

Computerized System to Manage Business Functions of E-Commerce Web Application using MERN Stack Technology

D.E. Fernando¹, M.D.J. Malshika², M.D.T. Saparamadu³, K.H.N.D. Dharamapala⁴, D. I. De Silva⁵ and S. Vidhanaarachchi⁶

¹Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

²Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

³Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

⁴Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

⁵Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

⁶Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

²Corresponding Author: jananimalshika98@gmail.com

ABSTRACT

In this research we analyze e-commerce web applications. This research focuses mainly on the advantages of having a web application to promote buying and selling all around the globe as a method to help solve the economic crisis. According to research, creating an online store with a web application is more productive than offline stores and makes buying and selling easier for the buyer and the seller. The method we developed helps ease the prevailing economic crisis as we need foreign currency and the web application developed helps solve that problem. The system was developed using MERN stack and was tested by performing the browser compatibility test and the functionality test in which both were successful with positive results. The system we developed solves many issues faced by offline stores and many other online store systems as our system was designed to accept payments in foreign currency and our store delivers to many areas around the globe.

Keywords-- E-Commerce, MERN Stack, React JS, Node JS, Express JS, Mongo DB, Items Management, Order & Rating Management, Customer Management, Seller Management, Admin Functions

I. INTRODUCTION

The economy in Sri Lanka has collapsed due to the lack of foreign currency to purchase goods [1]. A great number of research was performed to help improve the situation and it was found that one of the causes of the lack of foreign currency was due to the number of imports being more than the exports [1]. A proposed solution for this issue is to increase the number of exports and attract more foreign customers and then we can receive foreign currency. For this reason, to help improve the economy, Easy-buy online stores was created to encourage foreign customers to order online and make payments online via a payment gateway and with foreign currency.

Easy-Buy is an online store which is dedicated to serve customers by making purchasing goods as simple as

one click away and helps sellers to advertise their goods and makes selling easier.

The two main users of the system are the buyer and the seller. A web application for Easy buy was developed so that sellers may post the products to be sold and the foreign customer could see the posts and purchase goods.

According to research, a user-friendly system with good user interfaces and user experience attracts customers [2]. Therefore, the user interface was designed following good practices and unlike most other systems the interfaces are simple and does not contain any irrelevant information, there are no complex and system-oriented words, making it easier for the user to interact with the system.

Many other systems accept payments in local currency; therefore, they only have local customers and foreign customers will have to change their currency in order to purchase, many other systems do not provide the option to purchase items from anywhere in the world. This system consists of four main functions which are item management, customer management, seller management and order & rating management.

Easy-buy stores requested for an online system to help both the buyer and the seller to buy and sell goods. Therefore, it was decided to develop a web application using MERN stack where the frontend is developed using React, the backend using Express JS, NodeJS and MongoDB as the database.

In this research paper, we will first compare our system with other systems and their functionality.

Secondly, we will discuss the tools and technologies used to develop the system, using diagrams we will describe the backend processes related to the main functions of the proposed system., we will explain the techniques used in developing the system using diagrams.

We will then explain the main functions of the system using figures. We will then discuss our key findings or expected results, we will include the testing methods that were used for testing the main functions of the system.

Finally, we will conclude our research by

summarizing the paper’s findings and the main points, we will mention a few shortcomings of our work which would be useful to other researchers.

II. LITERATURE REVIEW

Most of the systems that are used today to purchase goods are either not very user friendly or do not have important functions that enable people from anywhere on the globe to place orders and make payments in foreign currency.

These systems are usually offline stores or online stores that do not accept foreign currency and are only available in a small region.

Many other online systems also attempt to solve the same problem and the system designed is based on similar concepts as most other online stores [3].

Offline stores for instance, only have a limited number of customers and make less profit compared to online stores. Offline stores are only accessible in a small region, within a particular country or city.

The Easy-Buy online store also sells similar items that one can find in an offline store and makes a profit that is more than that made by offline stores as we have customers from all over the world.

Online stores are accessible from anywhere in the world and the system for Easy-Buy online stores was designed to solve the problem with offline stores as it has more customers and receives foreign currency.

Clothing stores that have web sites will be able to sell clothes from all around the world which attracts foreign customers, pharmacies that use an online system will be able to deliver a variety of essential medical supplies to many parts of the world. Nowadays, even banks have online facilities so that customers may make transactions remotely and with different currencies from one country to another. In the past, banks did not have online facilities, people had to physically go to banks and do their transactions which was time consuming.

Most offline stores such as do not always deliver and the stores that do deliver only deliver within a certain region. Whereas Easy-Buy online store delivers goods to a wide region on the globe.

Only a very few online stores deliver, many of online stores require customers to place the order online and collect the goods themselves while Easy-Buy online store delivers the purchased items to the customer’s doorstep.

A few other online stores only accept local currency, the system developed for Easy-Buy stores solves this issue by accepting foreign currency making it easier for anyone to buy and sell products and therefore it could increase the amount of foreign currency received in the country if this type of system is implemented by other stores, this could be a good way to start overcoming the ongoing economic crisis.

III. METHODOLOGY

Easy-Buy e-commerce web application was developed using the MERN stack. React was used to develop the frontend, ExpressJS and NodeJS were used to develop the backend and the application was connected to the MongoDB database.

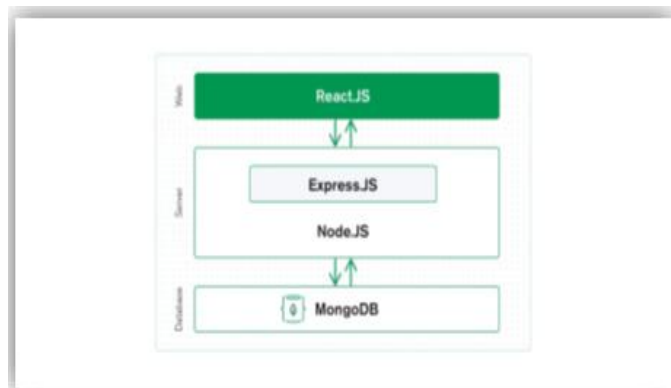


Figure 1: Structure of the React.

Website admin capabilities such as user administration, store management, analytics, and reporting were deployed. Since then, this issue has been proclaimed to investigate and develop a product search webpage so that small shopping stores and supermarkets may publish and manage their items directly on the internet.

In the meantime, the shop can provide a link to their own webpage. Customers may rapidly look for urgent items in their local retailers. Customers can contact the business owner directly based on their search results to learn more about the things they are seeking for.

The user interacts with the frontend of the application which is also known as the user interface, the data entered is passed to the backend where it is then saved in the MongoDB database.

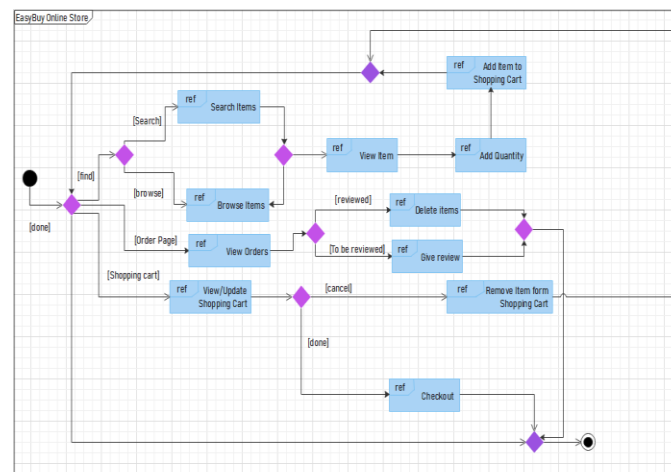


Figure 2: System Overview Diagram.

The user should be a registered user in order to access the system, if not the user should register. The registered user signs in and then if the user wants to place an order, the user selects the item and adds it to the cart.

The user may search, browse items or add items to the shopping cart. The user may also view the order placed and also view and update the cart. When the item is added to the cart the customer may add the quantity and checkout. The user may also delete items from the cart and give reviews.

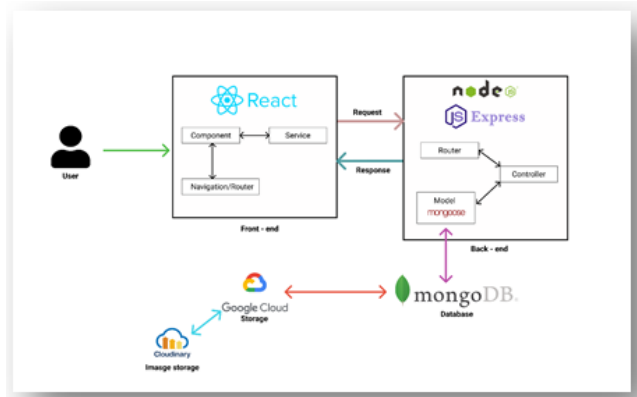


Figure 3: High Level Architectural Diagram.

We made various decisions regarding information protection and data hiding from third parties when we were designing the application. We collect sensitive information, such as NICs and passwords, throughout the registration process. Additionally, we offer an online payment option for customers to make payments quickly after registering and purchasing some things through the system. We requested the customer's card information at the time of purchase in order to facilitate payments going forward. Also, we provide option to save these details for make next payment easily. These card details are likewise incredibly private information that we should keep hidden from the public.

We developed a unique mechanism to encrypt those data before we save them in the database as a solution. To complete our task, we use the npm package called "bcrypt.js". It secures private information and sensitive data and can improve the security of communication between client apps and servers. In essence, if our data is encrypted, even if an unauthorized person or entity has access to it, they will not be able to read it.

IV. PROPOSED SYSTEM

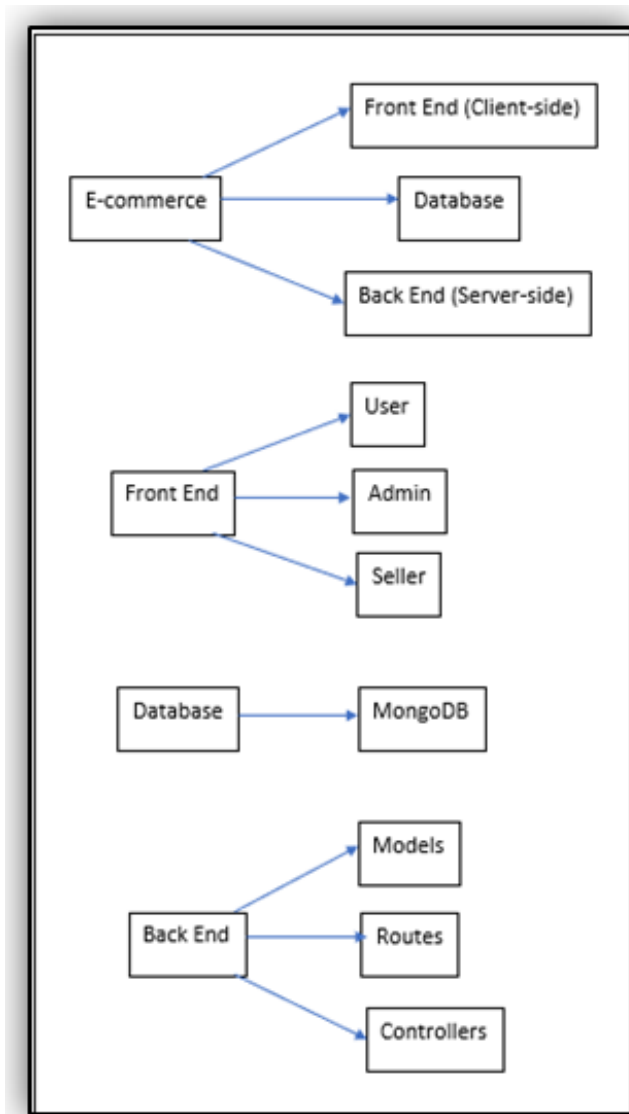


Figure 4: Web Application Structure.

The work on the e-commerce platform for online commercial operations that is proposed in this article makes use of the MERN stack of technologies. M stands for MongoDB, E for express, R for ReactJS, and N for NodeJS. The project consists of many components that are ordered in a certain sequence to make them easily accessible.

This store mostly caters to overseas clients. The seller is a registered user who has the ability to add, search for, delete, or edit things in the system as well as add, search for, and update his personal information. Before posting things, the seller must have authorization from the system administrator; the seller submits a request to add the item to the list, and the administrator may approve the request.

The client has the ability to view the postings that the vendor uploads as well as add and delete ratings. Before

completing the purchase, the client has the option to edit the things already put to the cart, delete items from the cart, and add more items.

The client may modify their data and manage their profile. The consumer may follow the transaction after completing the payment; the website will show if the order is processed, confirmed, or delivered. The four primary roles of this system are administration of items, management of customers, management of sellers, and management of orders and ratings. Easy Buy businesses sought a system that would enable both buyers and sellers to buy and sell things online. Below shows the proposed interfaces of functions.

A. Item Management

In the proposed system, there's an item management function. Customers can view the most recent and well-liked products after logging into the system and learning more about the website as shown in the Figure 5.



Figure 5: Customer View Items Interface

Below interface will be used by the seller to add items of each category to the system.

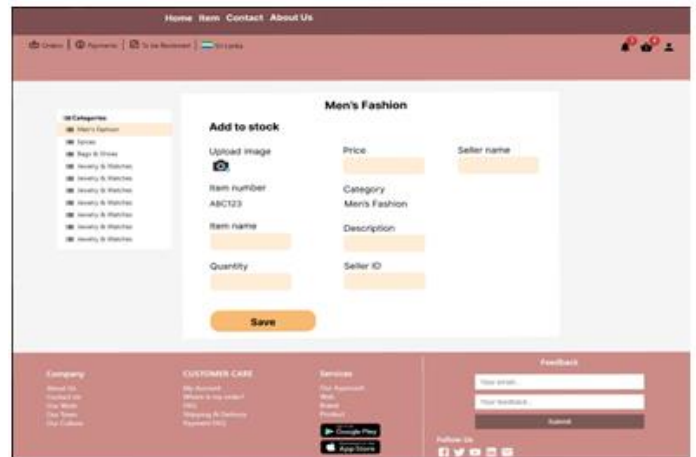


Figure 6: Add Items Interface.

Below Figure.7 is used by the seller to edit the item details.

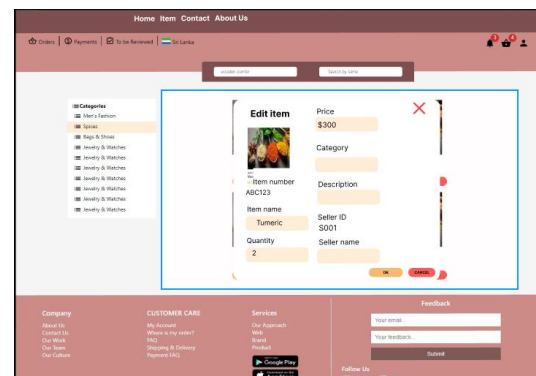


Figure 7: Edit Items Interface

Below Figure.8 is used by the seller to delete the post he uploaded, deleting the item from the system.

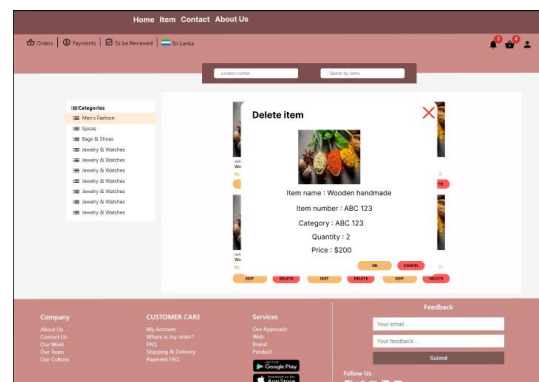


Figure 8: Delete Items Interface

B. Order and Rating Management

Customers can view more product details and easily understand about the product. If customer satisfied with this product customer can easily add product to the cart as shown in the Figure 9.

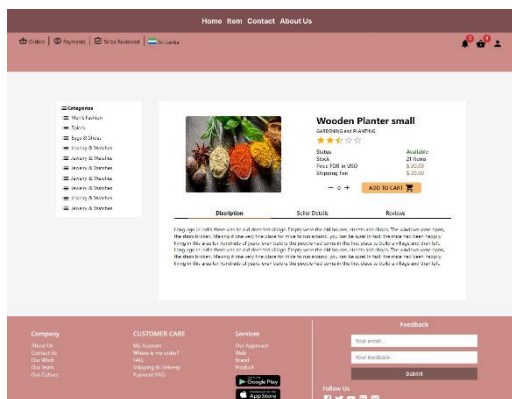


Figure 9: Customer View Details of One Product Interface

When customer select product and purchase those items at a same time. Before purchase items, customer must select the items and see the total bill and shipping fee. If customer wants to reduce bill amount or update product quantity quickly as shown in the Figure 10.

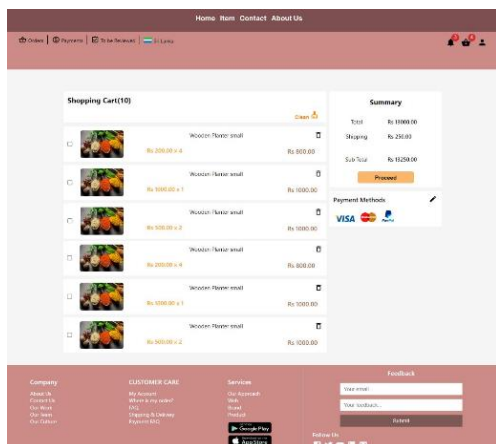


Figure 10: Shopping Cart Interface

Customer can view all the orders and order status. If customer wants to delete old orders, simply he can delete as shown in the Figure 11.

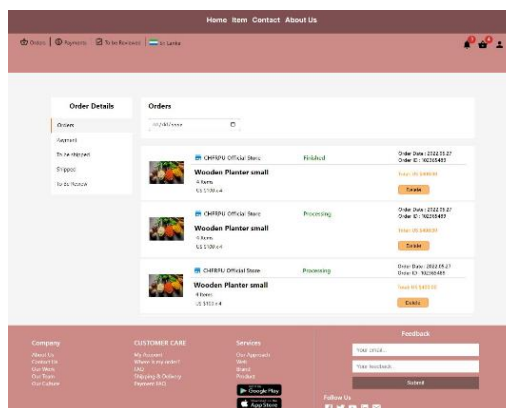


Figure 11: Customer View Orders Interface.

When customer received an item, he/she can review the items for share the experience with other customers. When customer receive a product, he/she can review product from this as shown in the Figure 12.

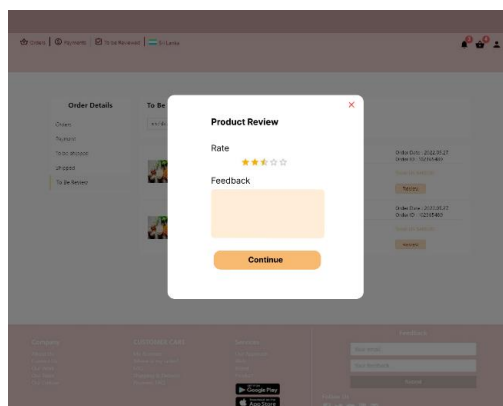


Figure 12: Customer Give Review Products Interface.

After the review the product, customer can give a review to the seller also.

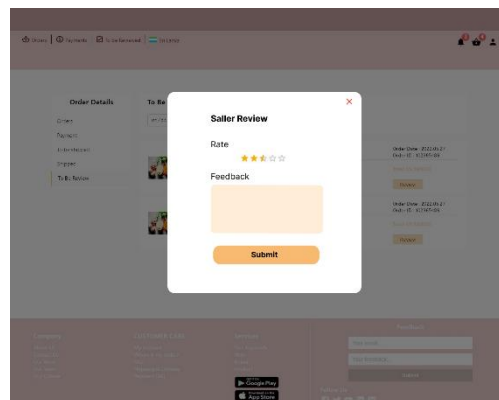


Figure 13: Customer Give Seller Rating Interface

C. Customer Management

The customer can navigate to view user details, edit user details, view address book, view payment options, view orders and view the given reviews by clicking the tiles or side navigation bar as shown in the Figure 14.

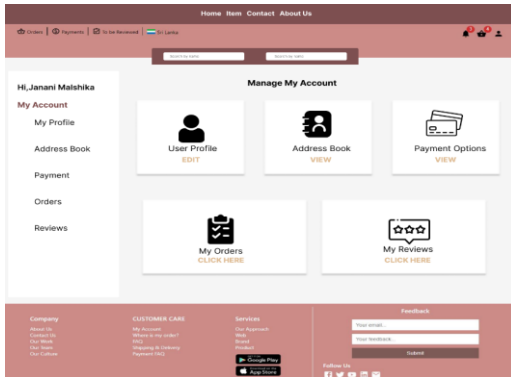


Figure 14: Customer Manage Account Interface

Customer can view the profile details. If customer want to edit these details customer can click the “EDIT PROFILE” button or if customer want to change the password can click “CHANGE PASSWORD” button. As well as if customer wants to delete the profile the customer can click “DELETE PROFILE” button as shown in the Figure 15.

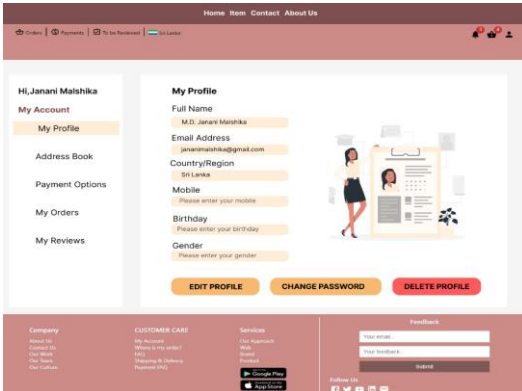


Figure 15: My Profile Interface

Below Figure 16. is used to change the password that customer used to login.

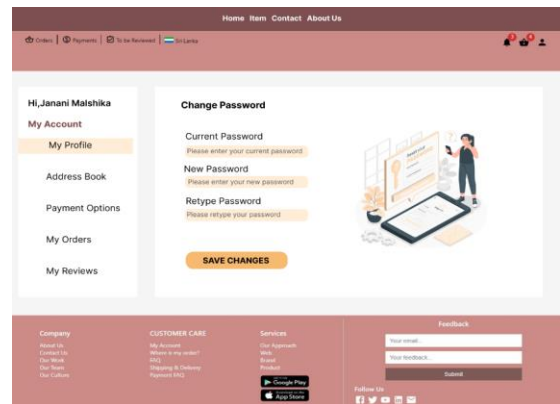


Figure 16: Change Password Interface

After clicking the “Address Book” customer will navigate to this interface and customer can view all the shipping addresses added and customer can add another new shipping address by simply clicking the plus icon and edit or delete those addresses from the system by clicking edit and delete buttons as shown in the Figure 17.

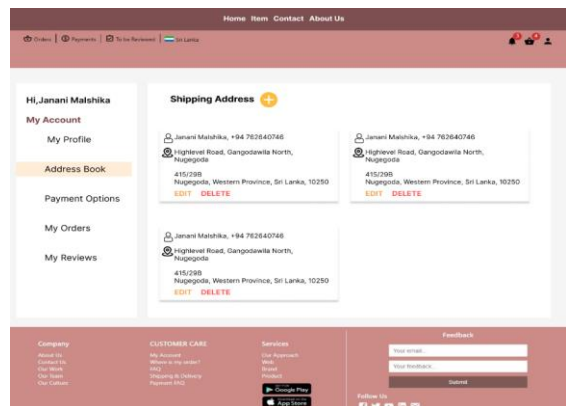


Figure 17: View Shipping Address Interface

Below Figure 18. is used to customer add a shipping address to the address book.

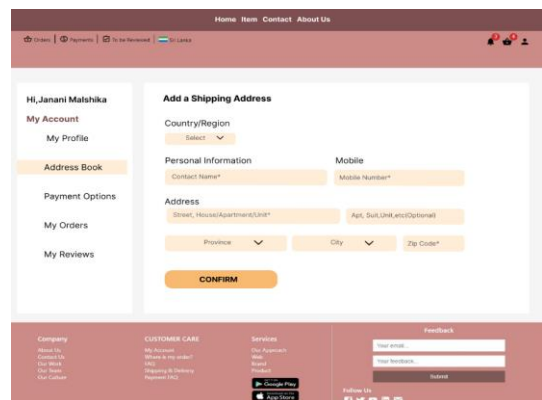


Figure 18: Add Shipping Address Interface

Customer can view all the payment details that customer has saved in the system. If he wants to add another payment option can add by clicking the plus icon. And if he wants customer can delete the payment details by clicking the “DELETE” button as shown in the Figure 18.

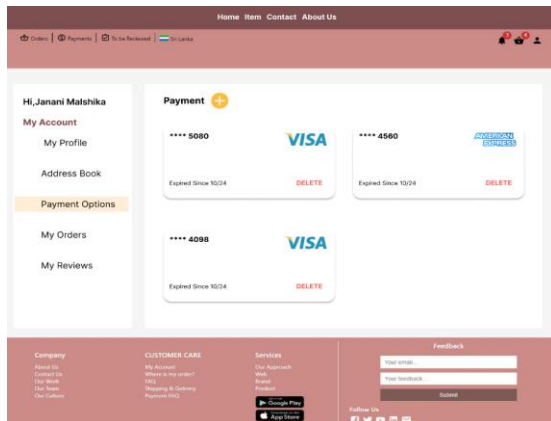


Figure 19: View Payment Option Interface

Below Figure 20. is used to add new payment details to be save in the system.

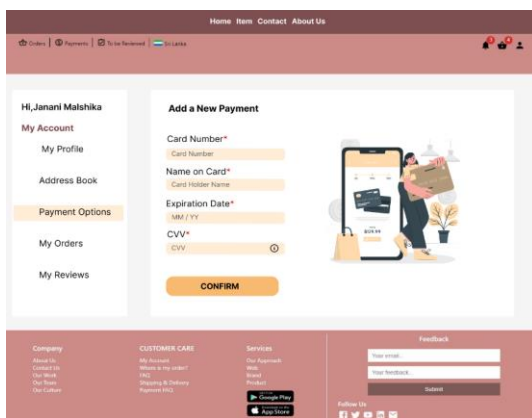


Figure 20: Add Payment Option Interface

D. Seller Management

Below Figure.21 shows the seller’s dashboard interface, seller can see 5 functions. After logged in, seller can see dashboard and 5 functions. There are Product details, Order details, Reviews, Profile and Seller support. User can click icon and enter to the corresponding interface.

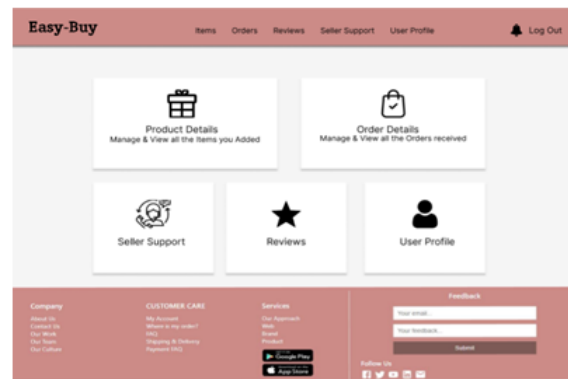


Figure 21: Seller Dashboard Interface

Below interface will be used to add seller support details to system.

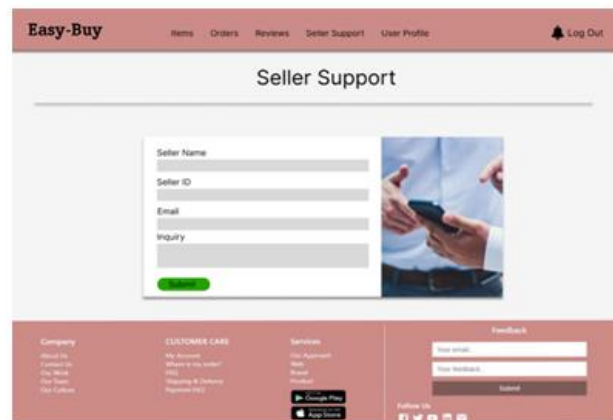


Figure 22: Seller Support Interface

Below Figure 23 is used by the seller to view customer reviews.

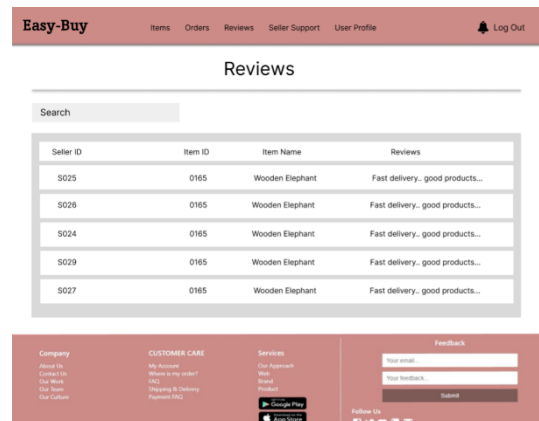


Figure 23: View Customer Reviews Interface

This interface is used by the seller to view product details and delete items. The user can see product details and if the seller needs to find his all-product details, he can click

on the 'go item' button and seller can delete items clicking delete icon as shown in the Figure 24.

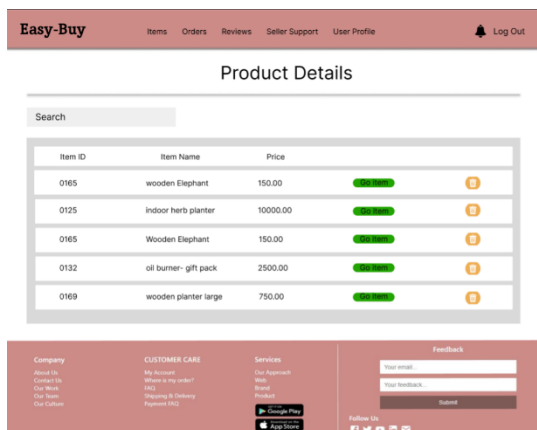


Figure 24: View Product Details Interface

Below Figure 25 is used by the seller to view product details and delete items. The user can see order details and after receiving an order, it will show as processing, Once the item is shipped, it can be changed to shipped.

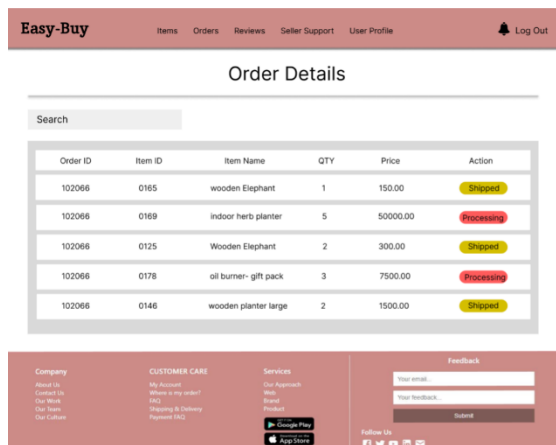


Figure 25: Seller's Order Details Interface

E. Admin Function

Below Figure 26 is used by the system admin to accept item requests sent by the seller. When the seller inserts an item, he should get permission from the admin, until the admin accepts the request the item will not be visible and will not appear on the item page. The item details along with the button to accept the request will be displayed to the admin. Once the admin clicks on the accept button and accepts the request and gives permission to the seller to add items, the item will appear on the item page.

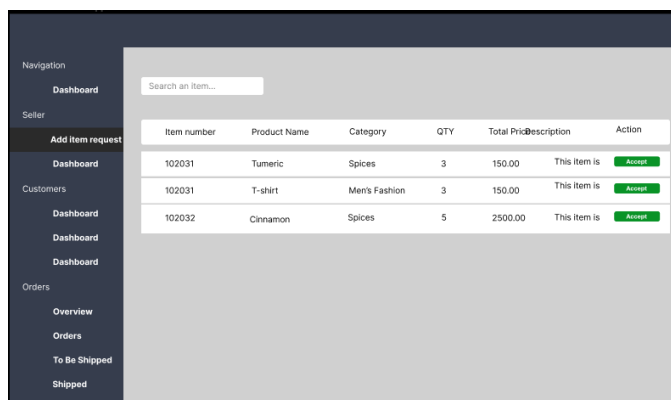


Figure 26: Add Item Request Interface

When customer place an order, admin can view the order details as shown in the Figure 27.

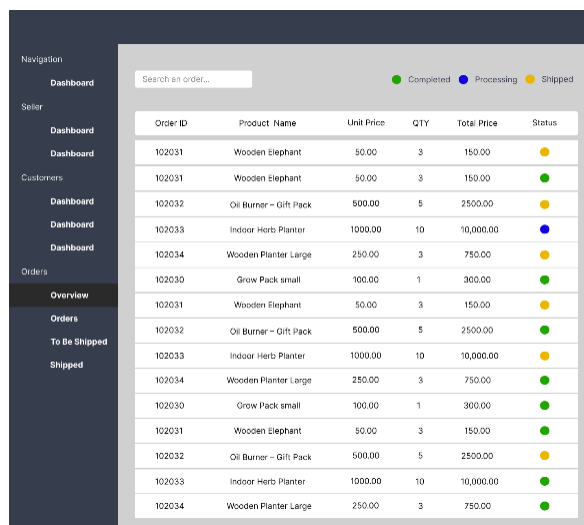


Figure 27: Admin View Order Details Interface

Admin can view all the customers' details and admin can search a customer by typing any user ID in search box. Finally, admin can delete a customer if he wants by clicking the delete icon simply as shown in the below Figure 28.

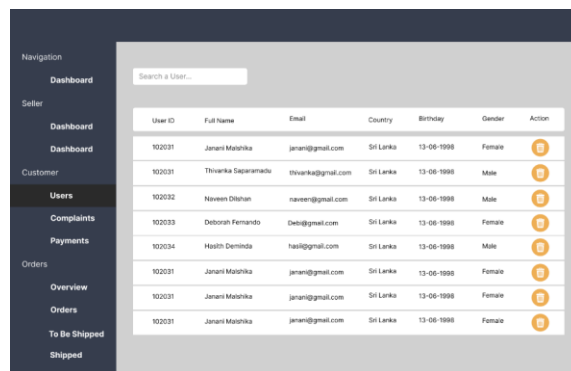


Figure 28: Admin View Customer Details Interface

Below Figure 29 is used by the admin to view seller's details and delete items. The admin can see registered seller's details and if the admin can delete items clicking delete icon.

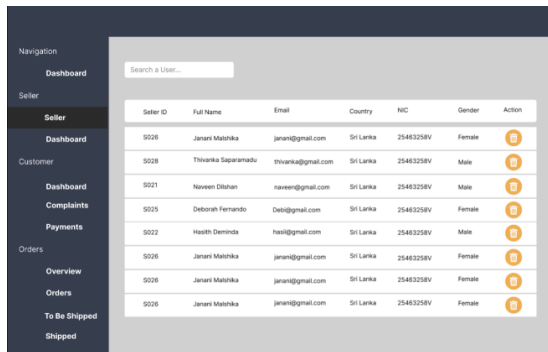


Figure 29: Admin View Seller Details Interface

Below Figure 30 is used by the admin to view seller inquiries. If the seller needs to clear the messages, he/she can click on the 'clear' button and admin can reply sellers using 'reply' button.

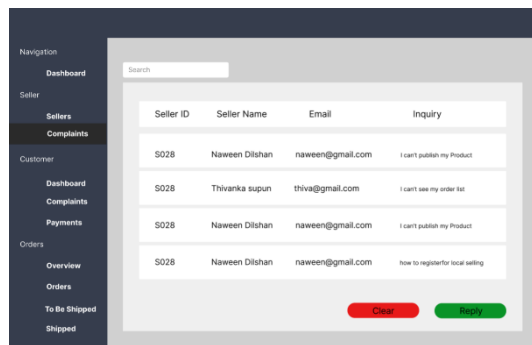


Figure 30: Admin View Seller Inquiries Interface

Below Figure 31 is used by the admin to reply to sellers. Initially, the user is required to input seller email and response. After entering the required values, a user needs to click on the 'submit' button to save the entered data. after, responses will be sent to sellers' email.

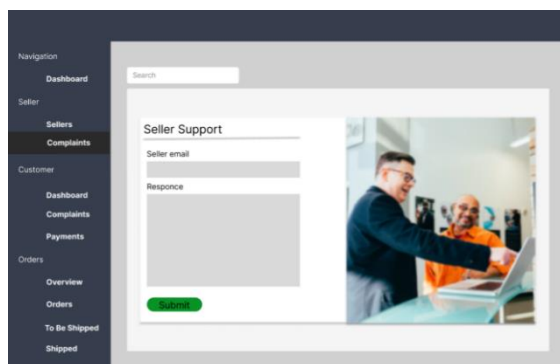


Figure 31: Admin Side Seller Support Interface

V. DISCUSSION

The results of the web application for e-commerce are shown in this chapter. Additionally, suggestions for prospective upgrades are explored in order to better the application in the future.

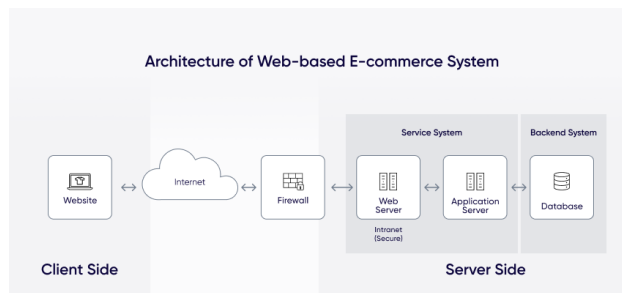


Figure 32: Architecture of Web-based E-commerce System

5.1 Results

In the end, the MERN stack served as the major full stack technology for the development of the E-commerce web application, proving that the MERN stack is capable of creating complex full stack applications. Various tools and technologies were combined with MongoDB, Express, React, and NodeJS to create the application's final version.

The technology and methods used were extensively covered throughout the thesis. As a result, the finished application meets every criterion listed in the project specifications. Any visitor may explore the items and choose a specific item to gain more information about it.

The system allows users to log in, add items to their shopping carts, manage their carts, and complete transactions. On the other side, customers with the administrative role, which translates to sellers, may add items, edit product information, and view the specifics of every user's order.

Since there are just a few steps needed for each visitor to go from being an unidentified customer to completing the purchase on the platform, the application is simple, friendly, and practical.

5.2 Testing

Testing is crucial for quality control since it confirms that the application is usable and compatible with the majority of modern browsers, including Chrome, Microsoft Edge, Safari, and Firefox. The browser compatibility test that was run in the following browsers was thus successful.

To improve user experience, the online material is also grammar-checked before publishing.

The functionality test is considered, which includes checking all the links, looking at items with photos, sorting the product list both in ascending order and descending order according to the date and price that the products were uploaded, and sorting the items by category and top seller.

Additionally, for the logged-in user, the add cart capability, changing the items in the cart, and examining their own purchase history were studied. On the other side, the administrator's product information was updated, with new goods added, the category list changed, and all user order reviews examined. Therefore, everything works as it should. As a result, the test met the criteria and was deemed successful.

5.3 Further Improvements

This research paper application complies with all criteria as expected, however there are still a number of areas where capabilities might be improved.

The online application only works on desktop computers at the moment, so responsive design for accessing other devices, such as tablets and mobile phones, can be created in the future to improve user experience.

Additionally, it is possible to install payment processors like PayPal, Stripe, Visa, and MasterCard. In order to speed up sign-in and improve user experience, registration and logging capabilities using external mailing services or social networking platforms like Gmail, Outlook, and Facebook can be built.

Email alerts can also be used to confirm successful payments and to confirm sign-in accounts. The order status is also used to keep tabs on the delivery or shipping process, enabling administrators to manage it and users to follow their orders. To allow consumers to assess items and compare product reviews and ratings before making a purchase, the item rating and review function may also be introduced.

On the other hand, more complex concepts and approaches may be used to improve other elements of the program. Search engine optimization (SEO) is enhanced to increase a web page's visibility in search engines like Bing and Google by adding server-side rendering (SSR), which increases search engines' access to the material on the web. In order to execute various testing techniques, including unit testing, integration testing, and end-to-end (E2E) testing, automated testing may be built utilizing a variety of well-liked tools, including react-testing-library, Jest, and Cypress. This reduces the errors and faults of the application.

VI. CONCLUSION

In our research we analyzed e-commerce web applications, through the research we learned that in a web application accessibility, user-friendliness, security, performance, and the design of the web application are important aspects to consider when developing a web application.

Our web application complies with all the above expectations. We learned that the web application developed should be useful to both buyers and sellers and that this type of system solves many problems faced by other offline stores and online store systems.

The system is easy to use as there are only a few steps for the user to perform when using the application. This system reached its goal to attract as many customers as possible and gain foreign currency to help resolve the economic crisis. MERN stack proved to be a good full stack technology for the development of this system.

However, we do encourage researchers to perform further research and try to create an application that can run on various devices to improve user experience, and to use external services such as Google, outlook and Facebook to sign in or register faster. Further research should also be conducted to include payment processors on web applications, email alerts and to execute various testing techniques.

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