .Anuja Kadam, Pragati Namde, Sonal Shirke, Siddhesh Nandgaonkar, Dr.D.R Ingle (2021)[3].**

Data mining algorithms are used to study the loan-approved data and exact patterns, which would help in predicting the reasonable defaulters, thereby helping the banks for making better choices in the future. Data Mining is the process of examining underlying and potentially useful patterns in big chunks of source data. For the packages of three algorithms (Logistic regression, Decision tree and Random Forest) were imported. The model was then defined and the accuracy score was evaluated. Logistic Regression was the best fit with the highest accuracy score 81.12%. The model was deployed in heroku.

**PAPER 3: Loan Prediction by using Machine Learning .Pidikiti Supriya , Myneedi Pavani , Nagarapu Saisushma , Namburi Vimala Kumari , K Vikas (2019)[4].**

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

**PAPER 4: Loan Approval Prediction based on Machine Learning Approach Kumar Arun, Garg Ishan, Kaur Sanmeet(2016) .**

With the enhancement in the banking sector, lots of people apply for bank loans but the bank has its limited assets which it grants to only limited people , so finding out to whom the loan can be granted is a typical process for the banks. So, in this paper , they tried to reduce this risk by selecting the safe person so as to save lots of bank efforts

and assets. It was done by mining the previous records of the people to whom the loan was granted before and on the basis of these records the machine was trained using the machine learning model which gave the most accurate result. The main goal of this paper is to predict if loan assignment to a specific person will be safe or not. This paper has into four sections (i) Collection of data (ii) Comparing the machine learning models on collected data (iii) Training the system on most promising model (iv) Testing the system.

## **2.1 Existing problem**

Existing models designed for predicting the loan approvals which cannot effectively predict accuracy for the different sets of the data on various attributes.

## **2.2 References**

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

## **2.3 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. But 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.

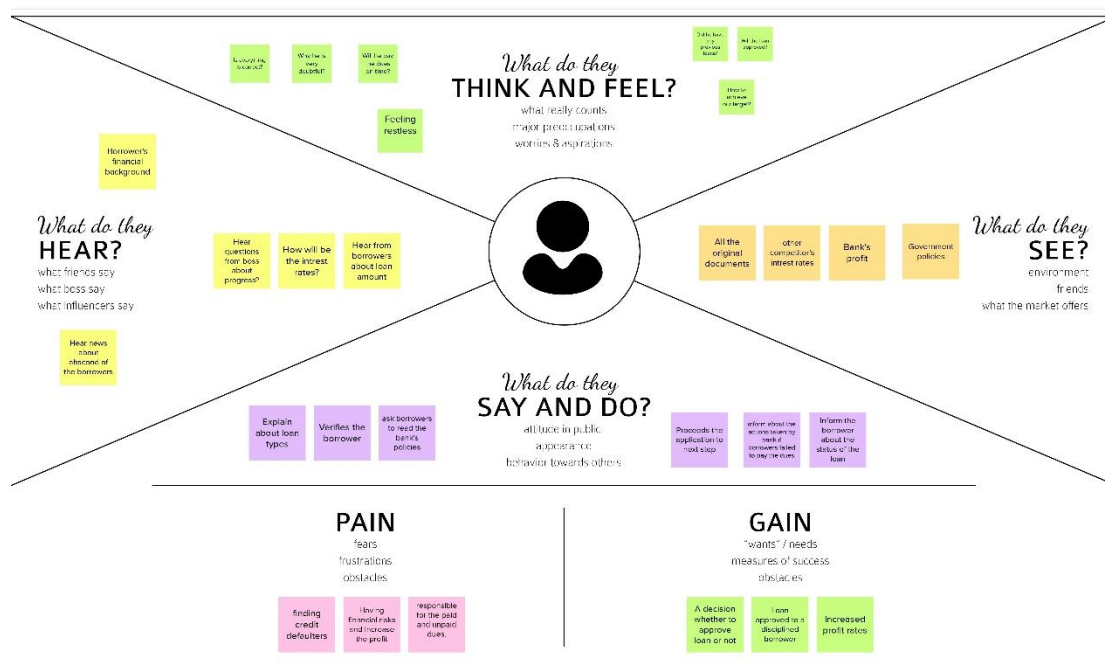
Therefore, bank employees need a way to do such a thing so that recovery of approved loans can take place without any loss. Machine Learning techniques can be used to perform such classifications of the credit defaulters as they are very crucial and useful in the prediction of these types of data. The pre-processed dataset will be trained and tested on with the ML algorithms. Finally, a best model is selected and used in the application.

### 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.


#### Empathy Map for Smart lender – applicant credibility prediction for loan approval



#### 3.2 Ideation & 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. Use this template in your own brainstorming sessions so your





## Brainstorm & idea prioritization

Use this template to your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 10 people recommended

### Before you collaborate

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

- 1. **Videochat**

### 1. Team gathering

Before you should participate in the session and read an agenda, share relevant information or pre-read ahead.

### 2. Get the goal

Think about the problem you'll be trying to solve in the brainstorming session.

### 3. Know how to use the facilitation tools

Use the facilitation tools to create a timeline for a 1-hour and 10-minute session.

Timeline

### Before your problem statement

What problem are you trying to solve? Frame your problem as a noun right the statement. This will be the focus of your discussion.

- 1. **Timeline**

### 2. Problem

### 3. Problem

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

- 1. **Timeline**

### 4. Problem

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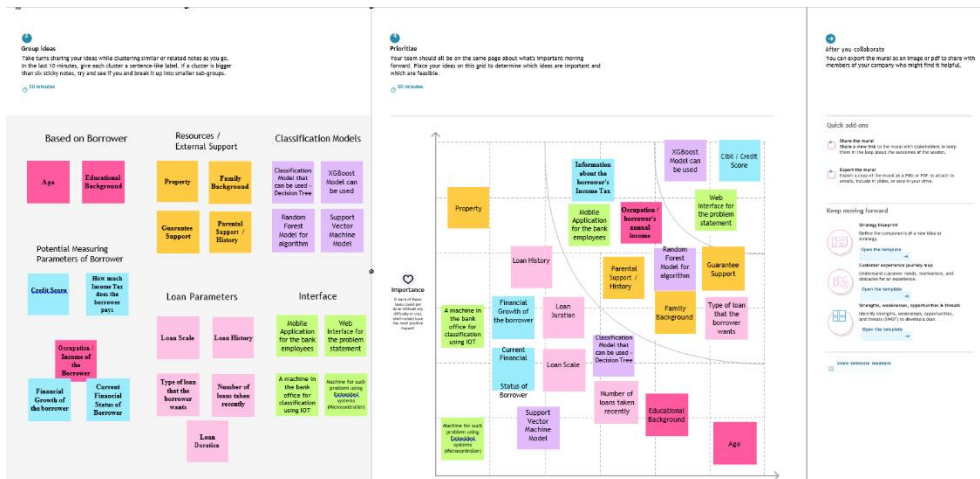
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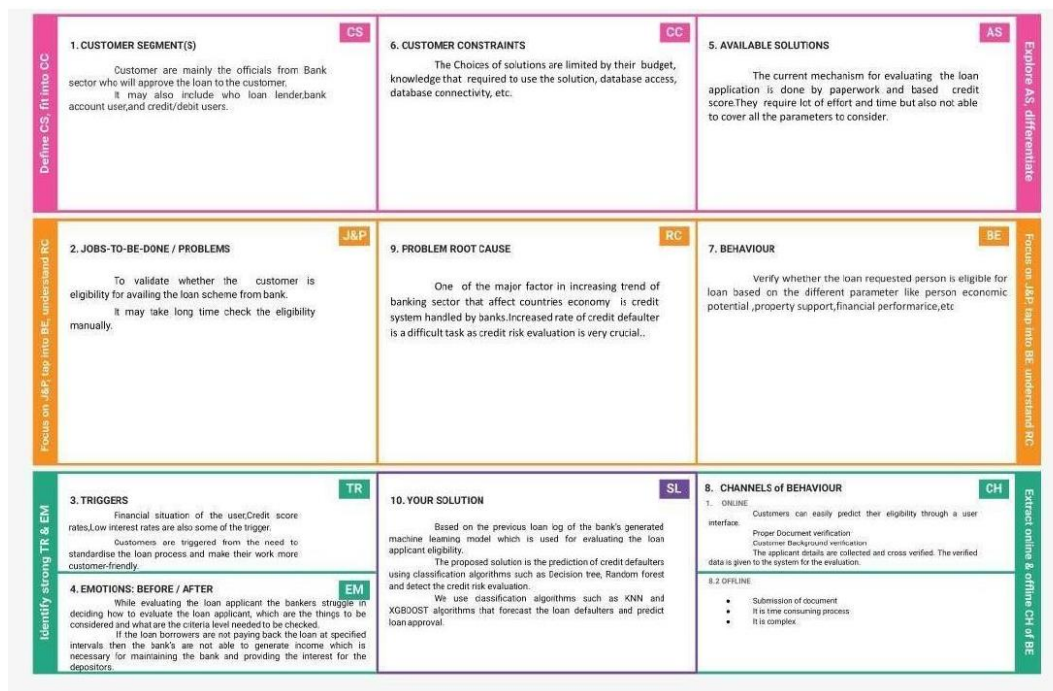


### 3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	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.
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, Random forest, KNN, Xgboost and 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. They need not put much effort into making decisions for loan approvals rather can leave that part to the application. The customers (bankers) get satisfied by the results of the application. Thus, better the accuracy, better classification of the applicants and better the satisfaction.

### 3.4 Problem Solution fit

This term is used to describe the point validating that the base problem resulting in a business idea really exists and the proposed solution actually solves that problem. We need to validate our problem hypothesis using real world data.



## 4. REQUIREMENT ANALYSIS

### 4.1 Functional requirement

A functional requirement is a description of service that the software must offer. It describes a software system or its component. Functional Requirement can range from the high-level abstract statement of the sender's necessity to detailed functional requirements. A function is nothing but inputs of software system, its behaviour, and outputs.

FR No.	Functional Requirement	Sub Requirement
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Bank Website
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User credit score	Confirm the CIBIL score of the client using banking applications and re-verify it.

FR-4	User enters loan details	Validated by bank or financial institution.
FR-5	Fund transfer By the bank to customer	Payment sent through the bank through NEFT, IMPS, DEMAT account etc.

## 4.2 Non-Functional requirements

Non functional requirements are the constraints or the requirements imposed on the system they specify the quality of attribute of the software. It deals with scalability, maintainability, performance, reliability, security and more.

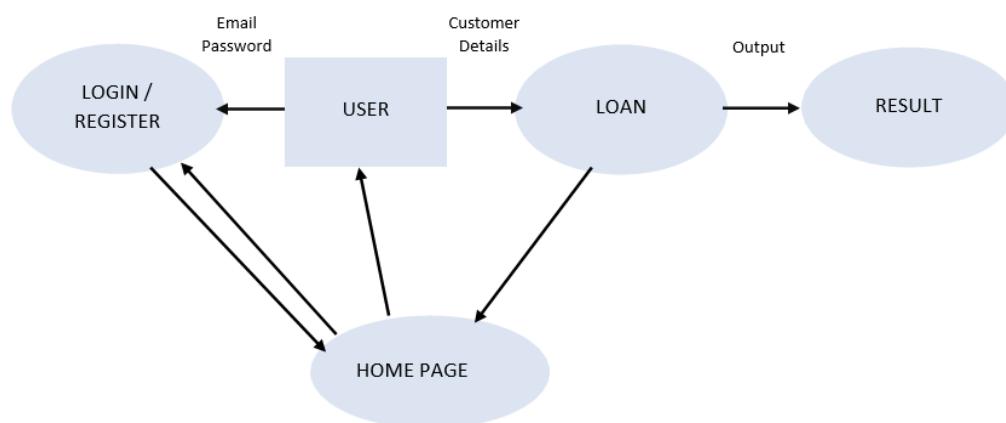
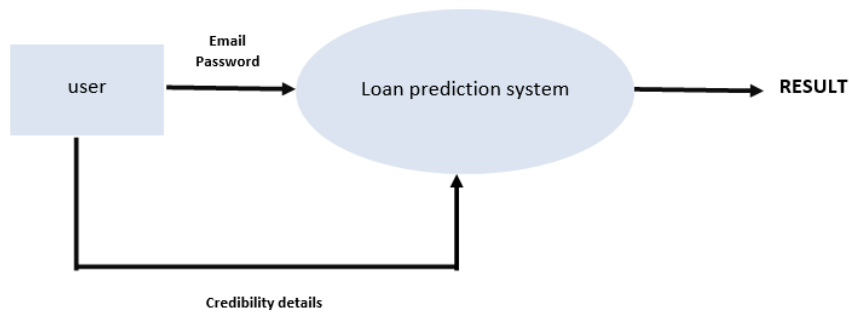
FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	The application must be easily accessible even with low network speed.
NFR-2	<b>Security</b>	Data must be private and must not be available to any 3 <sup>rd</sup> parties, also they must be encrypted safely.
NFR-3	<b>Reliability</b>	The machine learning module provides a reliable source for safe transaction.
NFR-4	<b>Performance</b>	Sleek and higher order functions ensure fast running and also low time complexity.
NFR-5	<b>Availability</b>	All banks, financial institutions and customers will be able to use the application.

## 5. PROJECT DESIGN

### 5.1 Data Flow Diagrams

Data flow diagram (DFD) is a graphical or visual representation using a standardized set of symbols and notations to describe a business operation through data movement. Data flow diagram can resemble flow chart or Unified Modelling Language, but they are not meant to represent details of software logic.

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 Architecture

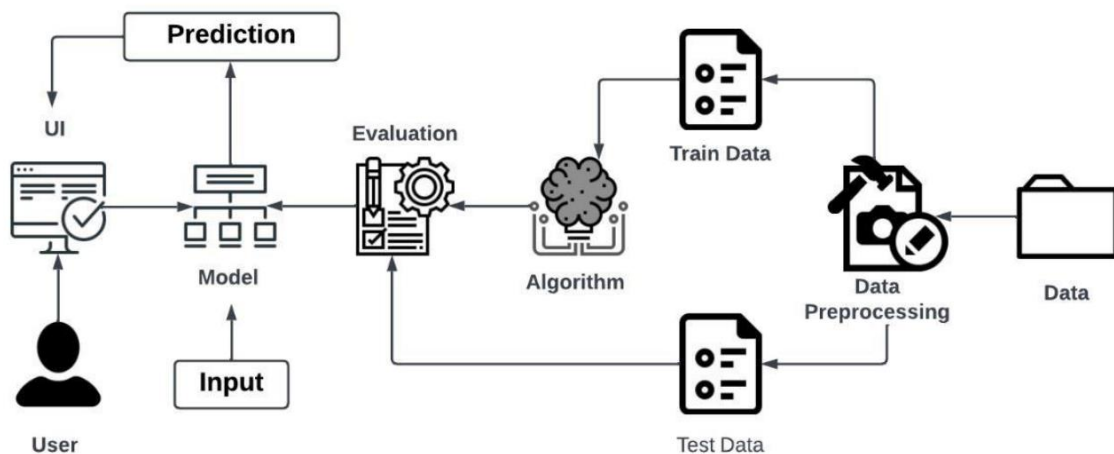
### Solution Architecture

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.

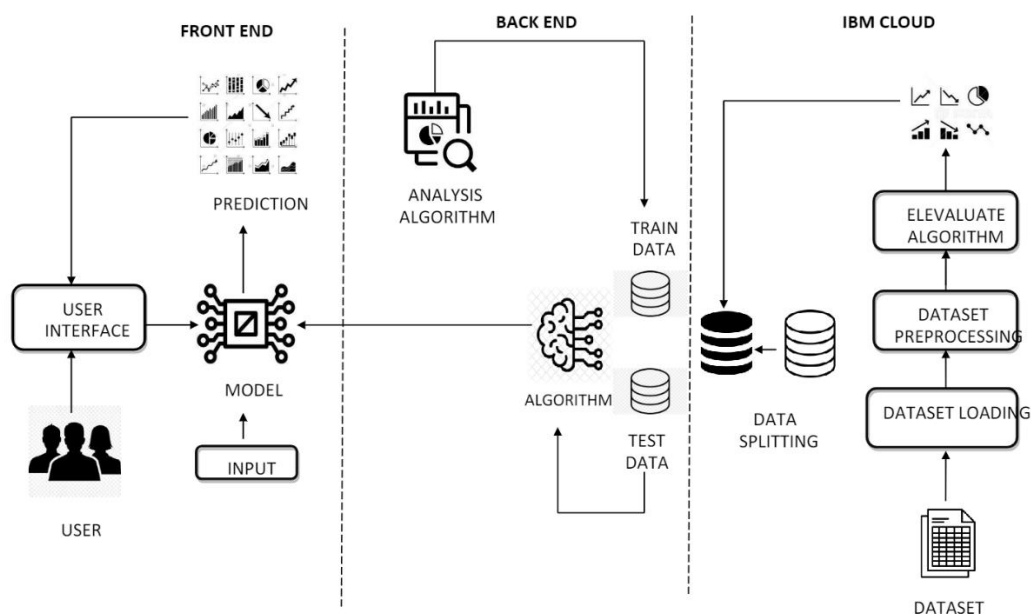
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

### Solution Architecture Diagram:



### Technical Architecture:

Technical Architecture refers to creating a structured software solution that will meet the business needs and expectations while providing a strong technical plan for the growth of the software application. It includes major components of the system, their relationships and the contracts that define interaction between the components. The goal is to achieve all the business needs.



**Table-1 : Components & Technologies:**

S.No	Component	Description	Technology
1.	User Interface	User interact with our application through web User Interface.	HTML, CSS and Python flask.
2.	Application Logic-1-Login.	When the user click on the login button , he/she is directed to login page, if they are registered already.	HTML ,CSS, Python flask.
3.	Application Logic-Registration	When the user click on the Register button , he/she is directed to Register page for further process.	HTML,CSS, Python flask.
4.	Application Logic-Test Vitals Form	After Logged in , when the user click on the test vital form button ,he/she directed to the form page to enter the vitals for prediction.	Front end- HTML ,CSS ,MySQL,Pytjon flask Back end-Python
5.	Database	Data type - String ,Numeric.	MySQL.
6.	Cloud Database	Database Service on Cloud	IBM.
7.	File Storage	File storage requirements	NIL
8.	External API-1	Purpose of External API used in the application	NIL

9.	External API-2	Purpose of External API used in the application	NIL
10.	Machine Learning Model	Get the data from the user and predict the data with tested and trained dataset models	Data Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	NIL

**Table-2: Application Characteristics:**

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	International Business Machines.	Cloud.
2.	Security Implementations	Access permission for login page using CAPTCHA	Encryptions.
3.	Scalable Architecture	The key of Three tier architecture is improving scalability.	Three Tier architecture.
4.	Availability	Load balancer or ADC is the key component that ensures high availability by sending request.	Load balancer.
5.	Performance	The system should be able to handle large number of users at the time	Load balancer.

## 6. PROJECT PLANNING & SCHEDULING

The process of planning primarily deals with selecting the appropriate policies and procedures in order to achieve the objectives of the project. Scheduling converts the project action plans for scope, time cost and quality into an operating timetable.

### 6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection and Pre-processing	USN-1	As a user, I can't interact anything. Waiting is user's task. User can listen the relationship exist between the various attributes of data by presentation of developer	2	high	Merlin Jone J, Mohammed Kaif S
Sprint-1	Model Building	USN-2	As a user, I can predict loan credibility by various developed ML models by console	1	high	Merlin Jone J, Mohammed Kaif S
Sprint-2	Model Evaluation	USN-3	As a user, I can predict loan credibility by best Model in various developed ML model by console	2	high	Merlin Jone J, Mohammed Kaif S
Sprint-2	Model Deployment on IBM Cloud using IBM Watson	USN-4	As a user, I can use the model by requesting the deployed model on Cloud	1	Medium	Merlin Jone J, Mohammed Kaif S
Sprint-2	Basic user interaction Dashboard	USN-5	As a user, I can use the model or prediction from model by interacting with dashboard	2	high	Merlin Jone J, Mugunthan R
Sprint-3	Improved Dashboard and GUI	USN-6	As a user, I can use the model or prediction from model by interacting with improved dashboard	1	Medium	Mugunthan R, Merlin Jone J
Sprint-3	Registration	USN-7	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Mugunthan R, Parthiban D
Sprint-3	Registration	USN-7	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Mugunthan R, Parthiban D
Sprint-3	Login	USN-8	As a user, I can log into the application by entering email & password and I can register .login to the application through Gmail	2	Medium	Mugunthan R, Parthiban D
Sprint-4	Raise query/complaint and give feedback	USN-9	As a user, I can raise complaint or query and give feedback	1	Medium	Mugunthan R, Parthiban D
Sprint-4	Improve overall web app	USN-10	As a user, I can user revised and improved version of web application	1	High	Mugunthan R, Parthiban D, Merlin Jone J, Mohammed Kaif S

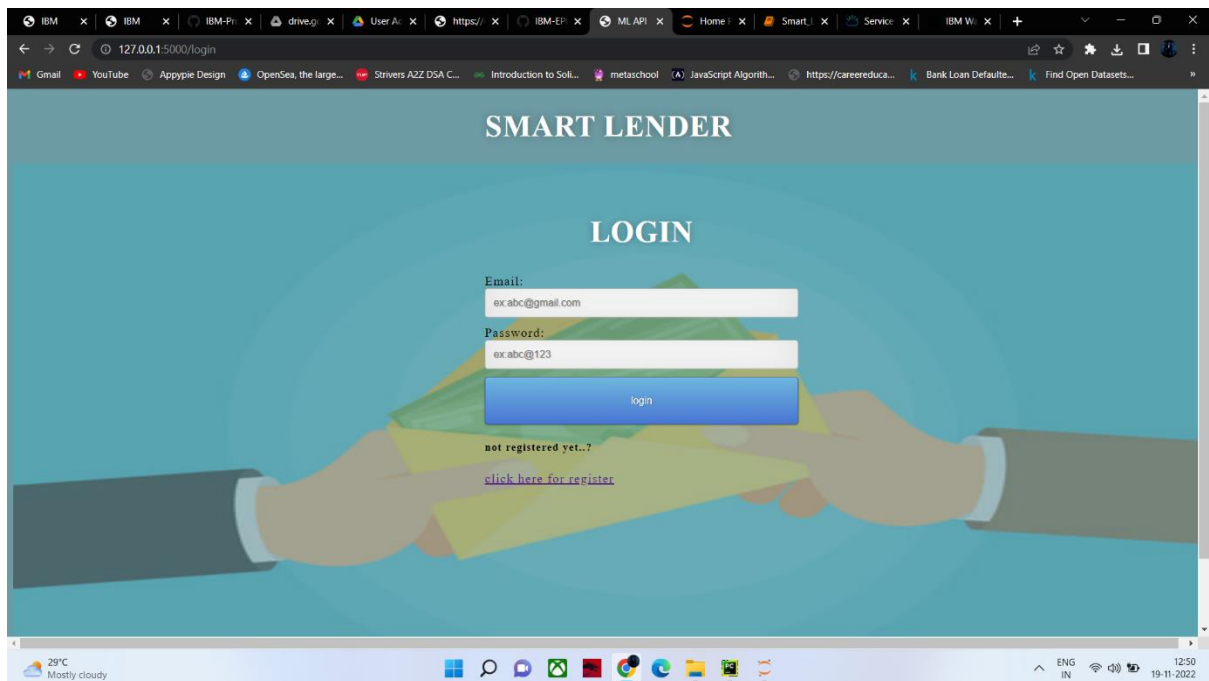


## 6.2 Sprint Delivery Schedule

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

## 7. CODING & SOLUTIONING

### 7.1 Feature 1



IBM x IBM x IBM-Pr x drive.g x User A x https:// x IBM-EP x ML API x Home x Smart.L x Service x IBM W x +

127.0.0.1:5000/reg

Gmail YouTube Apppie Design OpenSea, the large... Strivers AZZ DSA C... Introduction to Soli... metaschool (A) JavaScript Algorith... https://careereduca... Bank Loan Defaults... Find Open Datasets...

# SMART LENDER

## REGISTRATION

Email:  
ex:abc@gmail.com

Password:  
ex:abc@123

Confirm Password:  
re-enter same password

Register

29°C Mostly cloudy

ENG IN 12:50 19-11-2022

## 7.2 Feature 2

IBM x IBM x IBM-Pr x drive.g x User A x https:// x IBM-EP x ML API x Home x Smart.L x Service x IBM W x +

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# SMART LENDER

Income  
Income

Age  
Age

Experience  
Experience

Marital Status Single

House Ownership Own

Car ownership yes

Current job years

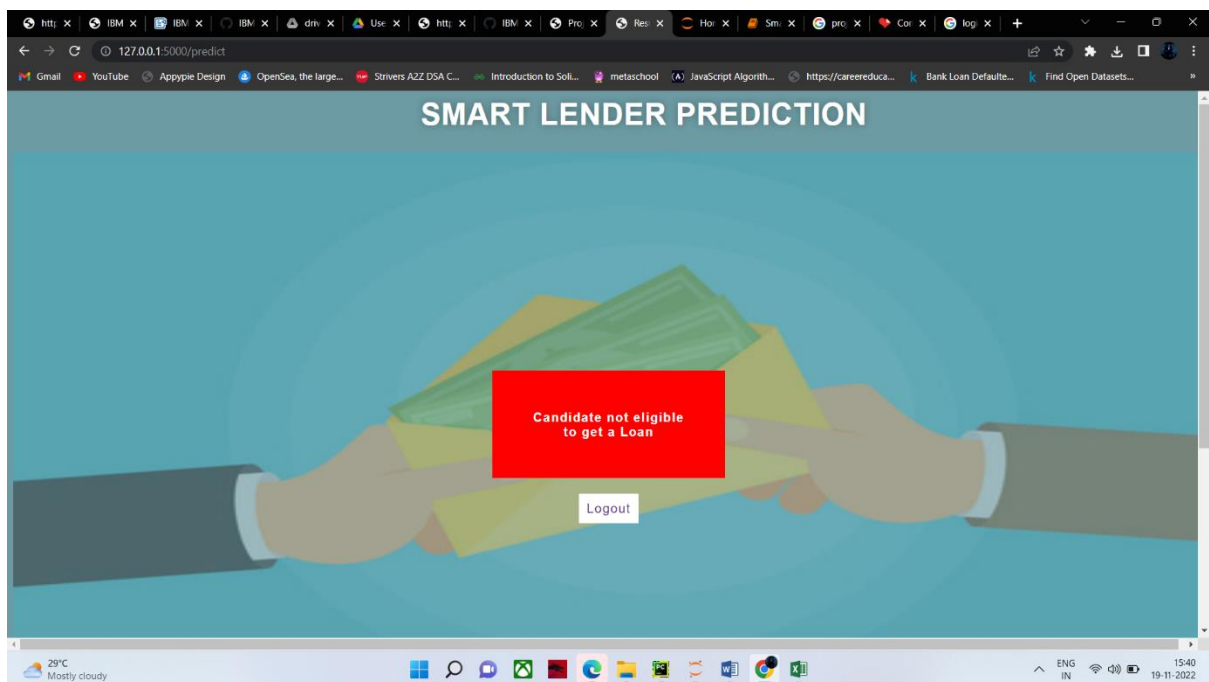
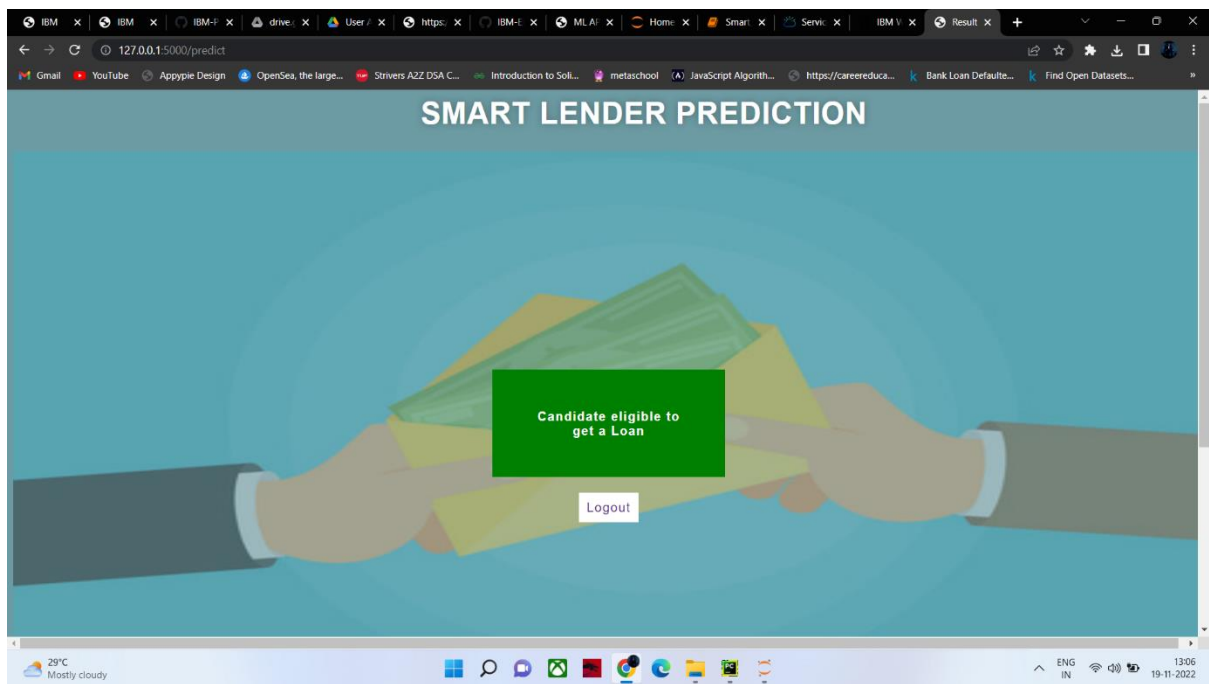
Current house years

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ENG IN 12:51 19-11-2022



## 8. TESTING

### 8.1 Test Cases

				Date	19-Nov-22								
				Team ID	FNT20221MD32530								
				Project Name	Smart Lender-Applicant credibility prediction for loan								
				Maximum Marks	4 marks								
Test case ID	Feature Type	Component	Test Scenario	Pre-Requirement	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_O3	Functional	Login Page	Verify if user is not able to login with email and password.	Nil	1.Enter URL and click go 2.Enter the email and password. 3.Click on login button.	Username: chalam@gmail.com password: Testing123	User should navigate to the register page.	Working as expected	Pass				
RegisterPage_TC_O01	UI	Register Page	Verify user is able to see the UI elements in the Register page.	Nil	1.Enter URL and click go 2.Verify whether the UI elements are displayed in		Application should show UI elements in the login page.	Working as expected	Pass				
RegisterPage_TC_O02	Functional	Register Page	Verify user cannot able to register if password doesn't match.	Nil	1.Enter URL and click go 2.Enter the email. 3.Enter the mismatching both password and confirm.	Email: mefin@gmail.com. Password: 32143 Confirm password: 1234	Application should show wrong confirm password.	Working as expected	Pass				
RegisterPage_TC_O03	Functional	Register Page	Verify user can able register successfully.	Nil	1.Enter URL and click go 2.Enter the email. 3.Enter the password and confirm password. 4.Click on the register button.	Email: mefin@gmail.com. Password: 32143 Confirm password: 32143	Application should redirect to the login page.	Working as expected	Pass				
LoginPage_TC_O4	Functional	Login Page	Verify user can able to redirect register page.	Nil	1.Enter URL and click go 2.Click on the not registered		Application should redirect to the register page.	Working as expected	Pass				
MainPage_TC_O01	UI	Main Page	Verify if user able to see the UI elements in the main page.	Nil	1.Enter URL and click go 2.Enter the valid credentials. 3.Click on the login button.		Application should show UI elements in the main page.	Working as expected	Pass				
MainPage_TC_O02	Functional	Main Page	Verify user can able to predicate the results by entering the values.	Nil	1.Enter vital values in the main page. 2.Click on the check button.		Application should show the result page with appropriate result and information.	Working as expected	Pass				
ResultPage_TC_O01	UI	Result Page	Verify user can able to see the result in the result page.	Nil	1.Enter vital values in the main page.		Application should show the result page.	Working as expected	Pass				
ResultPage_TC_O02	Functional	Result Page	Verify user can able to logout.	Nil	1.Enter vital values in the main page. 2.Click on the check button.		Application should redirect to login page.	Working as expected	Pass				

## 8.2 User Acceptance Testing

### Defect Analysis

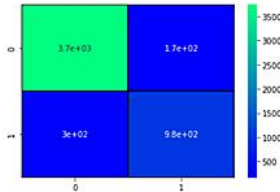
Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	11	3	2	4	20
Duplicate	1	0	3	0	4
External	1	3	1	1	6
Fixed	11	2	5	19	37
Not Reproduced	0	0	0	1	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	13	14	27	78

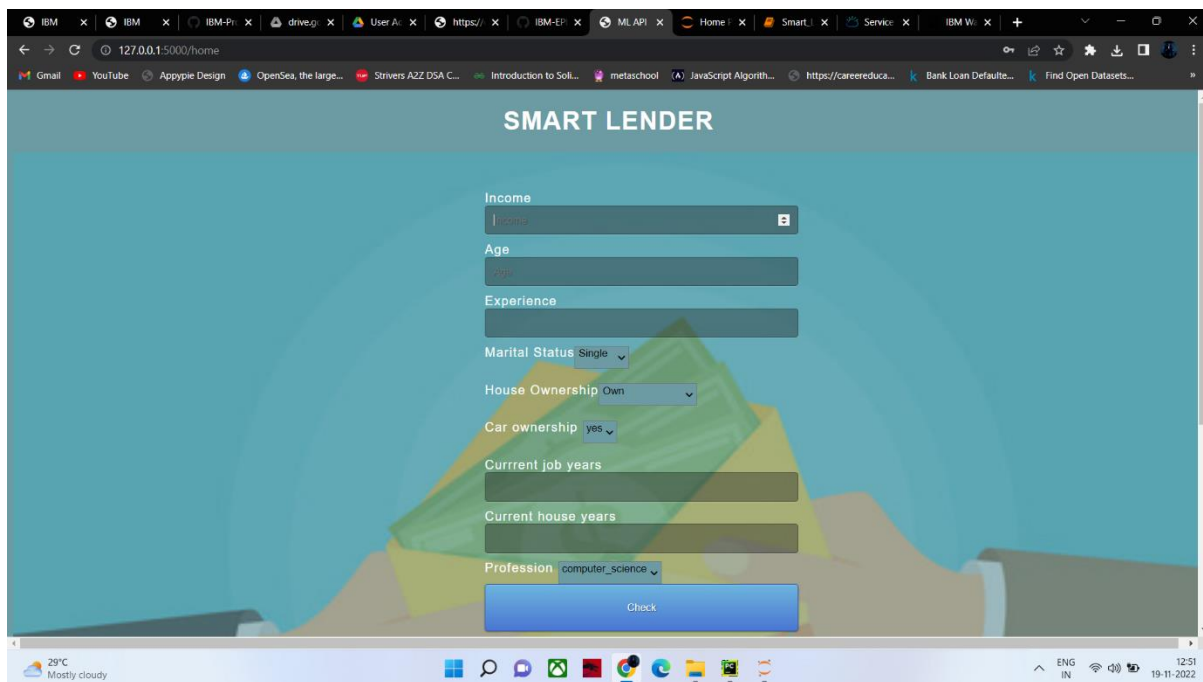
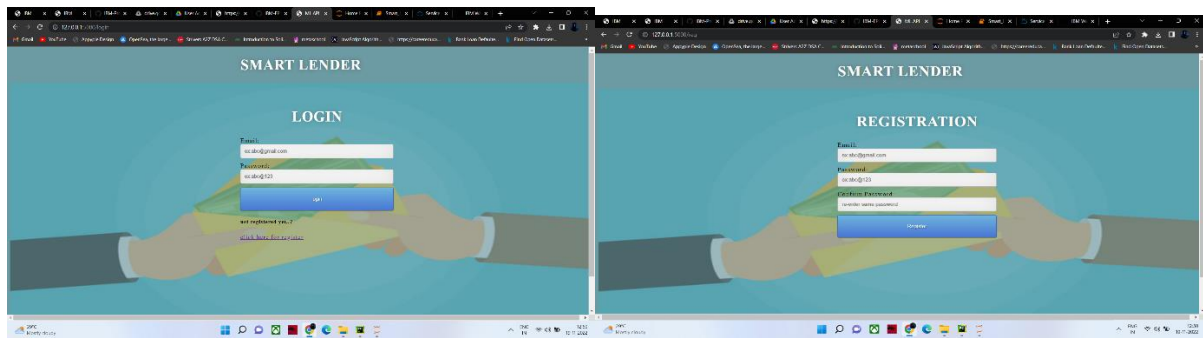
**Test Case Analysis**

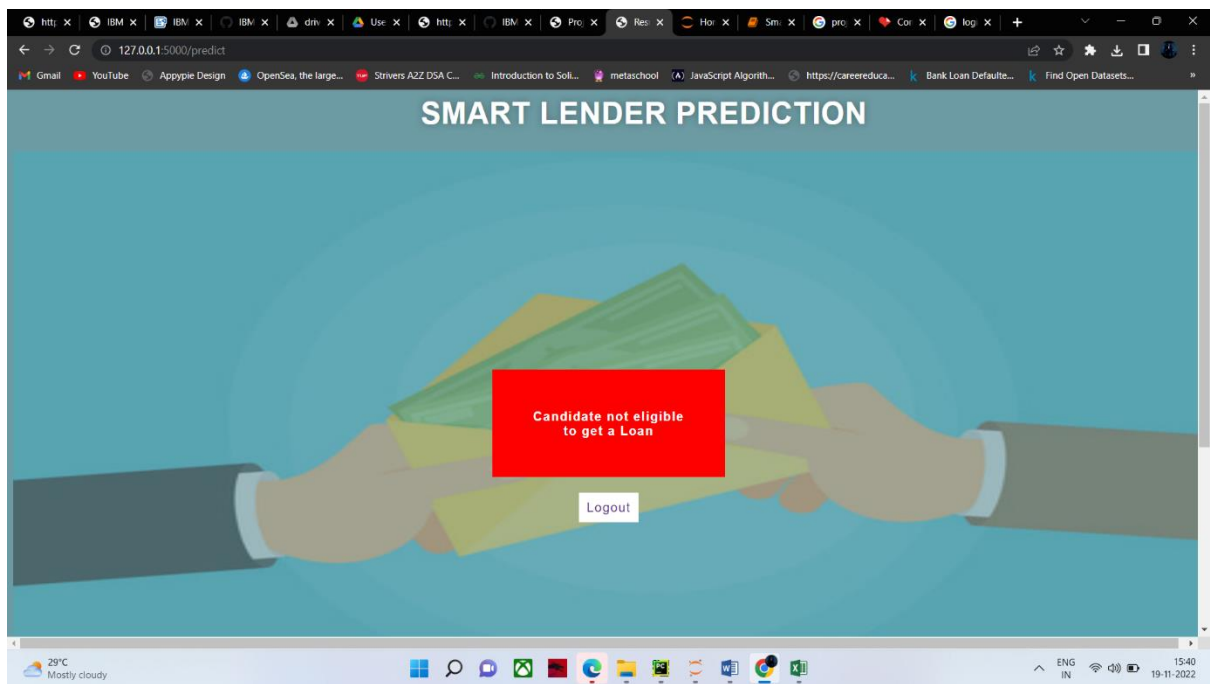
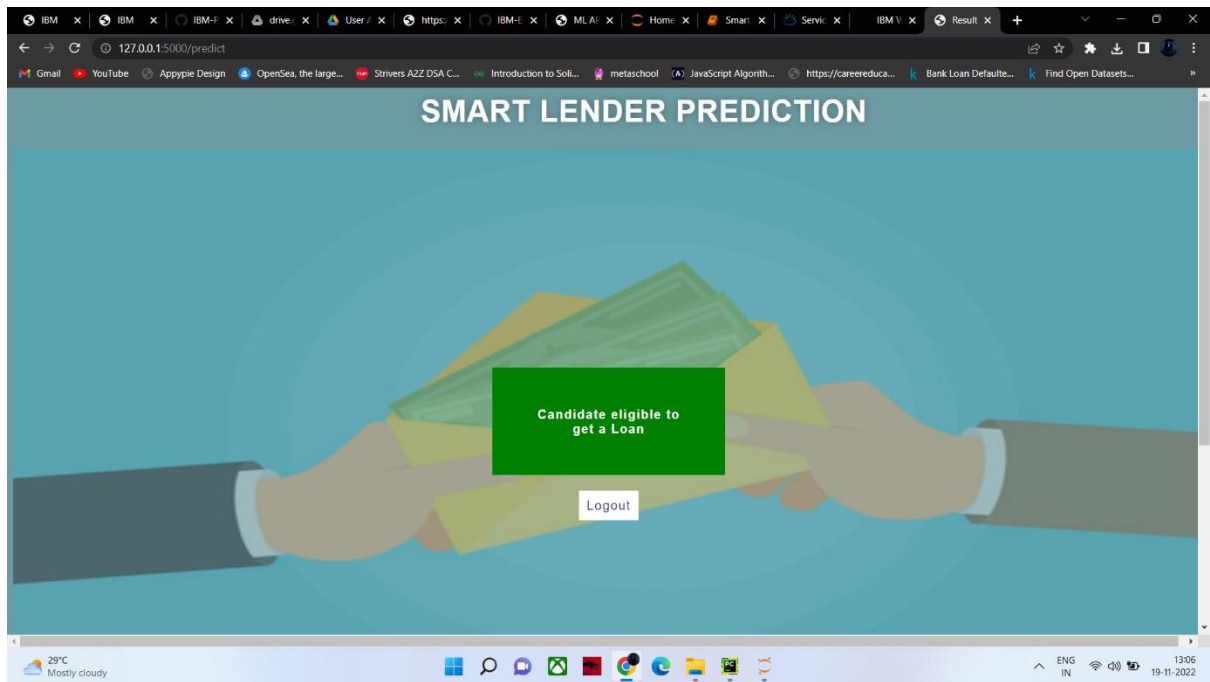
Section	Total Cases	Not Tested	F a i l	P a s s
Print Engine	7	0	0	7
Client Application	11	0	0	11
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

**9. Results:**

**9.1 Performance Metrics**

S.No.	Parameter	Values	Screenshot																														
1.	Metrics	<b>Classification Model:</b> Confusion Matrix – , Accuray Score- & Classification Report -	<pre>In [46]: from sklearn.metrics import confusion_matrix,accuracy_score,classification_report pred=rf.predict(x_test) cm=confusion_matrix(y_test, pred) plt.figure(figsize=(6,4)) sns.heatmap(cm, annot=True,cmap='winter',linewidths=0.3, linecolor='black',annot_kws={"size": 10}) TP=cm[0][0] TN=cm[1][1] FN=cm[1][0] FP=cm[0][1]  print('Testing Sensitivity for Random Forest',(TP/(TP+FN))) print('Testing Specificity for Random Forest',(TN/(TN+FP))) print('Testing Precision for Random Forest',(TP/(TP+FP))) print('Testing accuracy for Random Forest',accuracy_score(y_test, pred))</pre> <p>Testing Sensitivity for Random Forest 0.9263940520446097 Testing Specificity for Random Forest 0.8546409807355516 Testing Precision for Random Forest 0.9574795081967213 Testing accuracy for Random Forest 0.9105659648445046</p>  <pre>In [47]: print(classification_report(y_test,pred))</pre> <table><thead><tr><th></th><th>precision</th><th>recall</th><th>f1-score</th><th>support</th></tr></thead><tbody><tr><td>0</td><td>0.93</td><td>0.96</td><td>0.94</td><td>3904</td></tr><tr><td>1</td><td>0.85</td><td>0.77</td><td>0.81</td><td>1273</td></tr><tr><td>accuracy</td><td></td><td></td><td>0.91</td><td>5177</td></tr><tr><td>macro avg</td><td>0.89</td><td>0.86</td><td>0.87</td><td>5177</td></tr><tr><td>weighted avg</td><td>0.91</td><td>0.91</td><td>0.91</td><td>5177</td></tr></tbody></table>		precision	recall	f1-score	support	0	0.93	0.96	0.94	3904	1	0.85	0.77	0.81	1273	accuracy			0.91	5177	macro avg	0.89	0.86	0.87	5177	weighted avg	0.91	0.91	0.91	5177
	precision	recall	f1-score	support																													
0	0.93	0.96	0.94	3904																													
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macro avg	0.89	0.86	0.87	5177																													
weighted avg	0.91	0.91	0.91	5177																													
2	Tune the Model	Hyperparameter Tuning - Validation Method -	<pre>In [54]: from sklearn.model_selection import KFold,GridSearchCV,cross_val_score kf= KFold(n_splits=5,shuffle=True,random_state=42) param={     'max_depth':[4,5,7],     'max_leaf_nodes':[2,3],     'random_state':[42,56,72],     'criterion':['gini','entropy','log_loss'] }  In [55]: grcv=GridSearchCV(rf,param,cv=kf) grcv.fit(x_train,y_train) grcv.best_params_  In [56]: cv_result=cross_val_score(rf,x_train,y_train,cv=kf) cv_result  Out[56]: array([0.88477254, 0.88967584, 0.88586216, 0.89264305, 0.88692098])</pre>																														







## **10. ADVANTAGES & DISADVANTAGES**

### **ADVANTAGES :**

- Loan Prediction using Smart Lender can help financial institutions quickly process applications by rejecting high-risk customers entirely, accepting worthy customers, or assigning them to a manual review.
- Time period for loan sanctioning will be reduced.
- Whole process will be automated , so human error will be avoided
- Eligible applicant will be sanctioned loan without any delay.

### **DISADVANTAGES :**

- The drawback of this model is that it takes into consideration many attributes but in real life sometimes the loan application can also be approved on a single strong attribute, which will not be possible using this system.

## **11. CONCLUSION**

- In this project, we have analyzed the prediction using Random Forest Algorithm which takes less training time as compared to other algorithms and predicts output with high accuracy, even for the large dataset it runs efficiently also It can maintain accuracy when a large proportion of data is missing. By predicting whether a candidate will be granted a bank loan or not, the eligible applicant will be sanctioned loan without any delay.

## **12. FUTURE SCOPE**

This paperwork could be expanded to a higher level in the future, allowing the software to be improved to make it more dependable, secure, and accurate. The system has been trained using current data sets that may become older in the future, allowing it to participate in fresh testing to pass new test cases.

## **13. APPENDIX:**

**Source code:**

[https://drive.google.com/drive/folders/1iWLo3APDoZu-7i4BVm-FDIIfPnXdw71vP?usp=share link](https://drive.google.com/drive/folders/1iWLo3APDoZu-7i4BVm-FDIIfPnXdw71vP?usp=share_link)

**Github Link:**

<https://github.com/IBM-EPBL/IBM-Project-8369-1658916335.git>

**Project Demo Link:**

[https://drive.google.com/file/d/1zlnpWCNTz1ZvtreuSrx3Y-5JVEHMNrDv/view?usp=share\\_link](https://drive.google.com/file/d/1zlnpWCNTz1ZvtreuSrx3Y-5JVEHMNrDv/view?usp=share_link)