CUSTOMER DATA ANALYSIS IN E-COMMERCE USING MACHINE LEARNING

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled **"CUSTOMER DATA ANALYSIS IN E-COMMERCE USING MACHINE LEARNING"**, submitted by Md Abdullah Al Rahib, ID: 191-15-12247, Nirjhor Saha, ID: 191-15-12207 and Raju Mia, ID: 183-15-11995 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on January 24,2023.

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We hereby declare that, this project has been done by us under the supervision of **Mr. Abdus Sattar, Assistant Professor of CSE Department,** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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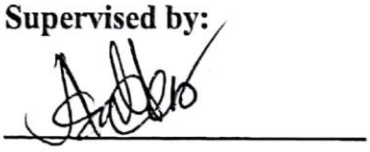

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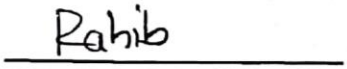

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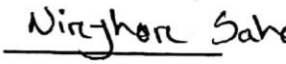

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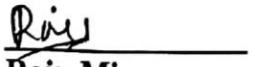

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ABSTRACT

In this project we want to develop a feature where admin can analyze customers data and predict what customers will need and do next in order to optimize offers. It also helps the e-commerce company to reach their target customers. The goal is to replace their current manual method with the use of fully functional software applications and computerized technology. In these features we add some graphical interface in the admin dashboard. As a result, it will aid organizations in making effective use of their abilities. This project focuses on the feature where admin can explore how their customers interact with the e-commerce site, what products they have interest and how much was the average purchase of the product. On our site, we create two different sections. One for the admin panel and another for the customers. Mainly in this project, we tried to apply machine learning in e-commerce customer data for analysis and prediction. We hope this system will help the e-commerce company to perform the right actions at the right time.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Machine learning can remarkably increase the online shopping experience for the shopper and the e-commerce company. It offers e-commerce companies new opportunities for providing an optimized customer experience for online stores. Also, it helps the online retail sector for better serve client demands. The use of machine learning e-commerce sector helps to discover patterns in the user data and helps making predictions based on these patterns, and resolving business issues. As a result, it will aid companies in making better use of their assets.

We tried to kept this feature is as simple as possible to eliminate mistakes. Additionally, it displays an error message when insert incorrect data. The admin doesn't require any special training to utilize this feature. This alone demonstrates how user-friendly it is. As previously said, this feature may result in an error-free, safe, and quick processing system.

1.2 Motivation

Modern technology is growing more advanced than ever, especially when it comes to machine learning. Today's most advanced technologies can perform tasks that were previously only human beings could complete, and they are assisting businesses in making better business decisions than ever before. Our main motivation for this project is develop a feature that will help the e-commerce company to observing and predicting the needs of the customer in the future. Now a days customers don't like to be treated like a number. They desire a customized shopping experience based on their preferences. Here machine learning can help e-commerce company by analysing customers past behaviour to better predict specific products that customer may be interested in.

1.3 Objectives

Our main objective for this project to create an environment for e-commerce admin, so that they can easily analyze customer data. Since the program was entirely developed on the administrative end, only the admin is assured accessibility. While developing this project, we always reminded that it will helps save time for e-commerce companies. Our front-end design for this project is very simple to use. The aim of the project is to construct a software application to eliminate the manual intervention for maintaining the e-commerce company.

1.4 Expected Outcomes

Anticipated results of the proposed work -

- Admin can easily analyze customers activity
- Predictive analysis system with graphical interface
- Can easily analyze customer churn.
- Product on time delivery and prediction with graphical analysis
- Annual spending prediction
- Admin can manage all the process
- Add products: admin can add new products.
- Pending order: here approved order from admin.
- Full authentication system
- Customized database

1.5 Report Layout

Later chapters will go into detail regarding the following subjects

Chapter 2, Discussed about the background of our project. Also added the information about the allied work, the opportunity and challenges of the project.

Chapter 3, Defined the diagram and data collection procedure. Also discussed about the features.

Chapter 4, Discussed about experimental result of our project and Design Specification of the project.

Chapter 5, Discussed about Implementation and testing our project.

Chapter 6, Discussed about Impact on Society, Environment and Sustainability of the project

Chapter 7, Discussed about conclusion and the scope for further development of the project.

Then, we concentrate on the appendices and references page.

CHAPTER 2

BACKGROUND

2.1 Preliminaries/Terminologies

The acceptance of contemporary technology continues improving. The preponderance of labour is now done by automated machines rather than by manual ones. Industrial automation development is directly related to technological development. This project, which has the working title "Customer Data Analysis in E-commerce using Machine Learning," was created with Python Machine Learning and Django as the back end. The whole method for analyse and prediction is controlled from the e-commerce admin side.

2.2 Related Works

As we are developing a feature for e-commerce platform, there are some platforms that are related to our platform. Some of the related platforms are Daraz, Chal Dal, Alibaba, Amazon etc. But our mission is building a feature that make it easy for admin to analyse customer data.

But on other platform client, inventory, revenue and customer data are all physically managed, which puts a great deal of pressure and strain on the business side.

2.3 Comparative Analysis

Nowadays e-commerce industry is growing rapidly. People will easily complete their shopping online. There are many kinds of e-commerce company, like Chal-Dal, Daraz, Bikroy.com, Alibaba etc. Now E-commerce sites offer all kinds of products for sale on their site. But we will try to build a feature that will analyse customer data from e-commerce site through machine learning. We also use churn prediction in our feature.

Because it is important for the e-commerce company to monitor and analyze how many users are leaving in the e-commerce platform and how many are users are sticking on the platform and the reasons behind them. Also understanding customer behavior may

significantly improve decision-making processes and further assist in lowering churn. The entire process may be completed in a few seconds. As a result, it achieves the system's goals.

2.4 Scope of the Problems

Today, the majority of e-commerce company operate manually and save information documents. The design phase of issues includes customers data, sales information, customer others record etc. Before beginning the conceptual design, the different components' designs are established and information are gathered.

2.5 Challenges

The purpose of our project is to develop a feature that will predict the e-commerce customer data through machine learning. Our System offers a very user-friendly layout that facilitate utilizing platform smoother and better. Implementing it to our project, however, is not a simple undertaking. We deal with a lot of challenges. Besides in our system add machine learning in e-commerce is very important task. With the help of SQL database, we are able to keep and access necessary data in an effective way, facilitating precise computations and straightforward workflows.

CHAPTER 3

METHODOLOGY AND STEPS

3.1 Research Subject and Instrumentation

Applying Machine learning in E-commerce to predict customer data and analyze predicted data to understand customer behavior to grow business and make a profit. Also, customers get the best desirable product and service from the E-commerce company like predicting customer churn and analyzing the predicted data to stop or decrease the churn of the customer, also predicting customer annual spending and analyzing the predicted data to increase the annual spending of the customer on E-commerce site, and ordered product on time delivery prediction and analysis the predicted data for try to improve delivery. For prediction, need data are collected from product information, customer profile, and their activity.

3.2 Data Collection Procedure

For this project, collected data from Kaggle to train data to predict and analyze an e-commerce website. We are working on three features which are customer churn prediction and analysis, customer annual spending depending on device usage, and product order on-time delivery prediction. There are various types of data in each dataset but used selective data which relates to predictions.

To train the customer churn model select five types of data which are Gender, Preferred Order Categories, marital status, Number of Addresses, and Order Count because of the result which will be predicted from customer real-time data. In this dataset, Gender, Preferred Order Categories, Marital Status are categorical data and the Number of Addresses, Order counts are numerical data. There are 5630 data in the dataset.

To train the model of Annual Spending Prediction depends on device usage where used data are Average Session Length, daily spending Time on mobile App, daily spending

Time on website and Length of Membership. In this dataset, all data are numerical 412 data are collected from user based on their device usage.

To train the model of ordered product on time delivery prediction depends on device usage where used data are Customer care calls, Customer rating, Cost of the Product, Prior Purchases, Discount offered, Weight in product importance. Customer care calls, Prior Purchases count and Customer rating data collect from customer data, Cost of the Product, Discount offered, Weight, and product importance are product data to predict ordered products on time delivery or late delivery. In this dataset, product importance is categorical data and Customer care calls, Customer rating, Cost of the Product, Prior Purchases, Discount offered, Weight and Count are numerical data. Around 11000 data in the dataset.

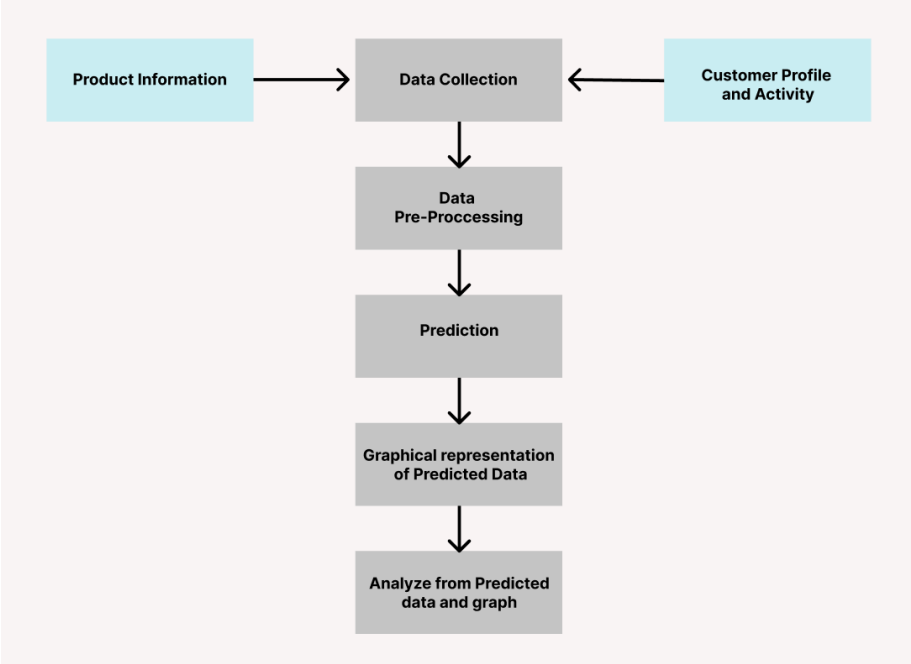

Figure.3.1 Steps of Data Collection and prediction to get analysis

3.3 Statistical Analysis

In the churn dataset, most of the customers ordered one or two orders and a good number of customers makes four to eight orders but a little number of customers who are making nine to sixteen orders are counted.

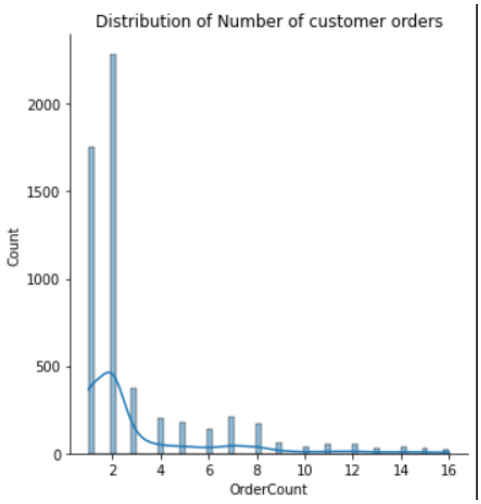

Figure.3.2 Customer Churn based on number of orders

Customer churn is compared based on Gender and Marital Status where the customer who is married the number of churns is low but for customers who are single the number of churns is high. On the other hand, the male customer churn rate is low than females.

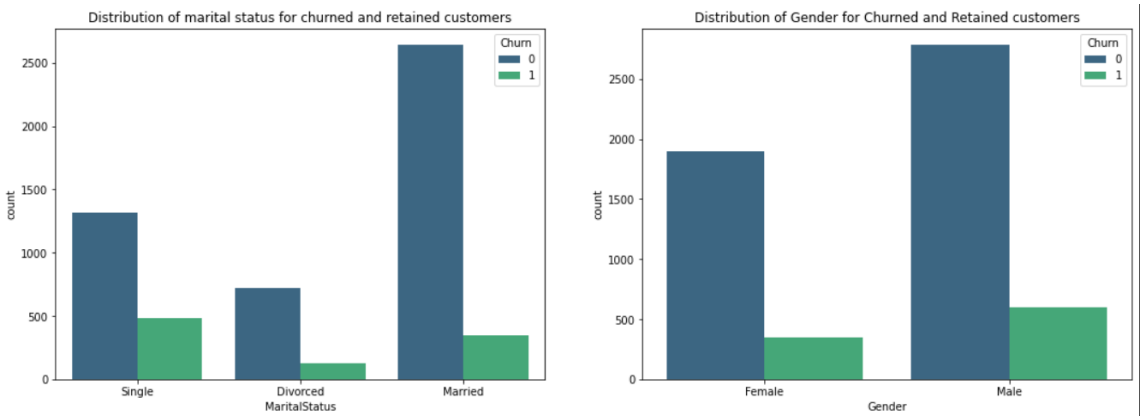

Figure.3.3 Customer Churn based on Gender and Marital Status

Average Session Length, daily spending Time on mobile App, daily spending Time on the website, and Length of Membership of customer to predict annual spending on this e-commerce. From the below graph if the Average Session Length, daily spending Time on the mobile App, and Length of Membership are increasing the annual spending is increasing but if daily spending Time on the website is increasing the annual spending is not increasing as compared to other parameters.

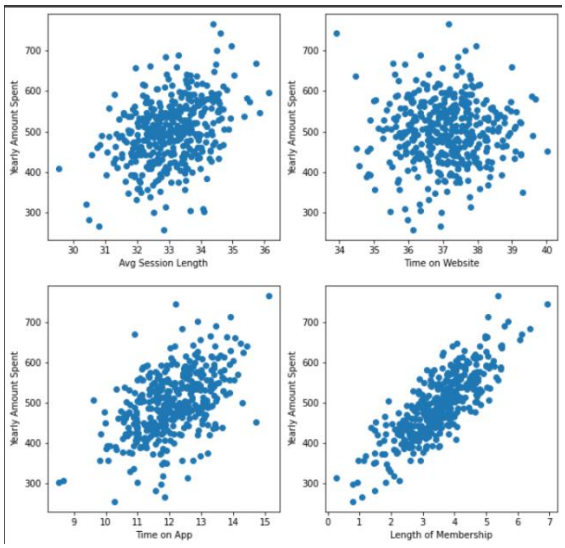

Figure.3.4 Annual Spending

The on-time delivery data is shown below histogram of the cost of the product, prior purchases, discount offered, and weight where most of whose price is 240-265$ and most of the customers get the 0-10$ discount.

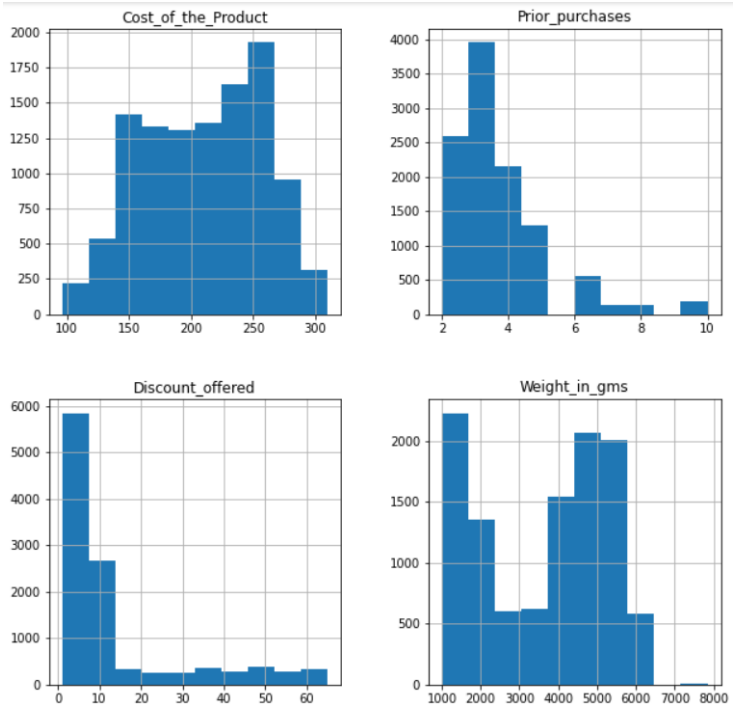

Figure.3.5 Product on time delivery

3.4 Proposed Methodology/Applied Mechanism

In this project after selecting data to train a machine learning model from the selected dataset and choose the machine learning algorithm for best output. After fitting the training data in the model, need to collect data from product information, customer profile and their activity to predict customer churn and annual spending of the customer and also ordered product on time delivery product

To train the churn model used five parameters from the dataset. Before train the dataset spited dataset into two part one is test data and other one is train data which is 75% data from whole dataset.

By using different types of machine learning model to train data and fit them. Predict test and train both data to cheek their accuracy. We choose the support vector classifier algorithm because their test data accuracy and train data accuracy differences are low. Because it is important to be not over fitted the model. In this model we get 83.09% accuracy.

Table 1: Training and Test Data accuracy for Churn Model

Algorithm	Test Data Accuracy	Train Data Accuracy
Logistic Regression	82.52%	83.20%
Random Forest	82.10%	87.70%
Decision Tree	82.52%	87.70%
Support Vector Classifier	83.09%	83.18%
XG Boost	82.52%	87.70%

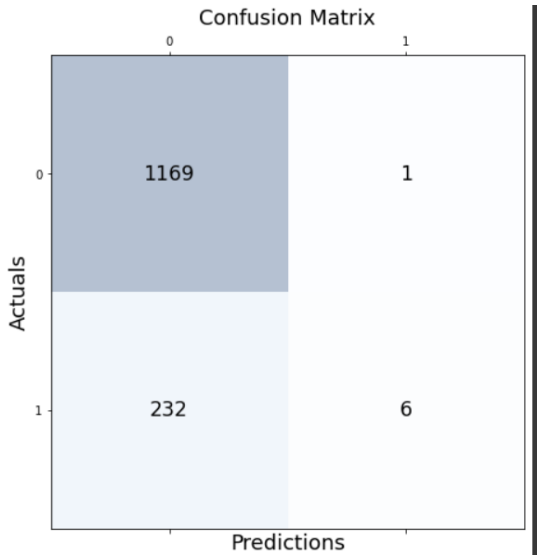

Figure.3.6 Test Data Confusion Matrix for Customer Churn

Classification Report :

	precision	recall	f1-score	support
0	0.83	1.00	0.91	1170
1	0.86	0.03	0.05	238
accuracy			0.83	1408
macro avg	0.85	0.51	0.48	1408
weighted avg	0.84	0.83	0.76	1408

Figure.3.7 Test Classification Report using SVC for Customer Churn

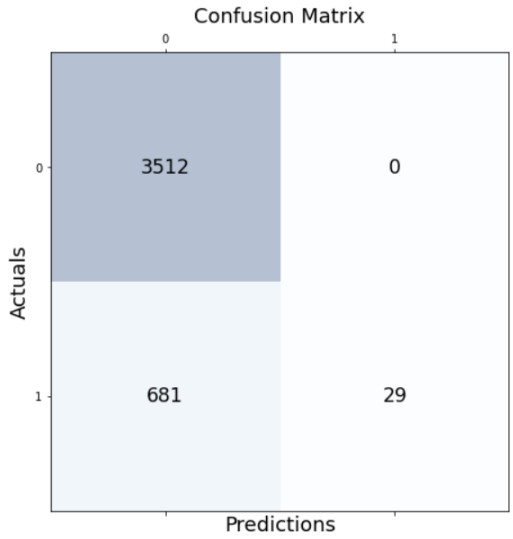

Figure.3.8 Train Data Confusion Matrix for Customer Churn

Classification Report :	precision	recall	f1-score	support
0	0.84	1.00	0.91	3512
1	1.00	0.04	0.08	710
accuracy			0.84	4222
macro avg	0.92	0.52	0.50	4222
weighted avg	0.86	0.84	0.77	4222

Figure.3.9 Train Data Classification Report using SVC for Customer Churn

For train the customer annual spending prediction model used Linear Regression algorithm where fit the data train data and test the data. Then the test data R2 score is 97.84%.

In on time delivery dataset, split the data set into train data and test data which is 70% and 30%. Using various types of machine learning algorithm to build model but choose Support Vector Machine where get test data 68.42% accuracy.

Table 2: Test Data Model Accuracy for on time Delivery

Algorithm	Test Data Accuracy	Train Data Accuracy
Decision Tree	68.48%	69.37%
Support Vector Machine	68.42%	68.67%
Random Forest Classifier	66.93%	1.0%
XG Boost	67.09%	76.03%

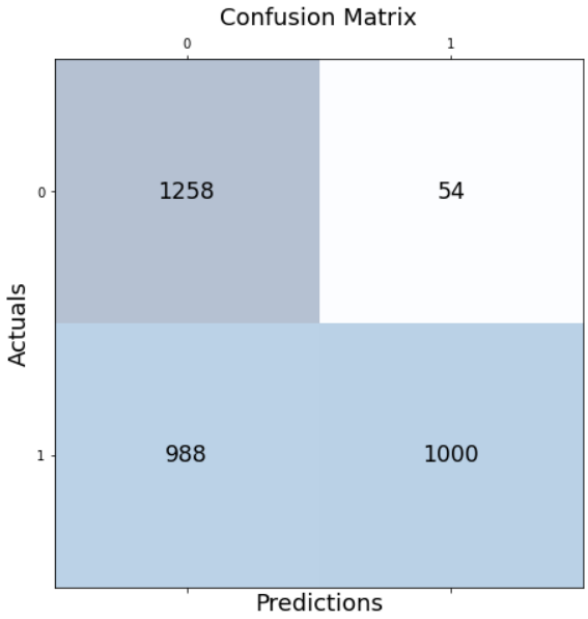

Figure.3.10 Test Data Confusion Matrix for On Time Delivery

Classification Report :

	precision	recall	f1-score	support
0	0.56	0.96	0.71	1312
1	0.95	0.50	0.66	1988
accuracy			0.68	3300
macro avg	0.75	0.73	0.68	3300
weighted avg	0.79	0.68	0.68	3300

Figure.3.11 Test Data Classification Report using SVM for On Time Delivery

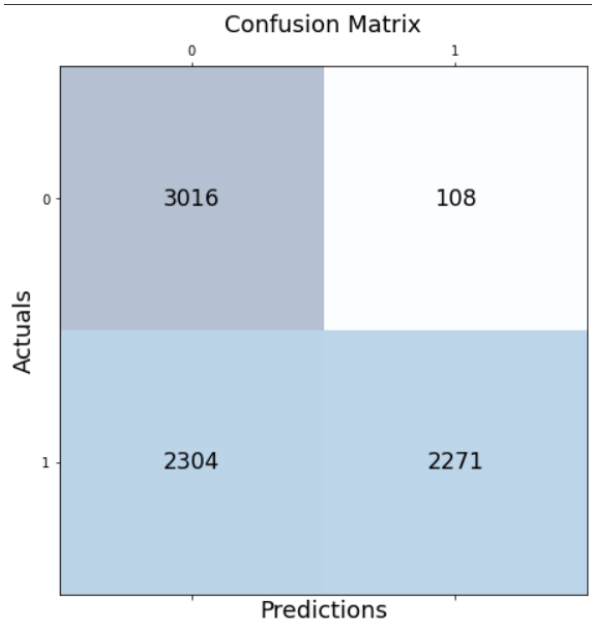

Figure.3.12 Train Data Confusion On Time Delivery

Classification Report :	precision	recall	f1-score	support
0	0.57	0.97	0.71	3124
1	0.95	0.50	0.65	4575
accuracy			0.69	7699
macro avg	0.76	0.73	0.68	7699
weighted avg	0.80	0.69	0.68	7699

Figure.3.13 Train Data Confusion Matrix and Classification Report using SVM for On Time Delivery

In this project, churn prediction is worked in real-time where collected data from customer profiles which are gender, marital status, preferred order categories, count number of addresses and count number of addresses. Gender, Marital Status, and preferred order categories are categorical data. To convert them into numeric data using One Hot Encoding for Marital Status, preferred order categories and used label encoding for Gender. Then predict data using the Machine learning model and show the data graphically based on predicted data like a pie-chart of prediction of customers will churn or not, some bar chart

based on gender, preferred order categories, and marital status where customers will churn or not.

Customer annual spending and ordered product on-time delivery prediction are not working in real-time because of there are some data which difficult to collect in real-time at this moment. Without those data could not get a good predicted result. For that reason, we made a database where manually stored data and predict the result and showed graphically depending on different parameters.

3.5 Implementation Requirements

As the implementation of our project, we need some essential requirements. Without those things we cannot run our utilization as we want to run for achieving our target. The features we developed using these languages are listed below:

ML Library:

- Pandas
- NumPy
- Scikit-learn
- Plotly

Framework

- Django

3.6 Use Case Modeling and Description

We created our feature by analyzing data from the internet about the problems faced by e-commerce users. If we look at our use case diagram, there are two actors here. One user and one other actor are administrators. Here the main player is the user. Here users can book product by providing legal information, see there all orders, bill payment etc. Admin can add or delete user provided data, add new information and delete the older one.

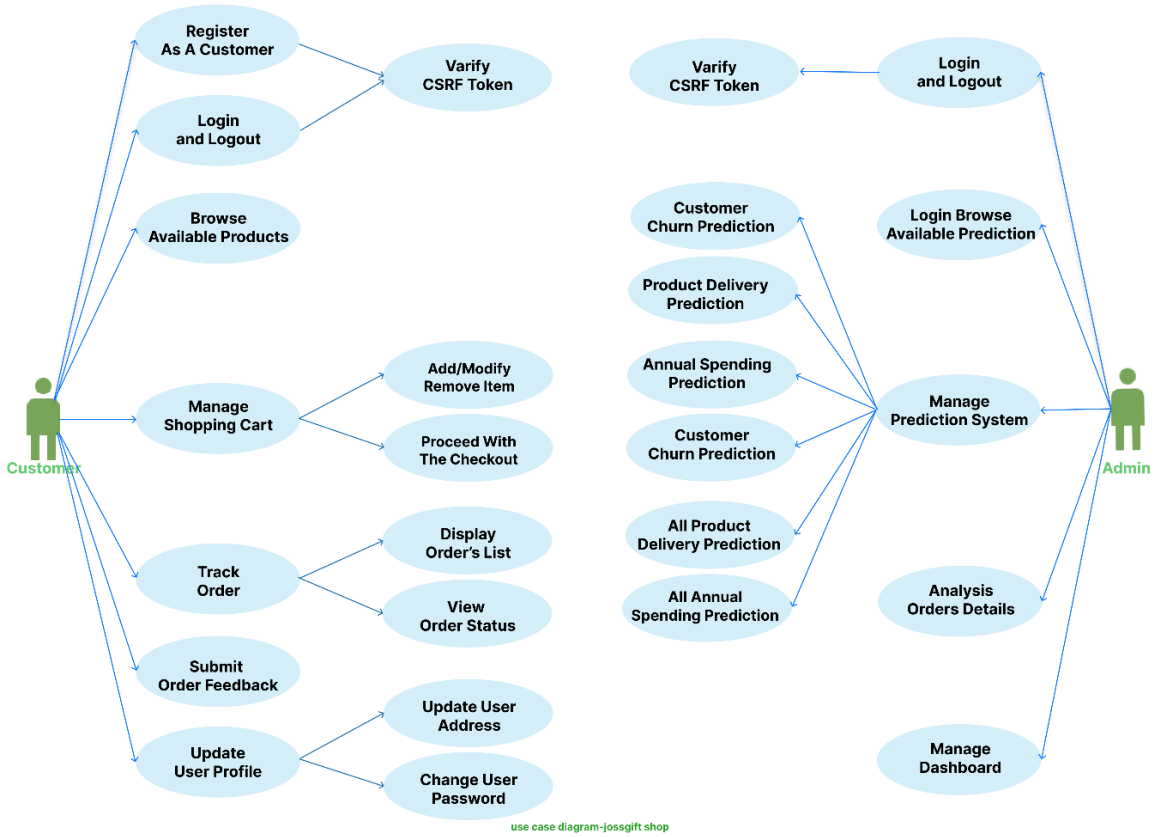

Figure.3.14 Use Case Diagram for Customer

Use Case Details:

Use Case: Home

Actor: User, Admin

Primary Actor: User

Description: User can purchase product by providing legal information, see there all orders, bill payment from the shop**.**

Pre-condition: Users must have to log in for purchasing or booking.

Post-condition: Before using product Information, booking product the user needs to connect to the internet.

CHAPTER 4

DESIGN SPECIFICATION

4.1 Front-end Design

Users can see the front-end design component, which makes it essential. HTML, CSS, Bootstrap, jQuery and JavaScript were used for the design aspect.

4.1.1 Customer Login Page

This is the login page where users can login to our application by using their username and password.

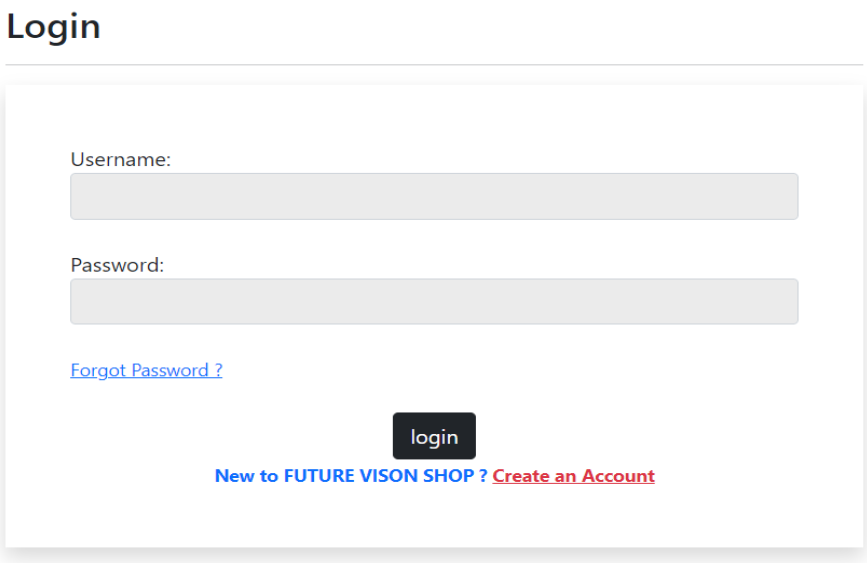

Figure.4.1 Login page

4.1.2 Customer Registration Page

This is customer registration page. After entering all valid information, customer can create their account.

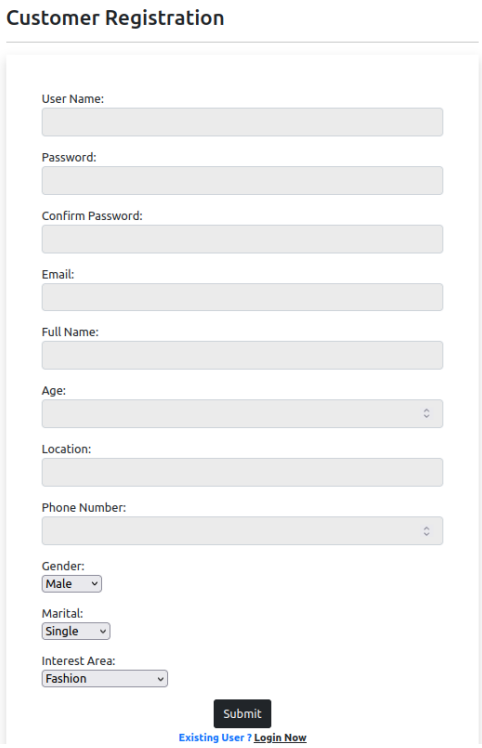

Figure.4.2 Registration page

4.1.3 Customer Profile

This is customer profile interface.

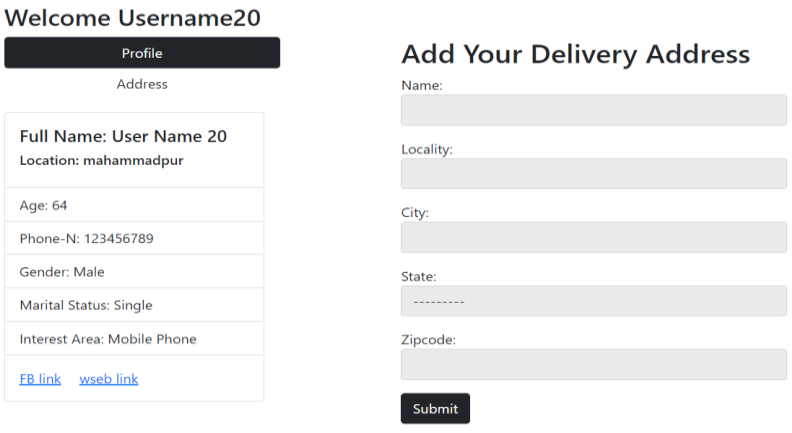

Figure.4.3 Customer Profile

4.1.4 Customer Order Interface

Customer order dashboard., where user can see their order status.

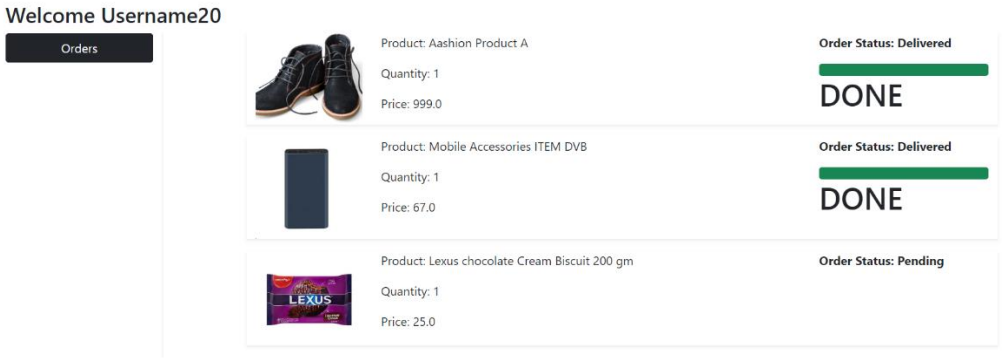

Figure.4.4 Customer Order Interface

4.1.5 Customer Shopping Cart

Here customer can track their selected products which they want to order and can cancel if they want.

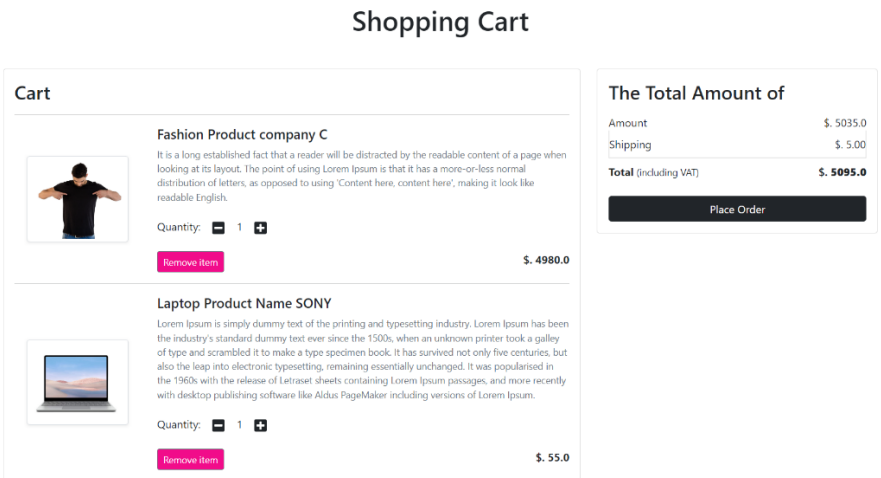

Figure.4.5 Customer Shopping Cart

4.1.6 Admin Login Page

This is admin login page.

Figure.4.6 Admin login page

4.1.7 Admin Dashboard

This is Admin Dashboard, where admin can track all necessary things. Like – total number of customers, total number of products, total orders and total orders which are successfully delivered.

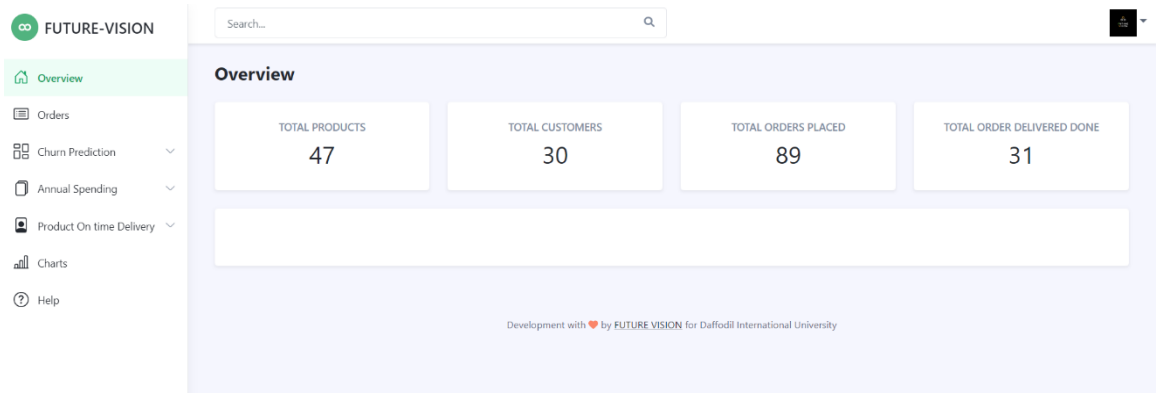

Figure.4.7 Admin Dashboard

4.1.8 All Customer Churn Prediction

This feature shown prediction of all customers which can be churned.

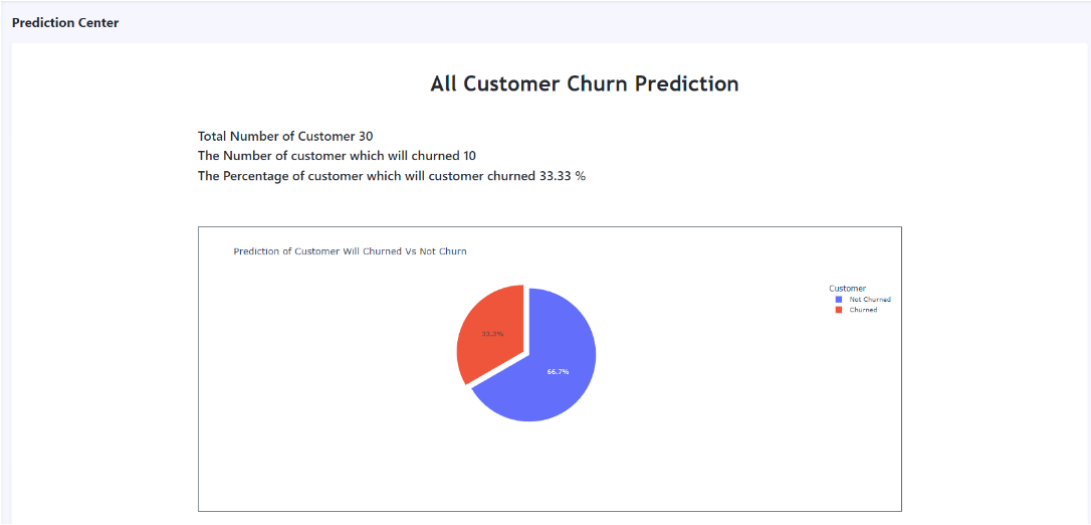

Figure.4.8 Add product

4.1.9 Single Customer Churn Prediction

In this section, admin can input data manually to see a single customer will churned or not.

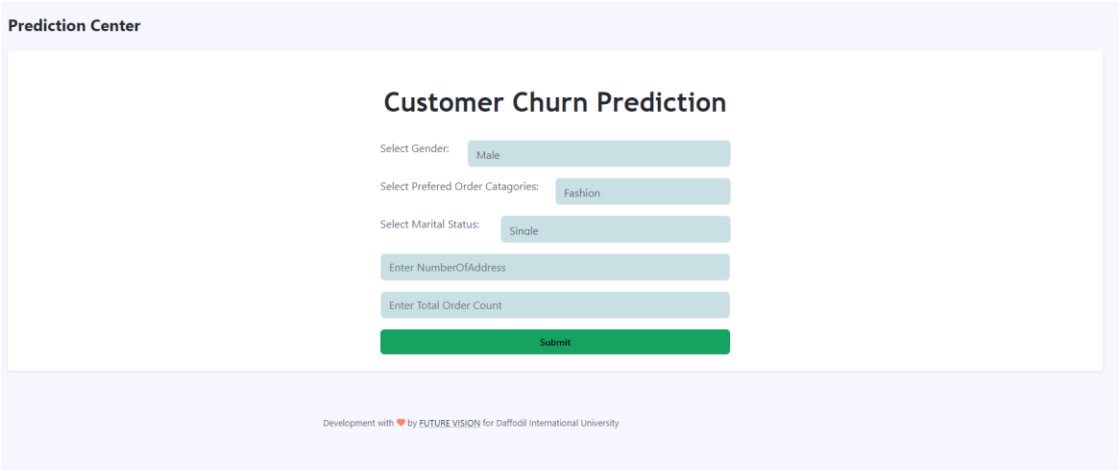

Figure.4.9 A Single Customer Churn Prediction

4.1.10 All Customer Annual Spending Prediction

This feature shown prediction of all customers Annual Spending in our e-commerce website based on their device usages.

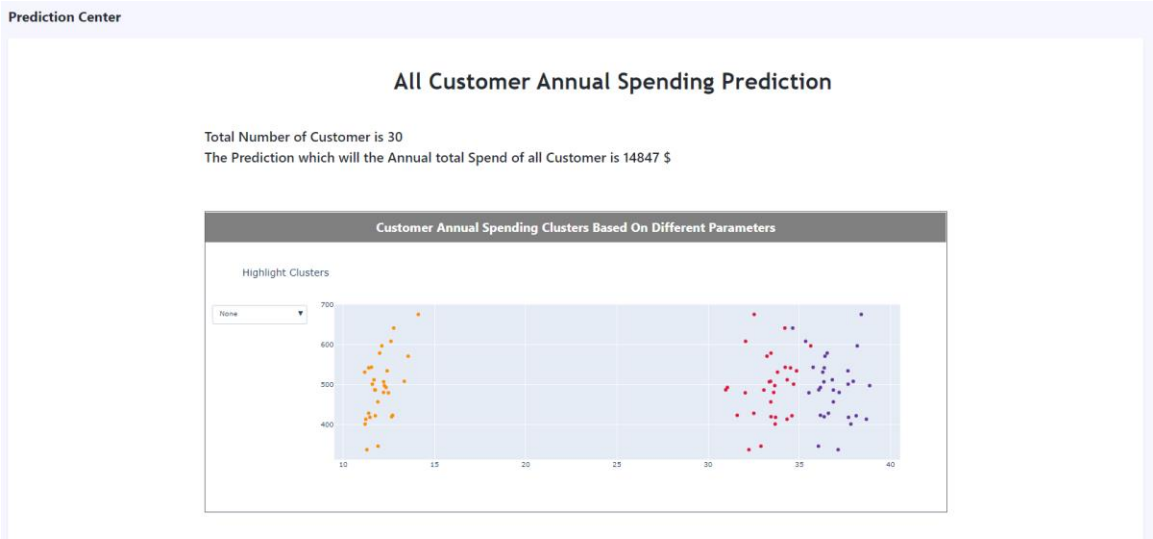

Figure.4.10 Annual Spending Prediction

4.1.11 A Single Customer Annual Spending Prediction

In this section, admin can input data manually to see a single customer annual spending prediction.

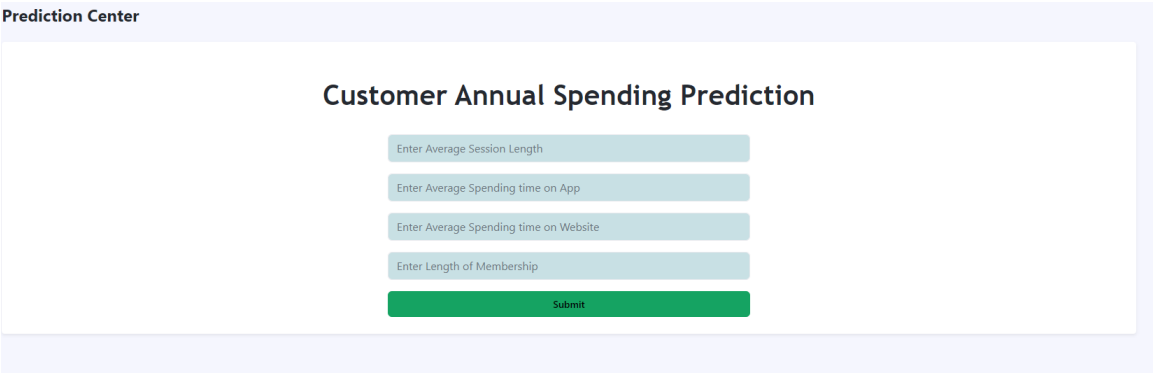

Figure.4.11 Annual Spending Prediction for a Single Customer

4.1.12 All Product on Time Delivery Prediction

This feature shown prediction of all products on time delivery which are ordered.

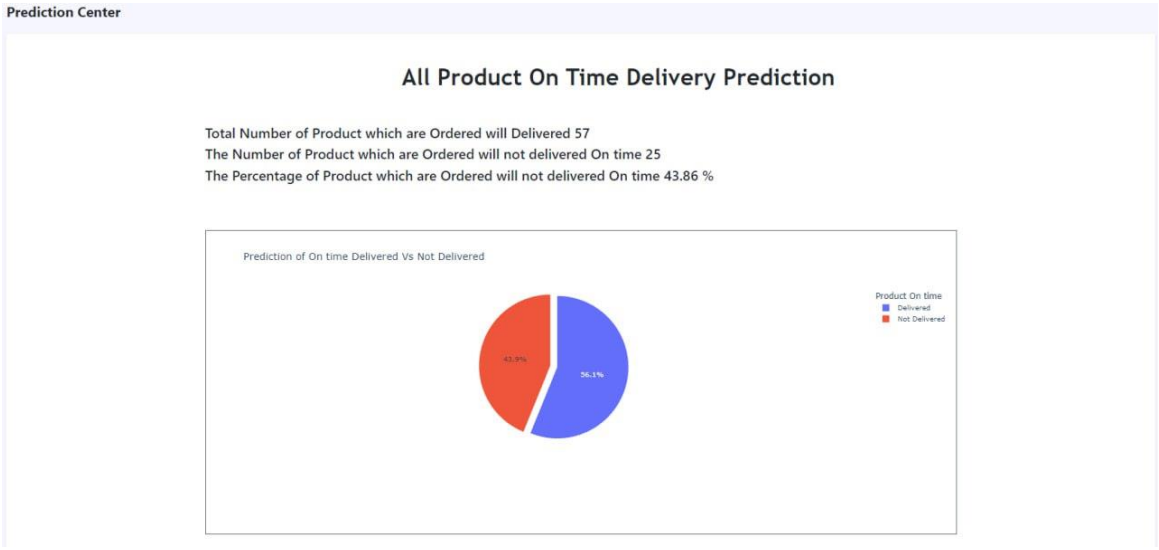

Figure.4.12 All product on time delivery prediction

4.1.13 Product on Time Delivery Prediction for a Single Order

In this section, admin can input data manually to see a single product delivery prediction which is ordered.

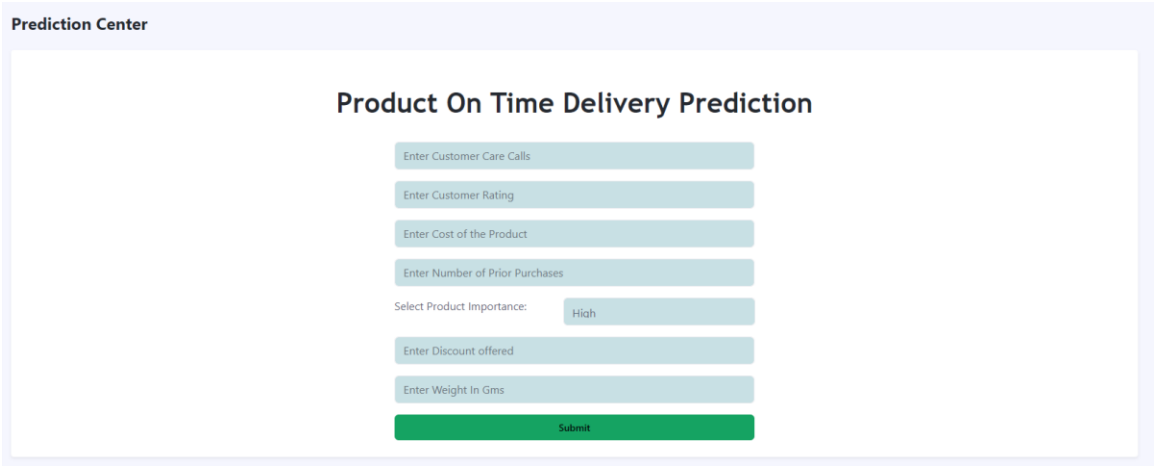

Figure.4.13 Single product on time delivery prediction

4.2 Back-end Design

The core of a project is the back-end design. The effectiveness of an application is determined by this design. We utilized the Python as the programming language for this section. We also use Django Framework for development.

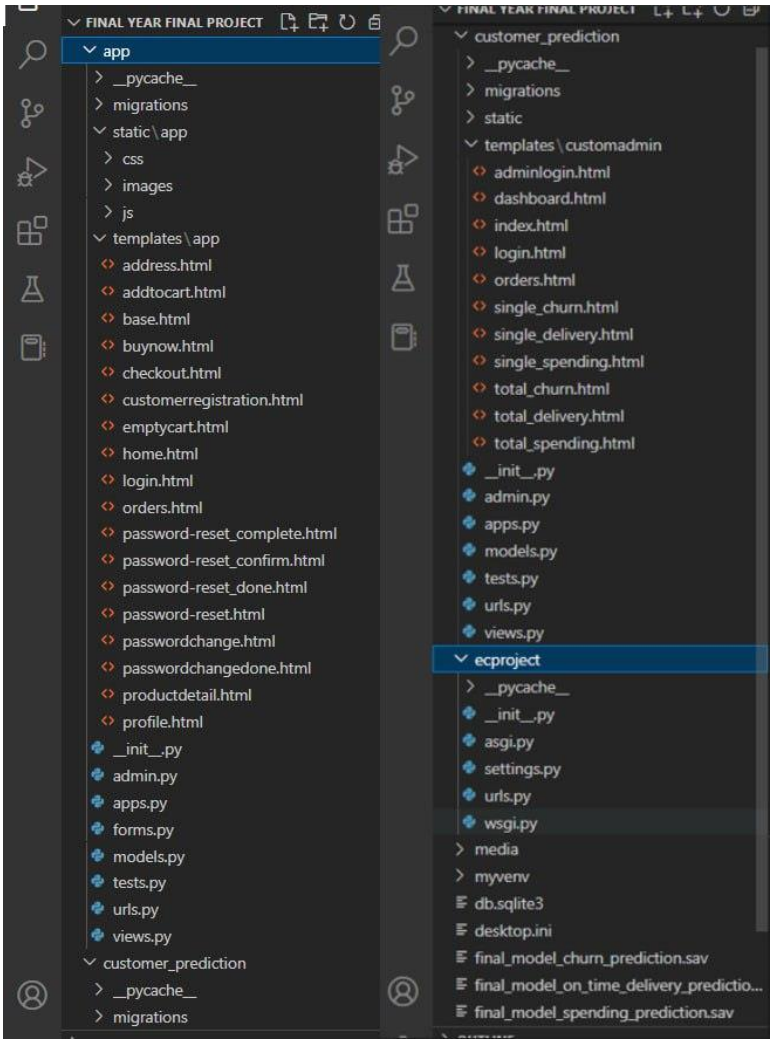

Figure.4.14 Backend-end Design

4.3 Design Requirements

Design specifications are crucial for a project because they enable us to deliver it to people in a more appealing manner. But we tried to keep it simple and lite for all users

Languages:

- HTML
- CSS
- Bootstrap
- JavaScript
- jQuery
- Python

CHAPTER 5

IMPLEMENTATION AND ANALYSIS

5.1 Implementation of Database

For database implementation,

- SQL

5.2 Implementation of Front-End Design

To execute the front-end design, we used some languages. HTML, CSS, Bootstrap and JavaScript, jQuery were used for the design aspect.

5.3 Implementation Result and Analysis

This section of the paper discusses the results of the described experimentations in the methodology section 3.3. After collecting data from customer side, we use those data for prediction. Then use predicted data for graphical analysis.

5.3.1 Customer Churn Based on Preferred Order Category

In this feature admin can analyze Customer churn based on customers Preferred order category like Glossary, Laptop Accessories, Mobile Accessories etc.

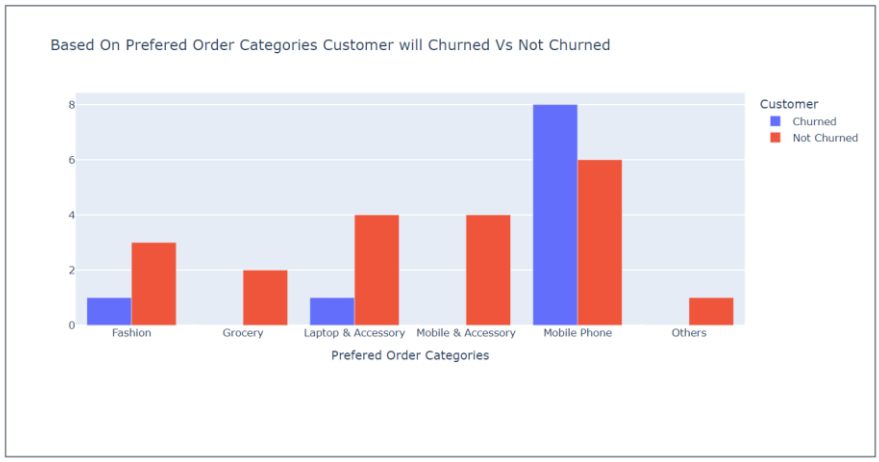

Figure.5.1 Customer Churn based on Preferred order category

5.3.2 Customer Churn Based on Marital Status and Gender

In this feature admin can analyze Customer churn based on customers Gender and Marital Status.

Figure.5.2 Customer Churn based on Marital Status and Gender

5.3.3 Product on time delivery Based on Product Importance and Customer Rating

In this feature admin can analyze on time product delivery based on customers product rating and product importance

Figure.5.3 Product on time delivery based on Product Importance and Customer Rating

5.3.4 Customer Annual Spending

In this feature admin can analyze Customer annual spending prediction, make cluster and comparison based on their Average session length in website, Time on app etc.

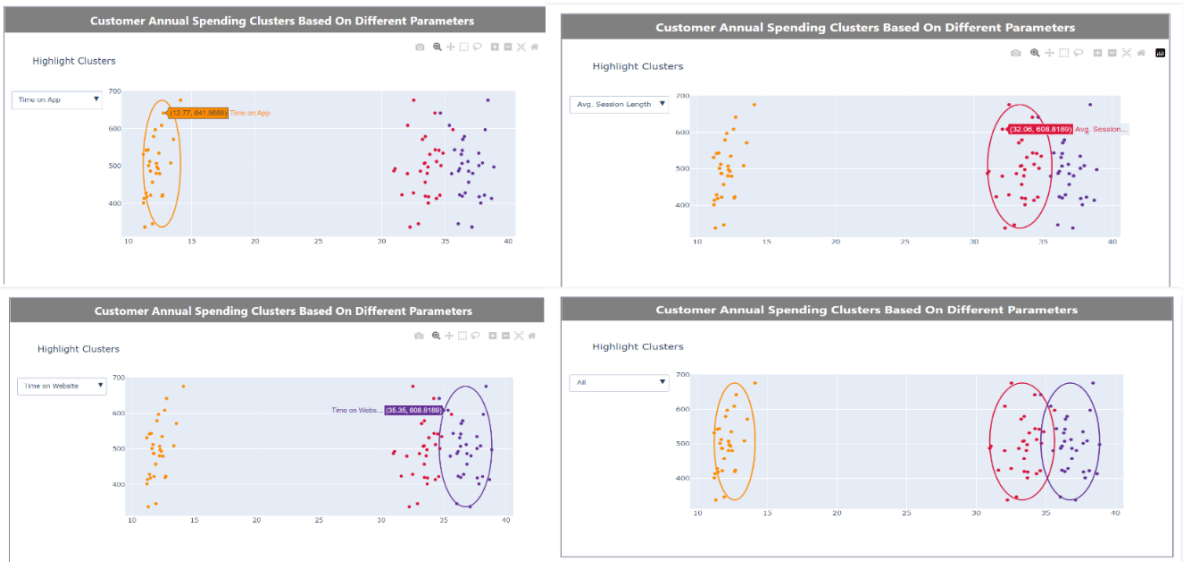

Figure.5.4 Customer Annual Spending

5.3.5 Customer Annual Spending based on Spending time on app

In this feature admin can analyze Customers Spending time on app for annual spending prediction.

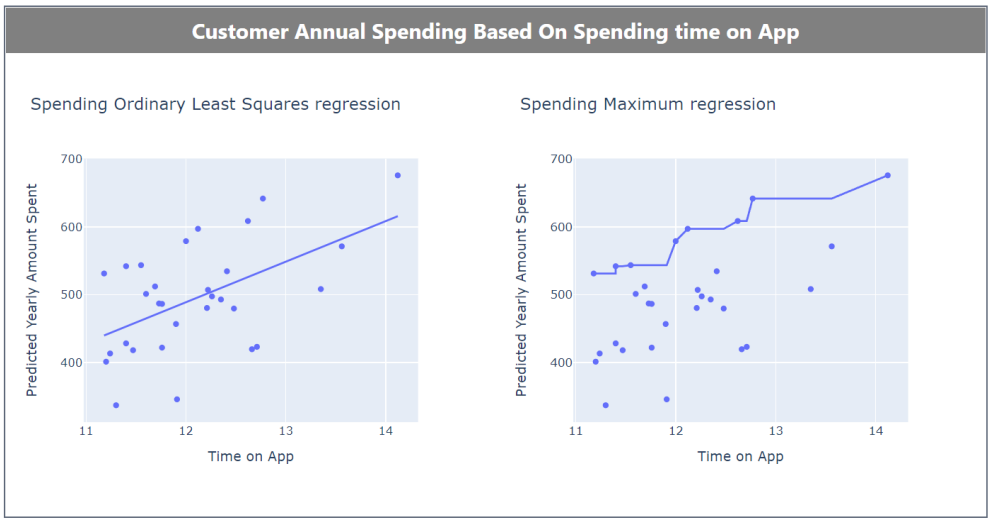

Figure.5.5 Customer Annual Spending based on Spending time on app

5.3.6 Customer Annual Spending based on Average Session Length

In this feature admin can analyze annual spending prediction for customers average session length on website.

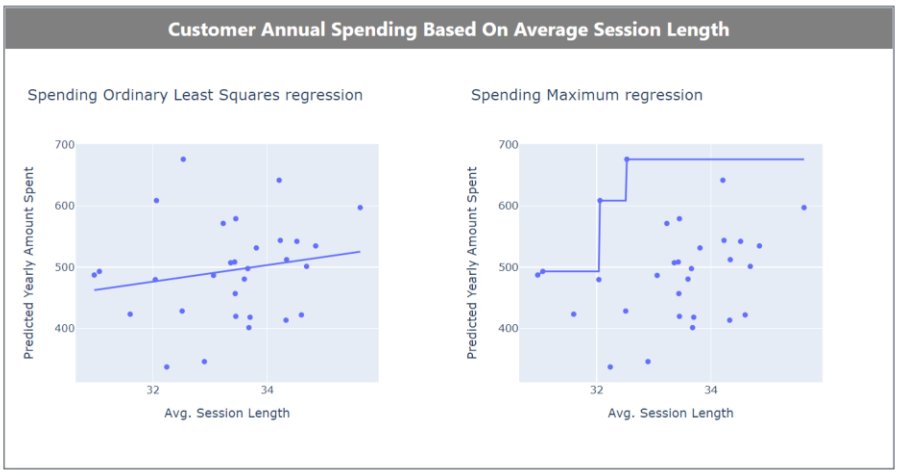

Figure.5.6 Customer Annual Spending based on Average Session Length

5.3.7 Customer Annual Spending based on Spending time on website

In this feature admin can analyze annual spending prediction for customers daily spending time on website.

Figure.5.7 Customer Annual Spending based on Spending time on website

5.3.8 Customer Annual Spending based on Length of Membership

In this feature admin can analyze annual spending prediction for customers Length of membership.

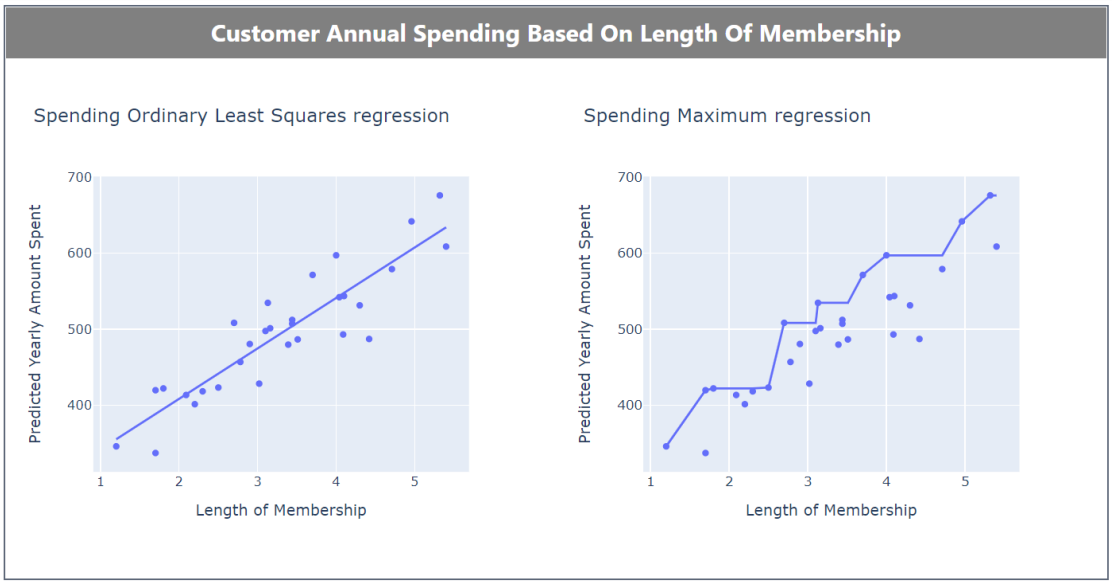

Figure.5.8 Customer Annual Spending based on Length of membership

5.4 Testing Implementation

We are going to build any notion into a system through implementation. It's necessary to test each stage of the implementation process. The procedure of correcting any inaccuracy will be simplified if we do this.

5.5 Test Results and Reports

For drafting reports, test findings and reports are crucial. so that we could track when each issue happens and determine if it has been corrected. The likelihood of leaving an error unfixed rises if we don't file a report. A table with all the details about such mistakes is required in order to show the results and report. For this reason, we also prepared a test case table that we would utilize in our project report. Below is the test case table for our application:

Table 3: A Test Case for the Application

Test Case Type	Details	Expected Result	Actual Result	Status	Date
Log in Admin	Log in as Admin	Log in	Logged in successfully	Pass	15-12-2022
Log in User	Log in As User	Log in	Logged in successfully	Pass	15-12-2022
Register	Register as User	Register	Registered successfully	Pass	15-12-2022
Add Product	Add new product information	Add product	Updated successfully	Pass	15-12-2022
Delete product	Delete Product	Delete	Delete successfully	Pass	15-12-2022
Order Product	Purchasing Product	Purchase	Purchase Successfully	Pass	15-12-2022

CHAPTER 6

IMPACT ON SOCIETY, ENVIRONMENT, SUSTAINABILITY

6.1 Impact on Society

Nowadays e-commerce sector plays a very important role in our daily life. This website has made our life significantly simpler in a few important ways. A web application attracts users when it makes all types of information, including purchasing, available at all times.

There are some amazing advancements and successes on the list here.

- It has made it possible easy for admin to analyse customer data in depth.
- Access to all updates and information is simple.
- Its excellent took over control, which enables users to know what kind of product is needed.

The previously described concepts are important.

6.2 Impact on Environment

An environmental consequence is any alteration to the environment whether positive or negative resulting from a facility's activities, products, or services. It could also refer to the consequences that people's decisions and actions have on the environment.

6.3 Ethical Aspects

It is a comprehensive document that lists the system's goals, taking into account its administrative, and economic components. These all-business applications concepts allow the industry practitioners to streamline ordinary tasks. Our main objective is to analyse all e-commerce customers data in admin side. Precise understanding of every customer data analyse is crucial in traditional way. But using machine learning help to analyse customer data easily for future prediction.

When a user logs into our system with the correct details, our application needs to show the most popular products at the time. This is how our view board initially appears. This is required to accurately ascertain a user's current job. Items that users have picked are kept in a card list. Admin is in charge of the entire backend. Our site allow admin to approved pending order but admin can't see the password verification from user site. Admin and user both sites need to an authentication for this.

6.4 Sustainability Plan

The digital period is driven by constant competition and dependent on knowledge. A new feature was developed today, but soon on, a second one with more features will arrive, diminishing the value of the initial request. For this competition, we have some really aggressive intentions to establish our application work. User will be able to acquire this web application for free. Browsing may help to locate any information quicker. As our system helps e-commerce business directly. And the activity of this business will always be going on, that's why of our system will always kept on and our system must sustain.

CHAPTER 7

CONCLUSION AND FUTURE PLAN

7.1 Discussion and Conclusion

Finally, we would like to briefly discuss of our project, which is to create a dynamic online web application that will help manage any form of web system. Nearly this project has been in our minds since last year. Later, we just construct it with God's permission. These projects are just the simplest approach that we could think of to administer any form of online system. We believe that individuals all across the world will find this program to be very useful. We wish to say something about this project, which was put up and successfully completed, in closing. We merely learn a lot of things from the beginning of this endeavor.

7.2 Scope for Further Development

We will change some features of our application for make it more gorgeous to the users and admin. We will add some feature to our application. There is no comparison section in our website. We want to add comparison feature which will allow admin to compare between two or multiple products. In future we will make a feature where annual spending prediction and product on time delivery prediction shown in real time.

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PLAGIARISM REPORT

CUSTOMER DATA ANALYSIS IN E-COMMERCE USING MACHINE

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