# AI Based Inventory and Sales Optimizer

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SESSION 2017-2021

AI Based Inventory and Sales Optimizer

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A DISSERTATION SUBMITTED AS A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN SOFTWARE ENGINEERING

DEPARTMENT OF COMPUTER SCIENCES
COMSATS UNIVERSITY ISLAMABAD,
ATTOCK CAMPUS – PAKISTAN

SESSION 2017-2021

# UNDERTAKEN

We certify that this is my/our own work. The work has not, in whole or in part, been presented elsewhere for assessment. Where material has been used from other sources it has been properly acknowledged. If this statement is untrue, we acknowledge that we will have committed an assessment offence and shall be liable to punishable action under the plagiarism rules of HEC.

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| Dated: _____ | Dated: _____ |

# FINAL APPROVAL

Certified that we have read this project report submitted by Mr. (Adeel Ahmed/Muhammad Haris) and it is, in our judgment, of sufficient standard to warrant its acceptance by Department of Computer Science, COMSATS University Islamabad, Attock campus, for the (BS degree) in Computer Science.

***Committee:***

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3. Chairperson _____
   (Chairperson Name)

4. Dean/Director _____
   (Dean/Director Name)

# DEDICATION

Dedicated to my parents, teachers, and best friends

# ACKNOWLEDGEMENT

We would like to express our gratitude to my primary supervisor, Madam SADIA IJAZ, who guided us about this project, and without her supervision and assistance, we would not be able to bring this project to its completion. I would also like to appreciate my friends and family who supported me during the timeline of this project.

We also acknowledge the help provided by the lab staff and all faculty staff of the computer science department to provide enough courage and support which helped us in completing our project in COMSATS University Islamabad, Attock campus.

# PROJECT BRIEF

| | |
|---|---|
| PROJECT NAME | /* AI BASED INVENTORY AND SALES OPTIMIZER*/ |
| ORGANIZATION NAME | /* COMSATS*/ |
| OBJECTIVE | /* TO MAINTAIN, TRACK SALES RECORD AND HELP IN OPTIMIZATION OF PRODUCTS STOCK */ |
| UNDERTAKEN BY | /* ADEEL AHMED, MUHAMMAD HARIS */ |
| SUPERVISED BY | /* MADAM SADIA IJAZ */<br>/* DESIGNATION */<br>/* COMPUTER SCIENCE */<br>/* COMSATS UNIVERSITY ISLAMABAD, ATTOCK CAMPUS*/ |
| STARTED ON | /* START DATE */ |
| COMPLETED ON | /* END DATE */ |
| COMPUTER USED | /* HP NOTEBOOK 250 G4 */ |

| | |
|---|---|
| SOURCE LANGUAGE | /* JAVA, PYTHON */ |
| OPERATING SYSTEM | /* ANDROID */ |
| TOOLS USED | /* ANDROID STUDIO, SQLite, GOOGLE DRIVE, ADOBE ILLUSTRATOR */ |

# ABSTRACT

The purpose of this Android application project is to provide a platform for shopkeepers or small business owners who will not be able to simply track and maintain a record of their daily sales or purchase activities, but also will be able to keep the inventory updated with the latest items which are mostly sold or in which users are mostly interested to buy them and to forecast the number of sale items in coming time through the use of AI. This application will be best suitable to be used by shops or small-scale business owners. This application will also allow its users to maintain data backup their value able data on local or on Google drive storage.

To use this application the users simply must register with their unique Email, Password, and other details like shop or store Name, Phone Number, Address, etc. After they have successfully registered for the first time they have to update their inventory database, by adding sale product details and their barcode code. Once the database of inventory has been created then from onwards the inventory products are simply updated using bar code through scanning it and entering the amount of specific item. Users will be also able to add details about their customers and vendors, to track other stats and analytics like profit or loss, commission, sales report on a daily, weekly, or monthly basis, etc not only in numbers but also in graphs. The application will be designed in a way to be secured enough with minimal and modern for easy and flexible use by even a layman person, so maximum people could benefit through this application.

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# Chapter 1

# Introduction

## 1.1 Project Background

The idea behind the proposal of this app is that the trade or finance sector of any country plays an important role in its GDP from small to mega-scale. So, while keeping this thing in our mind we decided to develop an app that will not only assist the business or shop owners to track and maintain the data of their business products or stock but will also perform some smart operation like giving useful suggestions about most selling products and making future sales predictions of different products based on the previous data. So, based on these suggestions shop owners will be able to keep their stock updated for future product sales to enhance their business.

This app will replace the manual or traditional paperwork system of maintaining and tracking data about sale products. So ultimately it will assist shop or business owners to get rid of paperwork expenses and will also help to save their time as compared to a manual paperwork system.


**Figure 1.1 Traditional paperwork system**

## 1.2 Brief

In this overall process, we are maintaining and tracking our stock products using this app in a very simple straight through our smartphone. So, the very first step in this whole proves will be that the user is first asked to register or signup by providing the required details like name, email, phone, password, etc. and afterward, he can log in using these credentials. Now the user will enter the product details of his stock like

the product name, category, id, image, purchase price, sale price, quantity, barcode and can customize these details according to his choice. So, for the very first time, the user will have to manually create a database and its entries, but later he can simply scan a barcode of any item from his smartphone using this app to update its details in inventory. This unique feature of barcode scanning will help to save a lot of time for shop or business owners while purchasing and selling any item.

Afterward, there will be another section of vendors and customers where users will be also able to add the details about them like their Name, Phone number, address, etc. and these details will be used while buying any item from a vendor or selling any item to his customers.

Another useful option in this app is tracking stats and transactions which the user can filter out on a daily, weekly, or monthly basis. Through this feature, users will be able to check how many products are sold and purchased and what is the amount and revenue generated or spent through them respectively. Moreover, the user will be also able to check profit or loss made through any item on a different time basis.

To remain updated or to be aware of any product quantity in stock is very important to keep the business in a running state. So, there will be an option of "Check Status" through which user can check shortlisted item which is below specific quantity and their stock needs to be updated. Through this feature, the user will be able to check inventory status and remain updated in real-time just on a button click instead of manually checking each item.

The most unique and core feature behind the development of this app is not only to track the sales items and business stats but instead it's the use of AI and data mining to optimize and predict the sale items by any shop or business owner to keep their inventory updated. So, through analyzing the trend that which product is currently most sold, or products which are usually purchased with other items and in which users are most interested we can achieve our goal.

## 1.3 Relevance to Course Modules

### 1.3.1 Machine Learning

In this course, we studied different machine or model training algorithms like "Neural Network" which will be used to perform sales forecasting using current data of the user.

### 1.3.2 Artificial Intelligence

We studied this course in 6$^{h}$ semester and we will be using AI along with data mining different data mining algorithms like "Apriori" or "Eclat" to know about the most sold products and interests of the customers.

### 1.3.3 Report Writing Skills

In his course, we learned about how to write professional reports and other formal documentation, for our FYP and in our professional life. So, this course is helping a lot at this stage while preparing this documentation.

## 1.4 Literature Review

This part contains the details about the previous related work and reports that have been completed. So, if we talk about the work efforts that have been done in the past 2 centuries to replace the manual system of inventory management done by human beings is described below.

In 1889, Herman Hollerith developed the first modern automatic computation machine. Replacing pen and paper and saving countless hours, the tabulator and sorter machine was specially designed to record information using punch cards.

In the mid-1970s, the barcode was introduced as a primary inventory management tool. This helped drive down costs for inventory management because retailers in the United States and Canada didn't have to purchase multiple barcode readers to scan competing barcodes.

In the early 1980s, personal computers began to be common and popular. This further pushed down the cost of barcodes and readers. It also allowed the first versions of inventory management software to be put into use, which was a new base for the upcoming era of future revolution towards the development of inventory management systems or apps.

Nowadays some of the modern and simple inventory management apps that are available on the play store are listed below.

### 1.4.1 Daily Sales Record App

The app for the business which saves your time & money without any technical knowledge. A simple way to Track Unlimited Sales, Profit, Stock, Generate Invoice,

CRM, POS & much more for FREE. Smartly designed for small-business owners and entrepreneurs.

### 1.4.2 Stock Management App

This app can be used by all types of businesses and organizations that have inventory. The expected benefit of this app is accurate and smooth inventory counting and record, and frictionless communication between inventory and sales teams, and inventory and purchasing teams.

## 1.5 Methodology and Software Lifecycle for This Project

So, for the development of this project, we will be using the "Iterative Approach" because we can distribute our goals and requirements in several chunks that can be incrementally implemented and delivered. At any stage, the plan is made just for the next increment and not for the whole project.

Therefore, we will be using the "Iterative Approach" due to its flexibility in accommodating new requirements or changes. It also provides room for improvement in succeeding iterations based on lessons learned from previous iterations. A basic flow process of the "Iterative Approach" is shown in the diagram below.

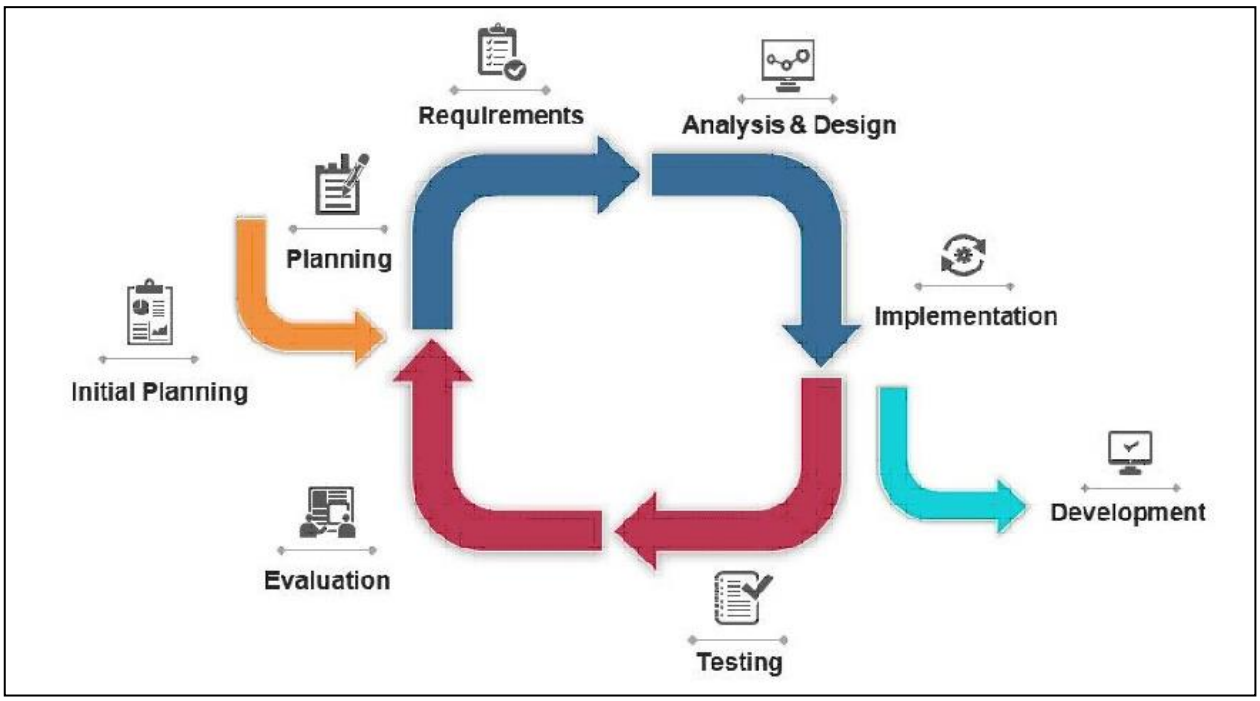


**Figure 1.2 Iterative Approach diagram**

# Chapter 2

# Problem Definition

# 2. Problem Definition

The main aim of our project is to automate the manual operation of inventory management and also provide the sales predictions and useful suggestions about the most selling products to maintain the stock updated for future sales.

## 2.1 Problem Statement

As technology evolution is getting fast day by day so people are getting more dependent on technology. Technology is almost impacting every aspect of our life so, on behalf of this approach we decided to develop an app to assist shop or small warehouse owners to facilitate them from their smartphones. While proposing this idea we kept in our mind that these people usually cannot afford a computer operator or hire an accountant who will responsible to maintain the records of sales and inventory to run the business successfully. So, in this aspect, this free app will provide major benefits to them by saving their time and money. Not only this but it will also help to optimize their sales and keep the inventory updated with the most selling products.

## 2.2 Deliverables

### 2.2.1 Mobile based application interface:

A responsive and meaningful mobile-based application interface for android devices that will allow the user to explore through the application in their perspective and ultimately will provide easiness and comfort to them.

### 2.2.2 Inventory setup:

Here users will have to enter the products detail which are currently present in his inventory and can customize them in different categories based on his own choice.

### 2.2.3 Image and barcode uploading:

The users will be able to upload images of different products in their inventory list and their barcodes also if they are available.

### 2.2.4 Barcode scanner:

The barcode uploaded by the user of any specific product can be used later to update its details in inventory later onwards by simply scanning it through the app which will save a lot of time.

### 2.2.5 Product sale prediction and optimization:

This section is about the suggestion and sales provided by AI and data mining algorithms by analyzing the previous sales records of any user to help in optimizing his sales and maintain the stock of products in inventory.

### 2.2.6 User data export and backup:

This section is about saving the previous value able data of the user. So, to preserve it we will be creating a local backup or a google drive backup.

## 2.3 Development Requirements

Following are the requirements which must be fulfilled by the user to run this app smoothly on his android smartphone.

### 2.3.1 OS requirement

Smartphone with Android OS 4 or above than this.

### 2.3.2 Software requirements

IDE: Android Studio, IDLE or PyCharm

Programming Language: Java, Python

### 2.3.3 Other tools

For designing app graphics, we will use Adobe Illustrator.

For making documentation we used Word. And for presentation we used PowerPoint.

## 2.4 Current System

Following are the related features of our system in running state which is successfully tested.

The system can

- Allows the registration of the user with the required details.
- The user can log in and logout of the system using his credentials.
- The system also allows the user to enter the product details and upload its image and barcode.
- Users can view the products entered into their database.
- The system also allows the user to enter the details of his vendors and customers.
- Users can customize their products based on category and brand.

# Chapter 3

# Requirements Analysis

# 3. Requirement Analysis

Software Requirement Analysis (SRS) provides a basic understanding of functional as well as non-functional requirements of any system. We valued this approach very much as a starting point of our project because it serves as a written contract between us and the project committee. It highlights the possible features and functionalities of our project. With the help of SRS, we tried to make a clear understanding of the system deliverables to the project committee.

## 3.1 Use Case Diagram

The use case diagram of our system is given below. The user is the main entity or focal point in this application. First, he will log in or register to start using this app, and then will carry on other operations.

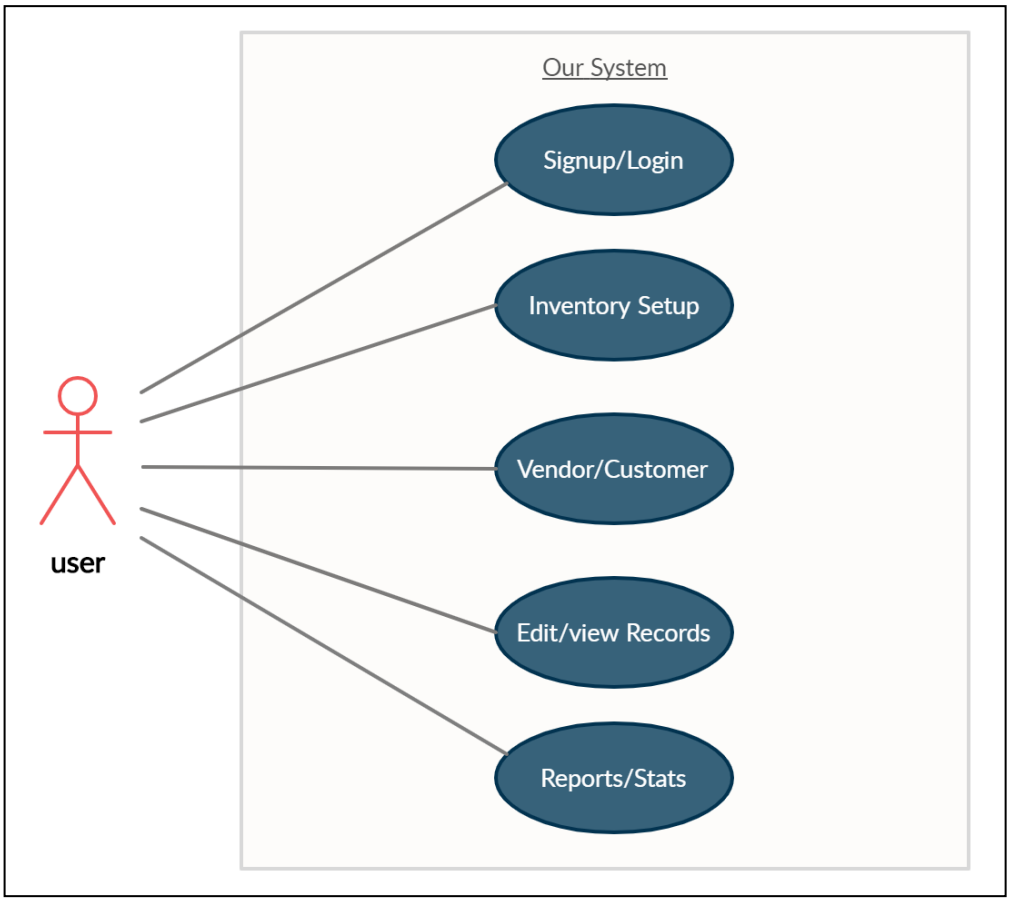


**Figure 3.1 Use Case Diagram**

## 3.2 Detailed Use Case

The use cases shown in the figure above are separately described below with clear details and action taker.

### 3.2.1 Signup/Login

**Use case name:** Signup/Login

**Action:** User

**Summary:** The user will provide the required details for the login or signup process, as an initial step to use this application.

**Pre-condition:** The user must provide correct details while signup and use similar details to login into the system, otherwise he has to face errors.

**Post-condition:** After signing in user can freely explore the app to carry on other processes.

### 3.2.2 Inventory setup

**Use case name:** Inventory setup

**Action:** User

**Summary:** The user will set up his inventory database when using this app for the first time. He can enter different details about the stock products and can also upload their image, barcode. He can even customize his stock products in different subcategories as per his choice.

**Pre-condition:** The user will enter the name. price, image, and other similar details for his products for inventory setup.

**Post-condition:** The user can also edit these details afterward whenever required.

### 3.2.3 Vendor/Customer

**Use case name:** Vendor/Customer

**Action:** User

**Summary:** The user can enter the details about his vendors and customers which will be used at the time of purchasing or selling any item.

**Pre-condition:** The user will enter the name. phone number, address, etc, and other similar details for his vendors and customers.

### 3.2.4 Edit/View Record

**Use case name:** Edit/View Record

**Action:** User

**Summary:** This section contains all the details about the products, vendors, and customers. Here users can view each of them in detail and can edit, update, or delete them.

**Pre-condition:** The user can view, edit, delete all the records of products, vendors, and customers he has entered before.

**Post-condition:** User can still view, perform an update, delete operation on the current data.

### 3.2.5 Report/Stats

**Use case name:** Report/Stats

**Action:** User

**Summary:** User can check all the business stats and reports and can get an idea about the items sold and purchased, profit and loss, etc on a daily, weekly, monthly basis.

**Pre-condition:** The user can only view the stats on a different time basis, but he can't modify them.

**Post-condition:** Stats and reports are generated by the system from time to time by analysing the user sales data.

## 3.3 Functional Requirements

Functional requirements are the requirements that must be present in any system to fulfill its purpose of development, and without those functionalities, a system is considered worthless. So, the functional requirements of our system include;

- Allows the user to sign up to using the app for the first time.
- Users can log in to the app after registering them successfully.
- Add inventory products and their details.
- Can also add image and barcode of inventory products.
- Customize the products on basis of different categories and brands.
- Add customer's and vendor's details.
- Update the product details by just simply scanning its barcode from the app.
- Review and update all the details of products, vendors, and customers by simply filtering out different factors.
- Users can view and track all the stats and records of sales and purchase, profit, and loss on different time periods.

- The system will update the user about the real-time stats of the products in his stock. Moreover, users can just check shortlisted items that are below specific quantity just on a button click.
- Use of local or Google drive storage to back up valuable data of the user.
- To predict or forecast the future sales of any product using ML algorithms like 'Neural network' to keep the stock updated.
- To know about the most selling products and the one which is often sold usually with the other products using data mining algorithms like "Apriori" or "Eclat".

## 3.4 Non-Functional Requirements

Non-Functional requirements of any system are those requirements that specify the quality and reliability of the system, and if these are not present in our system then still we can move our progress ahead. Following are some of the non-functional requirements of our system.

### 3.4.1 Efficiency

Our system is efficient, as it does not require much effort or hard work to operate and can be simply operated even by a layman.

### 3.4.2 Performance

Our system is optimized and it performs very well on all android devices of OS 4 or above. It requires very little time to perform any operation on user action.

### 3.4.3 Flexibility

The system provides great flexibility to the user just like customizing the product details in a very easy way of his choice.

### 3.4.4 Usability

Our system is super easy to use by shop or warehouse owners and can be simply operated even by a layman.

### 3.4.5 Availability

Our system will be published on the Google play store and will be available for free of cost to be used on any android device.

### 3.4.6 Reliability

Our system is tested various times to produce and generate 100% reliable and accurate results.

# Chapter 4

# Design and Architecture

# 4. Design and Architecture

After gathering all requirements of our system, the next step is to start planning that how we are going to design or develop our project, and how much resources, costs, time, benefits, or other items are required. After planning we move to the designing and architecture phase which specifies which techniques and methods we can use to develop our project. It is also the most challenging phase of project development.

## 7.1 System Architecture (Block Diagram)

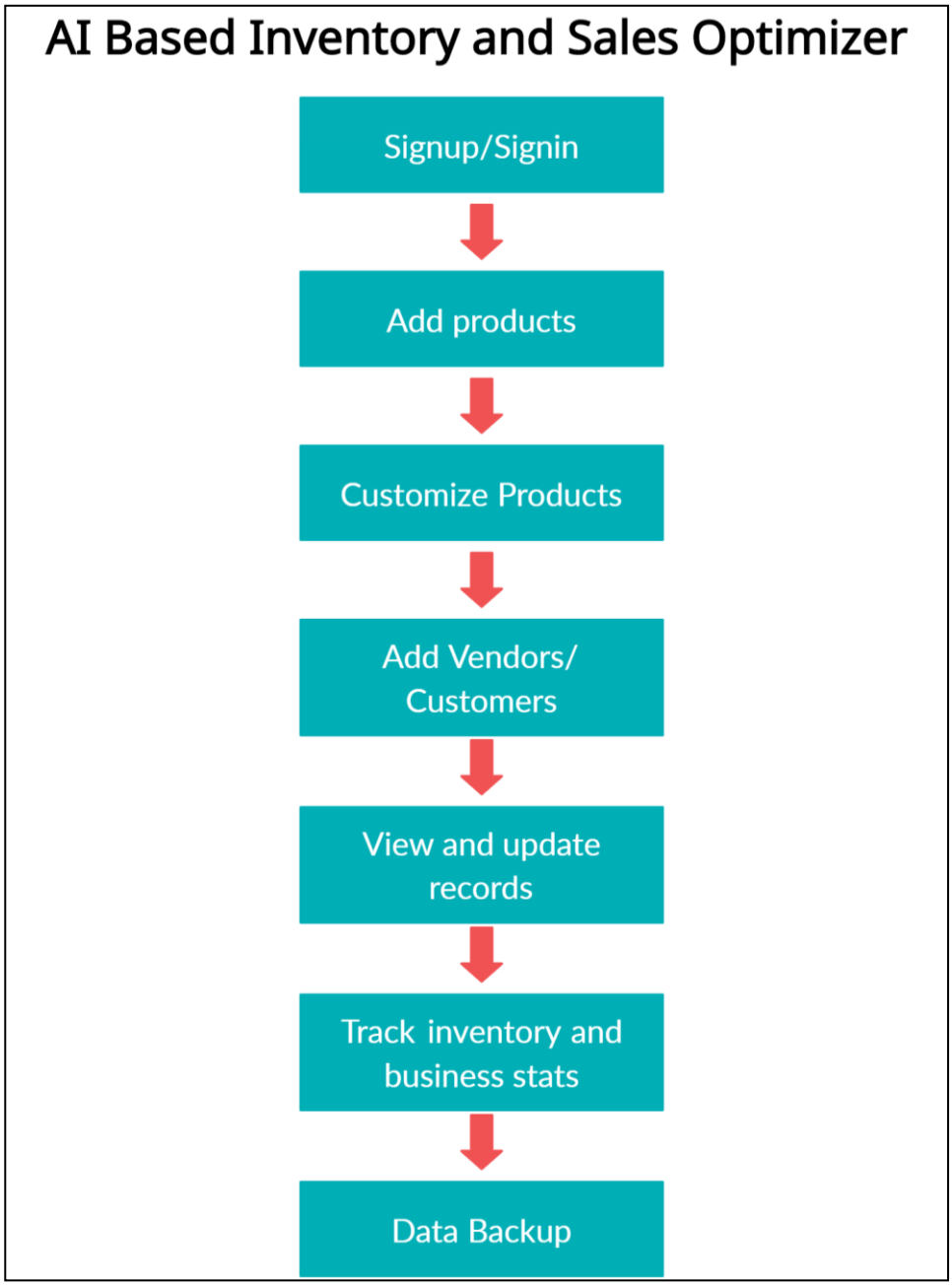


**Figure 4.1 System Architecture Diagram**

## 7.2 Process Flow Representation

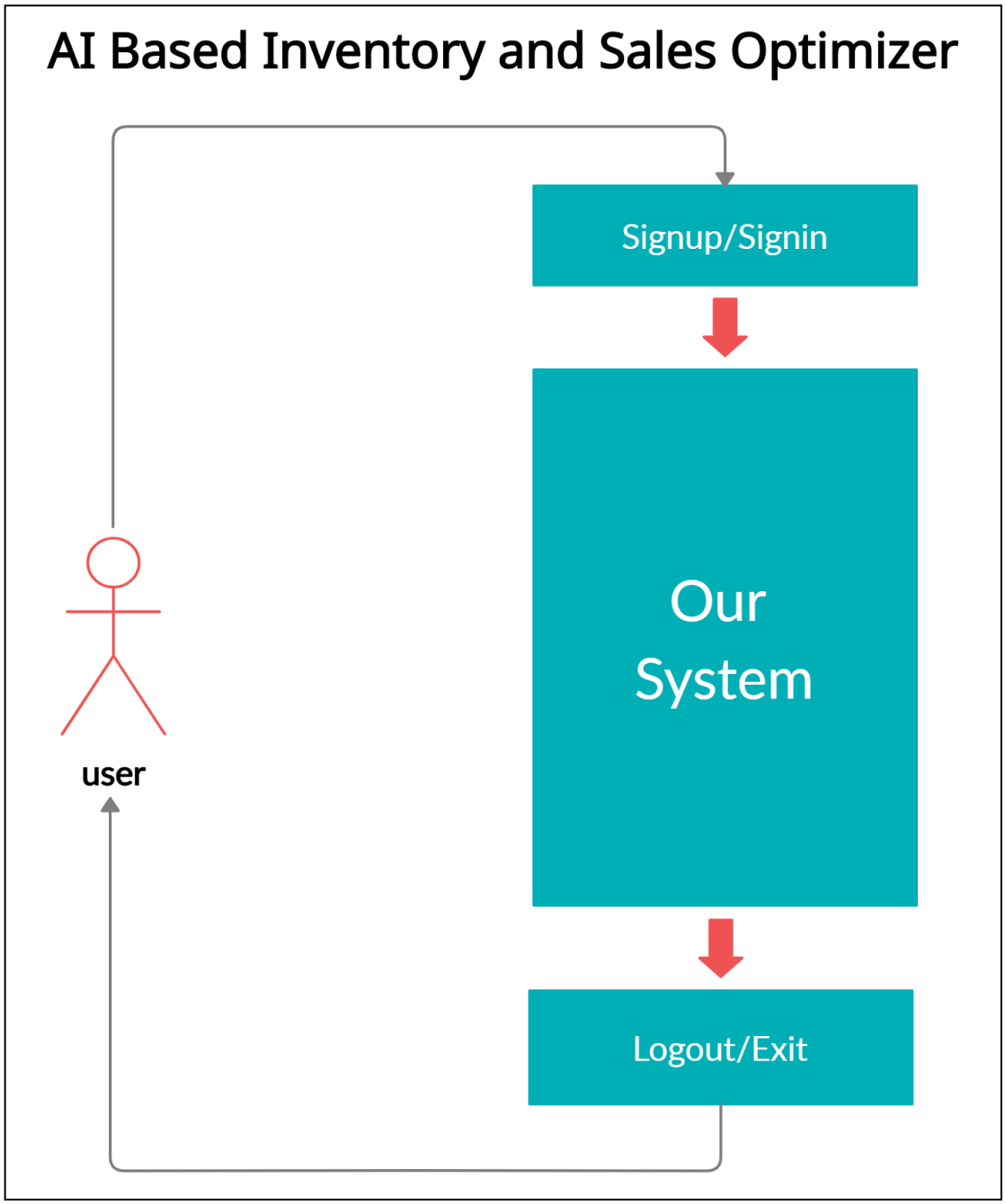


**Figure 4.2 DFD level 0**

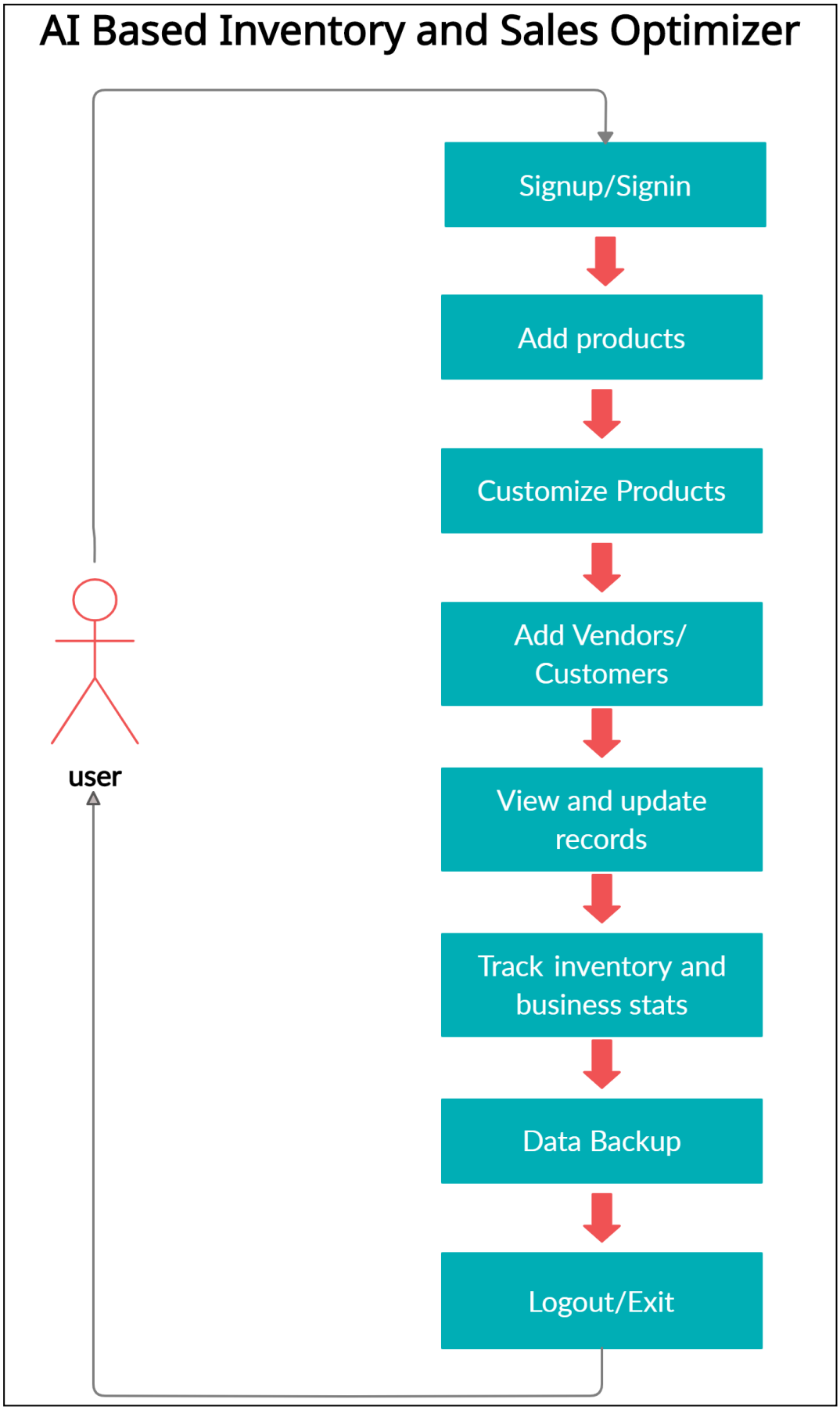


**Figure 4.3 DFD Level 1**

## 7.3 Sequence Diagram

The figure given below is the sequence diagram of our system. The user will first sign up or login into the system with required details and similarly will perform other operations as shown in the figure below.

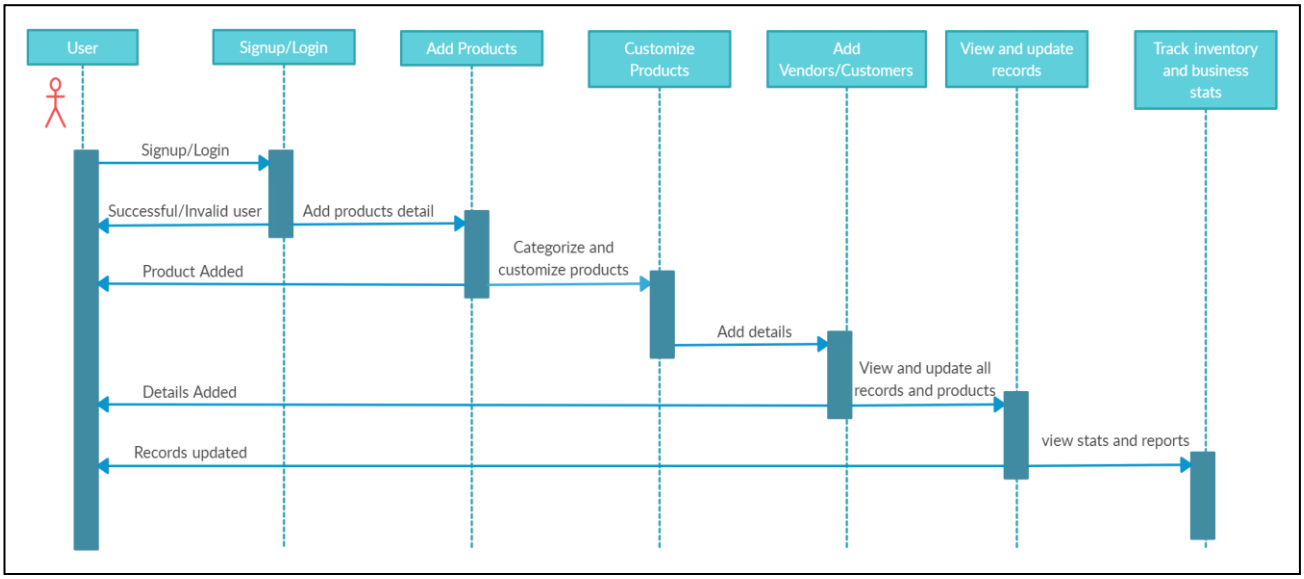


**Figure 4.4 Sequence Diagram**

## 7.4 Activity Diagram

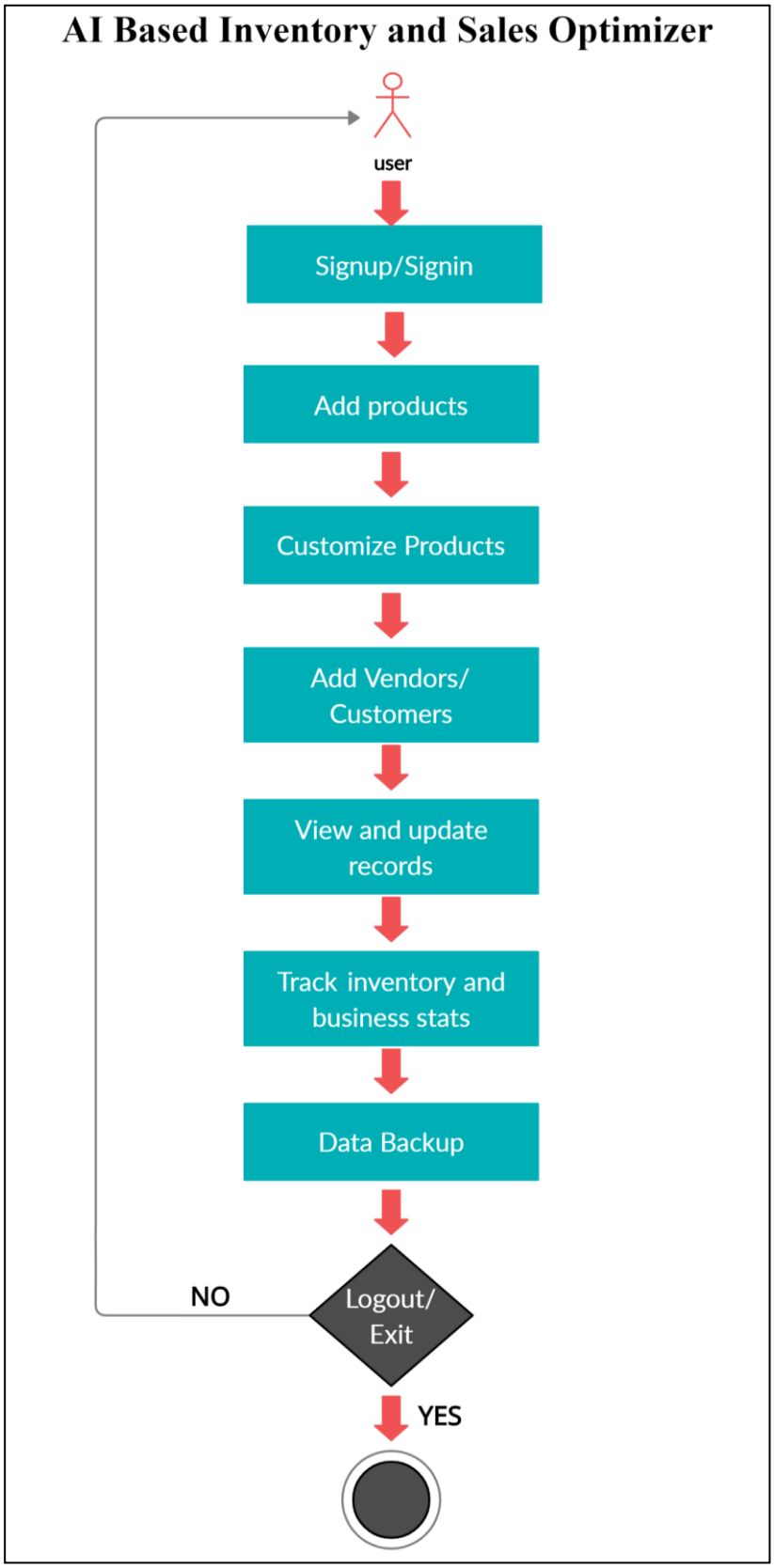


**Figure 4.5 Activity Diagram**

## 7.5 E-R Diagram

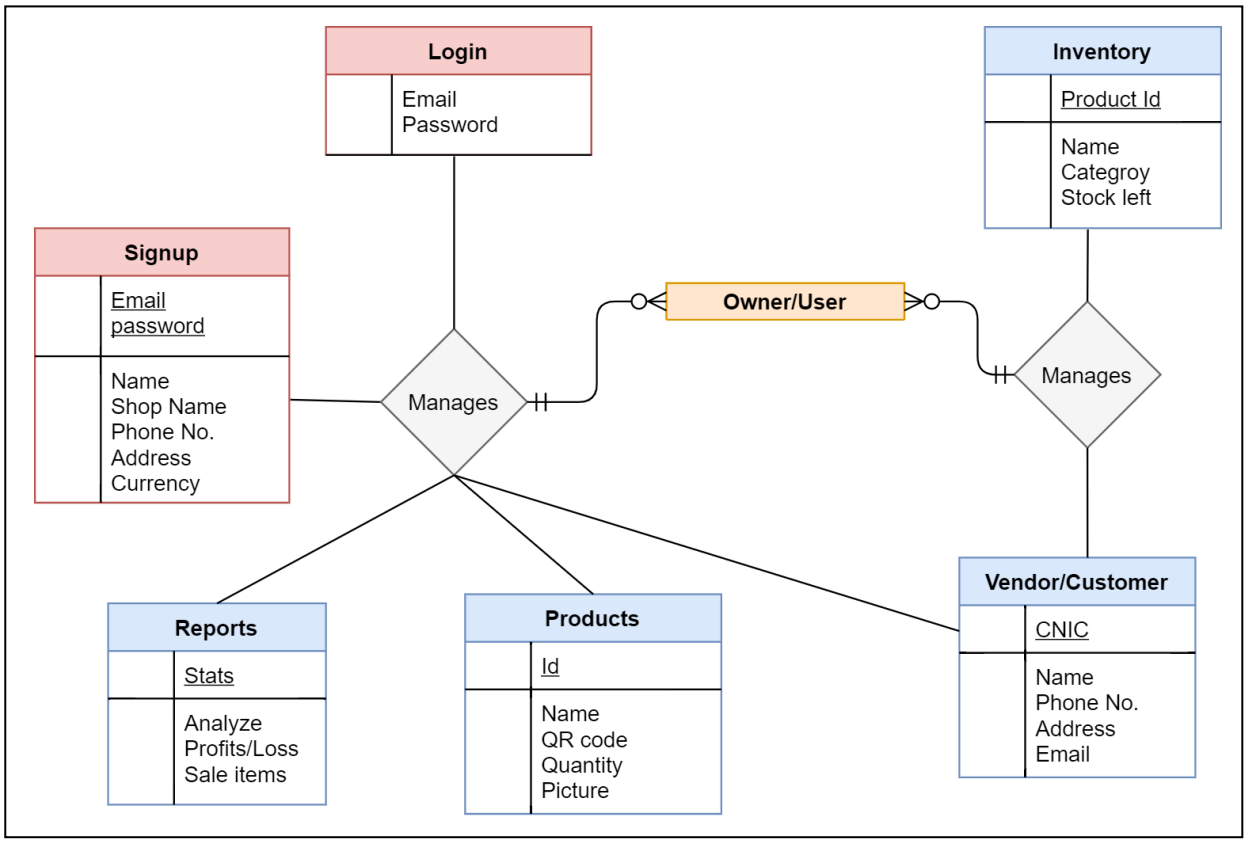


**Figure 4.5 E-R Diagram**

# Appendix A

## List of Reference Variables

[1] https://1000projects.org/projects/android-projects/page/5

[2] https://play.google.com/store/apps/details?id=com.kutirsoft.dailysalesrecord

[3] https://play.google.com/store/apps/details?id=com.inventory.sales.invoice.fmcg.storemanager

[4] https://play.google.com/store/apps/details?id=my.aahmetbas.stockcontroller