EyeWear.pk

PROJECT SUPERVISOR

Mr. Basit Ali

PROJECT CO-SUPERVISOR

Mr. Zain

PROJECT TEAM

Hashan Shaikh	K180419
Muhammad Anas	K191465
Affan Siddiqui	K190125

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Project Supervisor	Mr. Basit Ali	
Project Team	Hashan Shaikh	K18-0419
	Muhammad Anas	K19-1465
	Affan Siddiqui	K19-0125
Submission Date	May 18, 2023	

Mr. Basit Ali _____

Supervisor

Mr. Zain _____

Co-Supervisor

Dr. Zulfiqar Ali Memon _____

Head of Department

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We would like to express our gratitude to all the individuals and organizations that supported us throughout this project.

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We are grateful to the faculty members of **CS Department** for their support and encouragement throughout the course of this project. Their constant motivation has been essential in keeping us focused and on track.

We would like to thank **Fast NUCES** for providing us with the necessary resources and facilities to complete this project. Their support and cooperation have been greatly appreciated.

We extend our thanks to our fellow colleagues and friends who have supported us throughout this project. Their encouragement and feedback have been instrumental in shaping our ideas and improving our work.

Thank you all for your valuable contributions.

Abstract

Our software is meant to be an end-to-end customer service that provides a friendly user interface through which the customers can browse through and select the perfect optic for them. They will also be provided with an option to search for the specific frames they desire as well as apply filters on the list to arrange the products. These products that the customers will interact with are coming directly from well-known Optic markets/stores who is registered and whose owners would have agreed to deploy their products on our website in order to improve their business online. These shop owners is able to modify their inventory on our website at any time. The customers can then add the desired product to cart, choose from a variety of lenses for the frames, complete the payment process, and then get their order delivered to them in a few working days. Furthermore, other modules is integrated in our website to enhance user experience such as the option to calculate their face structure dimensions to assist in choosing the correct frame, as well as search for eye doctors and optic stores close by. They can then book an appointment for an eye test from an available doctor. An option to redeem points and discounts based on previous orders will also be integrated into the website.
There will also be a Machine Learning section which will include Deep Learning models where users can input an image of their eye (in the right format) and that model will classify whether the person has a disease such as Cataract Grading, Diabetic Retinopathy Detection, etc. There will also be a Chatbot implemented to help the users with any queries.

CONTENT

LIST OF FIGURES

INTRODUCTION

In today's digital age, online shopping has become increasingly popular among consumers, making it essential for businesses to have a strong online presence to remain competitive. Our group embarked on a project to develop a comprehensive end-to-end customer service for the optic industry. Our project focuses on developing a user-friendly website that allows customers to browse, select, and purchase their preferred optic products online. The website will feature a wide range of optic products sourced from well-known stores, with registered shop owners being able to modify their inventory at any time. To further enhance the user experience, we have integrated additional modules into our website, including the ability to calculate face structure dimensions to assist in selecting the right frame, and the option to search for eye doctors and optic stores nearby. Customers can also book an appointment for an eye test with a doctor. Moreover, we have incorporated Machine Learning techniques to classify eye images and diagnose diseases such as Cataract Grading and Diabetic Retinopathy Detection. A Chabot has been implemented to provide support to customers in real-time. This project aims to provide a comprehensive online platform for the optic industry, revolutionizing the way consumers purchase optic products and services.

RELATED WORK

We have done some research on previous similar products to our website, but their business model is just different from ours. Because they own their own manufacturing plants of the products and sell their eye wears from their own stock warehouses just like on of the example is of the lens kart [1], wabyparker [2] and eyemyeye [3]. These all three companies are a mission for catering all the problems of the vision by building customizable frames for the people by their own manufacturing plant whereas our business model solely focuses on the multiple shops located on our website for purchasing such eye accessories. Other than that, for solving cataract and diabetic retinopathy problem we have read multiple previous works and they different strategies of Machine Learning and Deep Learning they have used [4]. We have also read their results on this problem on different state of the art models just like inception net and mobile net model which is used for image classification [5]. Other than that, we also surveyed many optic shops and consulted eye doctors in the Gulshan area asking them whether this system will create any benefits for them and recorded their experiences.

REQUIREMENTS

1.1. Functional Hierarchy

This section will give a big picture of overall system functionality. The main modules/features of system and their sub-functions are described here in the form of a functional hierarchy so that, before getting into the use case, audience can grab the idea of overall system functions.

1.2. Use Cases

Use Case Diagram:

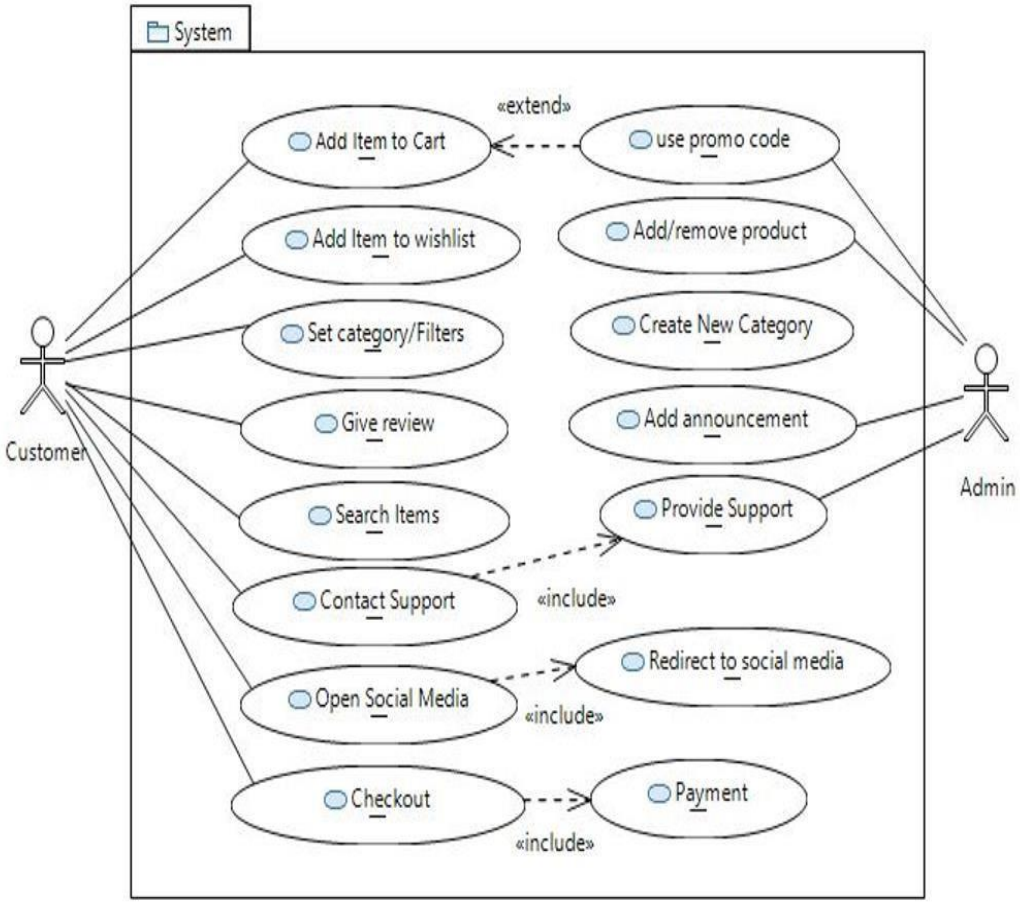

Figure 1

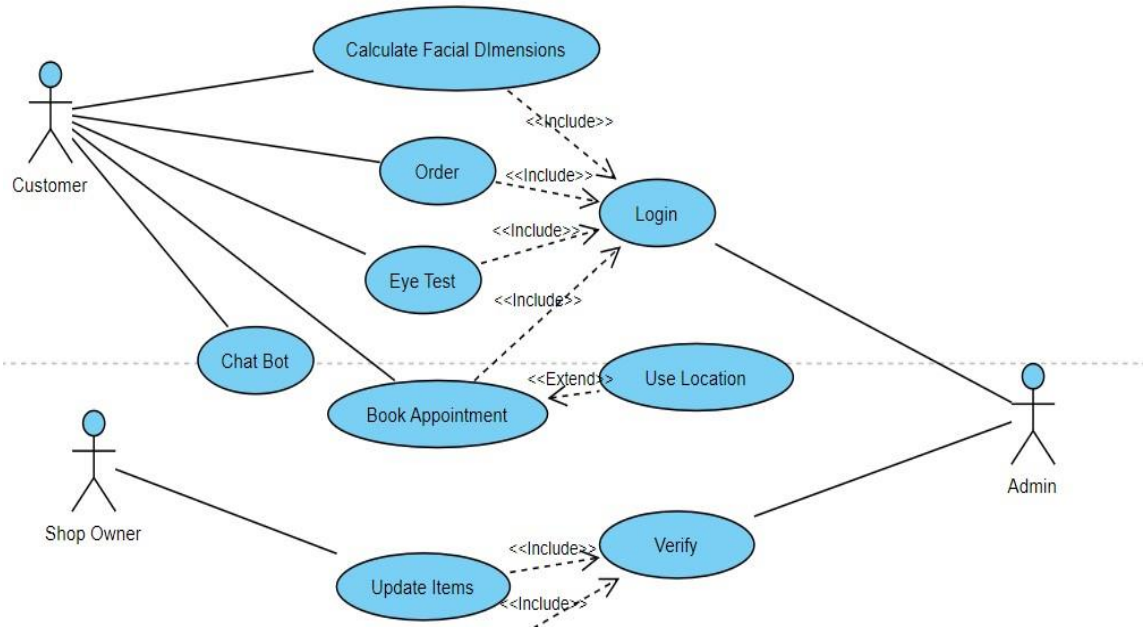

Figure 2

Use Case Descriptions:

4.2.1. Customer

Use Case name:	Customer Interaction/Order
Use Case Description: The use case shows that the webpage/system is enabling the users to interact with it in order to perform the required operations on the products.	
Primary actor: Customers	***Other actors:*** -
Stakeholder:	Customers

Relationships ▪ ***Includes:*** Payment() ▪ ***Extends:*** UsePromo***()***
Pre-conditions: Customer must have an existing account
Flow of Events: 1. Customer logs into the system and browses through the webpage. 2. Selects required frames or performs other operations. 3. Redirected to the checkout page or to other services according to the request.
Alternative and exceptional flows: ***4.1.*** If the payment is not completed successfully, the system displays error and transaction is not completed.
If a suitable Fundus image is not provided, the Deep Learning Models cannot provide accurate results.
Post-conditions: The database is updated after the transactions.

4.2.2.

Use Case name:	Customer Eye Test
Use Case Description: The use case shows that the webpage/system is enabling the users to provide a suitable image to the ML Classification Model to test if they have that particular eye disease.	
Primary actor: Customers	***Other actors:*** -
Stakeholder:	Customer

Relationships ▪ ***Includes:*** Login() ▪ ***Extends:*** NA
Pre-conditions: • Customer must have an existing account • Customer must have a suitable Fundus Image
Flow of Events: Customer logs into the system and browses through the webpage. Selects the model for the disease they want to test for. Redirected to the results page.
Alternative and exceptional flows: If a suitable Fundus image is not provided, the model will output inaccurate results or error.
Post-conditions: ▪ The model resets to be used again.

4.2.3.

Use Case name:	Customer Virtual Try On
Use Case Description: The use case shows that the webpage/system is enabling the users to Virtually Try On a specific product that they wish to buy.	
Primary actor: Customers	***Other actors:*** -
Stakeholder:	Customer
Relationships ▪ ***Includes:*** Login() ▪ ***Extends:*** NA	
Pre-conditions: • Customer must have an existing account. • Customer must have a self-facing camera available	

Flow of Events: Customer logs into the system and browses through the webpage. Selects the frame which they want and clicks the Try-On button. Redirected to the camera for a try on experience.
Alternative and exceptional flows: If a functional camera isn't available, this feature will display an exception.
Post-conditions: - Camera is exited

4.2.4. Admin

Use Case name:	Admin Verify/Register
Use Case Description: This use case is enabling the admin to manage all the shop owners and verify/register them onto the platform.	
Primary actor: Admin	***Other actors:*** -
Stakeholders:	Admin, Owner
Relationships ▪ ***Includes:*** Login() ▪ ***Extends:*** NA	
Pre-conditions: - Should be logged in and authenticated as an Admin.	
Flow of Events: 1. Admin logs into the system and browses the webpage. 2. Admin selects register/remove shop owner. 3. Appropriately modifies the shop owner list based on the previous input.	

Alternative and exceptional flows: If the login details are not correct, the system displays an error. If the shop owner trying to be removed does not exist, an exception is thrown.
Post-conditions: - The database is updated after the modifications.

4.2.5. Shop Owner

Use Case name:	Owner Update Items
Use Case Description: This use case shows the system will enable the registered shop owners to modify their respective inventories.	
Primary actor: Owner	***Other actors:*** -
Stakeholders:	Customers, Owner
Relationships ▪ ***Includes:*** Login() ▪ ***Extends:*** NA	
Pre-conditions: - Should be logged in and authenticated as a Shop Owner.	

Flow of Events: 1. Shop Owner logs into the system and browses the webpage. 2. Views, edits and modifies his own products. 3. Saves updated changes.
Alternative and exceptional flows: If the login details are not correct, the system displays an error. If the shop owner modifies the products in a way which violates a constraint, an exception is thrown.
Post-conditions: - The database and webpage is updated after the modifications.

2. Non-functional Requirements

2.1. Performance Requirements

- Response Time- The system will give responses within seconds when a product is selected or information regarding customers/products is requested from the database.
- Precision and Consistency- is achieved after every transaction as the database gets updated immediately.
- User interface- User interface screens and redirects will response within a few seconds
- Reliability- The system will provide failure-free operations if the conditions are satisfied.

2.2. Safety Requirements

Take help from a specialist while trying to produce a fundus image of your eye.

2.3. Security Requirements

The admin has control over the structure of the website, so admin authorization is very necessary. Someone who is not the admin should not be given access to the administration portal in whatever case.

If somehow this happens (due to a mishap), it could result in inconsistency and compromise of the database if changes are made.

2.4. User Documentation

The interface is user friendly and will look like the many other ecommerce websites users commonly use. However, we are open to supporting the customers regarding anything, whenever required.

DESIGN

Process Model

The process model for development we are using is **Agile** and its subset **Scrum**. We plan to release our project in iterations which is why we have chosen the agile process model as it offers the best workflow when it comes to projects that involve **CI/CD** (continuous integration and continuous delivery). We will first release a basic model of our application and then keep adding features as we go along while testing and evaluating everything. This will help us ensure that our product is fulfilling consumers' needs or not. In **Agile** model changes are easy to make and mistakes or fallacies can be reverted quickly. This is important for our project as its main purpose is to facilitate the people. If we cannot incorporate the feedback of our users in the product and that too as quickly as possible that the product is useless. **Scrum** is also particularly important in managing our project and ensuring its efficient delivery.

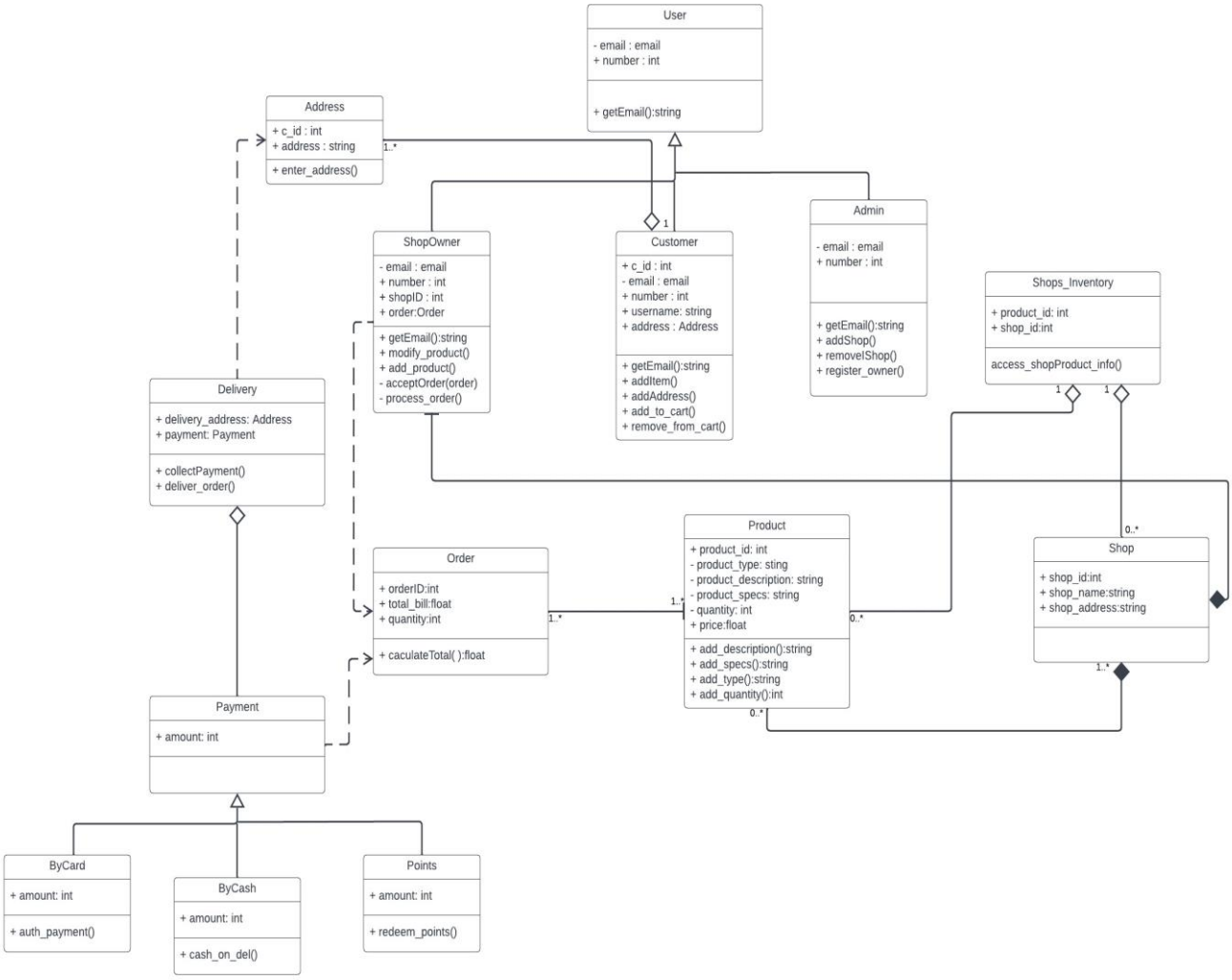

Figure 3

Our product will contain of 2 main interfaces:

1. **User (Customer):**
   The user will interact with our website through a client-side JavaScript library known as React. The request of user will make some state changes or will hit an http request and that request is made through an application programming interface that is based on express (A library of node.js) which makes an easy implementation. That request will hit the database and will manage some operations for suppose a customer willing to order some eyewear will make a

create request to the database and that notification is pushed to the shop owner interface where he might take that order or reject it

2. **Shop Owners:**
   Shop owners will also be able to manage their inventory through these crud operations.

The eye testing feature will have a deep learning model for detecting cataract and diabetic retinopathy. We will train different state of the art models like inception net and mobile net and many others to check which model is giving a good result on our dataset. Users can search for an area specific doctor by just filtering out the registered doctor's data from the database based on location and can also book an appointment by making a request to the doctor's interface. We will also calculate users face dimensions by detecting user's face dimension by the yolo algorithm and open cv techniques. And then we will also detect many face segments for checking user's face structure for recommending him the best fit frames from our website. The payments is floated with the dummy currency attribute that will flow in our website from user to shop owner or from user to doctor or an expert. The discounts are availed by many values to which the shop owner can interact in his database table. The users can write reviews for their experiences which all is stored in database and is rendered on UI. The existing chat-bot API is integrated for better User Experience when using our website.

IMPLEMENTATION

Our system is designed to create an easiness for the customer, who can just visit our website and can create an order from it. The customer will only have to open the webpage where he might see multiple eye optics registered stores. The customer can visit any of the nearby stores and can make some orders through our website. None the less, the customer can also visit our eye testing features where he or she can detect a cataract and diabetic retinopathy (A well-known disease for an eye).

Our mission through this system is to basically provide multiple eye related problems that can be solved through our system. Our system architecture is based upon these things: The backend database of our registered shops which is managed through a non-relational database system, and we is using mongo dB for it. Next, we will create some application programming interface for fetching the data from our database and that work is done through a well-known backend framework known as Node js.

Other than that, we will also be managing our crud operations through this application programming interface. We will also be working with the reviews to allow everyone to write their experiences for the frames on our website so that everyone can read them before making any choice. All front ends work the user and screen interaction and the state management on the user interface is done through a JavaScript library known as React-js. A user can interact with all the User Interface and our page through this React library which will listen to the events attached on our page. The request to the backend

service is made through our application programming interface. Next, we will use the transfer learning concept and some models of Keras like inception net or res-net for making our cataract detection and diabetic retinopathy. We will use these state of-the-art models and will modify them in our classes of cataract disease and then will deploy the weights of the model on our website backend service for making the predictions on the users-eye.

Beside this we will also detect a person's face structure through some open cv techniques and yolo algorithm for checking persons face dimensions and recommending him the frames that are good for his/her face dimensions. Other than that, our system is able to give some side suggestions on the products using some machine learning algorithm known as k nearest neighbor.

A normal chatbot is integrated on our website for some help on our website and that is done using an existing application programming interface. For our demonstration purpose we have created a currency attribute in our database to show the cash flows between the customer and shopkeeper. Some filtering techniques is used to render the data on the screen by applying those filters.

The discount offers is set up on our shops for getting customer attraction and more sales and this is done by creating some attributes for each shop that do they offer some discount and if they do so for how much. The customer can also book an appointment to the nearby eye doctors on our website through online payments.

The eye doctors and the people can also comment on some normal customer eye reports for giving some suggestions what initiative such a user can take in this situation, and this is done through some chat stored for that current customer whose data is fetched from the database.

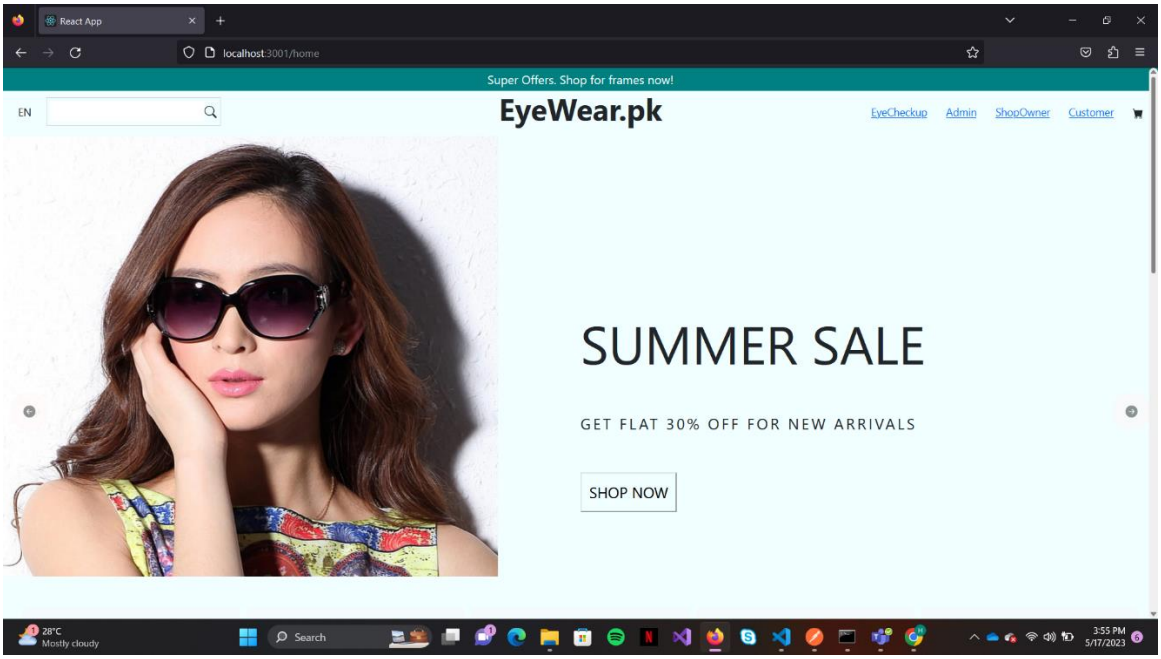

Figure 4

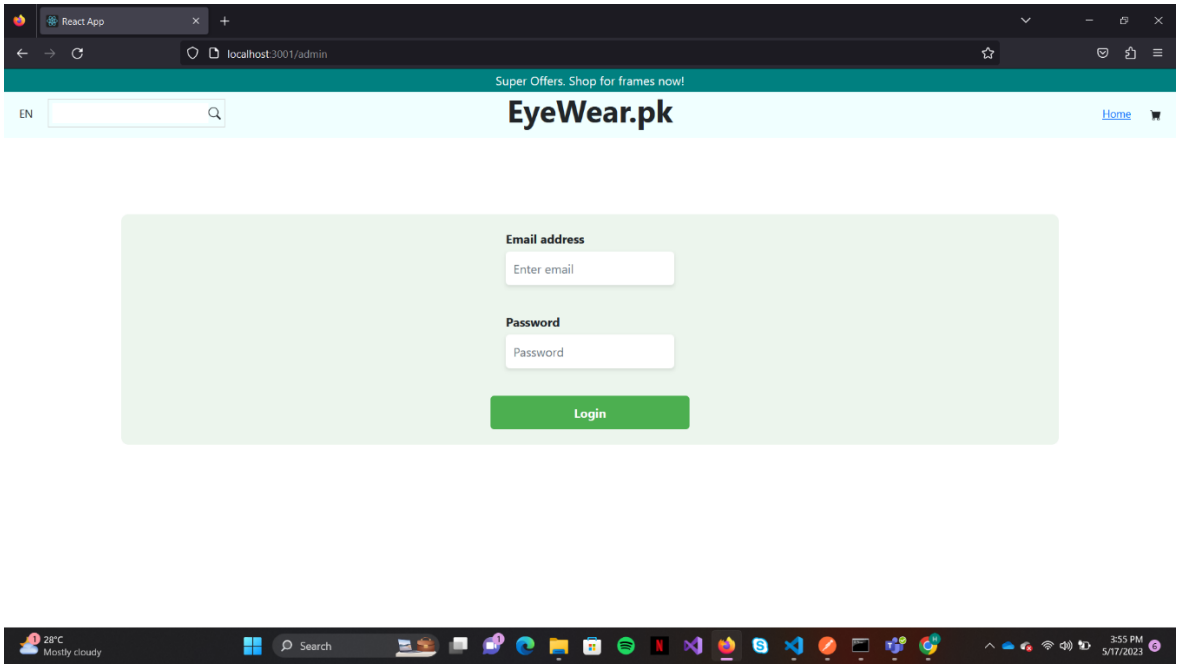

Figure 5

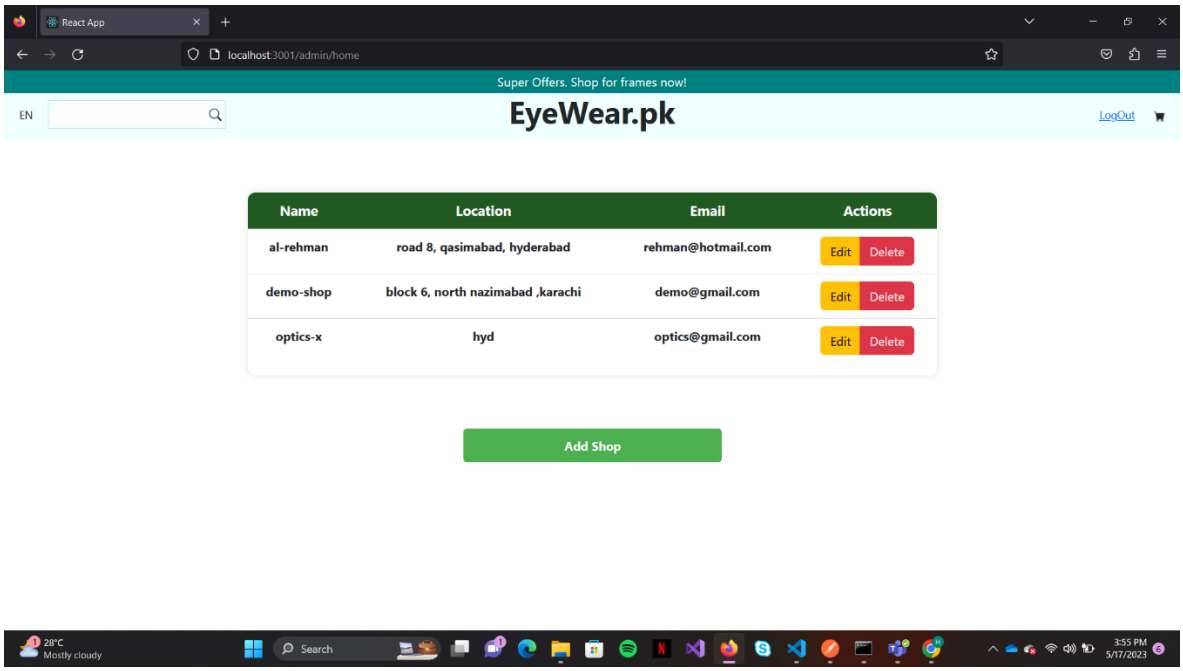

Figure 6

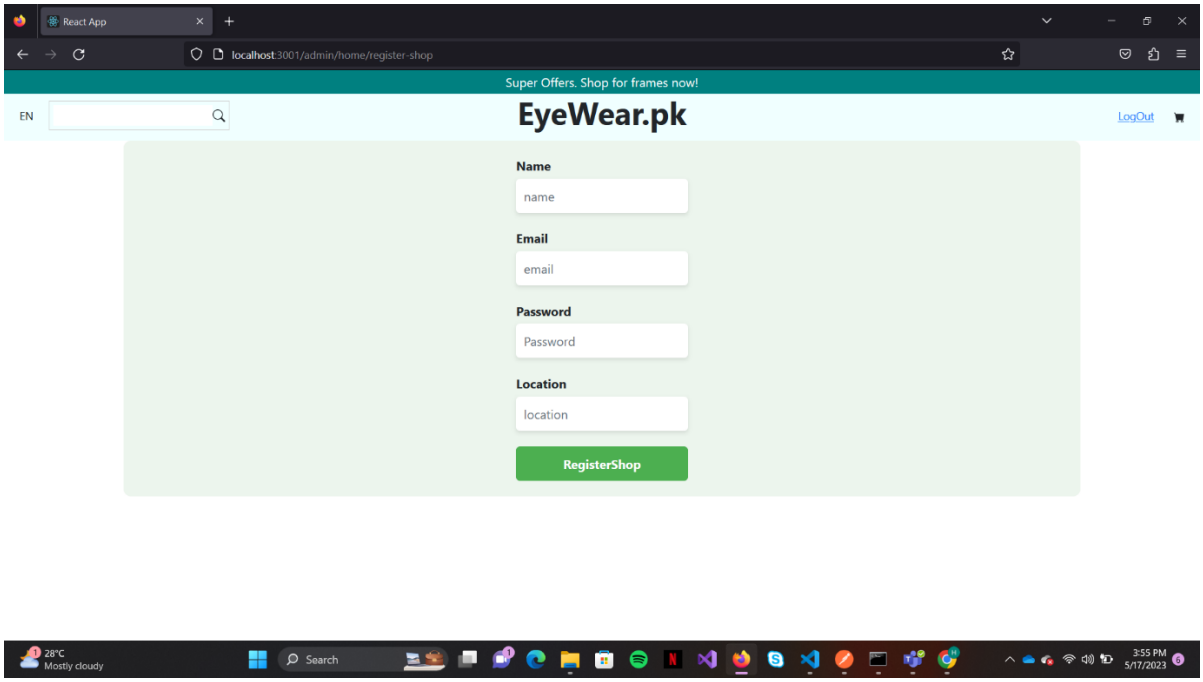

Figure 7

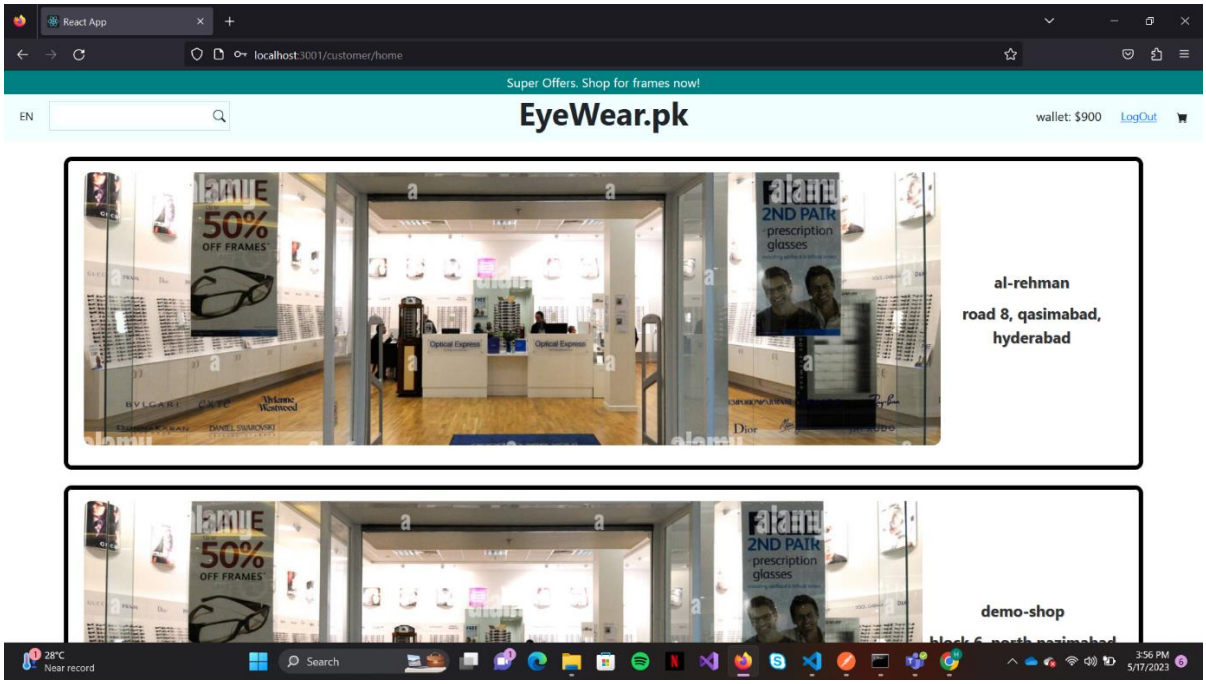

Figure 8

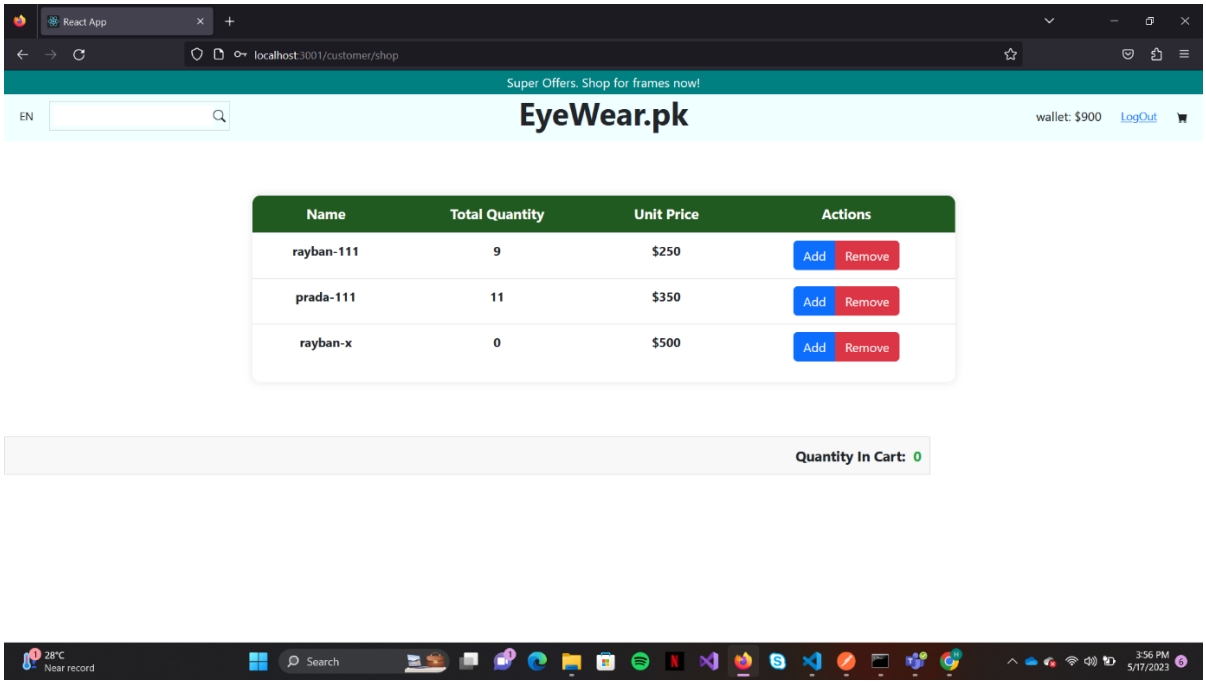

Figure 9

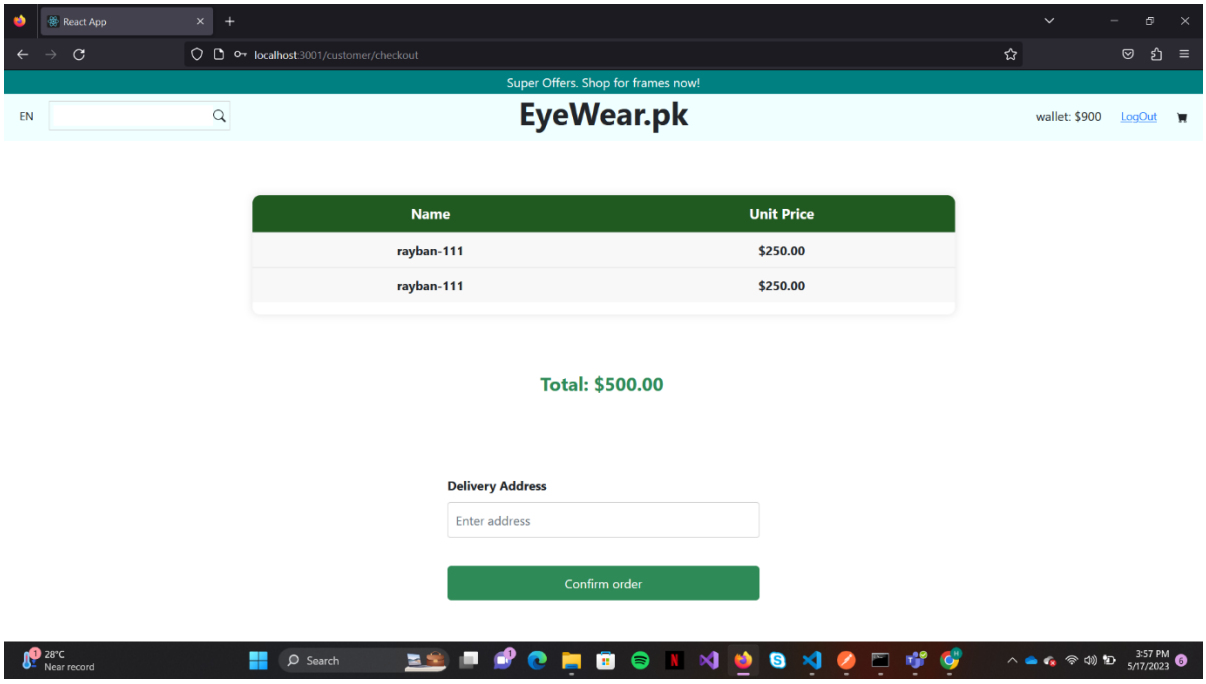

Figure 10

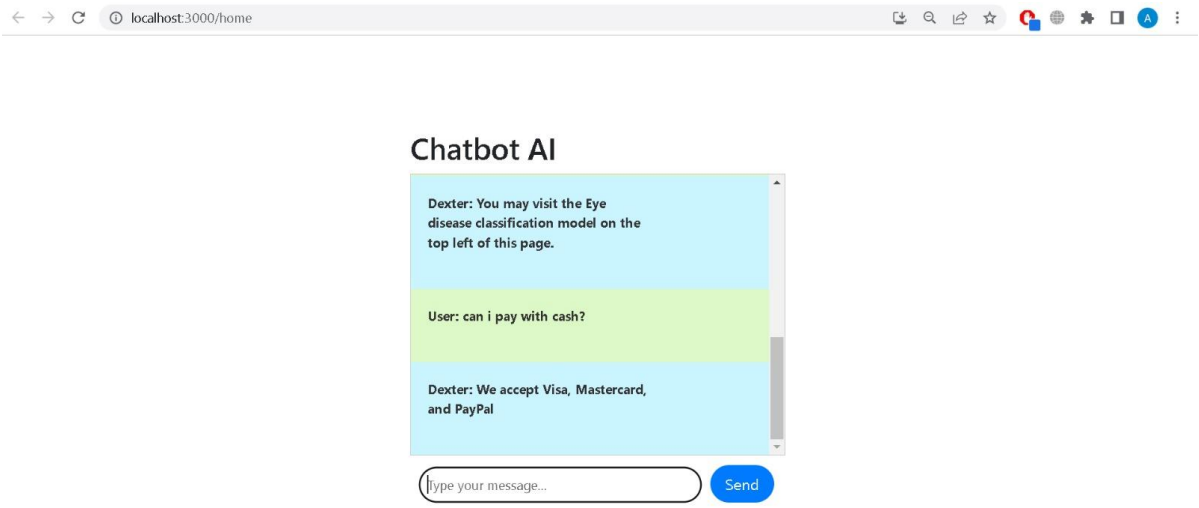

Figure 11: ChatBot

TESTING AND EVALUATION

Performance Requirements:

- Response Time- The system will give responses within seconds when a product is selected or information regarding customers/products is requested from the database.
- Precision and Consistency- is achieved after every transaction as the database gets updated immediately.
- User interface- User interface screens and redirects will response within a few seconds.
- Reliability- The system will provide failure-free operations as long as the conditions are satisfied.

- Furthermore, the customer can make purchases according to their needs.
- The AI Model has been evaluated and trained to produce high (97%) accuracy.
- Chatbot produces prompt responses on all test inputs.
- The Virtual Try on feature has been evaluated on various frames and faces.
- The payment gateway correctly deducts the amount from wallet.

Safety Requirements:

Take help from a specialist while trying to produce a fundus image of your eye.

Security Requirements:

The admin has control over the structure of the website, so admin authorization is very necessary. Someone who is not the admin should not be given access to the administration portal in whatever case. If somehow this happens (due to a mishap), it could result in inconsistency and compromise of the database if changes are made.

CONCLUSION

Our software is meant to be an end-to-end customer service that provides a friendly user interface through which the customers can browse through and select the perfect optic for them. They will also be provided with an option to search for the specific frames they desire as well as apply filters on the list to arrange the products. These products that the customers will interact with come directly from well-known Optic markets/stores who is registered and whose owners would have agreed to deploy their products on our website to improve their business online. These shop owners can modify their inventory on our website at any time. The customers can then add the desired product to cart, choose from a variety of lenses for the frames, complete the payment process, and then get their order delivered to them in a few working days. Furthermore, other modules is integrated in our website in order to enhance user experience such as the option to calculate their face structure dimensions to assist in choosing the correct frame, as well as search for eye doctors and optic stores close by. They can then book an appointment for an eye test from an available doctor. An option to redeem points and discounts based on previous orders will also be integrated into the website.

There is also a Machine Learning section which will include Deep Learning models where users can input an image of their eye (in the right format) and that model will classify whether the person has a disease such as Cataract Grading, Diabetic Retinopathy Detection, etc. There’s also a Chatbot implemented to help the users with any queries.

REFERENCES

We have taken references from other online eye optic apps by realizing their interface and features:

- Chashma.pk
- Lenskart.com
- Eyefashion.pk