

UNIVERSITY PARTNER



Project and Professionalism (6CS007)

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Statement of Project Details

Project Title: Product Recommendation System

Academic Questions:

- What tools and technologies will be used building this web application?
- Which AI is most preferable for running a smooth recommender system?
- How does AI help to get better recommendation?

Artefact

Recommendation systems are a sort of information filtering that forecasts the rating and preference of an item or social element. The AI recommends a product to the user, sparing them from having to navigate through the entire website. The web application will help filter out the products for buyer and recommend the product that is most likely to be bought by the user. We can divide it into three stages as well. First is information collecting phase where we collect all the information and next is learning phase where we process the data and build the model to train the data and finally the prediction/ recommendation phase where we predict the result and give prediction.

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Introduction

My final year project is based to help small retailer who want their business to grow out from a small local area to other parts of the world. By taking the business online we can do just that and more. With the help of my product recommendation system they can easily get a better head start in the leading business industry. Nowadays people tend to have less time so they want everything done in short amount of time. My AI recommends the product for the user so they don't have to scroll through the whole website. Recommendation system is a subclass for information filtering that seeks to predict rating and preference of an item or social element by using a model built around the feature of item or the buyer's social environment. (Singh, 2021)

Product Management system is a web e-commerce site where user can purchase goods and products from the website. The internet contains a vast collection of unstructured data which makes it very hard to search a valuable information. Recommendation system can be further classified into two groups. Firstly, content-based filtering focuses solely on the features of the

objects and offer suggestions based on their similarity. Here we have data of what the user previously like and watched/ listened. The system comprises a big database called Item Profile, which contains the items to be recommended as well as their attributes. It is also described as commercial transactions like online payment for goods or services that the customer has purchased along with that we have a recommendation model which predicts the product for the user to buy from their previous products using time-series LSTM algorithm. There are primarily four main types of tables that are used to describe all interactions between clients and software. User data will be saved in separate tables where users may register and login, and the data will be managed by the administrator. Everything aside there are many things to consider when we deploy website on the web. Whenever a big number of consumers utilize a website's resources, various issues must be addressed in order to protect the user's data and avoid legal action against the company. Ethical considerations, legal implications, safety concerns, and social concerns must all be addressed. The ethics of the website's operators, who will have access to all of the clients' information. Recommendation algorithms have changed the way websites and users connect in recent years. The recommendation engine sifts through massive amounts of data to locate users' areas of interest and makes information retrieval easier. The CHARM algorithm is a prominent pattern-finding tool that can handle enormous datasets, unlike previous association mining algorithms that could not. It is coupled with pattern discovery algorithms such as association rule mining and clustering. (Thomas, 2015)

Problem domain and how why system solves them.

Overview of recommender pipeline

- Pre-processing

In pre-processing first we normalize the data and then pick a model (matrix factorization) suitable for the data type then pick evaluation metric. (Cates, 2019)

- Hyper parameter tuning

We can use Grid search or random search for hyper parameter tuning for example. (`sklearn.model_selection.GridSearchCV`) (Cates, 2019)

Sequential Model-Based Optimization is an alternative smarter way for hyper tuning parameter.

- Model training and prediction

Using the value given by the optimal hyper parameter we can train our model to get predicted ratings so that we get optimal output or prediction in this case.

- Post- processing

In post-processing we will be filtering out the products or items that the user have purchased or watched/interacted.

- Evaluation

In traditional ML we split the data into half training set and validation set but doesn't work in recommendation system because the model won't work if we train all our data on a separate user population than the validation set. So we compare the predicted value with the actual value we have to evaluate the data. (Cates, 2019)

AIMS

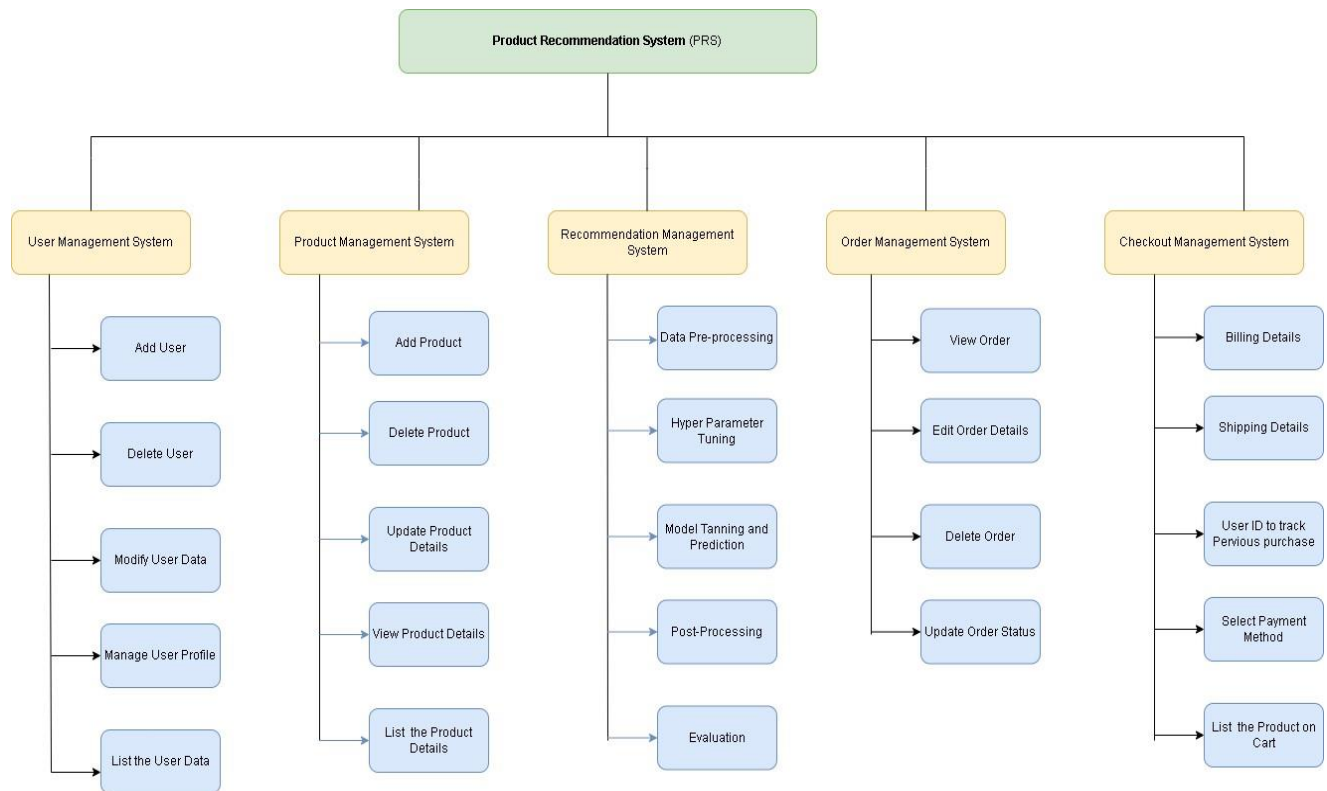
- To help small store to grow business online
- Help user navigate through products more easily
- To train the dataset according to the user preference

OBJECTIVE

- It will take user information and give them similar recommendation
- It will predict the possibility that a user would favor an item.
- It helps reduce the data cluster in the vast web and make searching easy.

Artefact Design

1. Functional Decomposition Diagram (FDD)



Artefact Elaboration

Project Recommendation system is a web application where customer to buy and order product along with an AI system that recommends the similar products to the user needs. There are many aspect to make this website fully functional and deploy it. We need to look at the security feature and we need to make sure we know where the item is being delivered. This project mainly consist of five sub-system which handles the different aspect of how to project functions

User Management System

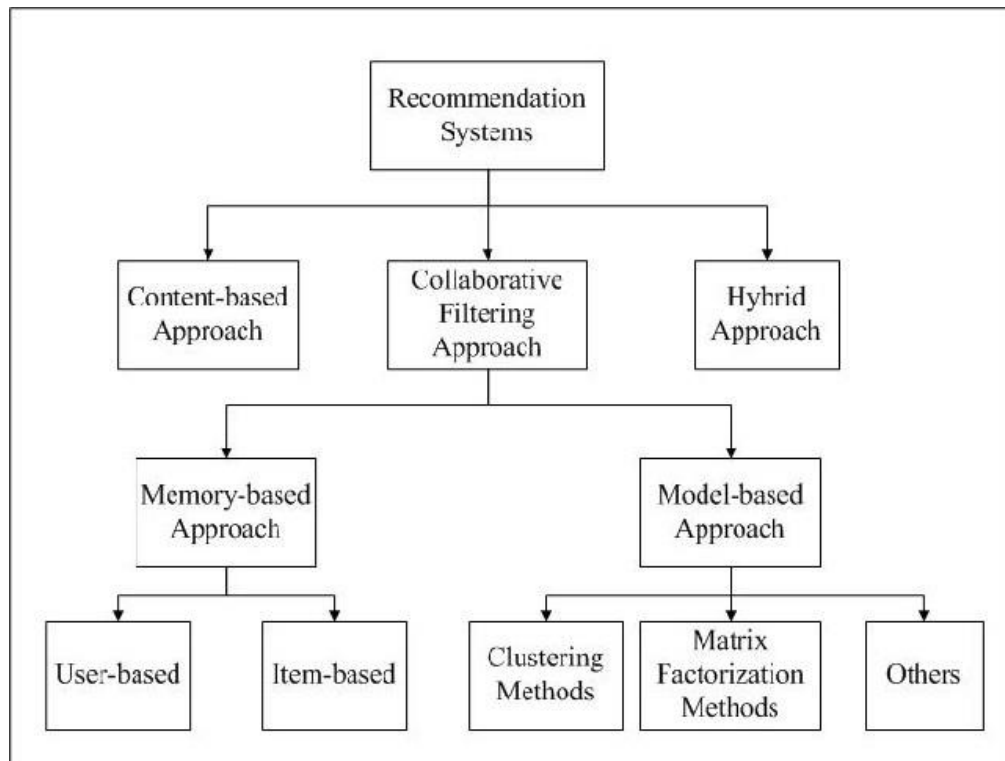
User management refers to an administrator's ability to govern user access to various IT resources such as systems, devices, applications, storage systems and more. Controlling and restricting user access to IT resources is an important part of any foundation's security. Using user management, administrators may control user access and on-board and off-board users to and from IT resources. Any identity and access management (IAM) solution, (Blanton, 2021) especially one based on authenticated users, should also include authentication services. Following that, a file system will authenticate, approve, and audit access management to user information and resources in a systematic manner where the admin can see who purchased a certain product.

Product Management System

Order Management System

Payment Management System

Recommendation System



Artificial intelligence does help in creating a better recommendation system. Because of the increased need to get a better understanding of users' preferences, recommender systems have advanced beyond simple user-item filtering to include many components for analyzing and integrating large datasets. For example we have OpenRec which is a Python framework for adaptable and extensible research in recommender systems. Each recommender is represented as a computational graph composed of an ordered ensemble of reusable modules linked by a set of well-defined interfaces and provides adaptability and flexibility while maintaining training efficiency and recommendation accuracy. (Deborah Estrin, 2018). As we know there are many approaches to building a good recommendation system. Machine learning is used to develop the core of AI recommendation system but in present day even deep learning approach are made to recommendation system as the market and competition is growing, companies demand a further advance way to read their clients behavior and patterns. Deep learning's ability to capture non-linear and non-trivial interactions between consumers and things, as well as its ability to integrate large amounts of data, makes it limitless in terms of generating high-quality recommendations. DNNs and CNNs are some of the deep learning algorithms used for recommendation system. (Rozhavsky) There are many

approach to giving recommendation accurately. Content based, collaborative or hybrid, we have to process the dataset no matter the approach and by using Hadoop we can do just that. Hadoop is an open source cloud computing platform using distributed file system, it implements the MapReduce framework. The MapReduce framework enables users to divide a huge problem into many smaller problems, which are then handled by the Hadoop platform, enhancing processing performance. (Ming-sheng Shang, Jan, 2010)

Literature Review

Initial research into source of information

The internet contains a vast collection of unstructured data which makes it very hard to search a valuable information. Recommendation system can be further classified into two groups. Firstly, content-based filtering focuses solely on the features of the objects and offer suggestions based on their similarity. Here we have data of what the user previously like and watched/ listened. The system comprises a big database called Item Profile, which contains the items to be recommended as well as their attributes. The contents of the item, as well as the ratings assigned to it, are used as training data in content-based filtering, which is a regression modeling issue or user-specific classification. Based on the user's prior selection behavior, the training data supplied for each user corresponds to the contents of the item. (Thomas Hofmann, 2004)

Collaborative filtering helps filtering for information or patterns using techniques that require collaboration across diverse players, perspectives, and data sources. Here we don't take past data or preference of group or an individual user. In collaborative filtering there may include problems that forces us of predicting unrated items, for such similarities between items and users are calculated using different approach. Basically collaborating filtering method is to make similarity assumption between users or between products, according to their past selection behavior of item or past ratings. (F.O.IsinkayeaY.O.FolajimibB.A.Ojokohc, 20th August, 2015)

Product Recommendation System

A recommendation system is an essential component of a scientific library's operations. It enables users to move beyond catalog searches. Recommender system are both beneficial to both user and service provider as it eases work for both the parties. Recent theoretical developments have revealed that recommendation system are being used widely on every platform gaming, e-comers and entertainment industry. Because of the standpoint of E-commerce as a framework that helps consumers search through records of information connected to their interests and preferences, these techniques have been important in the area. One of the major topics to be investigated in this field is collaborative filtering as it

promotes product by detecting other users with common likes to the active user and depending on their suggestions. Collaborative recommender systems have been utilized in a wide range of applications. (F.O. Isinkaye, 2015) Knowledge-dependent or knowledge-poor recommendation techniques are both possible. Knowledge dependent refers to the use of ontological descriptions of users or objects, or restrictions, or social relationships and activities of users, whereas knowledge deficient refers to the use of simple and basic facts, such as user ratings/evaluations for products. (Mehrbakhsh Nilashi, April 30, 2013) In order to accomplish the core job of picking useful products, a recommender system must appraise items that are beneficial for presenting to the target user. The system must be able to predict how some of them will be used, or at the very least evaluate how specific products will be used and then decide which things to recommend based on that judgment. (Mehrbakhsh Nilashi, April 30, 2013)

Explicit evaluations are those in which a user is stimulated to provide an estimation on a specific item whereas implicit ratings are those that can be deduced from a user's activities. These could be scalar rating, binary ratings or unary ratings as well. Each row contains a user, each cell a distinct merchandise, and the number there at confluence of a row and a column reflects the participant's grade. (J. Ben Schafer, 2007)

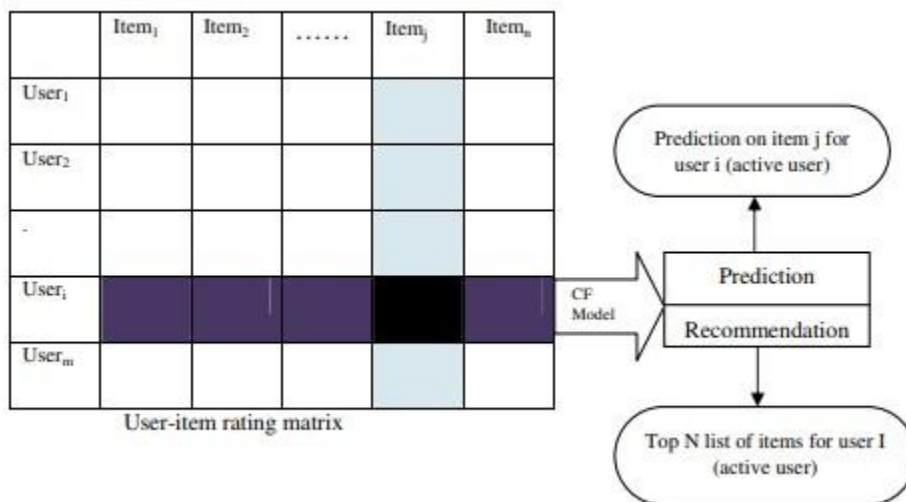


Figure 1 Collaborative Filtering

Data in a memory-based collaborative filtering system is kept in a "User x Item" matrix, where the rows represent the U users and the columns represent the items. The memory-based technique makes advantage of user input on objects. Model-based tactics have been implemented into recommendation systems to enhance and fix faults with memory-based approaches. (Abdelakder Grota, 2021) The weighted average of the active users' ratings on the connected items k is used to construct the prediction. To calculate item/user similarity, a number of similarity metrics are utilized. Correlationbased and cosine-based resemblance measurements are by far the most common. The Pearson's correlation coefficient is a measurement of how closely two factors are connected statistically. It is defined as:

$$s(a, u) = \frac{\sum_{i=1}^n (r_{a,i} - \bar{r}_a)(r_{u,i} - \bar{r}_u)}{\sqrt{\sum_{i=1}^n (r_{a,i} - \bar{r}_a)^2} \sqrt{\sum_{i=1}^n (r_{u,i} - \bar{r}_u)^2}}$$

Figure 2

This equivalence denotes the correspondence between two user (a and u) and (r.a,i) is the assessment given to an item. It finds the mean rating of an item.

$$p(a, i) = \bar{r}_a + \frac{\sum_{i=1}^n (r_{u,i} - \bar{r}_u) \times s(a, u)}{\sum_{i=1}^n s(a, u)}$$

Figure 3

Cosine similarity, unlike the Pearson-based metric, is a vector-space model based on linear algebra rather than a statistical technique. It calculates how similar two n-dimensional vectors are by measuring the angle between them. In the domains of data reclamation and script withdrawal, a cosine-based metric is commonly used to compare two text booklets, which in this case are characterized as vectors of words. The similarity of two items, u and v, may be expressed as (F.O. Isinkaye, 2015)

$$s(\vec{u}, \vec{v}) = \frac{\vec{u} \cdot \vec{v}}{|\vec{u}| * |\vec{v}|} = \frac{\sum_i r_{u,i} r_{v,i}}{\sqrt{\sum_i r_{u,i}^2} \times \sqrt{\sum_i r_{v,i}^2}}$$

Figure 4

Model-based algorithms are also based on earlier user evaluations (profiles), but instead of making predictions right away, this approach splits people into groups or develops models

from their data. (Abdelakder Grota, 2021) To increase the efficacy of Collaborative filtering Methods, this technique uses historical ratings to learn a model. Machine learning and statistical techniques may be used to create models. Supervised learning have also transformed the way suggestions are made, shifting the focus from advising clients on what to consume to advising clients on when to take a commodity. As a result, it is vital to examine the various learning approaches used in model-based recommender systems. (F.O. Isinkaye, 2015) The focus of this research will be matrix factorization, often known as matrix decomposition. It requires breaking a matrix down into several smaller matrices. Making the merchandise of these mediums will result in the original matrix. Matrix factorization has achieved positive outcomes in recommender systems.

Association rule: Association rules withdrawal methods abstract instructions that anticipate the arrival of a certain item based on the existence of other items in a transaction. A B pattern, for example, is applied to a collection of transactions by an association rule, where A A and B are two sets of objects.

Clustering: Classification technique, picture processing, data presentation, and knowledge extraction are all examples of applications that use clustering techniques. The goal of the clustering is to divide a collection of data into comment thread in order to find meaningful groupings within them. (F.O.

Isinkaye, 2015)

Decision tree: The tree graph technique is used to construct a decision tree, which is constructed by reviewing a set of training samples for which the class labels are known. They are then utilized to classify previously unidentified instances. If trained on very high quality data, they can provide highly accurate predictions. (F.O. Isinkaye, 2015)

Artificial Neural network: An artificial neural network (ANN) is characterized by a large collection of linked neurons (nodes) organized in layers in a uniform way. Neuronal interconnections are given weights based on how much impact one synapse has on someone else. In some issue circumstances, neural nets have a number of advantages. (F.O. Isinkaye, 2015)

Link analysis: The technique of creating networks of connected objects in order to analyze patterns and trends, it has showed a lot of promise in terms of improving the efficiency of web

search. In link analysis, the PageRank and HITS algorithms are utilized. Most link analysis tools approach a web page as a single node in the web graph. (Tirthankar Ghosh, 16.05.2018)

Matrix completion techniques: The basic purpose of the matrix completion approach is to forecast unknown values in user-item matrices. The rating matrix is frequently vast and sparse since users do not score the bulk of the objects. In reality, several low rank model modifications have been used for matrix completion, notably in collaborative filtering. (Tirthankar Ghosh, 16.05.2018)

Regression: Whenever multiple variables are assumed to be systematically associated by a linear connection, regression was used to analyze. It is a versatile and effective method for identifying the associative links between one and perhaps more completely reliant and study variables. Curve matching, forecasting, and testing fundamental claims about variable connections are all examples of regressive applications. A curve, whether linear, parabolic, or of a different kind, can be used to identify a trend in a dataset. (F.O. Isinkaye, 2015)

Pros and Cons within collaborative filtering

The CF technique may make surprising predictions, which means it may propose items relevant to the user even if the content is not in the user's profile. Despite their efficacy, the widespread use of CF techniques has indicated a few potential concerns. Some of the problems we face with CF is a cold-start problem happens when a recommender does not know enough about a user or an item to make accurate recommendations. (J. Ben Schafer, 2007) Lack of data to process is also another problem that causes the CF to not function to its prime potential. Furthermore, a lack of data invariably leads to coverage concerns. Recommendation systems must be able to handle large numbers of users and objects in a database. Scalability is another challenge for recommendation systems, because computation increases linearly with the size of the database. As a result, it is vital to employ recommendation algorithms that can properly scale up as the number of datasets grows. Synonymy refers to the tendency for extremely comparable commodities to have unique names or listings. Most recommender systems have difficulty discriminating between similarly related items, such as baby clothes and baby cloth. Collaborative filtering systems typically

find no match between the two sentences when calculating their similarity. (F.O. Isinkaye, 2015)

Uses of collaborative filtering

Recommendation algorithms have changed the way websites and users connect in recent years. The recommendation engine sifts through massive amounts of data to locate users' areas of interest and makes information retrieval easier. Collaborative filtering helps filtering for information or patterns using techniques that require collaboration across diverse players, perspectives, and data sources. Here we don't take past data or preference of group or an individual user. In collaborative filtering there may include problems that forces us of predicting unrated items, for such similarities between items and users are calculated using different approach. (J. Ben Schafer, 2007)

User Functionality

- Assist me in finding new items that I would appreciate
- Advise me on a specific item
- Assist me in locating a person (or a group of users) that I might like
- Assist our group in finding something new that we would like
- Assist me in finding a combination of "new" and "old" products

System Functionality

- Recommend items
- Predict for a given item
- Commend from a set of substances

Recommendation System Using Deep Learning

A recommender system is a tool that helps consumers search knowledge data based on their interests and choices. It can employ collaborative filtering, content-based filtering, or a mixture of the two. The most developed and extensively used technique is collaborative filtering. Recommender systems assist consumers in dealing with information overload by proposing personalized, one-of-a-kind content and services. Because of collaborative and content-based

methods to recommender systems, the accuracy and performance of search engine suggestions have increased. By integrating two or more filtering algorithms in various ways, hybrid filtering has been proposed to address some of the shortcomings of both techniques. Based on their activities, they are classified as weighted hybrid, mixed hybrid, switching hybrid, feature-combination hybrid, cascade hybrid, and meta-level fusion. Ziegler et al. introduced a hybrid collaborative filtering technique for using bulk taxonomic information for exact product categorization. (Tirthankar Ghosh, 16.05.2018)

To avoid defects and maximize performance, the qualities of both contained and explicit feedback can be combined in a hybrid system. This can be achieved by leveraging implicit data to validate explicit ratings or by allowing the user to submit explicit input only when he indicates explicit interest. For example we can use two algorithms to filter the datasets one for popularity based and another to evaluate precision and precision recall. Then we can filter out unique users and unique products so that we can build a recommender based on personalized model for unique user. (Tirthankar Ghosh, 16.05.2018)

K-Nearest Neighbor (KNN)

The K-NN approach, which is based on the Supervised Knowledge methodology, is one of the most essential Machine Learning algorithms. Although it may be applied to both regression and classification issues, it is more typically employed for classification problems. When fresh data is generated, the K-NN technique may be utilized to quickly put it into an appropriate category. The KNN technique considers that new and old instances are comparable and assigns them to the category that is most similar to the existing categories. It executes an action on the dataset during classification. (javatpoint, 2021) The Knearest neighbor (KNN) strategy is widely used to train an accurate model from a small set of data. Traditional KNN labels new data based on previously labeled data points' labels. The calculation of point distance is based on non-weighted feature values, which is insufficient for calculating network flow. This paper introduces the concept of feature weight, and a weighted feature KNN (WKNN-Selfada) approach is developed to account for the varied contributions of multiple features. To get the optimal feature and feature weight set, a feature selection and feature adaption technique for WKNN is proposed.

(Chencheng Ma, 2020) Undertake there are two classes, A and B, and that we get a new data point x_1 . Which of the following categories will this data point come under? A K-NN method is required to address this sort of problem. We can simply discover the category or class of a dataset using K-NN:

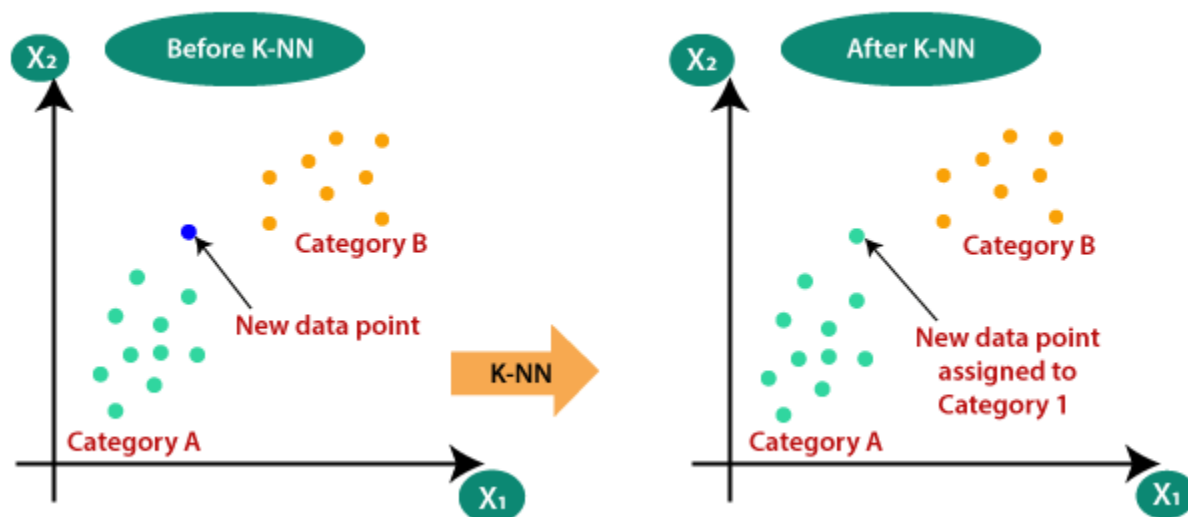


Figure 5 KNN working Steps

The KNN algorithm picks K , which is the number of neighbors. Calculate the Distance matrix between K of your closest neighbors. Count how many data points there are in each class among the closest neighbor. Allocate the sets of data to the subcategory with the most adjacent pieces of data. Our prototype is finished.

Long Short Term Memory (LSTM)

LSTM networks are a sort of recurrent neural network that can learn order dependence and may be used to solve sequence prediction problems. This is necessary in a variety of difficult issue areas, including machine translation, speech recognition, and others. The LSTMs of deep learning are a difficult issue. It may be challenging to comprehend the notion of LSTMs and how terms like bidirectional and sequence-to-sequence apply to the field. The LSTM system must be able to hold data indefinitely and be noise resistant (i.e. fluctuations of the inputs that are random or irrelevant to predicting a correct output). A recurrent neural network system's parameters can be altered (in reasonable time). (Brownlee, 2017) Every automatic learning approach requires data pre-processing. Pre-processing is done to optimize data for

the learning model. The categorizing operation will be undertaken out on preprocessed data. Deep learning algorithms might be used to categorize data. Deep learning is a way of expressing data that employs a computer model comprised of several layers of processes. Deep learning categorization may be used in conjunction with a wide range of development approaches. One of them is the Long Short-Term Memory (LSTM) method. (Ahmad Hanif Asyhar, 2020) The fact that LSTMs were one of the first solutions to tackle technical challenges and deliver on the promise of machine learning algorithms is a crucial factor in their success.

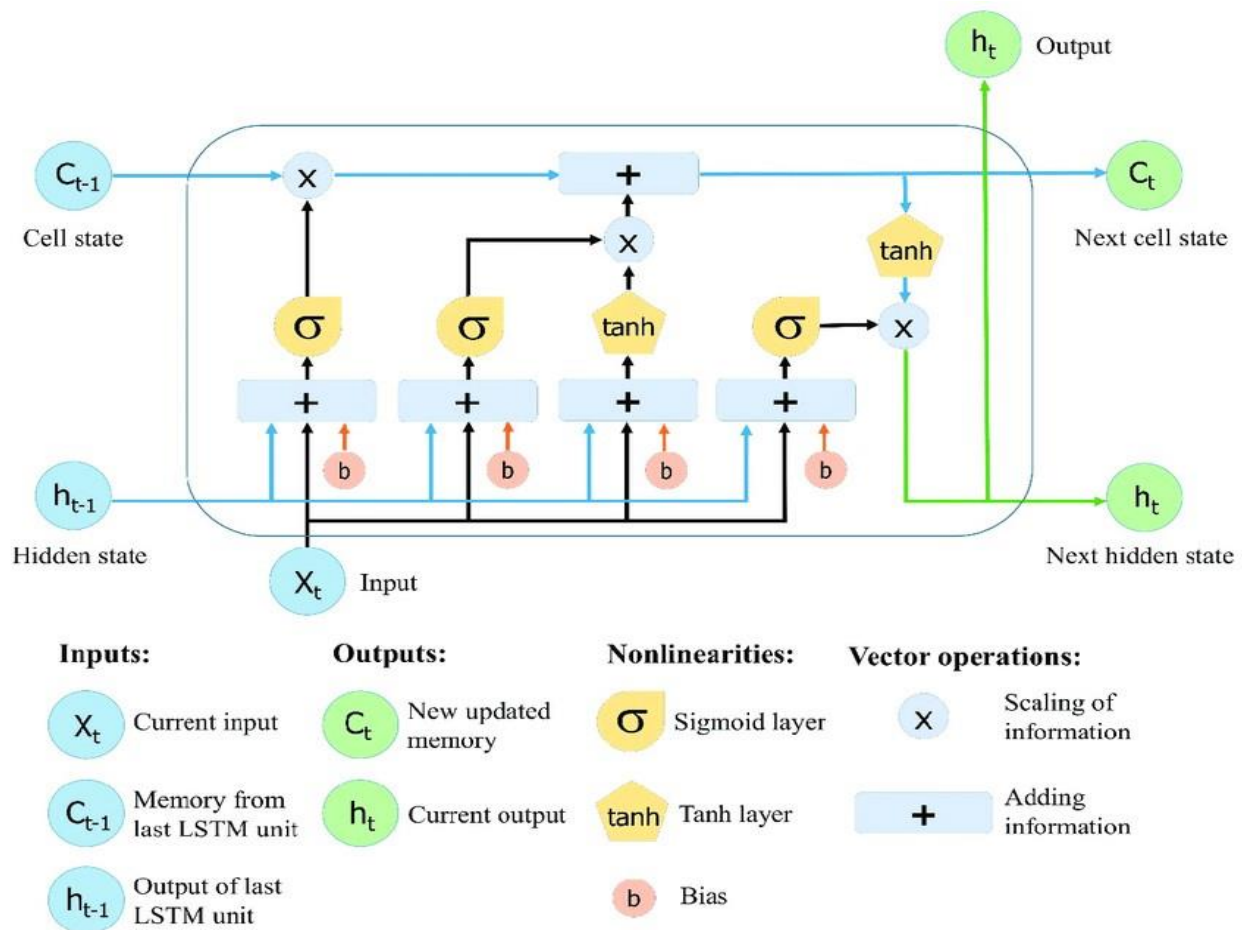


Figure 6 LSTM Working steps

How the LSTM works is that the forget gate decides whether bits of long-term memory should now be forgotten based on the previous hidden state and the current data point in the sequence (have less weight). To do this, a neural network is trained to produce values close to 0 when a component of the input is judged irrelevant, and values closer to 1 when the component is deemed relevant. This network generates a vector for each member in the [0,

1] range (ensured by sigmoid activation). This network is then transmitted up and pointwise multiplied with the cell state that came before it (inside the forget gate). Consider each component of this vector to be a filter/sieve through which more information can flow as the value approaches one. The new memory network and the input gate are used in the next phase. This is a neural network that learns how to integrate the prior hidden state with incoming input data to produce a 'new memory update vector.' Given the new input, this vector informs us how much to update each component of the network's long-term memory (cell state). The input gate is a sigmoid activated network that functions as a filter, determining which components of the final combined vector should be retained. Now that our modifications to the network's long-term memory are complete, we can proceed to the final stage, the output gate, which determines the new hidden state. This is accomplished by updating the cell state, prior concealed state, and new input data. Then, to acquire the new concealed state, we design a filter, the output gate. We put the freshly updated cell state via a tanh function before applying the filter to obtain the compressed cell state. This ensures that just the information required is output (saved to the new state). (Dolphin, Oct 21, 2020)

Collaborative Filtering Algorithms: Theory and Practice

We can disregard product tags and demographic information in order to focus on the users and their ratings. We'll put the hybrid model through its paces to determine if combining a model-based (LSTM) and a memory-based (KNN) method yields better results than either strategy alone. The combined model is quite precise that suggests the majority of the suggested things are relevant. However, the model has a relatively low recall, which means that only a tiny fraction of relevant items are recommended. More generally, these basic findings are consistent with research showing that LSTM algorithm is more useful for building a recommendation model that using a KNN algorithm as KNN is more suitable for small scale data's and whereas LSTM is more reliable and consistent even with large data sets being an improved version of recurrent neural network. LSTM is more suitable for using as a recommender system using Keras LSTM for product purchases as time-series data where purchases are considered as time-series data and 2 new products are recommended based on last 3 purchases.

Methodology

I've broken this entire system into sprints to make it simpler to complete, and an iterative approach is one of the best sprint strategies for this project because it allows me to focus on past work throughout each sprint.

Requirement stage

Requirement stage is one of the important stages for a project to be handled out swiftly. In this stage we do research and investigate the necessary information for the project to be done. We make decision on which technique, datasets and software/ hardware to be used.

Design stage

After that we come to the design state. Here we look at the requirements and build a wire frame or a design prototype so that we have a brief idea on what the project may look like and work according to it and make improvements along the way.

Execution and testing stage

After we have got the optimal design we need to complete the project so we start execution required and functioning features to the project and test them out. Backend and frontend development and any other aspect is done and tested on this stage.

Deployment stage

Finally after everything is complete we can now finally deploy the service or project to user, client or the public. Or this all the previous stage s should be carried out swiftly so that we don't have any errors after the deployment so that the client does not have any problem on operating the system

Testing

For the testing of the web application we can follow scrum methodology by having a test case and a bug report for the following test case. First we put what we are testing and find if it is the actual result that we want if does not fill the required output then the test is failed and move to bug.

For example:

Task Type	Description	Test Step	Expected Result	Status
Functionality	Area should accommodate 20 characters	Input up to 20 characters	20 characters in the request should be appropriate.	Pass or Fail

Plan and Schedule

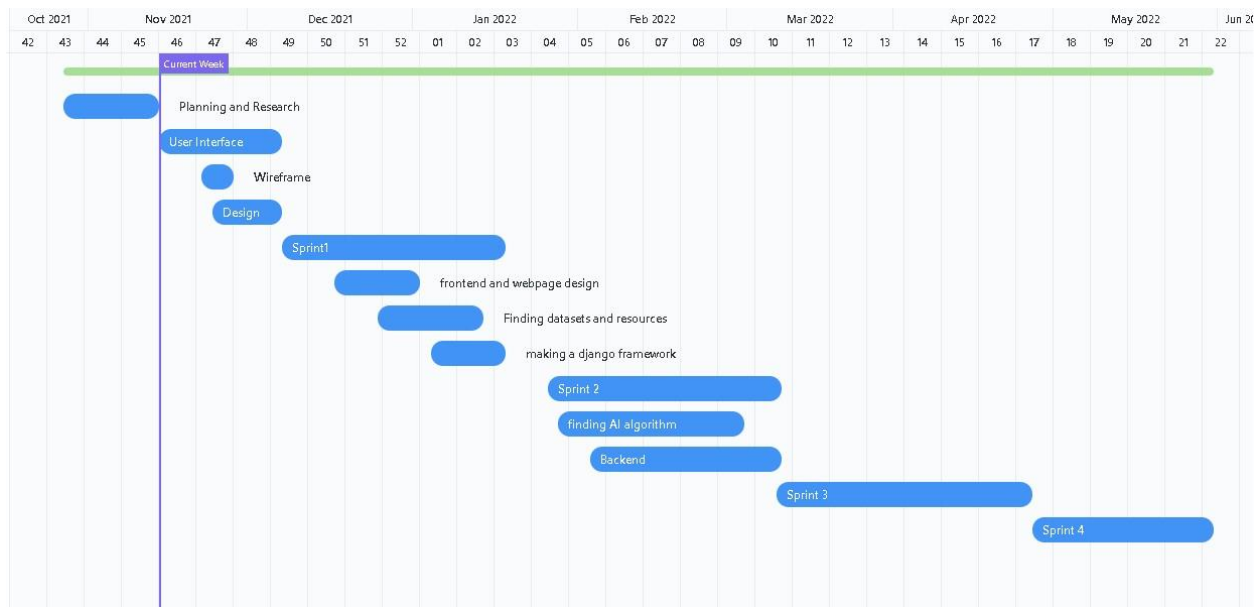
As we are following scrum / agile method to build our web application. We have to separate our projects into different sprints and each sprint will have its own backlog and will be following the work breakdown structure. As for the scheduling we will be using Gantt chart for keeping track of the project and the deadline for each part of project.

Work Breakdown Structure

Level 1	Level 2	Level 3
Recommendation System	1 Initiation	1 Project Registration Form (PRF) 2 Communication Plan 3 Initial Project Plan 4 Getting a PRF Approved 5 PRF registration
	2 Planning	1 Submit Project Proposal 2 Develop Scope Baseline 3 Understand the Requirements 4 Project Risks 5 Project Plan Approval 6 Discussion of Initial Design/Prototype
	3 Execution	1 Project Assessment 1 2 Project Review Meeting 3 Design Solution 4 Project Presentation 5 Build the System 6 Monitoring and Control 7 Test the System
	4 Monitoring and Control	1 Project Review Meeting 2 Respond to Changes 3 Artefact Progress Check (Testing) 4 Respond to Changes

	5 Closure	1 Draft submission of report 2 Document Feedback 3 Final Project Report and management 4 Archive Documents 5 Demonstrate Artefact
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Gantt chart



Scope and Limitation of the project

Conclusion

In conclusion, this is a web application for ecommerce which uses artificial intelligence such as recommendation system to interact with the user and help them enhance the user interaction with the website all sell their products more efficiently. A recommender system's primary principle is to evaluate a user's previous interactions with products, because previous item selections may impact the user's future choices, allowing comparable items to be recommended to the user. . (Kwan, 2012)

Tools and Technologies

Some of the tools that will help me build this web application are listed below:

1. PyCharm

It is an IDE for python programming which is free and used by professional developer.

2. Brave browser

It is a web browser where we can research and download useful datasets.

3. Python and Django

It is programming language we will be using for backend. We will be using Django framework. Python is an excellent programming language for beginners as well as advanced programmers who have worked with other programming languages such as C++ and Java. Both the front-end and back-end works of the web application can be done in Django which is designed to build application as quickly as possible. Django is a high-level Python web platform for building stable and maintainable websites quickly. (geeks, n.d.)

4. React.Js

It is a framework used in frontend development of this web application.

5. HTML/CSS

HTML is a markup language that is used to create electronic documents (also known as pages) that can be viewed through the Internet. Each page has a number of hyperlinks that connect it to other pages. Every web page you see on the Internet was built using HTML code in some fashion.

CSS, or Cascading Style Sheets, is a simple design language created to make the task of rendering web pages presentable easier. The look and sound of a web page is handled by CSS.

6. Git-Hub

It is a web hosting business that focuses on software development and GIT version control. It incorporates GIT distributed version control and source code management capabilities.

7. Open CV

We will be using jupyter notebook for handling and training datasets from open sources like kaggle and other websites. We can also use some of the tools like:

8. Python tools

Import surprise (@NicolasHug)

Import implicit (@benfred)

Import LightFm (@lyst)

Import pyspark.mllib.recommendation

2. SRS Table

Introduction

The Software Requirements Specification is used to record and specify the customer and developer's agreement on the software product specs. Its primary purpose is to provide a concise and detailed "expression of user needs" that can be used as a guide for future software development. This article is structured into parts that logically separate the software needs into sections that may be easily accessed. This Software Requirements Specification attempts to describe the Functionality, External Interfaces, Attributes, and Design Constraints placed on the software system, which are specified throughout the rest of the document during development. Throughout the article, the terminology and vocabulary used to describe the software system should be clear and consistent.

Purpose

The main purpose of this software requirement specification is to define the features and purpose of product recommendation system. The primary scope of this documentation is the

system's primary uses and required functionality as specified by our customer. Another one of the main purpose is that small company owner can easily grow their costumers online with little effort and also meet their needs.

Scope

The software system or web application being created is called product recommendation system. It is being created with scope to a business owners who are intending to grow their market online. The product recommendation System is a web application which will allow users to create an account and order products through the website. On the bright side the web application will keep track of the users purchase data and will recommend product that user may be interested in the future visits. The main scope of this project is to develop an AI model that can analyze any user's product preference and give similar movie recommendation to the user and also to help reduce time and effort for both user and web sites to give quality experience on the market. With all that said our project recommendation project is going to have some constrains such as not able to pay online via card such as credit and debit card processing. The scope is to meet the requirement of the user who wants to sell their product in the global market and provide quality experience for the user on the site as well.

2.1.User Management System (UM)

Req.Code	Req.Desc	MoSCoW Prioritization
UM-F-1.0	Users should be able to register themselves in the system	Must Have
UM-NF-1.1	User's information should be encrypted while transmitting to the server.	Must Have
UM-NF-1.2	User's registration password must be above eight length and must contain alphabet and number.	Must Have
UM-NF-1.3	If user's email and username already exists in the database, an error message should be displayed.	Must Have

UM-NF-1.5	New user should not be able to login with the existing user's information.	Must Have
UM-F-1.6	Admin should have option to delete a user profile.	Must Have
UM-NF-1.7	There should be delete option in every user's information list through which user can delete user from the website.	Must Have
UM-F-1.7	Admin should have option to ban a user profile.	Must Have
UM-NF-1.8	There should be ban option in every user's information list through which user can ban user from the website.	Must Have
UM-F-1.9	All the users should be able to login and off the website.	Must Have
UM-F-2.0	All the users should be able to reset/ change their password.	Must Have

2.2.Product Management System (PM)

Req.Code	Req.Desc	Use Case	MoSCoW Prioritization
PM-F-1.0	All the products and category should be displayed to the user.	View Product	Must Have
PM-NF-1.1	Product should be displayed in home page of the website		Should Have
PM-NF-1.2	All the products should be displayed in systematic order.		Should Have

PM-NF-1.3	Special products that have been recommended by model should be displayed in the homepage.		Could Have
PM-NF-1.4	All the category should be managed and displayed in a systematic way.		Must Have
PM-F.1.5	Search bar should be fully functional.	Search Product	Must Have
PM-NF-1.6	User should be able to search for products with the name of the product.		Must Have
PM-NF-1.7	User should be able to find particular product through search bar if it is available.		Must Have
PM-F-1.8	Admin should able to add new product to the website	Create Product	Must Have
PM-NF-2.0	Admin should have add option to add a new product. When clicked, new page should be displayed through admin can add a new product.		Must Have
PM-NF-2.1	Admin should be able to add product's images, description, price and other information while adding new product to the website.		Must Have
PM-F-2.2	Admin should be able to update product.	Update Product	Must Have
PM-NF-2.3	Admin should have update option to update a product. When clicked, new page should be displayed through admin can update a product.		Could Have
PM-NF-2.4	Admin should be able to update product's images, description, price and other information while adding new product to the website.		Could Have

PM-F-2.5	Admin should be able to delete a product.	Delete Product	Must Have
PM-NF-2.6	Admin should have delete option to update a product. When clicked admin should able to delete a product.		Must Have
PM-NF-2.7	Delete product should not be visible in both database and website.		Must Have

2.3.Order Management System (OM)

Req.Code	Req.Desc	Use Case	MoSCoW Prioritization
OM-F-1.1	All the product selected by the user must appear on the cart page with total amount and quantity of product		Must Have
OM-F-1.2	The product on the cart page will be able to remove form the page when the user change their mind		Should Have
OM-F-1.3	The cart must provide details of the product purchased		Could Have
OM-NF-2.1	The user must have at least an item for the checkout		Must Have

OM-NF-2.2	The product order cannot exceed the order quantity more than the available quantity.		Could Have

3. Class Diagram

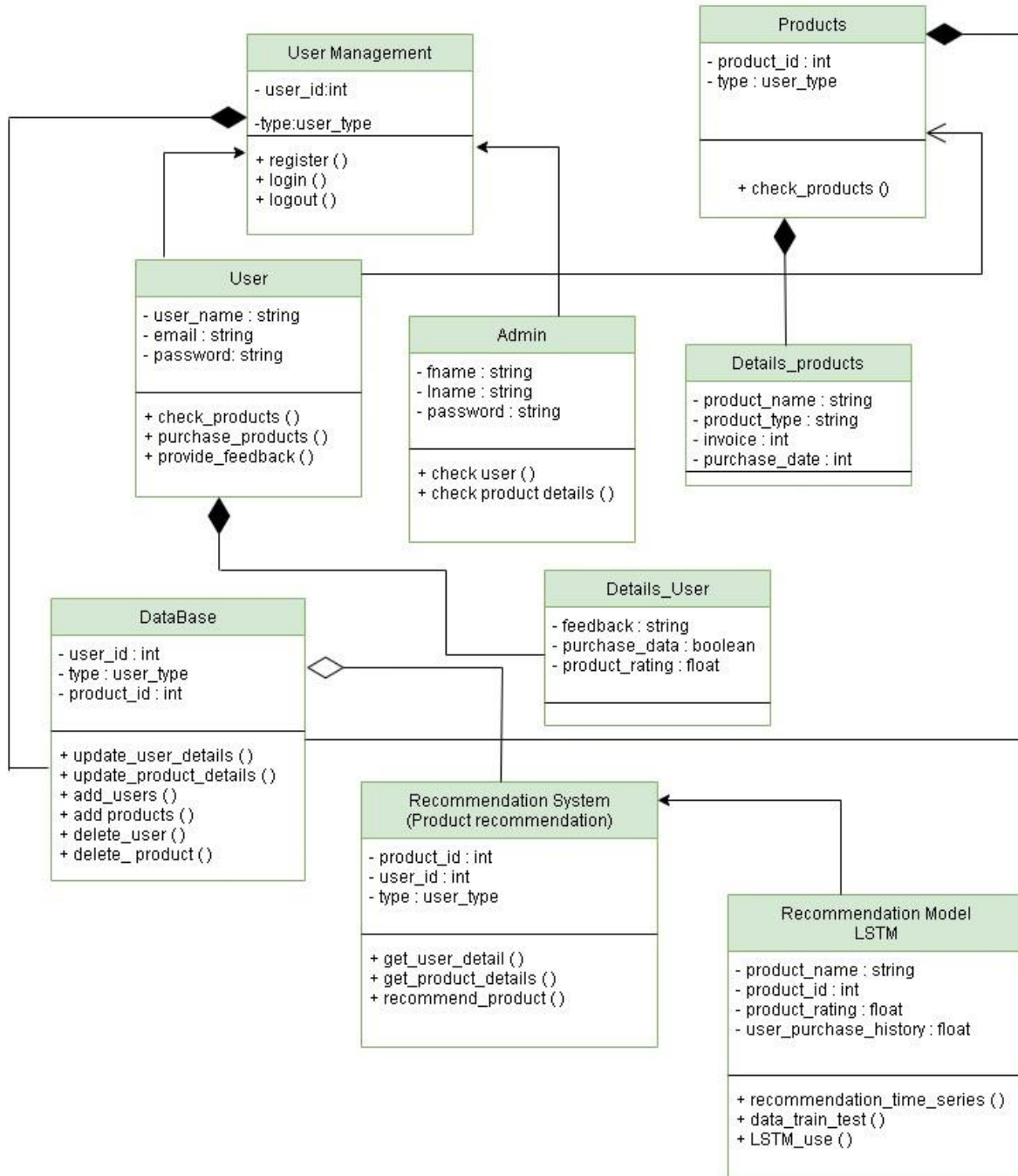


Figure 2 System class diagram

4. Entity Relationship Diagram

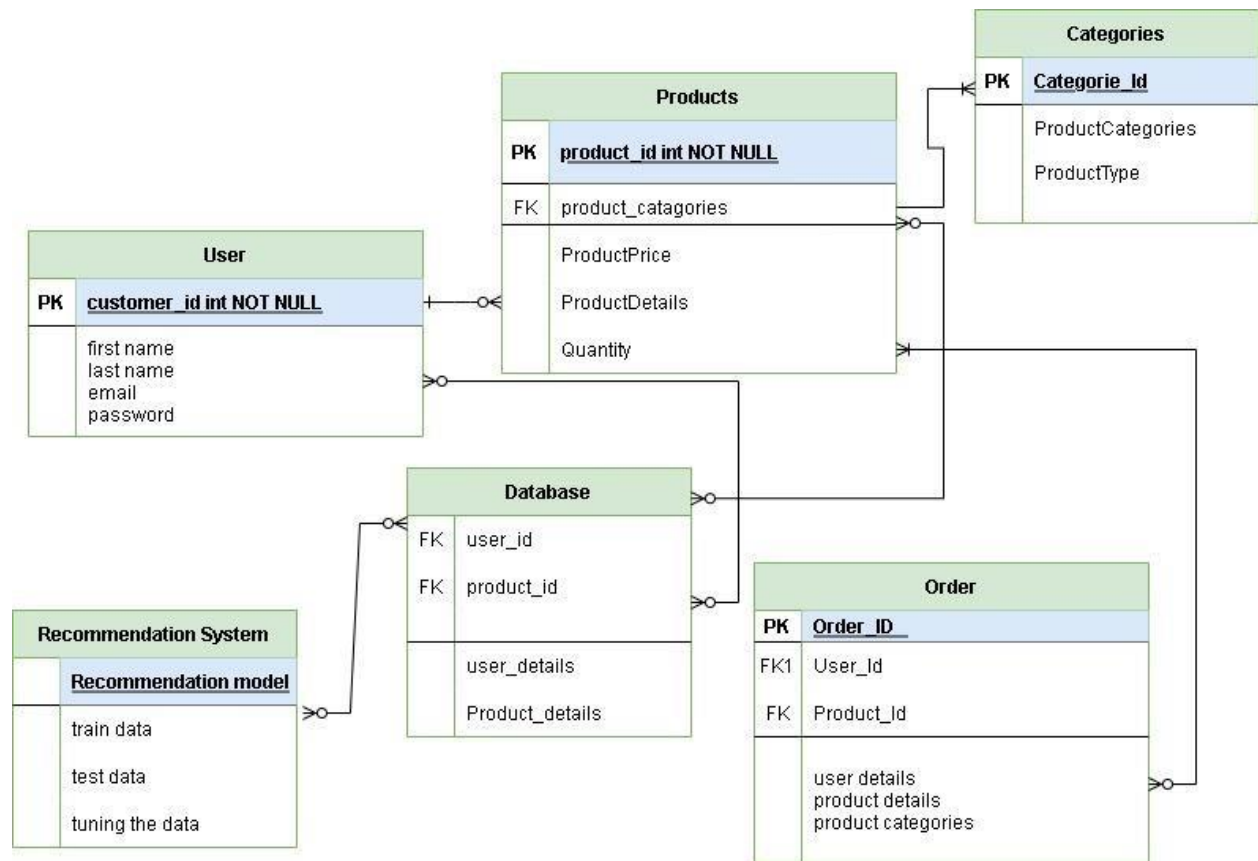


Figure 3 Entity Relation Diagram

5. Use Case Diagram

5.1. User Management (UM)

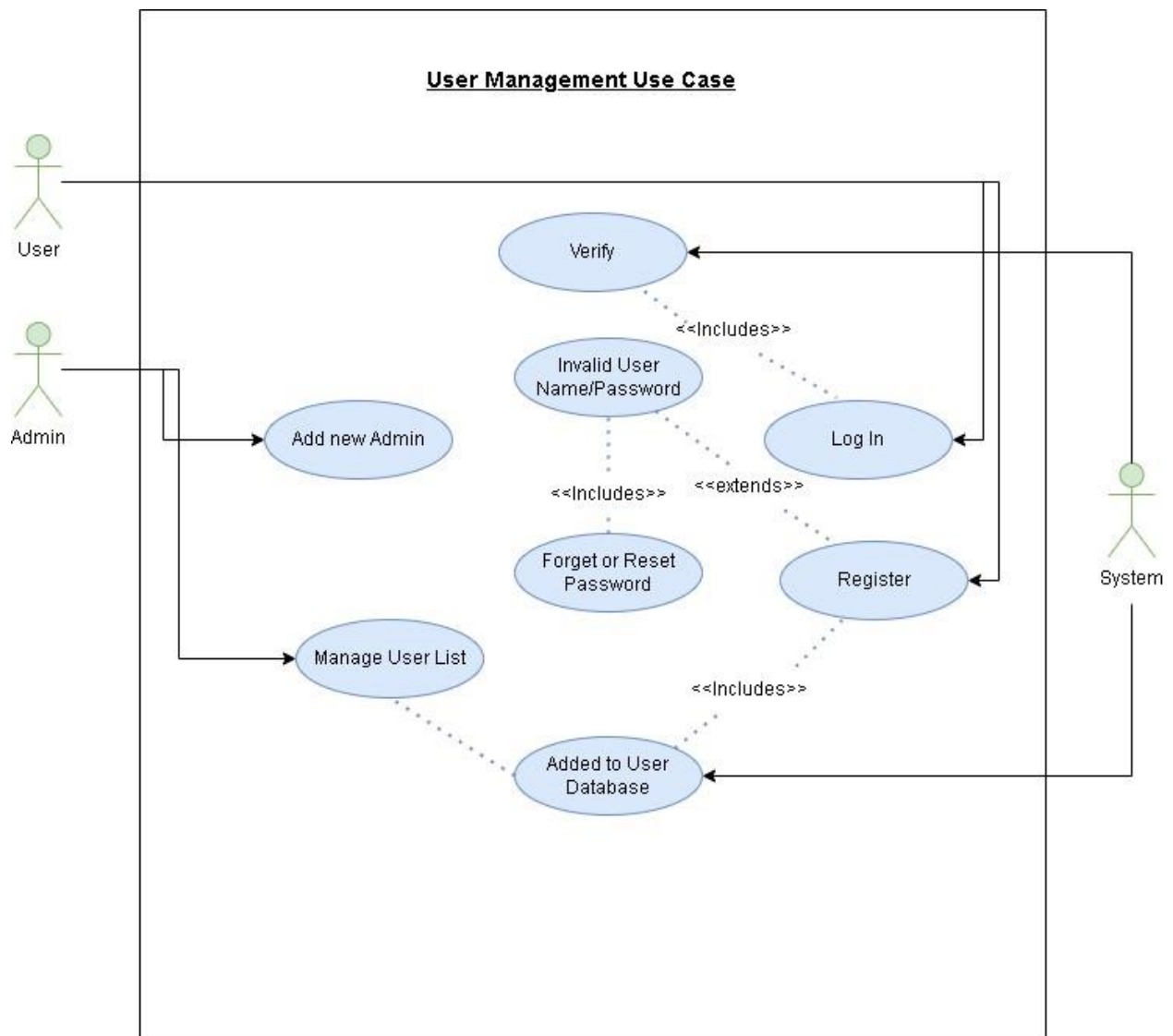


Figure 4 User Management Use Case

5.2. Product Management (PM)

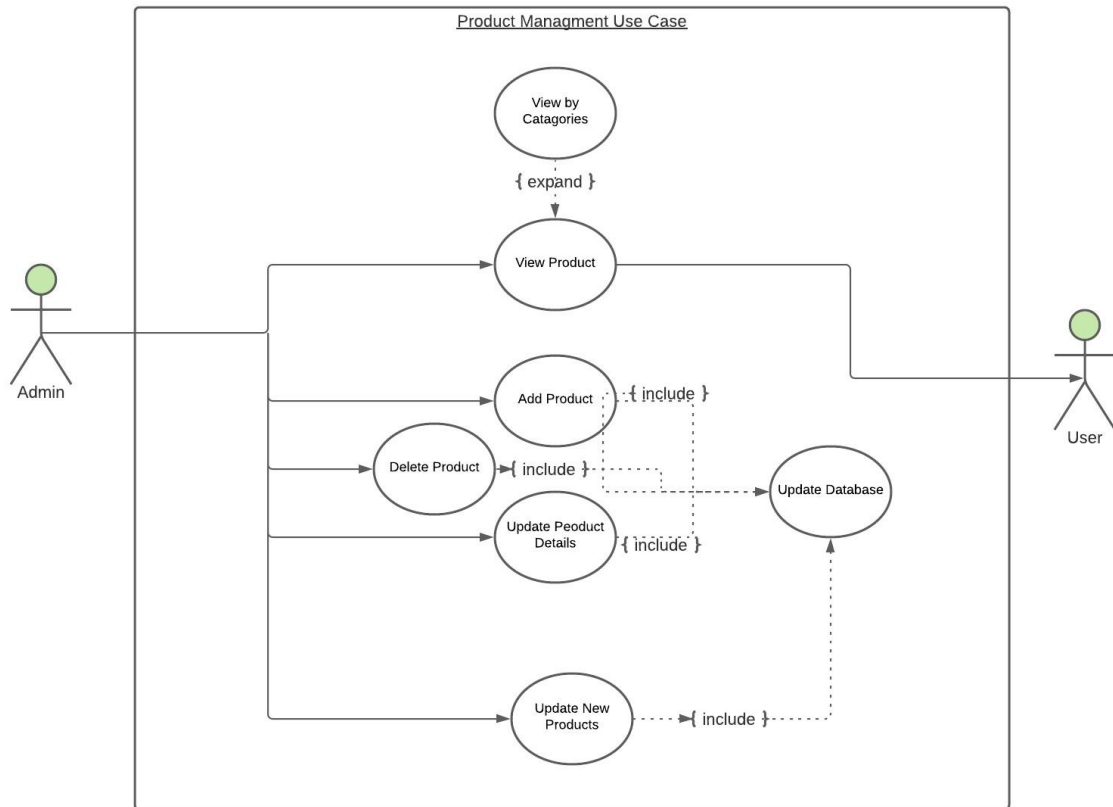


Figure 5 Product Management Use Case

5.3. Order Management (OM)

Order Management Use Case

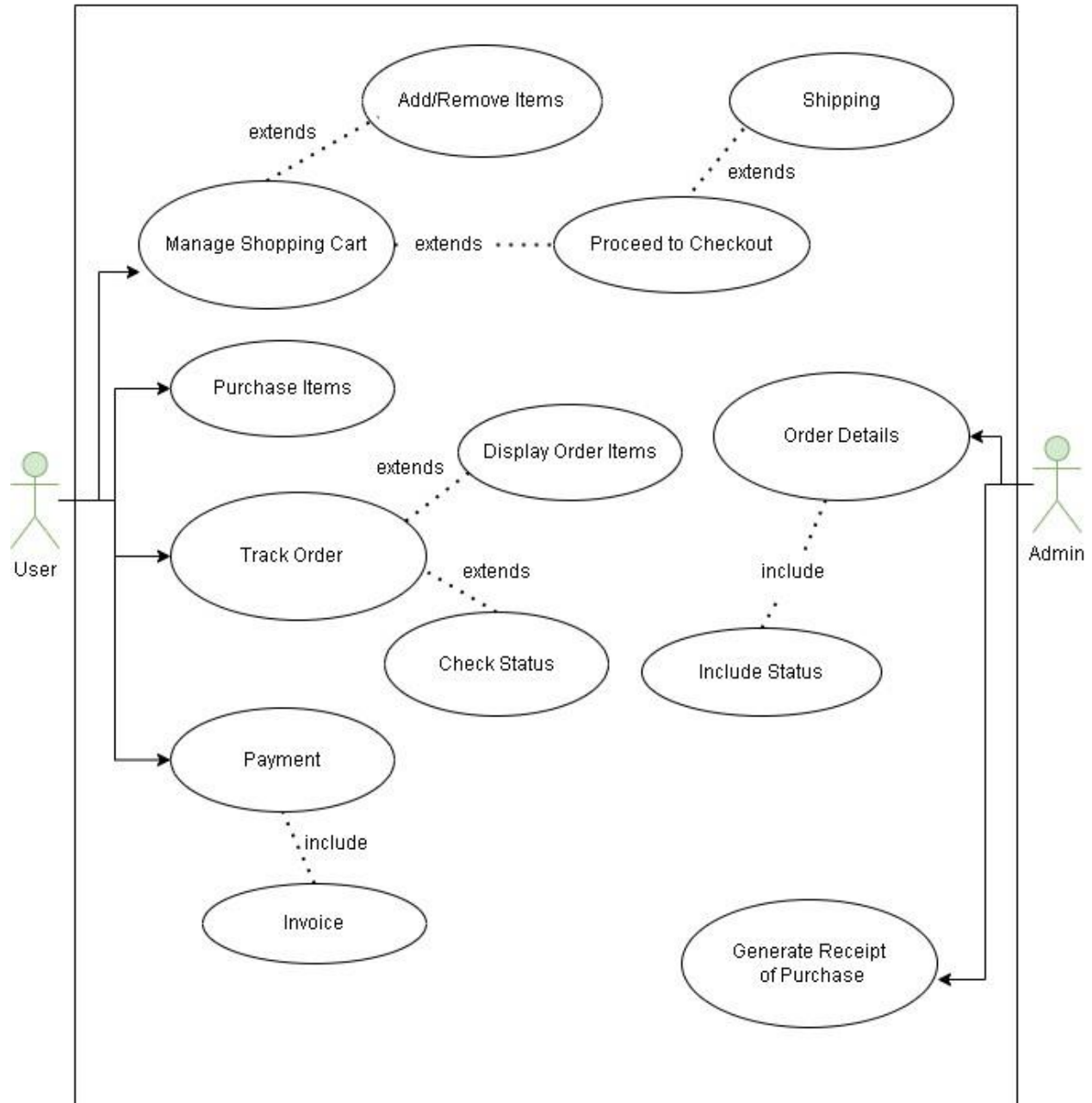


Figure 6 Order Management Use case

5.4. Recommendation Management (RM)

Recommendation System Use Case

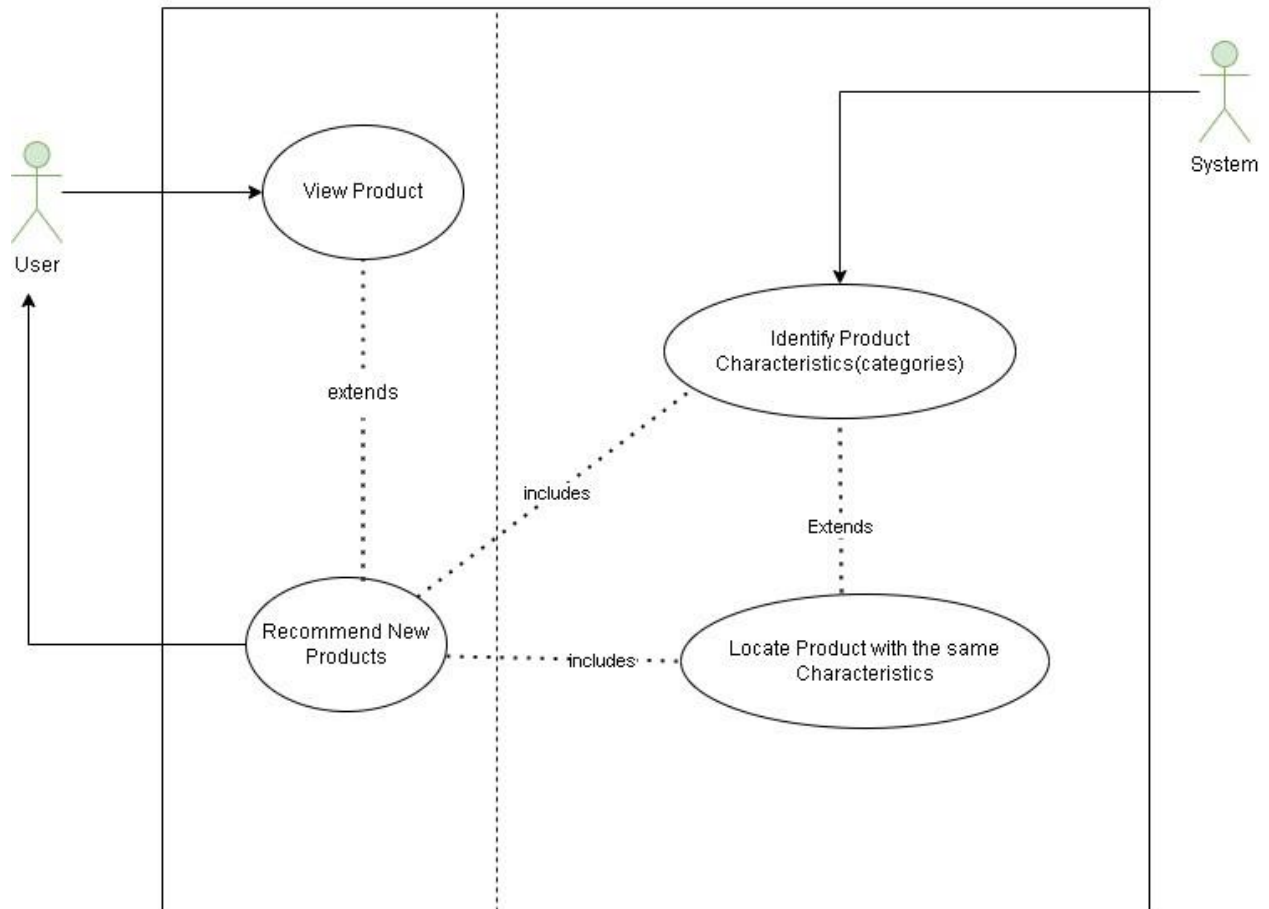


Figure 7 Recommendation Management Use case

6. System Functionality with Activity and Sequence diagram

6.1.Registration system

6.1.1. Sequence Diagram

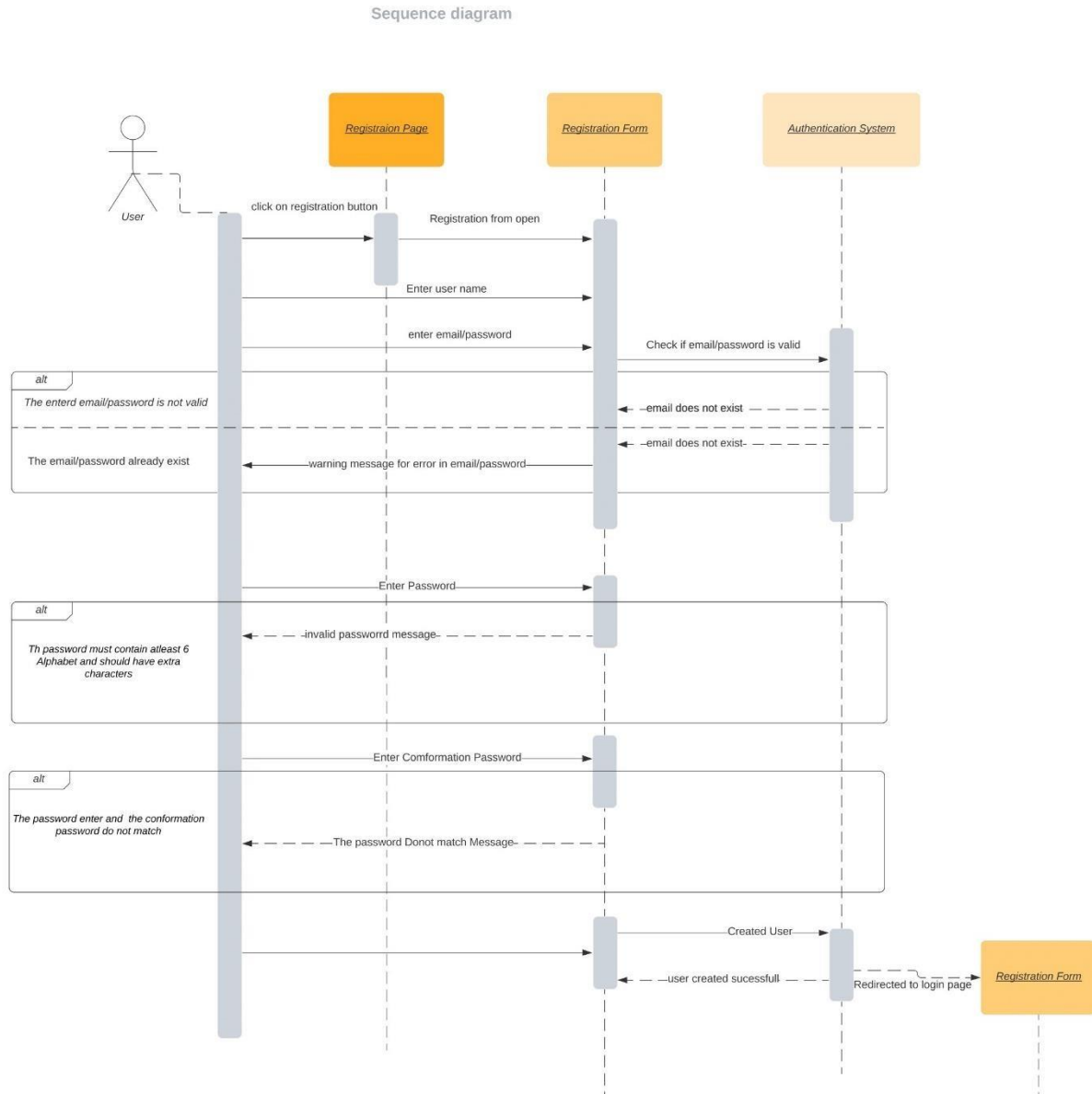


Figure 8 Registration Sequence

6.1.2.

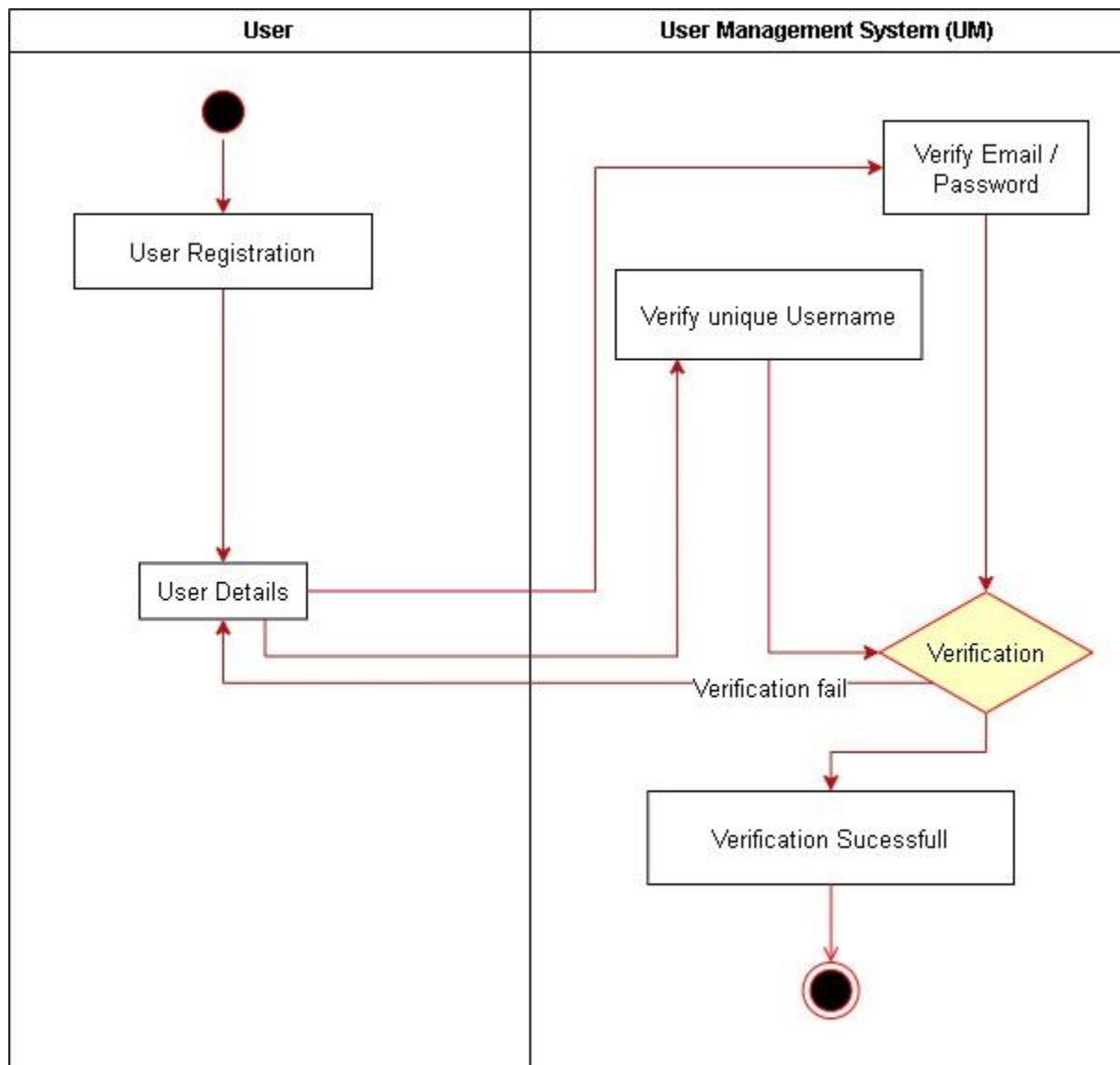


Figure 9 Registration Activity

6.2. Login

6.2.1. Sequence Diagram

Sequence diagram

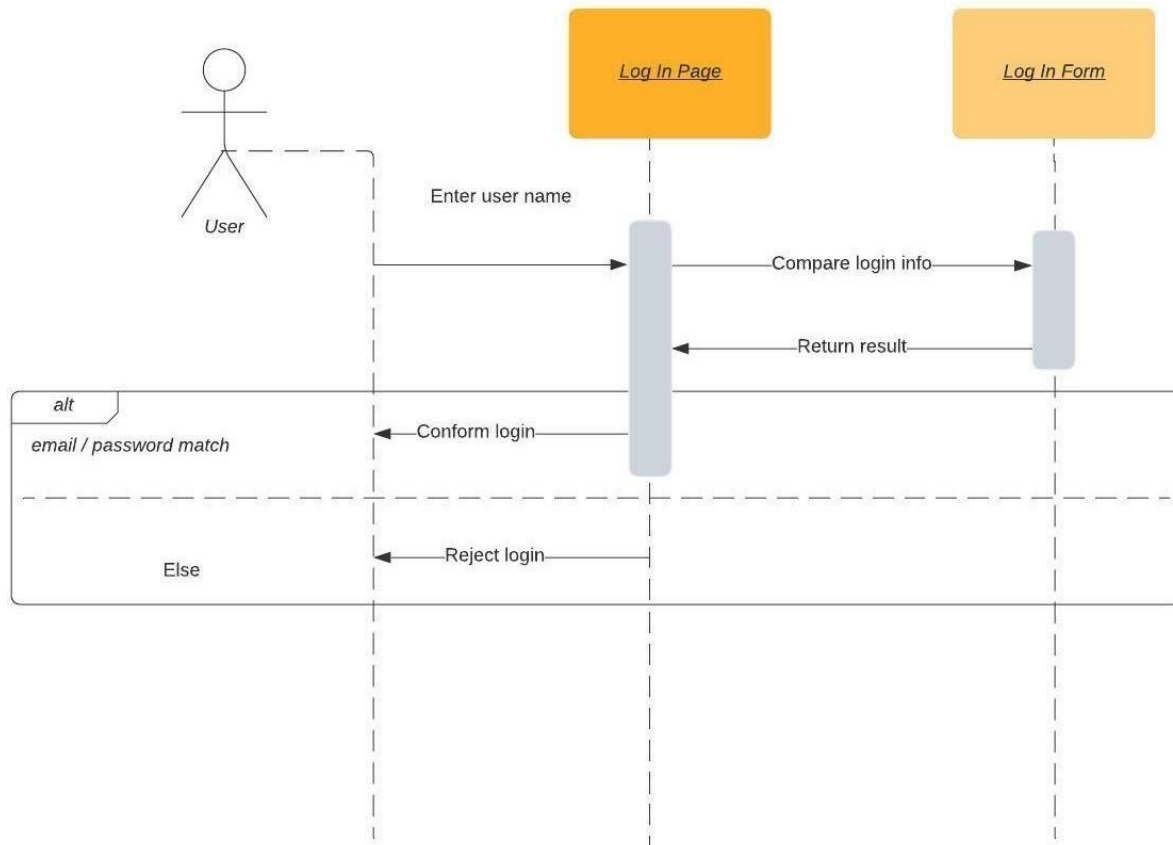


Figure 10 Log in sequence diagram
6.2.2.

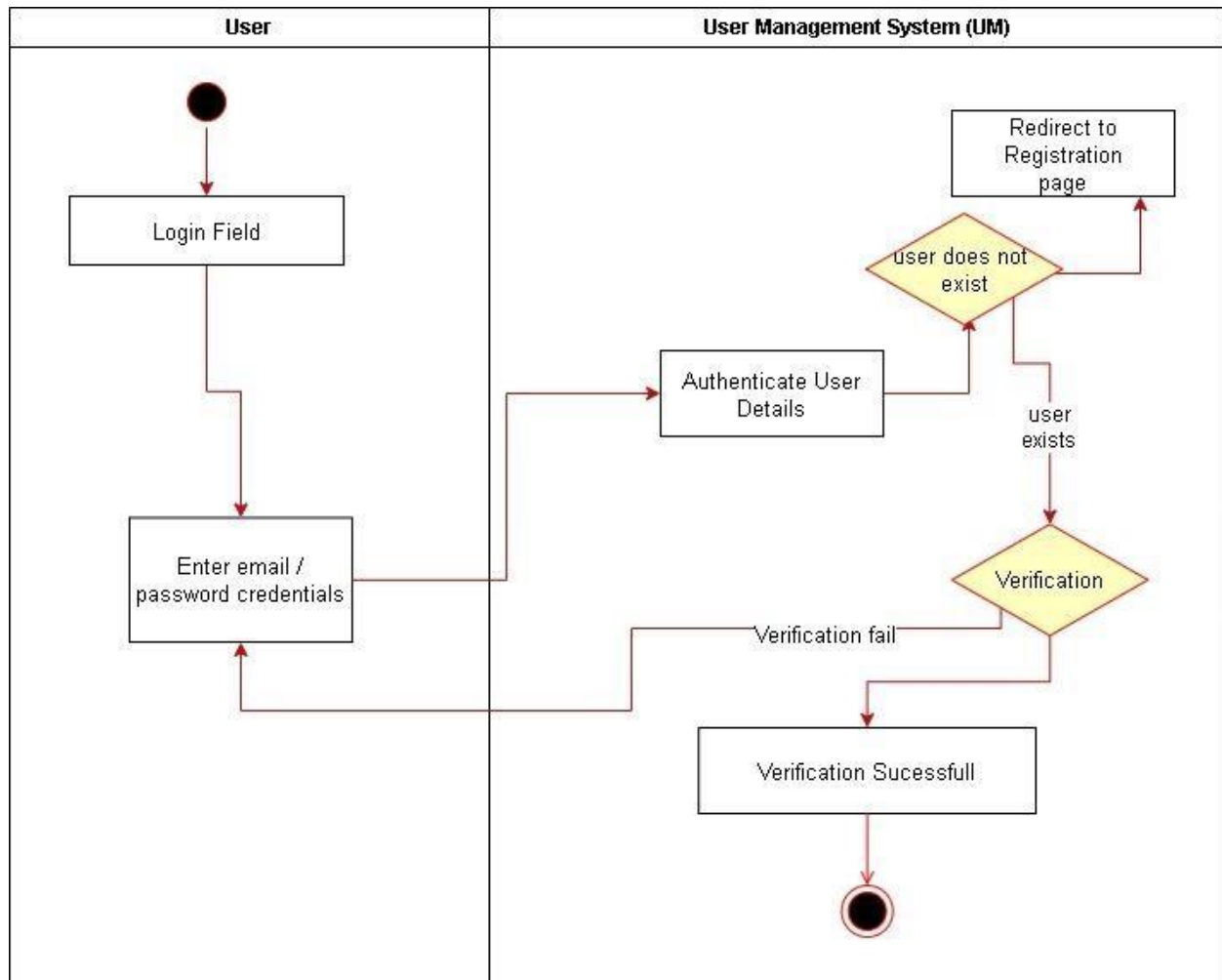


Figure 11 Log in Activity Diagram

6.3.Adding Product

6.3.1. Sequence Diagram

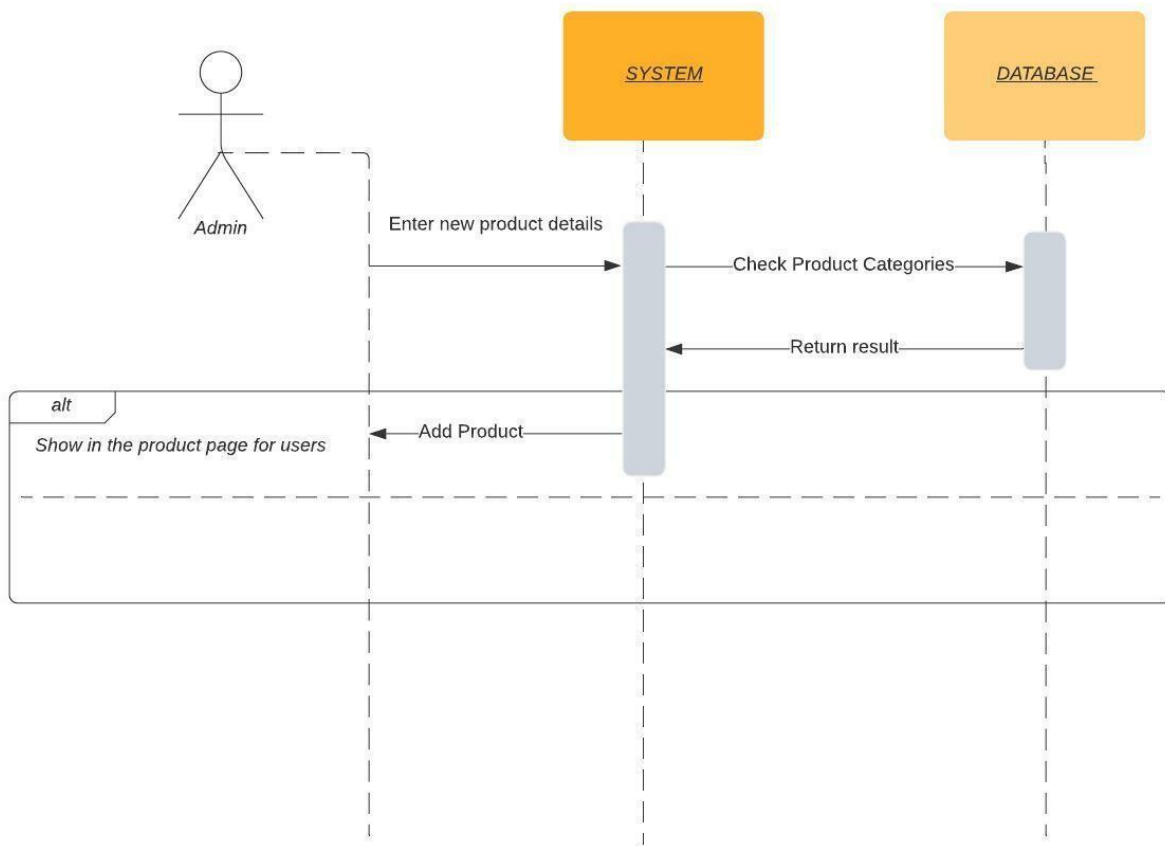


Figure 12 Adding Product Sequence Diagram

6.3.2.

Activity Diagram

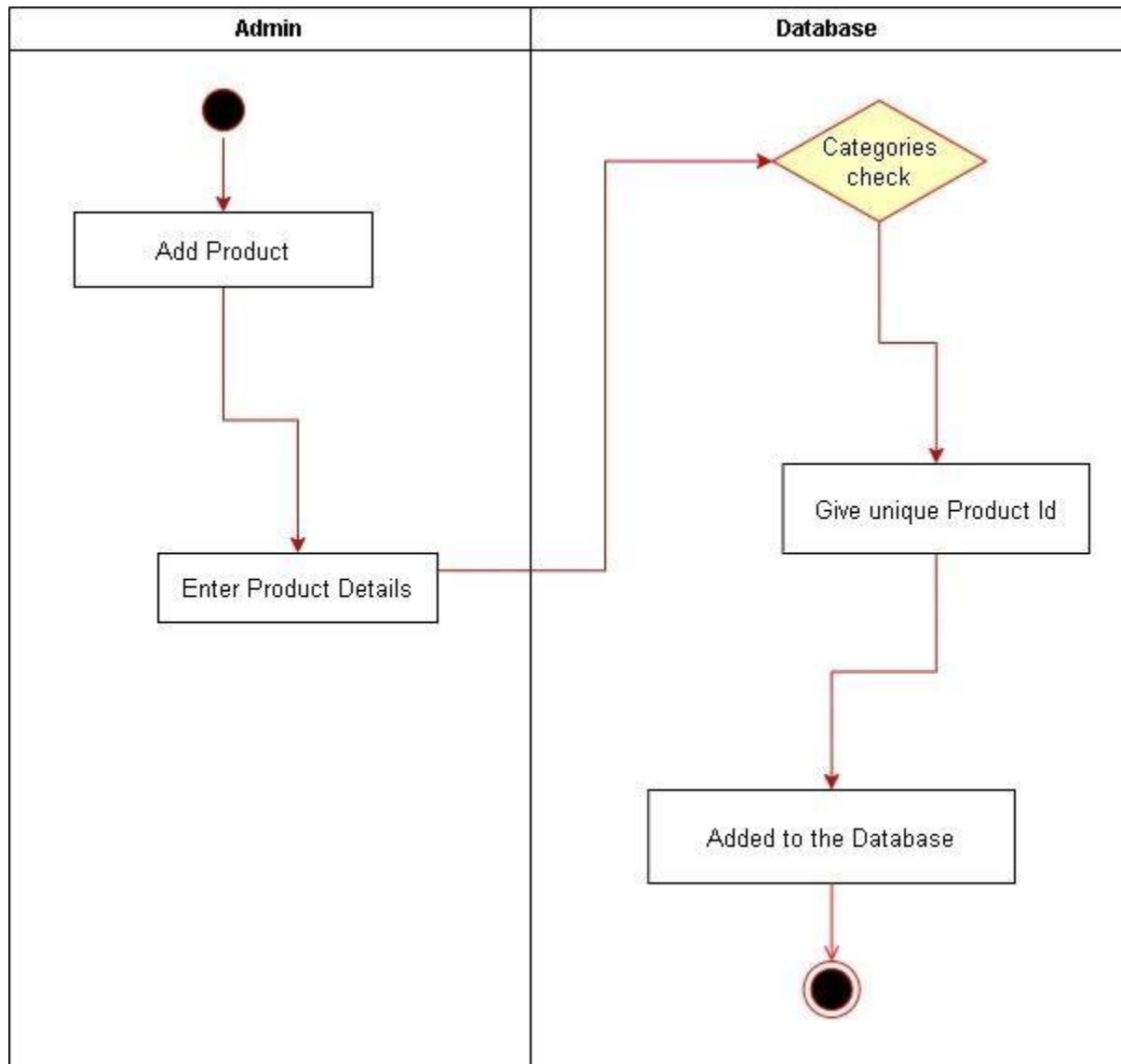


Figure 13 Adding Product Activity Diagram

6.4. Updating Product Details

6.4.1. Sequence Diagram

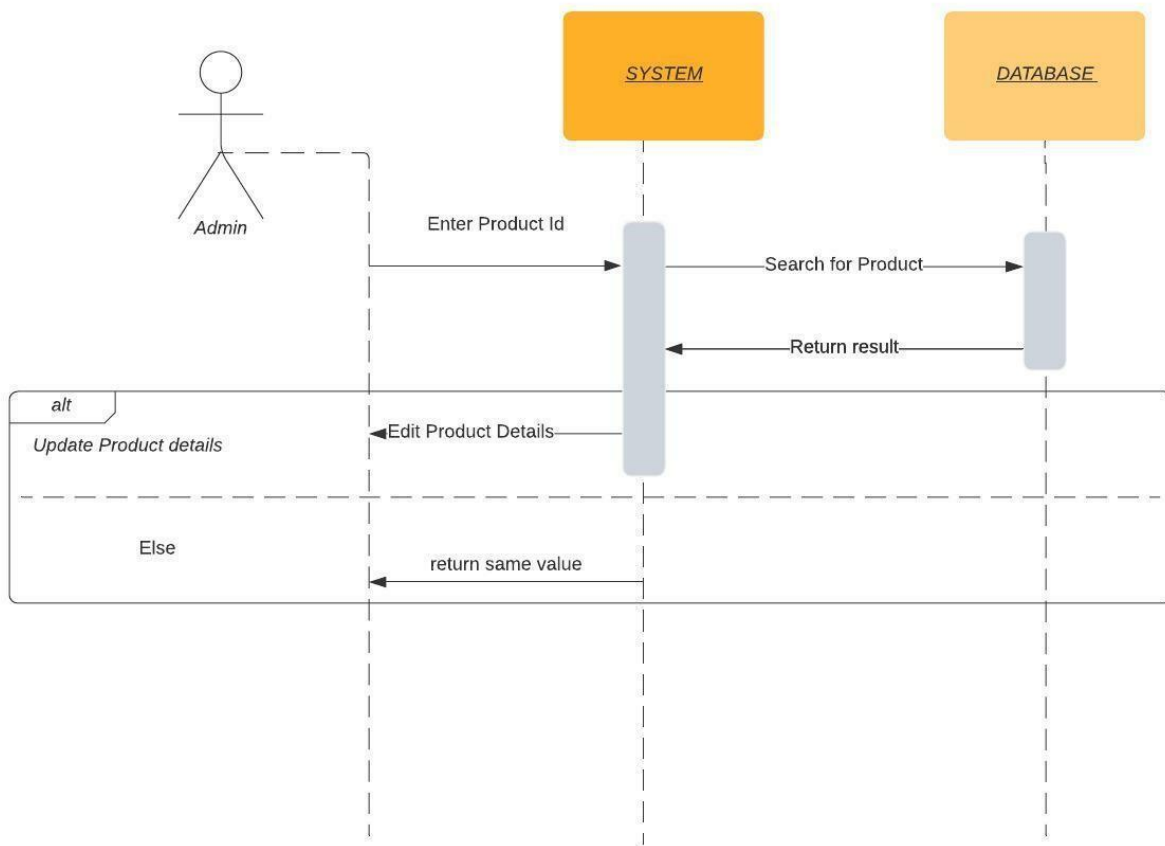


Figure 14 Updating Product Sequence Diagram

6.4.2. Activity Diagram

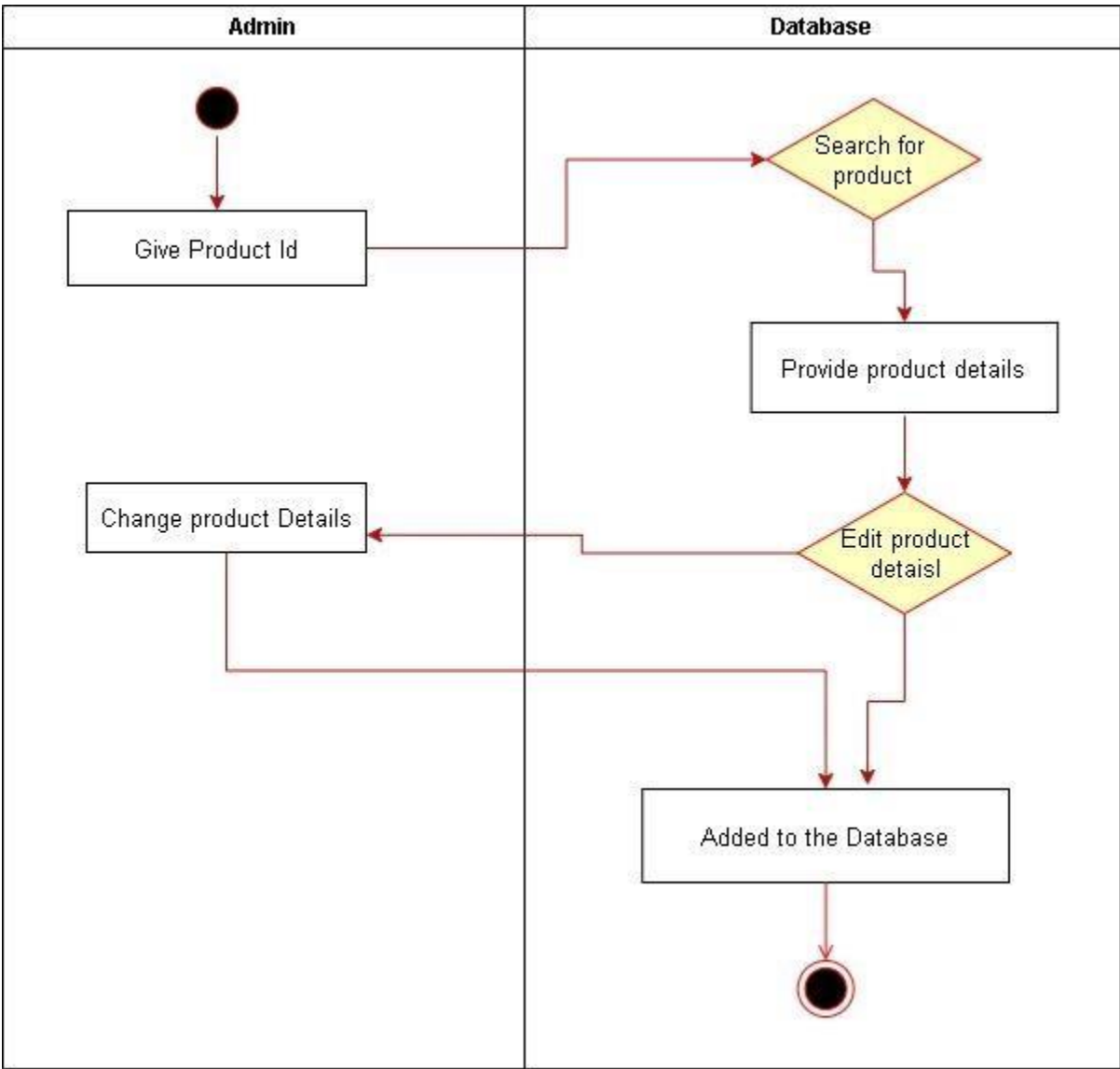


Figure 15 Updating Product Activity Diagram

7. Data Dictionary

Field: name, user_id, product_id, email, password, product_name, categories

Field Name	Description	Data Type	Character Length	Example	Required	Accept Null Value
User_id	Store user unique id to identify user (primary key)	Int	100000	1	Yes	No
Product_id	Store product id to identify the product (primary key)	Int	100000	12	Yes	No
Name	Store user name	varchar	25	Upshot	Yes	No
Password	Store user password in encrypted format	varchar and int	25	P@ss12	Yes	No
Email	Store the user email address to log into the website	varchar	35	@info.mail	Yes	No

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8. Wireframe

8.1. Homepage

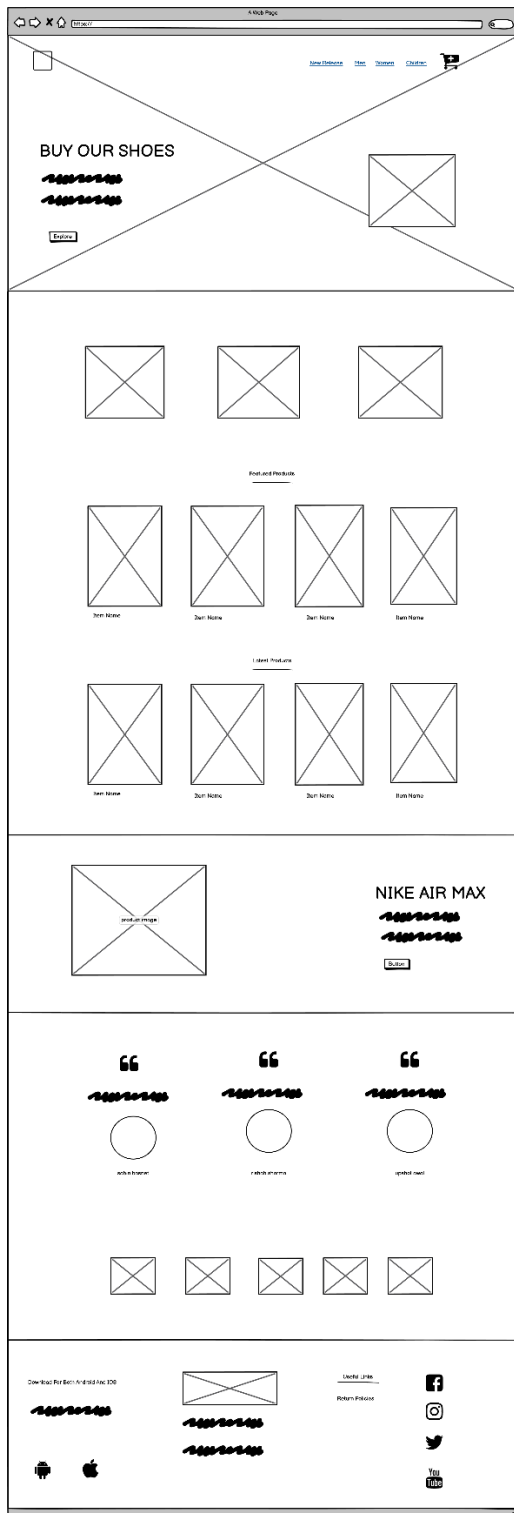


Figure 16 Home page
8.2. Product View Page

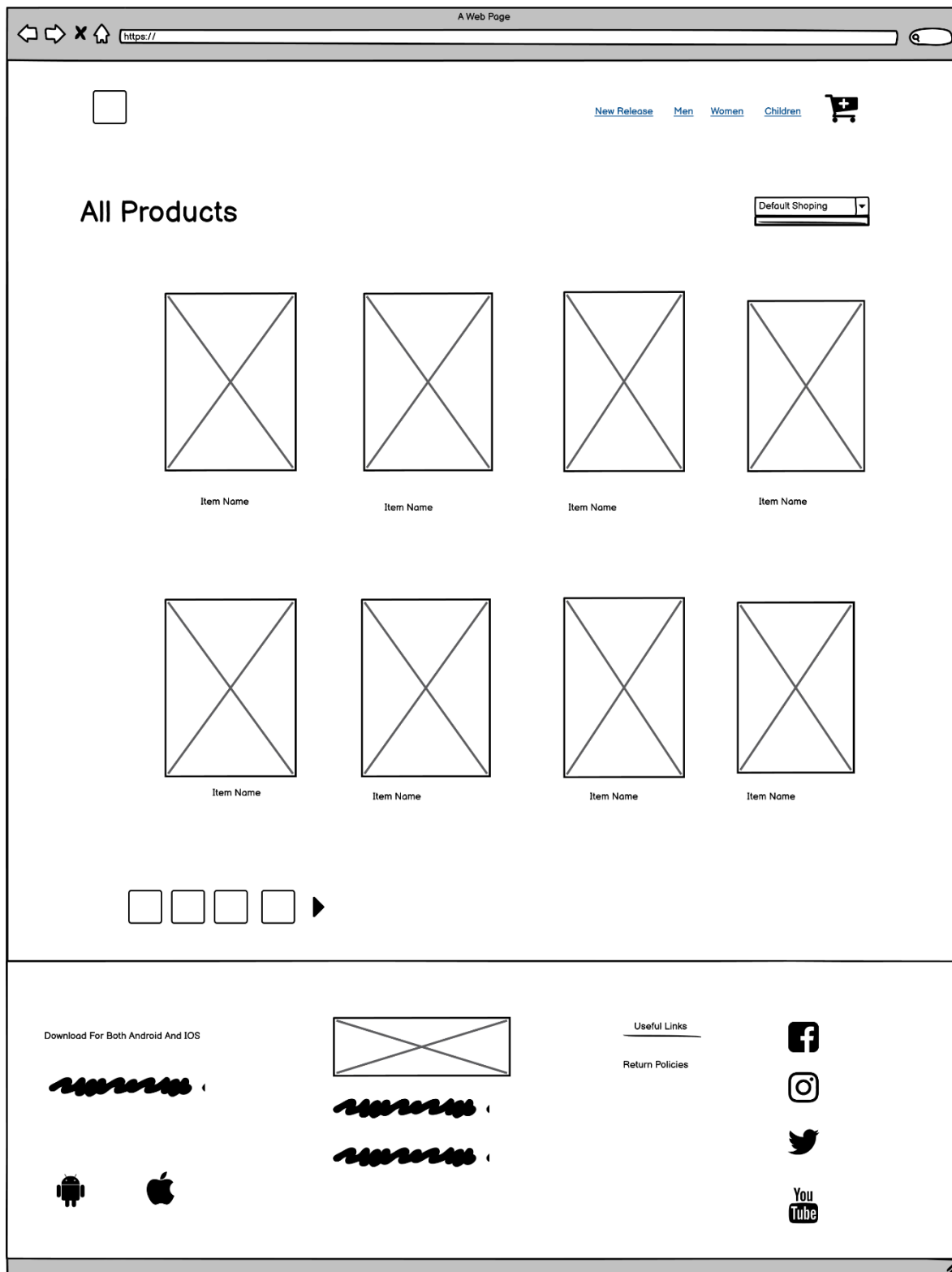


Figure 17 Product Page

8.3. Cart Page

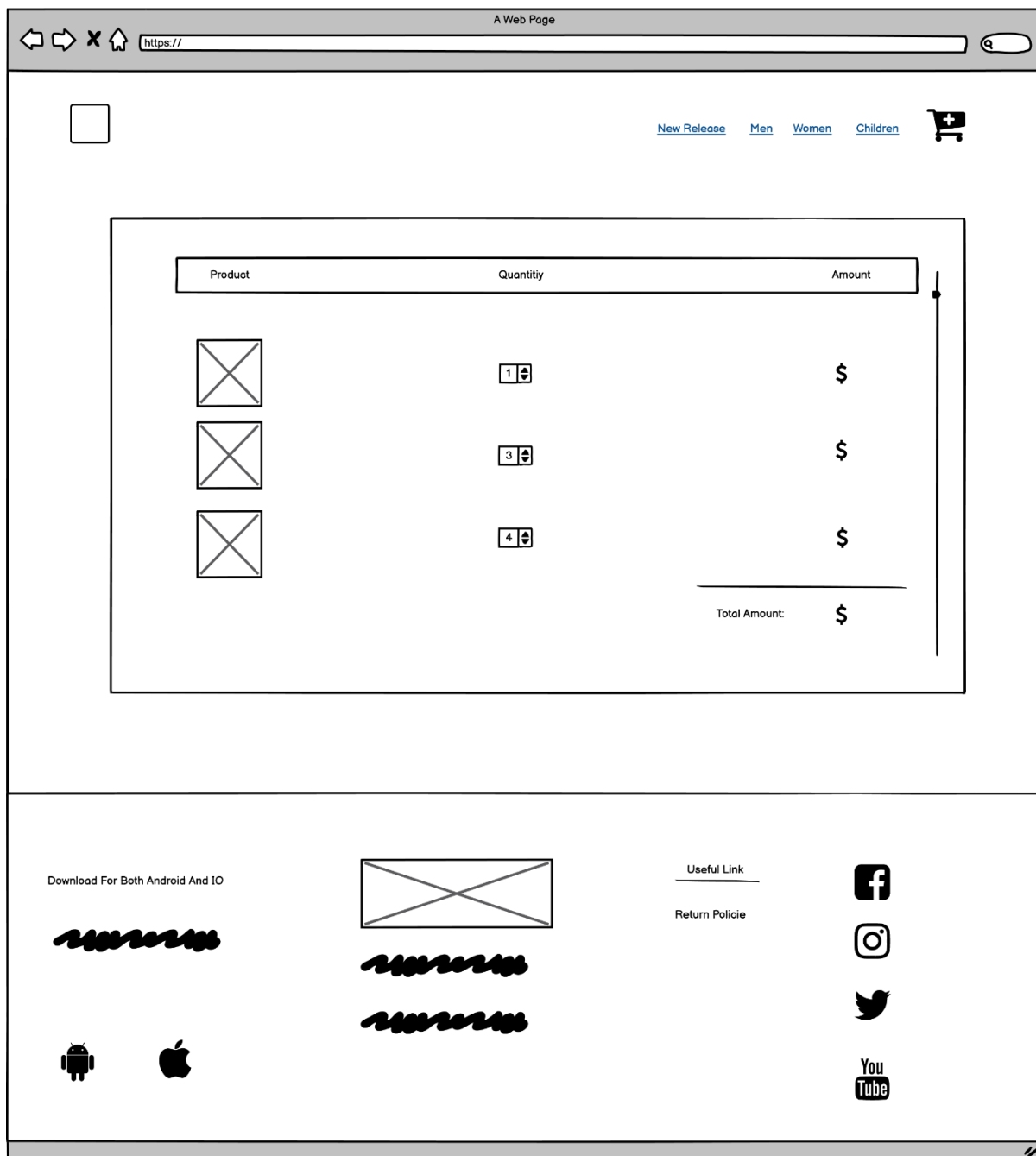
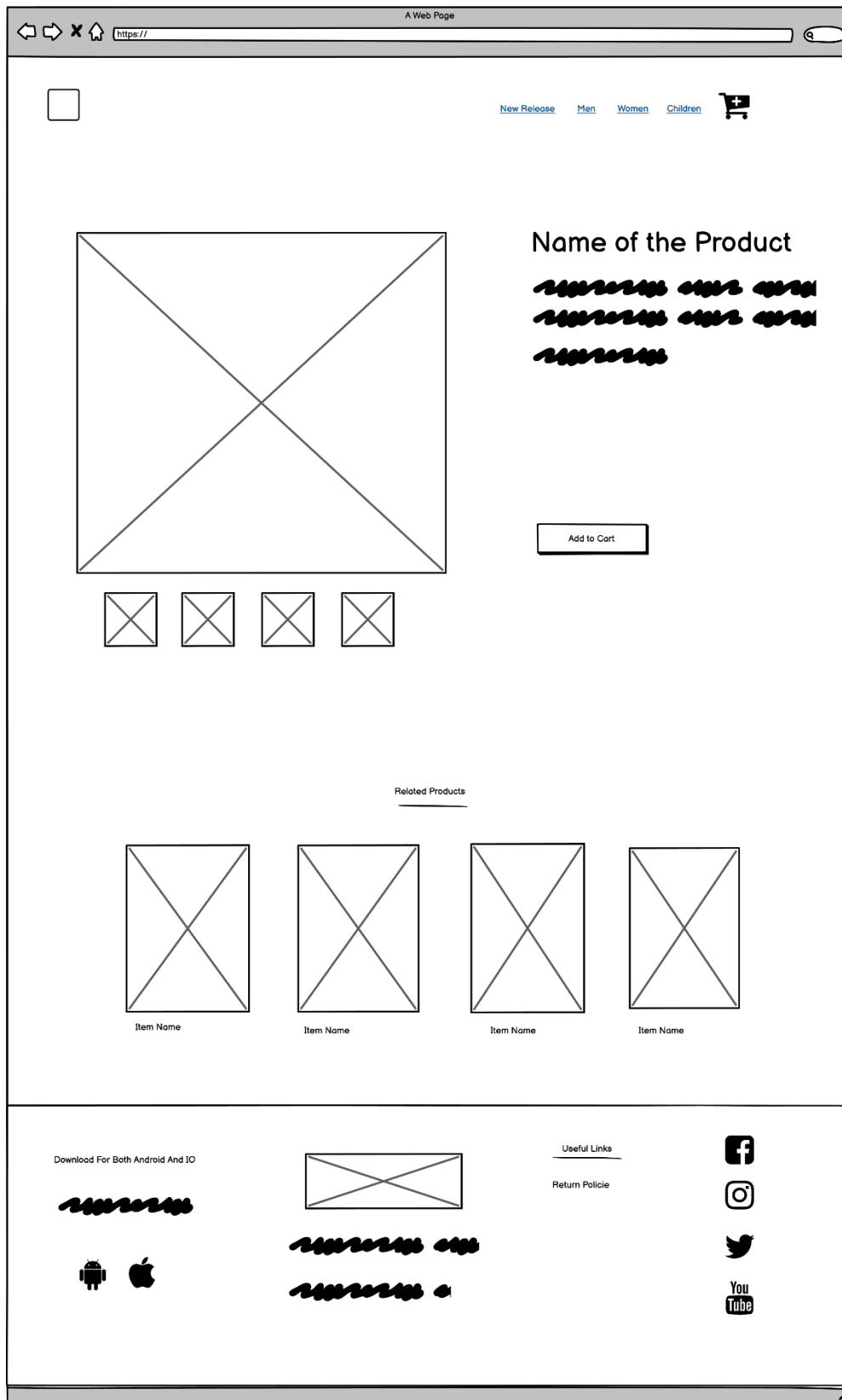


Figure 18 Cart Page

8.4. Product Detail Page



8.5. Payment Detail Page

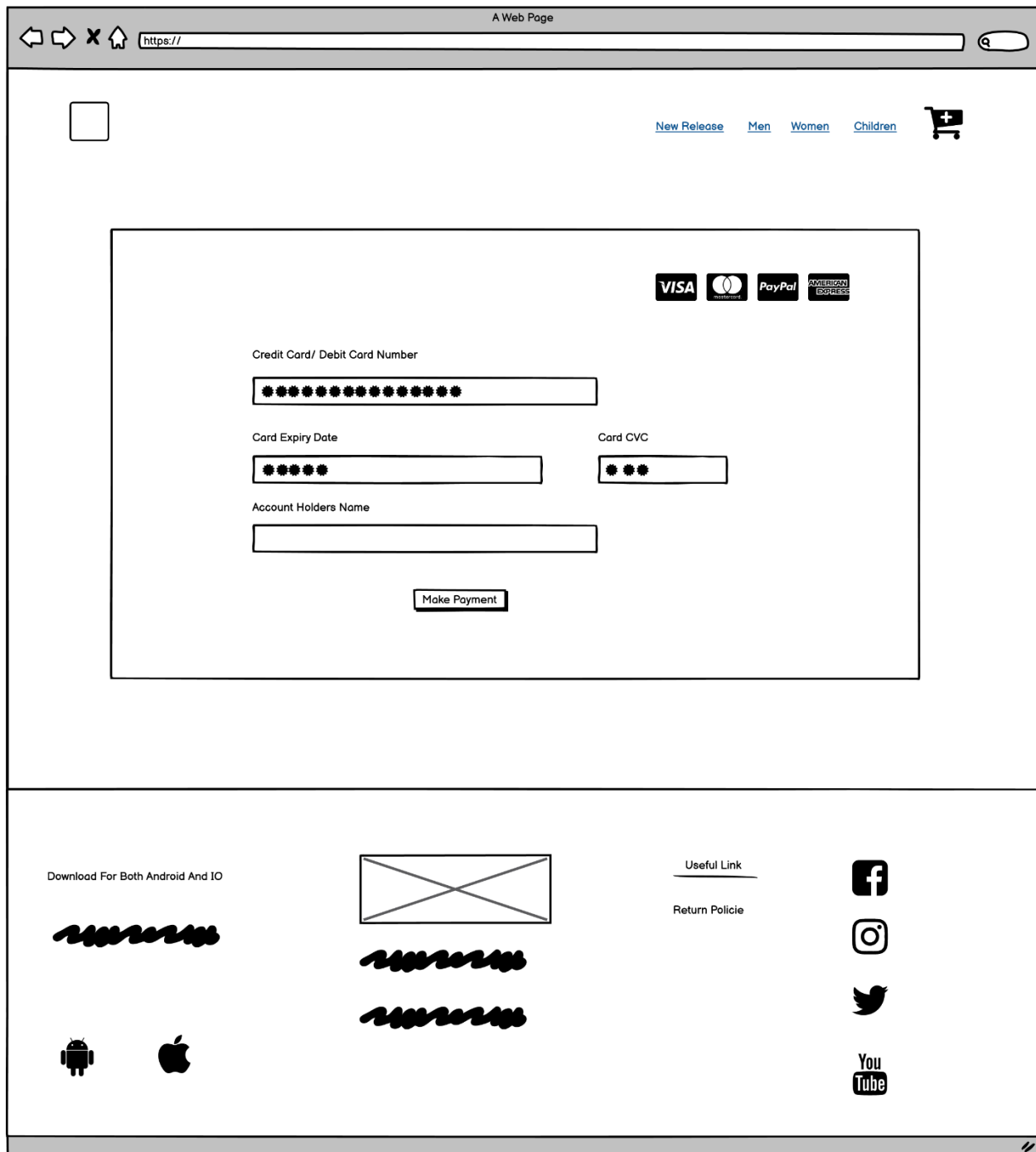


Figure 19 Payment Page wireframe

9. Test Case

TC ID	Test case Title	Precondition	Steps	Test Data	Expected Result	Actual Results
TC_001	Verifying Admin Login	1. Should have admin access.	1. Enter email id. 2. Enter Password. 3. Click on login button.	Email: admin Password: admin12345	Admin should be redirected into administration page.	Admin is redirected into administration page.
TC_002	Verifying Admin Login	1. Should have admin ID and Password.	1. Enter email randomly or any unregistered email.	Email: ADMINN Password: admin12345	Invalid email popup should show.	Invalid email popup is shown.
TC_003	Verifying Admin Login	1. Should have admin ID and Password.	1. Enter email id. 2. Enter random password. 3. Click on login button.	Email: admin Password: qwerty	Invalid password popup should show.	Invalid password popup is shown.

TC_004	Verifying Admin Login	1. Should have admin ID and Password.	1. Leave email field blank. 2. Leave password filed blank. 3. Click on login button.	Email: Password:	Please fill in this filed popup should show.	Please fill in this filed popup is shown.
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Conclusion

Critical Evaluation of the project

Evidence of Project Management

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Appendices

