Software Requirements Specification
for
"Sales Trend and Forecasting Using Data Mining Techniques"

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1. Introduction

1.1 Purpose

The purpose of designing this system is to provide ease to whole business community including small store owners. So, by doing the predictions the user can easily analyze and grow their business progress and can have better understanding with the trending products in the market in current situation and after a specific time period which will assist them for a smooth business planning according to situation. This document will outline all the requirements, functions and capabilities for Sales Trend and Forecasting System Using Data Mining Techniques.

1.2 Intended Audience and Reading Suggestions

The main audience is store owners. This document is to be read by the development team, the project managers, marketing staff and testers. The SRS has been organized approximately in order of increasing specificity. The developers and project managers need to become intimately familiar with the SRS.

1.3 Product Scope

Scope of our proposed solution is that the store owner will be able to manage their resources cash flow according to the prediction and trends of the sales. [12] This proposed solution helps the store owner to save their unnecessary investment on products and their sales. In addition, it will provide the store owners to take right decisions on right time. This web based application will be easily accessible to any registered store owner. The registration packages will be affordable with the excellent services and support at the back end.

1.4 References

[1]. Panjwani, M., Ramrakhiani, R., Jumnani, H., Zanwar, K., & Hande, R. (2020). Sales Prediction System Using Machine Learning (No. 3243). EasyChair.

[2]. Triayudi, A., Sumiati, S., Nurhadiyan, T., & Rosalina, V. (2020). Data Mining Implementation to Predict Sales Using Time Series Method. Proceeding of the Electrical Engineering Computer Science and Informatics, 7, 1-6.

[3]. Afifi, A. A. (2020, June). Demand Forecasting of Short Life Cycle Products using Data Mining Techniques. In IFIP International Conference on Artificial Intelligence Applications and Innovations (pp. 151-162). Springer, Cham.

[4]. Aung, M. M., Han, T. T., & Ko, S. M. (2019). Customer churn prediction using association rule mining. International Journal of Trend in Scientific Research and Development, 3(5), 1886-1890.

[5]. Poonkuzhali, S. V. K. S. (2018). Improvising the sales of garments by forecasting market trends using data mining techniques. International Journal of Pure and Applied Mathematics, 119(7), 797-805.

[6]. Alfiah, F., Pandhito, B. W., Sunarni, A. T., Muharam, D., & Matusin, P. R. (2018). Data Mining Systems to Determine Sales Trends and Quantity Forecast Using Association Rule and CRISP-DM Method. International Journal of Engineering and Techniques, 4(1), 186-192.

[7]. Vengatesan, k., visuvanathan, e., kumar, a., yuvaraj, s., & tanesh, p. S. (2020). An approach of sales prediction system of customers using data analytics techniques.

[8]. Ramya, B. S. S., & Vedavathi, K. (2020). An Advanced Sales Forecasting Using Machine Learning Algorithm.

[9]. Sagaert, Y. R., Aghezzaf, E. H., Kourentzes, N., & Desmet, B. (2018). Temporal big data for tire industry tactical sales forecasting. Interfaces, 48(2), 121-129.

[10]. Shakti, S. P., Hassan, M. K., Zhenning, Y., Caytiles, R. D., & SN, I. N. C. (2017). Annual Automobile Sales Prediction Using ARIMA Model. International Journal of Hybrid Information Technology.

[11]. Siwerz, R., & Dahlén, C. (2017). Predicting sales in a foodstore department using machine learning.

[12]. Alves, N., & Miguéis, V. (2017). Predicting product sales in fashion retailing: a data analytics approach.

[13]. Keinänen, M. (2018). Creation of a web service using the MERN stack.

[14]. Aggarwal, S., & Verma, J. (2018). Comparative analysis of MEAN stack and MERN stack.

2. Overall Description

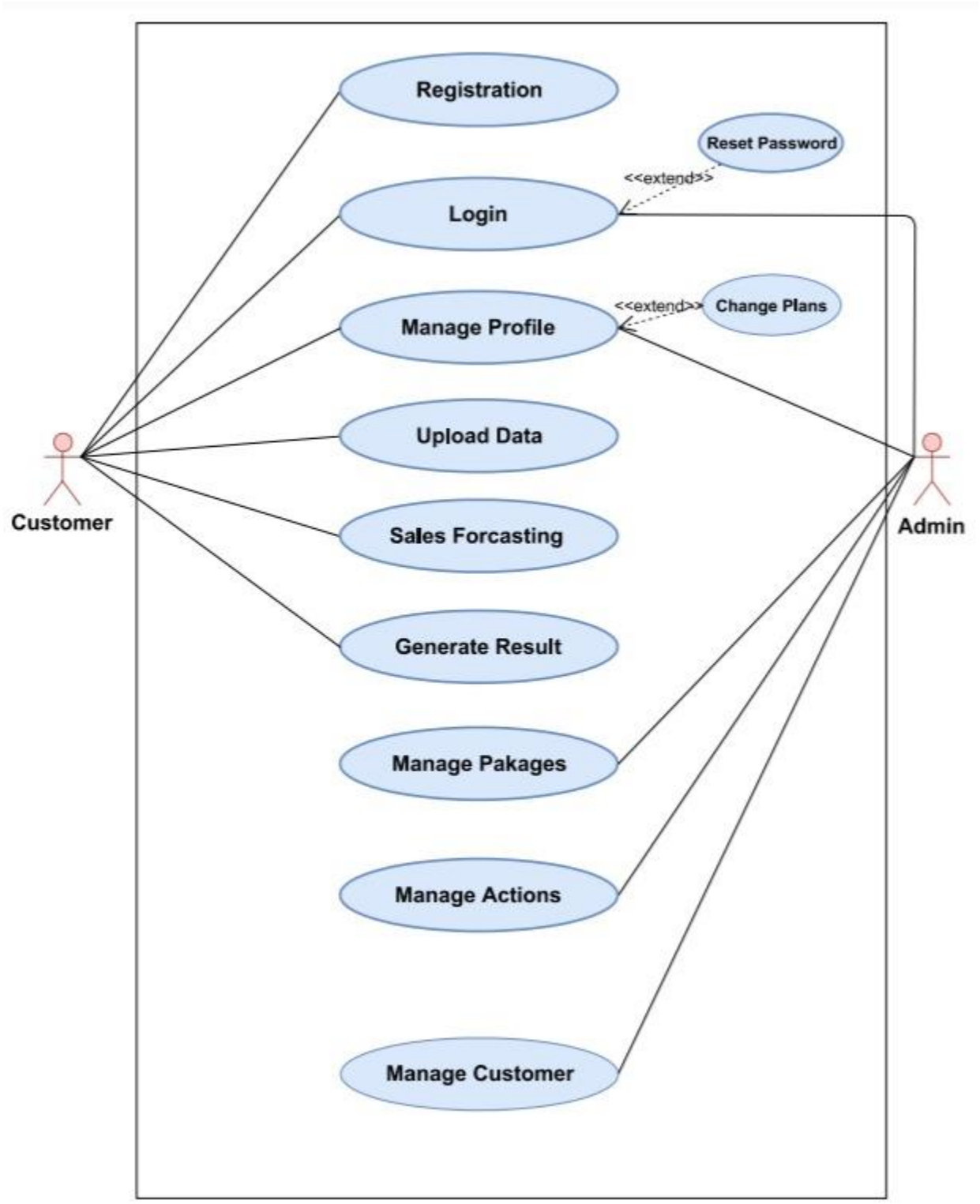
2.1 Product Perspective

To know the prediction and trend of sales within a specific time period has a huge impact on the progress of business and also helps a lot for taking right decision at proper time. For this purpose, there are many data mining techniques & tools for extracting key knowledge from a large amount of data-sets for the sake of forecasting. But the problem is that traditional forecasting systems are a little difficult to deal with large data sets and may not as much accurate as it should be. So, in this proposed solution we will introduce and make use of latest and innovative techniques & tools for a much accurate and reliable sales trends and forecasting system which would be up to mark and will fulfill all the requirements of this modern era of industry.

Small businesses play a vital role in the establishment of Economy of a country by creating a number of jobs and revenue also. So, this project will facilitate store owners to grow their businesses. There is a need of such application capable of accommodating small stores with such credible information. Furthermore, the store owners will get a visual representation of the results which can help them in decision making. Here proposed solution (sales trend and forecasting using data mining techniques) provides a platform for these store owners to utilize the data at their disposal to grow and expand their services above and beyond the need of the valuable customer. The proposed solution will use data mining techniques to implement a series of predictions and sales trend. [11]

The provided data by user will be preprocessed using data mining techniques and then some operations will be applied on this data set and certain results will be gained for each of the multiple actions. When the system is done with these operations, visualizations will be generated based on the results using some visualization tool. Moreover, the user will be offered a simple, streamlined and efficient user interface. This proposed project will not only help the store owners (user) to understand the nature of the sales but will also guide them to enhance it. Our proposed solution will provide services to the store owners via a simple web application hosted on cloud.

2.2 Use case diagram



Use case diagram

2.3 Use Case Description

2.3.1 Registration

Name	Registration
Actors	Customer
Summary	Customers will be able to register their accounts
Pre-Conditions	Web application Should be opened
Post-Conditions	Customer should be registered successfully
Special Requirements	None

Basic Flow			
Actor Action		**System Response**	
1	User will open the Sign-Up page.	2	Registration page will be display, asking for to enter credentials for registration.
3	User will enter credentials and presses submit.	4	System will verify the credentials; and establish a session for the user, Registration will be Successful. System will Redirect the user to the login page.
Alternative Flow			
Actor Action		**System Response**	
3	User will enter invalid email or password.	4-A	Alter the user if credentials will incorrect and system will prompt the error message: Incorrect credentials entered.

2.3.2 Login Account

Name	Login Account
Actors	Admin, Customer
Summary	All the users will be able to login to their respective accounts
Pre-Conditions	Customer should be registered in system
Post-Conditions	Logged in successful
Special Requirements	None

Basic Flow

	Actor Action		System Response
1	User will open the login page.	2	Login page will display asking for email and password.
3	User will enter credentials and presses submit.	4	System will verify the credentials, establishes a session for the user and redirects the user to the home page.

Alternative Flow

3	User will enter invalid email or password.	4-A	Alter the user if incorrect login credentials and system prompt the error message: Incorrect email or password entered.

2.3.3 Manage Profile

Name	Manage Profile
Actors	Admin, Customer
Summary	Login user should be able to see his profile and update it.
Pre-Conditions	Customer should be logged in.
Post-Conditions	Profile should be update successfully.
Special Requirements	None

Basic Flow			
Actor Action		**System Response**	
1	User will open the My Profile page.	2	My Profile page will be display to the user.
3	User will click on edit if he/she want to change email, password OR click on profile image to change image.	4	System will verify the credentials, update it and show a message to the user: Update successfully.
Alternative Flow			
3	User will enter invalid email or password.	4-A	Incorrect login credentials and system prompt the error message: please chose a correct format to update.

2.3.4 Reset Password

Name	Reset Password
Actors	Admin, Customer
Summary	Reset password for user
Pre-Conditions	User should have valid account
Post-Conditions	User should be successfully update his password
Special Requirements	None

Basic Flow			
	Actor Action	**System Response**	
1	User will open reset password page through login page.	2	System will display page and asking for credentials
3	User will enter valid credentials and clicks on submit.	4	System will verify credentials and sent an email to user with password reset link.
5	User will open email id and clicks on received link.	6	System will display password reset page and ask to enter new password.
7	User will enter new password twice and clicks on submit.	8	System will update new password, and redirected user to login page.
Alternative Flow			
3	User will enter invalid credentials and submit	4-A	Incorrect credentials and system prompt the error message: Incorrect credentials entered.
7	If password is weak or correct format not followed.	7-A	Error: Please choose a correct password format.
7	If password and repeat once again password is not same.	7-B	Error: Please enter same password.

2.3.5 Upload Data

Name	Upload Data		
Actors	Customer		
Summary	Customer upload his data for prediction		
Pre-Conditions	Customer should be logged in.		
Post-Conditions	Data uploaded successfully		
Special Requirements	None		
Basic Flow			
	Actor Action	**System Response**	
1	User will click on upload data option from side menu.	2	System will display upload data page.
3	User will select upload from main screen.	4	System will show File Explorer to select data file.
5	User will select excel file (.csv) from PC folders.	6	System will upload file to web site, which take some time.
7	User will click at upload.	8	System shows a dialog box with message (Data uploaded successfully.)
Alternative Flow			
5	If file will not in excel (.csv) format.	6-A	System will show “Data Upload Unsuccessful”
7	User will click on upload button without Selecting the first.	7-A	System will show error to select the file first.

2.3.6 Sales Forecasting

Name	Sales Forecasting
Actors	Customer
Summary	Applying forecasting on data like country based, time series based to check valuable country and their related specific products.
Pre-Conditions	User should be logged in and data uploaded successfully.
Post-Conditions	Forecasting predictions added in a home page list successfully.
Special Requirements	None

Basic Flow

	Actor Action		**System Response**
1	User will select Sales Forecast from side menu.	2	System will display Sales Forecast page.
3	User will select Include this Action.	4	System will include this prediction in a list.

No Alternative Flow

2.3.7 Generate results

Name	Generate results
Actors	Customer
Summary	Visualized results will be generated after doing predictions.
Pre-Conditions	Data should be uploaded and forecasting should be done successfully.
Post-Conditions	Visualized results should be generated.
Special Requirements	None

Basic Flow

	Actor Action		**System Response**
1	User will clicks at visualize results	2	System will display the results in the visual form.

No Alternative Flow

2.3.8 Change Plan

Name	Change plan		
Actors	Customer		
Summary	Change plan from free to others or vice versa		
Pre-Conditions	Customers registered and login.		
Post-Conditions	Plan should be successfully changed.		
Special Requirements	None		
Basic Flow			
Actor Action		**System Response**	
1	User will select change plan from upper right corner of the screen.	2	System will display the change plan page.
3	User will select that plan which he/she want to subscribe	4	System will open the payment page for this plan.
5	User will enter valid payment credentials	6	System will update your payment status after validation and verification.
Alternative Flow			
5-A	If user will enter wrong credentials.	8-A	System will show red error and will not change plan

2.3.9 Manage Packages

Name	Manage Packages
Actors	Admin
Summary	Change plan from free to others or vice versa.
Pre-Conditions	Customers registered and requested to change his plan.
Post-Conditions	Plan should be successfully changed.
Special Requirements	None

Basic Flow			
Actor Action		**System Response**	
1	Admin will see a change request from user	2	System will display the change plan request page.
3	Admin will select that plan which he/she want to subscribe	4	System will open the payment page for this plan.
5	Admin will verify the payment for that selected plan.	6	System will update payment status after validation and verification.
Alternative Flow			
5-A	If user will enter wrong credentials.	8-A	System will show red error and will not change plan

2.3.10 Manage Customers

Name	Manage Customers
Actors	Admin
Summary	Add, delete, edit customers
Pre-Conditions	System should be in running state and admin should be login.
Post-Conditions	Customer should be successfully updated.
Special Requirements	None

Basic Flow			
S#	**Actor Action**	**System Response**	
1	User will select Manage Customer from side menu.	2	System will display Manage Customer page.
3	User will select clicks on add customer or Delete customers or update customers button	4	System will show input fields for the new customer, clicks on delete to delete customer or show fields for updating.
5	Admin will enter details of new customer or Old customer in order to update and click on submit.	6	System will add the customer in the system and updates the customer's list.
Alternative Flow			
5-A	If admin will enter invalid details of new customer and click on submit.	6-A	System will show error in the invalid input field.

2.3.11 Manage Actions

Name	Manage Actions
Actors	Admin
Summary	Able and disable predictions and recommendations.
Pre-Conditions	System should be in running state and admin should be logged in.
Post-Conditions	Admin should be successfully able/disable predictions button.
Special Requirements	None

Basic Flow			
S#	**Actor Action**	**System Response**	
1	User will select actions from side menu.	2	System will display actions page.
3	User will ticks the predictions he want to do and unselect all others, clicks on update button.	4	System will ask for confirmation.
5	User will click on ‘Yes’	6	System will update actions in the system.
No Alternative Flow			

2.4 Functional Requirements

The functional requirements can be divided amongst the user, admin and the automated predictor system.

2.4.1 Functional requirements for users

- System will allow user to create a new account.
- System will authorize the unique email, password from the user and allow to login.
- System will allow the user to reset password via email.
- System will allow user to upgrade package from free to basic or premium.
- System will allow user to upload sales data.
- System will allow user to add actions.
- System will allow user to view visualization of the actions.
- System will allow user to pay via payment gateway.
- System will allow user to edit profile.

2.4.2 Functional requirements for admin

- System will allow admin to add new user.
- System will allow admin to manually remove existing user.
- System will allow admin to edit user profile.
- System will allow admin to change the plan of any user.
- System will allow admin to able/ disable any action.

2.4.3 Functional requirements for automated system

- The system will run an **ETL (Extract, Transform, Load**) [1] model by using the resulting dataset for the predictions and recommendations.
    a) De duplication
    b) Date format standardization
    c) Removing Missing values
    d) Derived table of transaction wise data

- System will do a **time series forecast** of the sales data. This prediction will be done by using attributes like invoice number, invoice date, unit price and country. The resulting table will contain the predicted sale dates, unit price. [3]

- System will use **market basket** analysis to determine which products to be associated with which products. This will use the invoice number of each transaction and product name, both being unique, to find relationship between certain products. Basically system will use association rule mining and use the concept of strong rules to determine which products are relatable. [2]

- System will make **segments of the customer base** into 3 categories. [5] The categories are as follows:
    e) Customers that buy least frequently and generate low revenue
    f) Customers that buy average amounts

g) Customers that buy most frequently and generate high revenue

- RFM (Recency Frequency Modeling) scores will be generated to make segments of the customer base. This will be done by using the customer id, product name, quantity, unit sale, invoice number and date. The results will have every customer associated with a segment.

- System will apply **customer predictive lifetime modeling** to find out the life time value of the customer. This will be done by fixing a time slot of the customer's active period and predicting the next time slot. An LTV score will be used to train the model. [4] The required attributes will be same as for the segmentation of customers.

- System will use **uplift modeling** to predict the customers, which are beneficial, or not to include in a promotional campaign. For this, system required three columns that are historical purchases by a customer, offers i.e., buy one get one free or some discount, conversion (previous order detail). System will predict campaign, which gives the best order uplift and revenue uplift. [6]

- System will use **churn analysis** prediction to find which customers are likely to churn. Retention rate will be used to determine whether a customer is about to churn away. [8] The required attributes are the same as for last 2 functionalities. However, the results will be in the form of a yes or a no. For every customer, for a time slot, system will predict whether the customer will churn or not.

- System will implement **market response** modeling to determine which type of offers will be best suited for the store itself using the data of already conducted offers such as discounts, bongo offers etc. [7]

2.5 User Classes and Characteristics

The system will do different predictions using the data uploaded by the customer and generate the visual representations of the resulted predictions.

2.5.1 Admin User Class

Admin user has full admin rights of the system and will be responsible for the whole system.

2.5.2 Identifying External Entities

The identification of the external entities is based on abstract of "Sales forecasting and trends using data mining techniques". The two phases of identification are following:

2.5.2.1 Over Specify Entities from Abstract

The following entities from the Sales forecasting and trends using data mining techniques case study are identified from abstract:

- Admin

- Customer

2.5.2.2 Perform Refinement

In Sales forecasting and trends using data mining techniques we found the following most related entities:

- Admin
- Customer
- Database

2.6 Operating Environment

The product will be operating in web application environment.

2.7 Design and Implementation Constraints

The system is developed using python language. For implementing this system, an efficient computer with at-least 8GB RAM and MogoDB is necessary. High speed internet is also required so that the system must response within time constraints and must generate the good results with high accuracy.

The developer must consider the security of the system i.e. login credentials so that no one can access the system and confidential data. If the customer organization is responsible for maintaining the system, the developer must set some design standards and programming language so that it can easily be maintained. As this system is primarily designed for security related authorities so the policy must be set that the confidential data cannot be misused or the developer must design and implement this system in a way that no one can breach into the system through any sources.

2.8 User Documentation

The delivered system will include user manual. The user manual will consist of product overview, complete outline of functions, instructions of how to get started and how to use the product with examples.

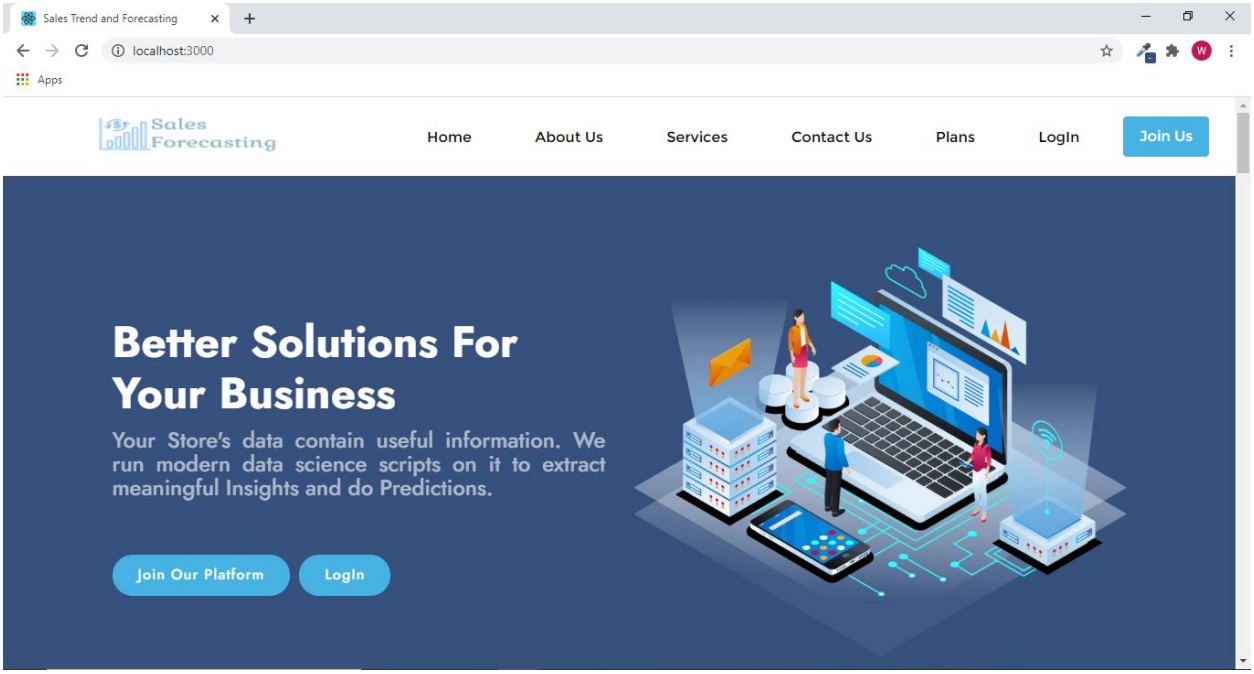
2.9 Assumptions and Dependencies

- We assumed user has Desktop with 4GB RAM, 1.8 processor and 64 bit Operating system.
- User should have browser in their desktop which is compatible for JavaScript.
- User must have internet connection as it is a web based application.
- Data provided by user would be cleaned other than few anomalies.
- Data provided by user has required columns which will be used for predictions and recommendations.
- User familiars with basic visualization such as charts, graphs and diagrams.

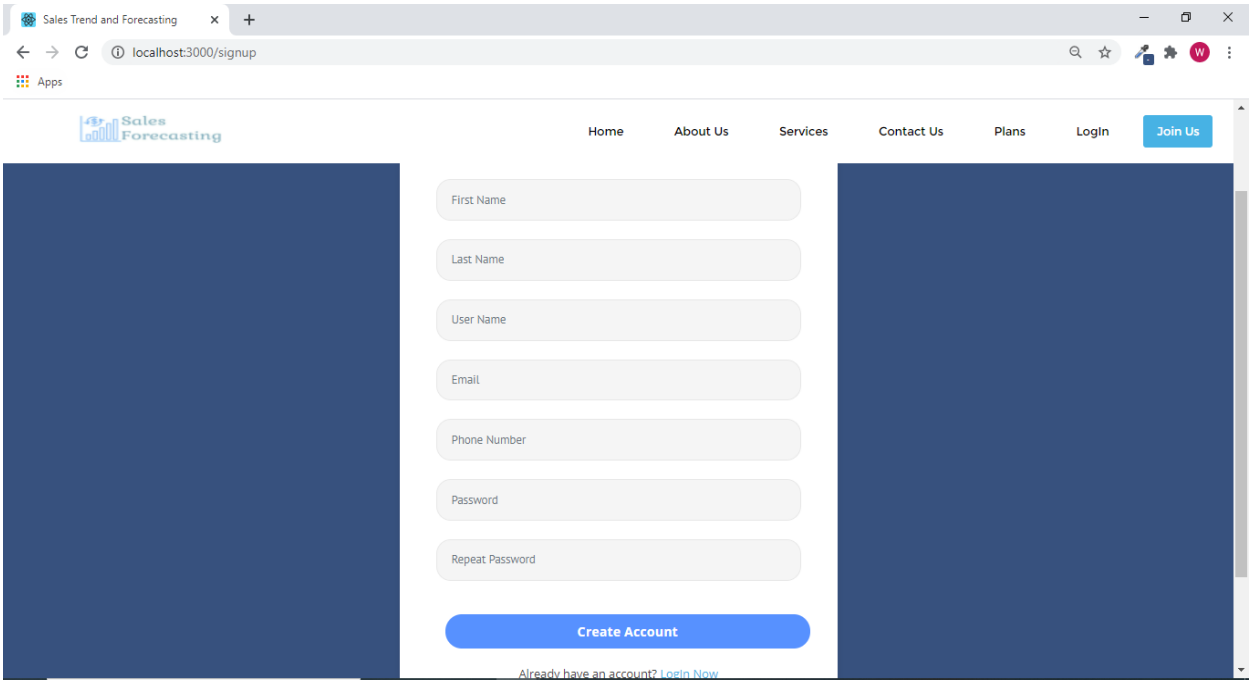
3. External Interface Requirements

3.1 User Interfaces

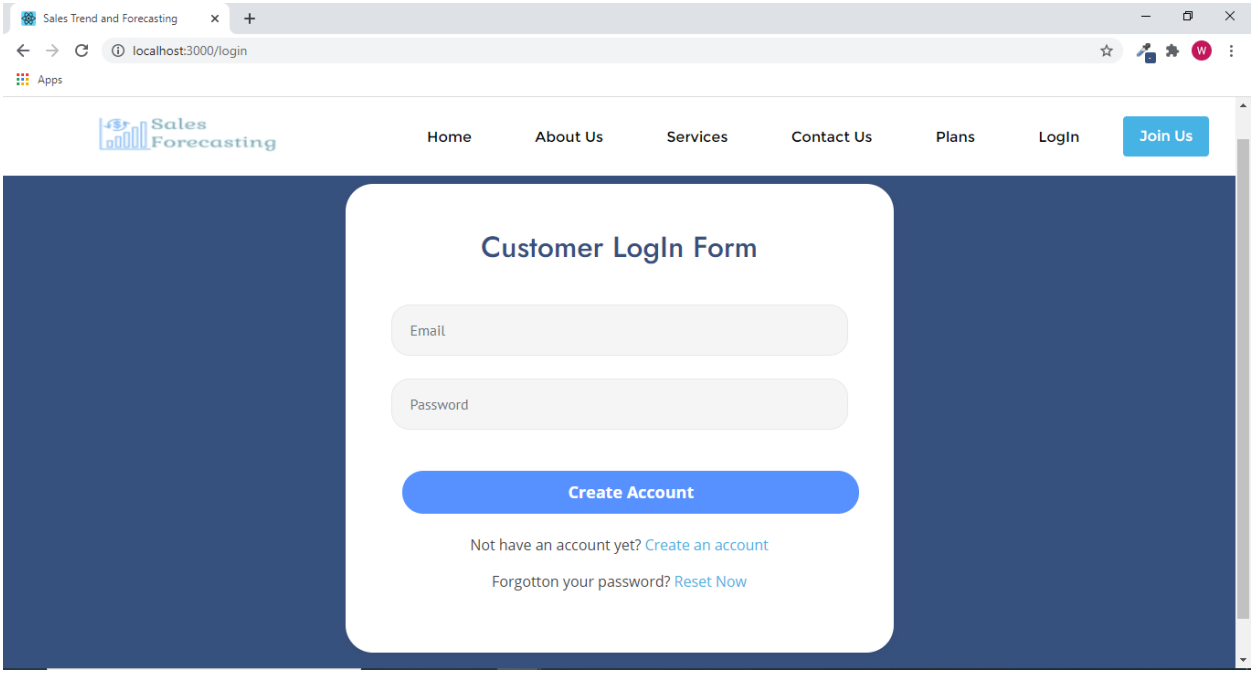
3.1.1 Main Page



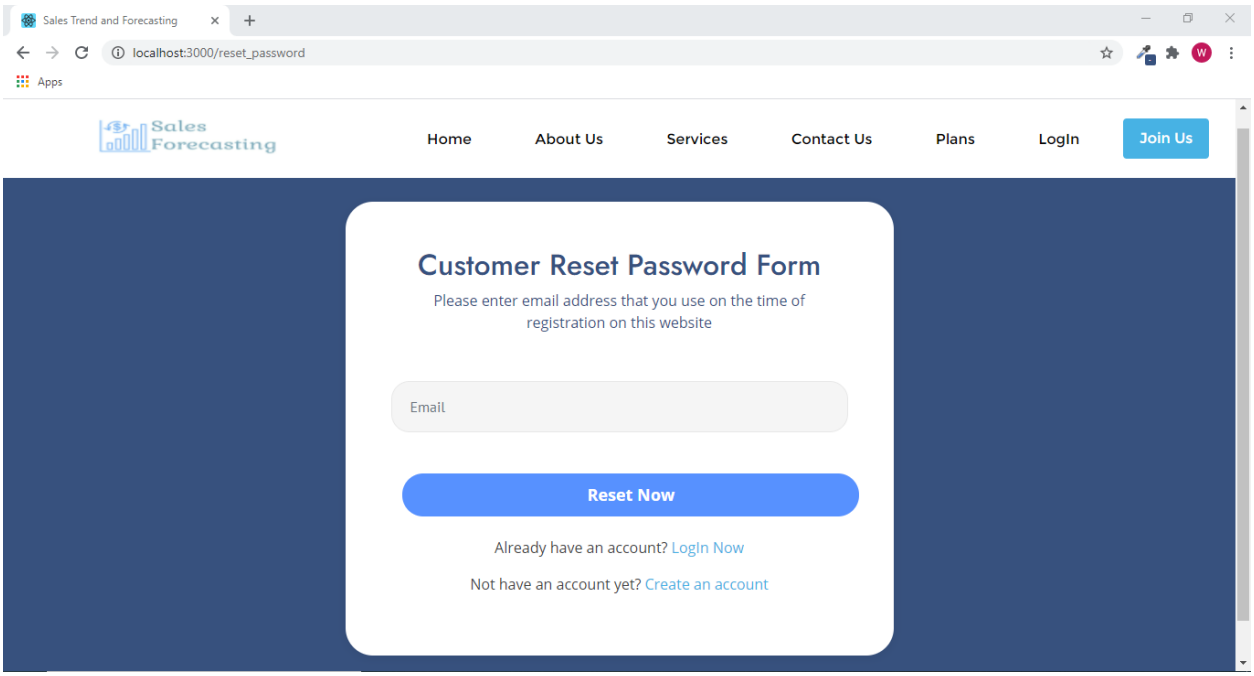
3.1.2 Sign Up



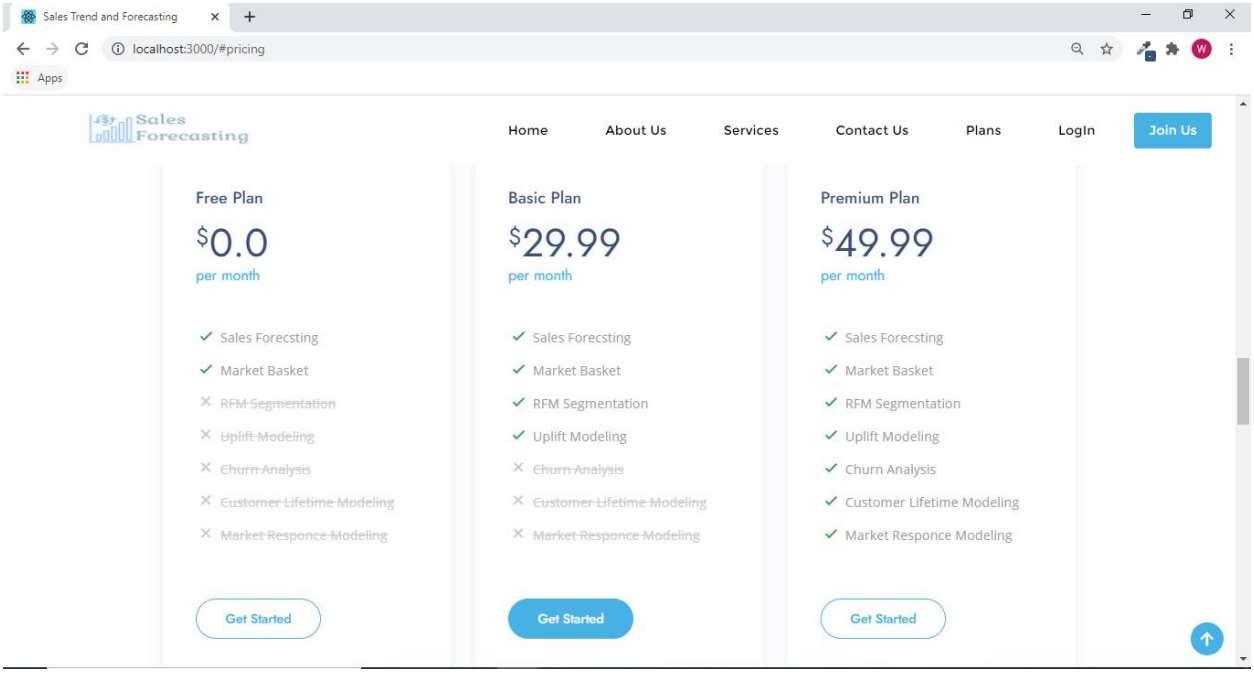
3.1.3 Login



3.1.4 Reset Password



3.1.5 Packages



3.2 Hardware Interfaces

For development, the hardware requirements are the following:

- Desktop with 4GB RAM , 1.8 processor and 64 bit operating system
- High speed online servers

For usage, the hardware requirements are the following:

- Desktop with 4GB RAM, 1.8 processor and 64 bit Operating system

3.3 Software Interfaces

For development, the software requirements are the following:

- Python: 3.6.8
- Jupyter Notebook
- Code editor: Visual Studio code
- MongoDB Atlas Database
- Express: WEB application Framework
- React: A JavaScript library for Frontend [13]
- Node: JavaScript runtime environment (v12.4.0-x64) [14]
- Node Package Manager (For installing dependencies)
- Amazon Web Services (AWS Lambda)

Browser: Google chrome, Mozilla Firefox, Opera.

4. System Features

Sr. #	Initial Requirements
1.0	Customer shall login to the system.
2.0	Customer shall upload the data.
3.0	The customer shall choose actions to be performed.
4.0	The system shall do predictions according to the selected actions.
5.0	The System shall generate visual representation of the predictions.
6.0	Customer shall manage his profile.
7.0	Admin shall manage customers.

Allocate Requirements

Sr. #	Initial Requirements	Use case name
1.0	Customer shall login to the system.	LOGIN
2.0	Customer shall upload the data	Upload data
3.0	The customer shall choose actions to be performed.	Manage Actions
4.0	The system shall do predictions according to the selected actions.	Sales forecasting
5.0	Admin shall manage customers.	Manage Customers
6.0	Admin shall mange packages	Manage packages

4.1 Prioritize Requirements

Sr. #	Rank	Initial Requirements	Use case ID	Use case name
1.0	Highest	Admin shall login to the system.	UC_2	LOGIN
1.0	Highest	Customer shall upload the data	UC_4	Upload data
1.0	Highest	Customer shall choose actions(predictions)	UC_7	Manage actions
2.0	Highest	The system shall do predictions according to the selected actions.	UC_5	Sales forecasting
2.0	Highest	The system shall generate the results of predictions that will be visible to the customer	UC_6	Generate Results

4.2 Requirements Traceability Matrix

Sr. No.	System specification	Build	Use case name	Category
1	Admin shall login to the system.	B1	LOGIN	Business
2	Customer shall upload the data.	B2	Upload data	Business
3	Customer shall choose actions (predictions).	B3	Manage Actions	Business
4	The system shall do predictions according to the selected actions.	B4	Sales forecasting	Business
5	The system shall generate the results of predictions that will be visible to the customer	B5	Generate results	Business

5. Other Nonfunctional Requirements

5.1 Performance Requirements

- The application will load within 2 seconds. [9]
- The application performance will increase by using high speed online servers (AWS).
- The application will handle millions of users at one time by using Node. [10]

5.2 Sustainability

- The system application can be accessed from any computer or browser with mentioned specifications in hardware requirements.

5.3 Safety Requirements

- We will use cloud storage to secure the data of our valuable users.

5.4 Security Requirements

- The major deliverable of our project is in retail stores and malls.

5.5 Software Quality Attributes

- **Availability:**
- The system should be available for constant monitoring 24/7 for doing forecasting.
- **Reliability**:
- System will have an uptime of near to 100% due to the very reliable cloud servers.
- **Usability:**
- The system should satisfy a maximum number of customers' needs.
- System interface will be easy to use and attractive, guide customers in an intuitive manner.
- User should be able to respond with in a seconds after looking at the interface.

5.6 Business Rules

Under any circumstances, the administrator will have full-fledge rights of the system.