SAAS SOLUTION FOR LOGISTICS OPERATIONS

Submitted by

Noor Ul Huda (BSCE19001)

Muhammad Hassam Mujahid (BSCE 19019)

Mohammad Rohail Zuberi (BSCE19032)

Supervised by

Mr. Usama Bin Shakeel

Mr. Umer Farooq

Department of Computer Engineering

Information Technology University of the Punjab

Lahore, Pakistan

June 2023

SAAS SOLUTION FOR LOGISTICS OPERATIONS

A Dissertation
Presented to
The Academic Faculty

by

Noor Ul Huda (BSCE19001)

Muhammad Hassam Mujahid(BSCE19019)

Mohammad Rohail Zuberi (BSCE 19032)

In Partial Fulfillment
of the Requirements for the Degree of
BS COMPUTER ENGINEERING in the
INFORMATION TECHNOLOGY UNIVERSITY OF THE PUNJAB
LAHORE, PAKISTAN

Department of Computer Engineering
Information Technology University of the Punjab
Lahore, Pakistan
June 2023

CERTIFICATE OF ORIGINALITY

We hereby declare that this report titled "Project final report" is our own work to the best of our knowledge. It contains no materials previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any degree or diploma at ITU or any other education institute, except where due acknowledgment, is made in the thesis. Any contribution made to the research by others, with whom we have worked at ITU or elsewhere, is explicitly acknowledged in the thesis.

We also declare that the intellectual content of this report is the product of my own work, except to the extent that assistance from others in the project's design and conception or in style, presentation and linguistic is acknowledged. We also verified the originality of contents through plagiarism software.

_____

Noor Ul Huda (BSCE19001)

_____

Muhammad Hassam Mujahid (BSCE 19019)

_____

Mohammad Rohail Zuberi (BSCE 19032)

The undersigned hereby certify that they have read and recommended the report entitled " Project mid report " by Noor Ul Huda (BSCE19001), Muhammad Hassam Mujahid (BSCE19019)and Mohammad Rohail Zuberi (BSEC19032) for the degree of Bachelor of Science in Computer Engineering.

Mr. Usama Bin Shakeel, Advisor
Department of Computer Engineering,ITU

Mr. Umer Farooq, Co-Advisor
Department of Computer Engineering, ITU

ACKNOWLEDGMENTS

We would like to express our sincere gratitude and appreciation to especially our advisor, Mr. Usama Bin Shakeel, and to our co-advisor, Mr. Umer Farooq, for their invaluable guidance, support, and expertise throughout the duration of our final year project. Their unwavering commitment to our success, their insightful suggestions, and their patience in addressing our queries have been instrumental in shaping our project and enhancing its quality. Their profound knowledge in the field has been truly inspiring and has played a crucial role in expanding our understanding. We are truly fortunate to have had the privilege of working under their mentorship, and we are deeply grateful for their continuous encouragement and belief in our abilities. Their contributions have been invaluable, and we are honored to have had them as mentors.

TABLE OF CONTENTS

LIST OF FIGURES

Abstract

With the advent of E-commerce trends in Pakistan, many new logistics companies are emerging to meet the need of those businesses and meet the customer demand. They do not have enough resources to initially invest in hiring a developer for their management processes or buying one from online vendors because they are expensive. To combat this issue, we are coming up with a SAAS solution for the logistics companies, which will be cost-effective and can be used by our local companies. Our project will be having several users ends such as Riders, Customers, and Branch managers. We will be implementing the project using mern stack. The LPI index ranking of Pakistan is 122/160 [1] which is unfortunately very low. That is due to inefficient systems used by the companies, not implementing fully secured systems, where everything can be traced and tracked to hold everyone accountable for misplaced shipments. We are planning to build a system which will be efficient in terms of these metrics, and will serve as a help for those logistics companies while kick starting their work

CHAPTER 1

INTRODUCTION

For any expanding business, if cannot keep up with the demand, it will eventually lose customers and run out of business. Every business needs a system to work things out efficiently. If they do not have a proper system for filing and record keeping, the owners will try to solve this by employing more people to keep track of deliveries, finances, payments, etc. The owners might also become overwhelmed if they keep doing everything themselves with increasing customers. This is where they will start to feel the pressure and after this, the quality of service will drop, and eventually, they will lose their clients and business. With e-commerce taking over, there are a lot of small-time couriers, logistics, or e-commerce companies opening up in Pakistan. These small-time companies cannot bear the costs of setting up an expensive system. This is where we come in and provide cheaper solutions with our software as a service.

1.1 Motivation

With the rising trend of E-commerce in Pakistan, many companies have their own logistics companies but most of them rely on third party logistics companies to handle their operations. So, many courier and logistic companies are emerging to meet the needs of new small-scale businesses. These companies do not have enough resources initially to manage to develop a software solution for their company. So they proceed with manual work, full of hassle. To avoid this and escalate the whole process, we are aiming to provide a SAAS solution to these small companies.

1.2 Challenges

The main challenge will be the integration of a wide range of services, such as warehousing, COD, normal deliveries, Bulk deliveries, etc in one product in the form of a SAAS solution, which will be dynamic and customizable according to the needs of the company. Moreover, to implement a system that will have enhanced security features, to hold everyone accountable for misplaced consignments.

1.3 Problem Statement

There are drastically low-efficiency rates and traditional methods being used by expanding logistics businesses.

The potential problems are listed as follows:

- Pakistan has a ranking of 122(out of 160 countries) in World Bank's Logistics Performance Index(LPI) with an LPI value of 2.42/5 as per records of 2018 [2]. This standing is because of poor performance in custom clearance, tracking, tracing and time lines through our country.
- If the product fails to arrive at the right time, is damaged or the driver's service is inadequate, the customer may not re-purchase at the online store. Logistics, then, plays a crucial role in e-commerce [3].
- Paper based documentation systems has alot of risk factors attached to it, such as loss of documents, enviormental damage, alot of allocated storage space, high cost in terms of buying paper, stationery, printers etc.

1.3.1 Unmet Need

Currently, a SAAS solution for logistics and courier companies is not available for small-scale companies at an affordable price due to their work being manual and full of hassle.

1.3.2 Potential Market

There are a number of businesses out there that provide logistics which includes warehousing, picking, packaging, and shipping. In this era of technology, logistics companies fuel e-commerce. Logistics companies can process orders and prepare them for shipment on the same day. So, many retailers go to logistics companies for reducing the costs of managing logistics and for better customer satisfaction by faster delivery dates. The logistics market was valued at $7.64 trillion in 2017 and is projected to reach 12.98 billion by 2027. Pakistan's logistics market is valued at $35 billion and is expanding gradually[4].

Apart from this, the need for logistics is directly correlated to the increasing trend of e-commerce in Pakistan. Pakistan is the 37th largest market for eCommerce with revenue of US$5.9 billion in 2021,

placing it ahead of Iran and behind Israel[5].

1.4 Report Outlines

This report deals with the following sections:

- Chapter 1 describes the motivation, and problem statement of the project.
- Chapter 2 comprises of literature review
- Chapter 3 has proposed methodology and architecture.
- Chapter 4 consists of System Architecture and Requirements
- Chapter 5 discusses milestones, work division, and cost
- Chapter 6 includes the results
- Chapter 7 concludes everything

CHAPTER 2

LITERATURE REVIEW

2.1 Comparison Table

The literature review section of this FYP report aims to provide a comparison between existing solutions related to logistics operations. By examining these solutions, we aim to identify the features which are missing and how can we incorporate those to our solution. Additionally, we explore the benefits and implications of utilizing a SaaS model in the context of logistics management systems, considering factors such as scalability, security, and cost-effectiveness. Following table illustrates the comparison between features of existing logistic solutions.

	SHIPTRACK	BRINGOZ	DISPATCH SCIENCE	TCS	TRAX	ELOGISTIQUE
Cash on delivery	Yes	Yes	Yes	Yes	yes	Yes
Domestic delivery	Yes	No	Yes	Yes	Yes	Yes
Pickup and delivery	No	No	Yes	No	No	Yes
Warehousing	Yes	Yes	No	Yes	Yes	Yes
Bulk delivery	Yes	Yes	Yes	Yes	Yes	Yes
SAAS solution	yes	Yes	yes	No	No	Yes

Figure 2.1: Comparison of different solution.

2.2 Finding:

We have compared certain SAAS solutions with each other and also included the softwares of the logistics companies i.e. the features they are offering. We came to know that the prices of the SAAS solutions are very high for a local person, starting his new company, Moreover,, our solution will be having multiple features in one place.

SAAS SOLUTION	PRICING
Dispatch Science	$650
Bringoz	Nil
Cigo	$99

Figure 2.2: Pricing of various solutions

CHAPTER 3

PROPOSED METHODOLOGY AND ARCHITECTURE

3.1 Proposed Solution

We are going to develop a system that will work completely on the internet. If you have a smartphone, tablet, laptop, or a computer, you can easily gain access to our system through your credentials. Since this is a SaaS solution, we will be maintaining everything related to the system. Our customers will have to only pay a monthly fee of how many ever resources they plan to use from our system. We already have a client and we plan to expand this to small and large scale logistics companies over time.

The system aims to streamline and optimize various aspects of the logistics process. It includes a range of key features to enhance the overall logistics management experience. These features encompass a pickup schedule module, enabling users to efficiently plan and schedule pickups. The system incorporates optimized routing algorithms to optimize delivery routes, reducing time and costs.

Moreover, it provides comprehensive customer records, facilitating easy access to customer information and order history. Payment records are securely stored, ensuring transparency and accuracy in financial transactions. The system also includes an intuitive order records management module, allowing users to efficiently track and manage orders. The administrative records feature empowers administrators with access to vital information for effective decision-making.

Additionally, the system offers dedicated modules for rider management and generating labels, ensuring smooth and accurate dispatch operations. Email updates keep stakeholders informed about order statuses and relevant notifications. Furthermore, the system includes a tariff calculator, simplifying cost calculations for shipments.

It provides separate portals for administrators, users, and riders, offering tailored functionalities and user experiences. The administrative portal offers a centralized control panel for managing the entire logistics operation. The user portal enables customers to conveniently place orders, track shipments, and access relevant information. Riders can utilize the rider portal to view assigned tasks, update delivery statuses, and communicate with the system.

Finally, the system incorporates data analytics capabilities to provide valuable insights and perfor-

mance metrics. Our proposed solution encompasses these features to provide a comprehensive and efficient logistics management platform, enhancing the overall logistics operations and improving customer satisfaction.

Feature List		
Pickup Schedule	Payment Records	Rider Records
Optimized Routing	Order Records	Generating Labels
Customer Records	Admin Records	Email Updates
Tariff Calculator	Admin Portal	Electronic Proof of Delivery
User Portal	Rider Portal	Data Analytics

Table 3.1: Features Offered by the Website

3.2 Methodology

3.2.1 Research Design:

The research design for this project is a combination of quantitative and qualitative methods. It involves developing a web application using the MERN (MongoDB, Express.js, React.js, and Node.js) stack, with MySQL as the database management system. This design allows for the collection of both quantitative data from the database and qualitative data from user interactions.

3.2.2 Participants or Sample:

The project does not involve direct human participants. Instead, the sample consists of simulated logistic data, including orders, inventory, shipments, and other relevant information. This data will be generated and stored in the MySQL database to simulate real-world logistic operations.

3.2.3 Data Collection:

The data collection process involves generating simulated logistic data and populating the MySQL database manually as well. The data will be collected using a combination of backend APIs and manual input through the web application's user interface.

3.2.4 Development of the Web Application:

The web application will be developed using the MERN stack. The backend will be built with Node.js and Express.js, providing the necessary APIs to interact with the MySQL database. The frontend will be developed using React.js to create a user-friendly interface for logistic operations. The development process will follow an iterative and agile approach, allowing for continuous feedback and improvement.

3.2.5 Database Management:

MySQL will be used as the primary database management system for storing and retrieving logistic data. The database schema is designed to efficiently store and retrieve information related to orders, inventory, shipments, and other relevant entities. SQL queries and transactions will be used to ensure data integrity and consistency.

3.2.6 User Authentication and Authorization:

The web application will include user authentication and authorization features to secure access to sensitive logistic data. User registration, login, and session management is implemented using industry-standard authentication practices such as famous frameworks such as Redux and Redux saga. Role-based access control will be enforced to restrict user access based on their assigned roles and permissions.

3.2.7 Testing and Quality Assurance:

Comprehensive testing will be conducted after the development phase has been completed. Unit testing, integration testing, and end-to-end testing will be performed to ensure the functionality, performance, and reliability of the web application. Quality assurance techniques, including code reviews and continuous integration, will be employed to maintain code quality and stability.

3.2.8 Deployment and Hosting:

The final web application will be deployed to a hosting environment, such as a cloud platform or a dedicated server. The deployment process will include configuring the necessary infrastructure, such as servers and databases, and setting up continuous deployment pipelines for seamless updates.

3.2.9 Project Evaluation:

After the development and deployment of the web application, an evaluation will be conducted to assess its effectiveness in supporting logistic operations. This will involve collecting feedback from

potential users, assessing system performance, and comparing the application's functionality against the initial project objectives. The evaluation results will inform future enhancements and improvements.

3.3 Expected Output

A complete SAAS-based solution that will have features integrated into it, which will be meeting needs of logistics companies with different structures, and will be customizable according to their needs.

3.4 Platforms Used:

- Node.js - Server side programming
- React.js - Frontend
- Mysql - Database
- Postman - API testing
- Github - Version control

CHAPTER 4

SYSTEM ARCHITECTURE AND REQUIREMENTS

4.1 System Architecture and Requirements

The system architecture for the logistic operations website will follow the MERN stack (MongoDB, Express.js, React.js, and Node.js), with MySQL as the database management system. The frontend will be built using React.js, providing an interactive and user-friendly interface for logistic operations. The backend will be developed using Node.js and Express.js, which will handle the API requests and data processing. MySQL will be used as the database to store and retrieve logistic data, including orders, inventory, shipments, and related information.

4.1.1 Functional Requirements:

User Registration and Authentication:

Users should be able to register an account with the system using an email address and password. Registered users should be able to authenticate themselves to access the system's features and functionalities.

Order Management:

Users should be able to create new orders by providing relevant details such as customer information, item details, and shipping address. The system should allow users to view, update, and delete existing orders. Users should be able to track the status of their orders and receive notifications on any updates.

Inventory Management:

The system should provide functionalities to manage the inventory, including adding new items, updating item quantities, and deleting items. Users should be able to view the current stock levels of each item and receive alerts when stock levels are low.

Shipment Tracking:

The system should integrate with external shipment tracking services to provide real-time tracking information to users. Users should be able to track the status and location of their shipments using shipment tracking numbers.

4.1.2 Non-Functional Requirements:

Performance:

The system should handle a significant number of concurrent users and provide fast response times for data retrieval and updates. zseThe website's frontend should be optimized to ensure smooth and responsive user interactions.

Security:

User authentication and authorization should be implemented to ensure secure access to the system's functionalities and protect user data. All sensitive data, such as passwords and personally identifiable information, should be securely stored and transmitted using encryption techniques.

Usability:

The user interface should be intuitive, visually appealing, and provide a seamless experience for users performing logistic operations. The website should be responsive and compatible with different devices and screen sizes.

4.1.3 Hardware and Software Requirements:

The system should be compatible with commonly used web browsers, such as Chrome, Firefox, and Safari. The frontend will be developed using HTML, CSS, and JavaScript with React.js. The backend will be built using Node.js and Express.js. MySQL will be used as the database management system.

4.1.4 Data Requirements:

The system will store and retrieve logistic data, including order details, customer information, inventory data, and shipment information. The data will be organized and stored in the MySQL database, following an appropriate database schema design. Performance Requirements:

The system should be capable of handling a minimum of 100 concurrent users without significant performance degradation. Data retrieval and processing should be optimized to provide fast response times.

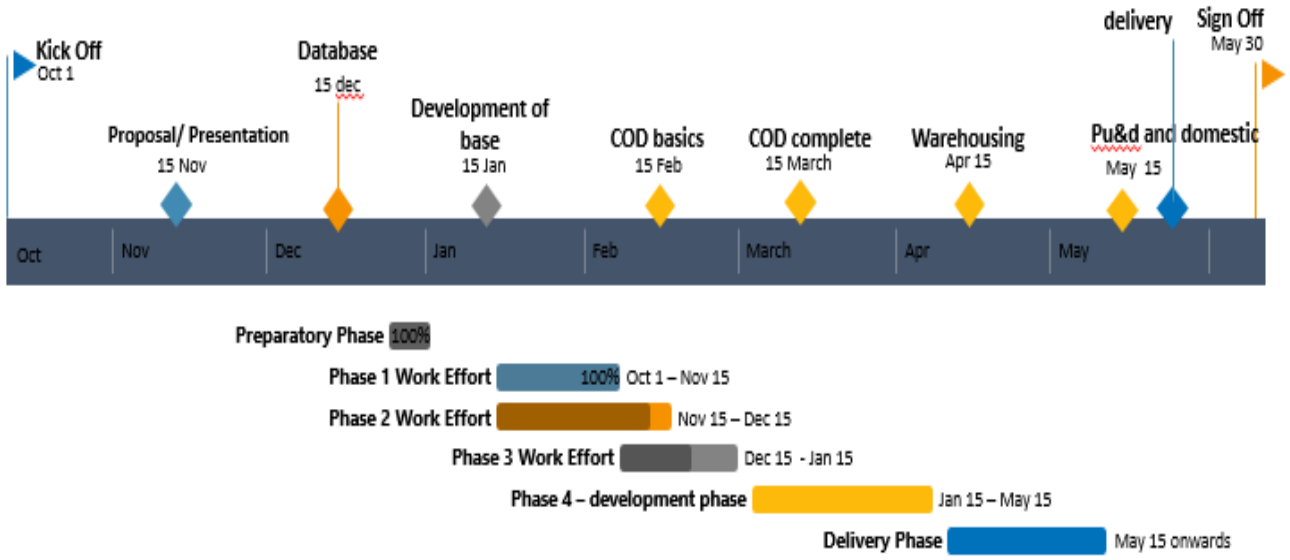
4.1.5 Security Requirements:

User authentication should be implemented using secure password hashing and salting techniques. The system should protect sensitive data by encrypting it both at rest and during transmission. Measures should be taken to prevent common security vulnerabilities, such as SQL injection and cross-site scripting (XSS)

CHAPTER 5

MILESTONES, COST AND WORK DIVISION

5.1 Milestones



5.2 Cost

Following are the costs that we will be having for the development and deployment of this software project.

- purchasing a template for the front end of our system.
- cost for using google api for tracking purposes
- cost for registering a domain for the product
- cloud costs.

5.3 Revised Work Division

In order to effectively manage the workload and ensure efficient progress in the development of our FYP, we divided the work among team members based on their areas of expertise. The division of responsibilities was as follows: Noor Ul Huda was primarily responsible for the SRS/REPORT component, handling the documentation and requirements gathering aspects. For the DATABASE implementation, Noor Ul Huda took the lead in designing and managing the database structure. Rohail Zuberi was entrusted with the FRONTEND development, focusing on creating an intuitive and visually appealing user interface using modern web technologies. Hassam Mujahid spearheaded the BACKEND development, working on server-side logic and integration of APIs. As for TESTING, it will be a collaborative effort involving Noor Ul Huda, Rohail Zuberi, and Hassam Mujahid, ensuring comprehensive testing and quality assurance of the entire system. By distributing the workload based on individual strengths and expertise, we aimed to streamline the development process and ensure a well-rounded implementation.

SRS/REPORT	Noor Ul Huda
DATABASE	Noor Ul Huda
FRONTEND	Rohail Zuberi
BACKEND	Hassam Mujahid
TESTING	Noor Ul Huda + Rohail Zuberi + Hassam Mujahid

Table 5.1: Roles and Corresponding Values

CHAPTER 6

RESULTS

6.1 overview

The software is still in the process of development however certain features have been developed till now, the description of each feature has been stated below.

6.1.1 Login/ Register

To implement login and register functionality using Redux Saga in a React application with MySQL, Express, and Node.js, we followed a series of steps. Here's a high-level overview of the process:

1- Backend Setup:

We created an Express server to handle API requests. Routes for user registration and login were set up. We connected to the MySQL database using a MySQL library for Node.js, such as mysql2 or sequelize.

2- Redux Actions:

We defined action types for login and register actions. Action creators were created for these actions, which are dispatched to the Redux store.

3- Redux Sagas Implementation:

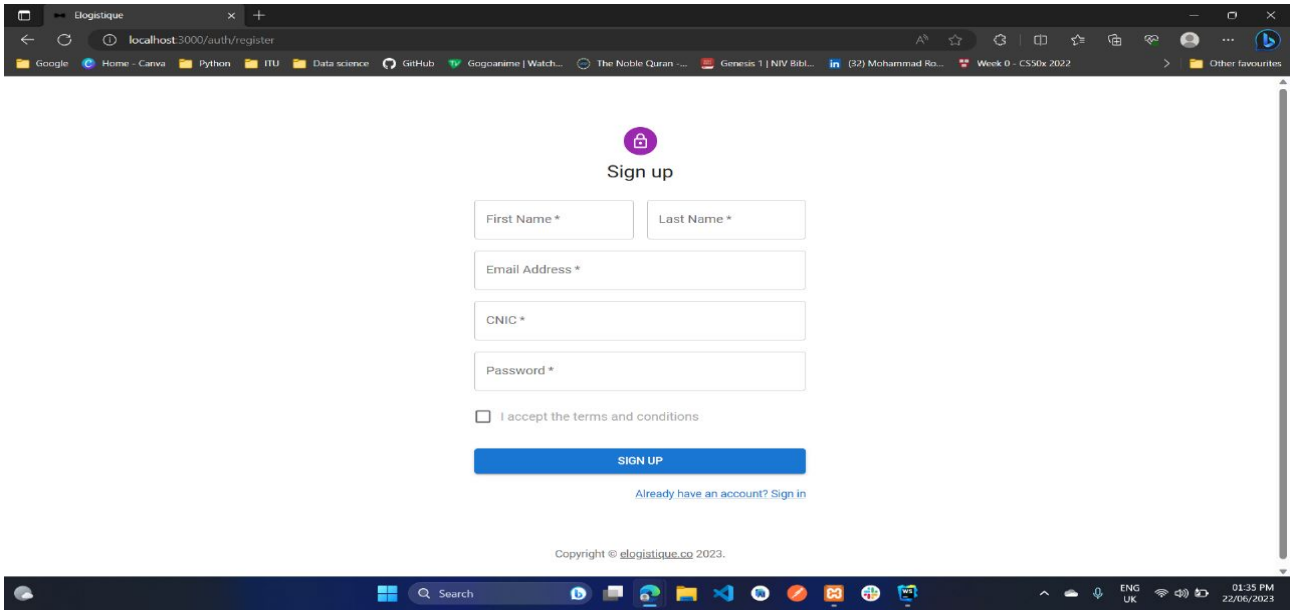
We set up a saga middleware and integrated it with our Redux store. A saga was created to handle user registration: This saga listens for the register action and makes an API call to the backend to register the user. Another saga was implemented to handle user login: This saga listens for the login action and makes an API call to the backend to authenticate the user.

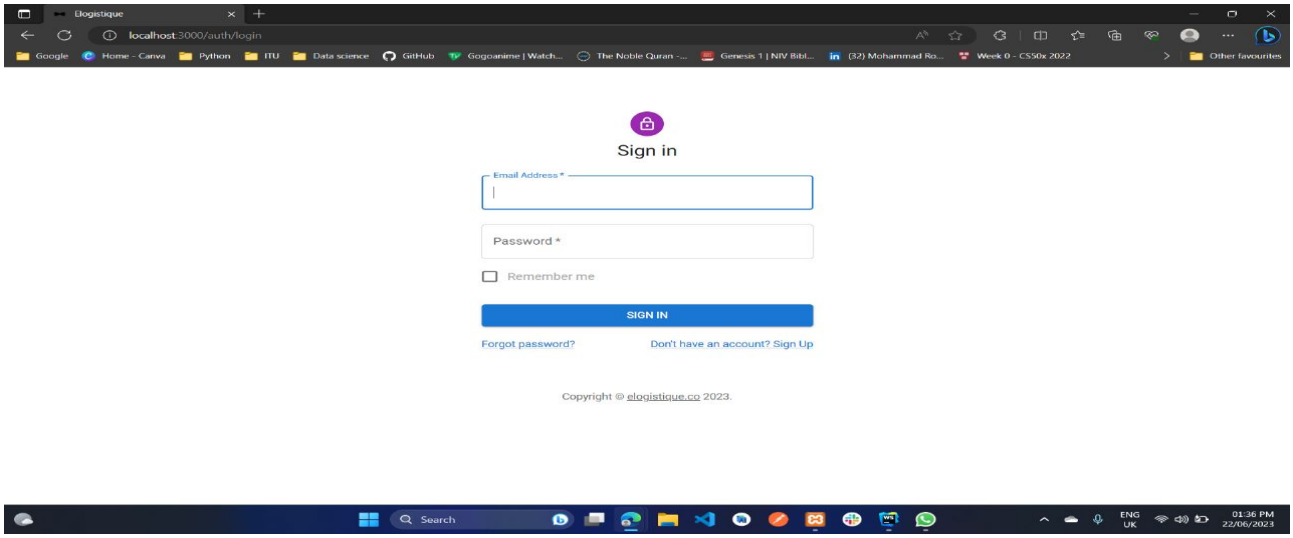
4- API Calls:

We implemented API endpoints on the backend for user registration and login. The MySQL library was used to interact with the database, perform necessary queries, and validate user credentials.

5- React Component Update:

Login and registration forms/components were created in our React application. These components were connected to the Redux store to dispatch the corresponding actions. We handled the API response in our components to display appropriate messages or redirect the user.



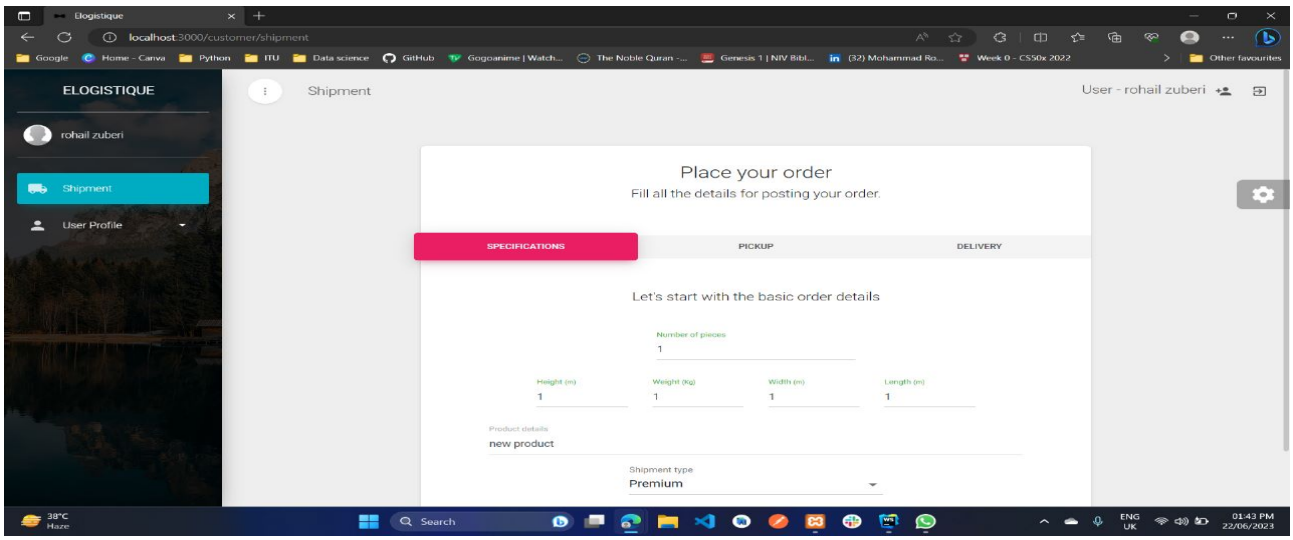


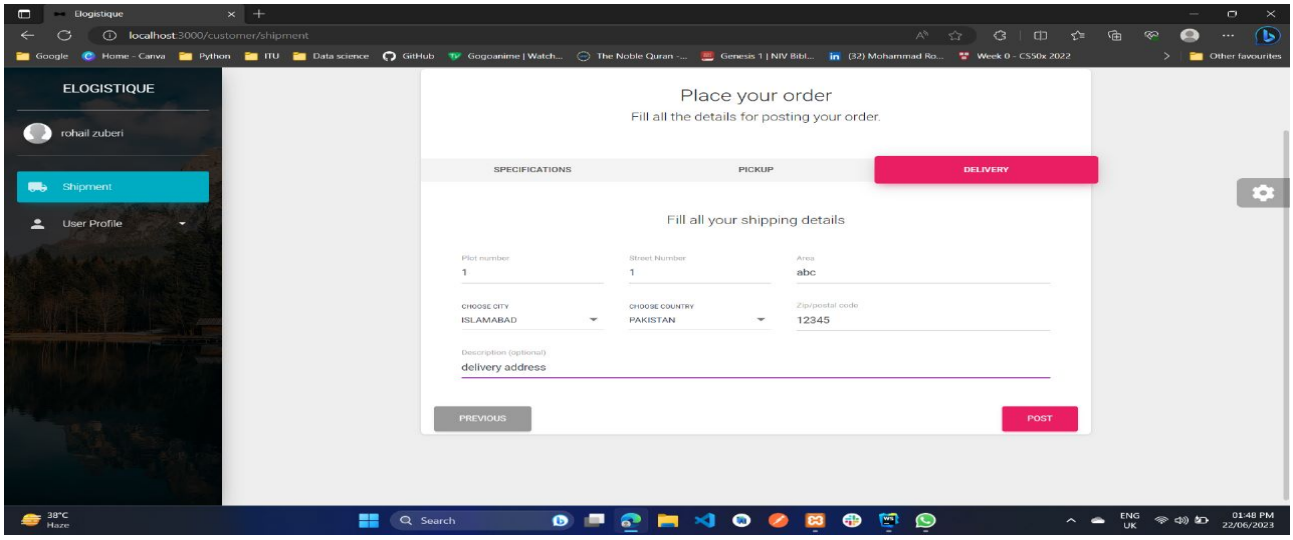
6.1.2 User:

The User part of the project has following functionalities.

1- Shipment:

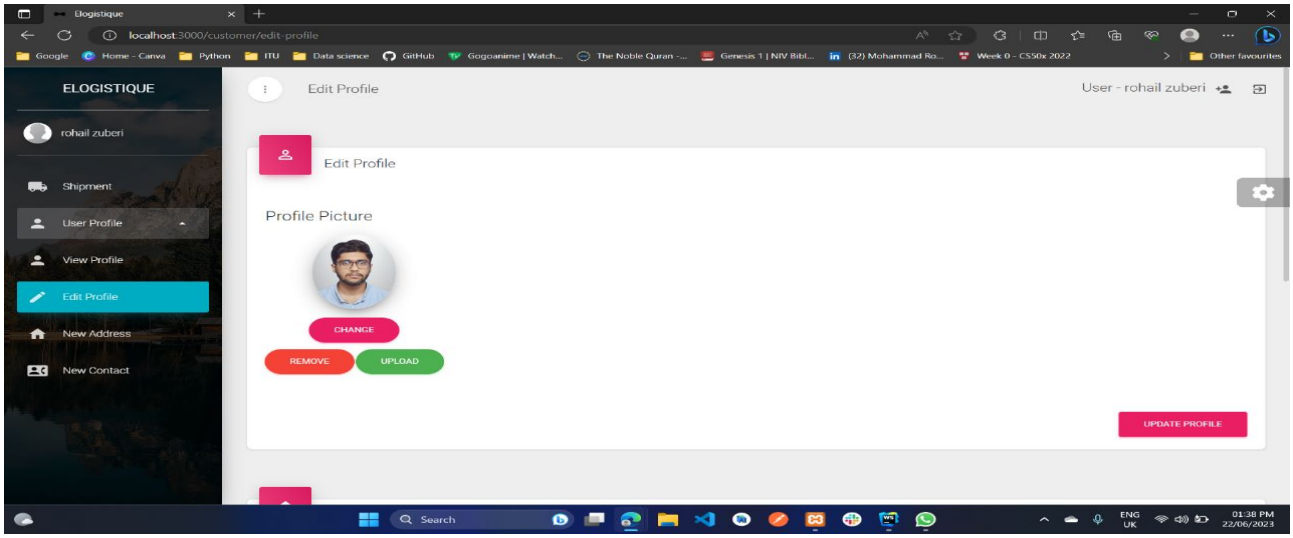
The shipment page allows Users to successfully create new shipments. The users are prompted to add their personal details, then the address on which they want to send the shipment and pickup address and other related information.





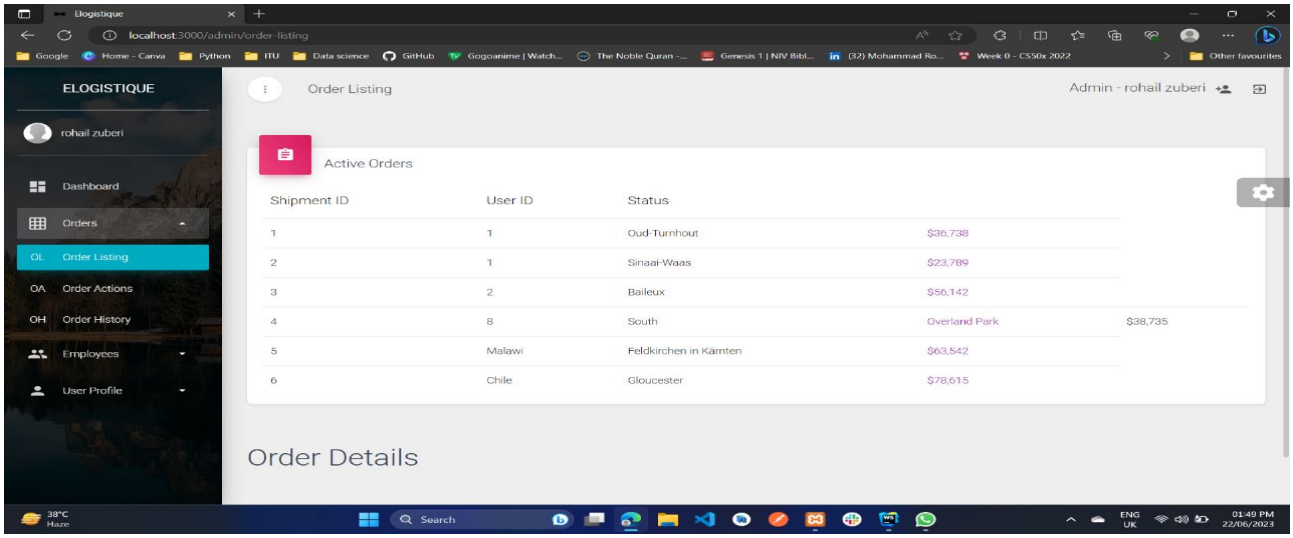
2- User Profile:

The Users can edit their profile picture and their personal details, they can add new address edit old address, moreover, they can also add new contact as per different categories.



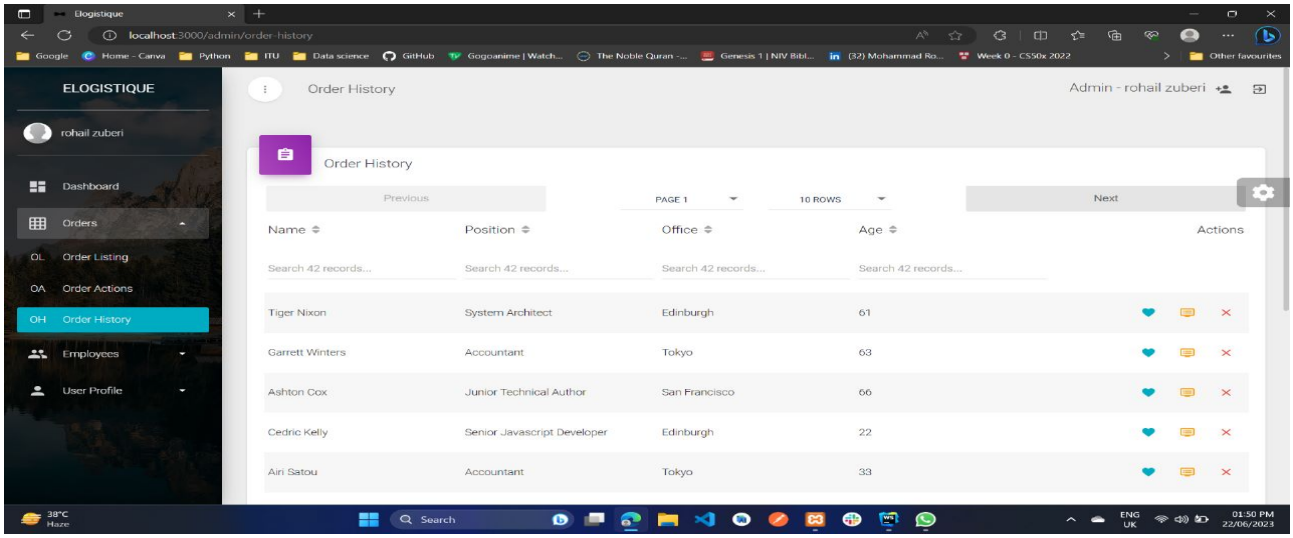
6.1.3 Admin:

1- Order listing: In this tab orders are listed and their shipment id and status has been showed



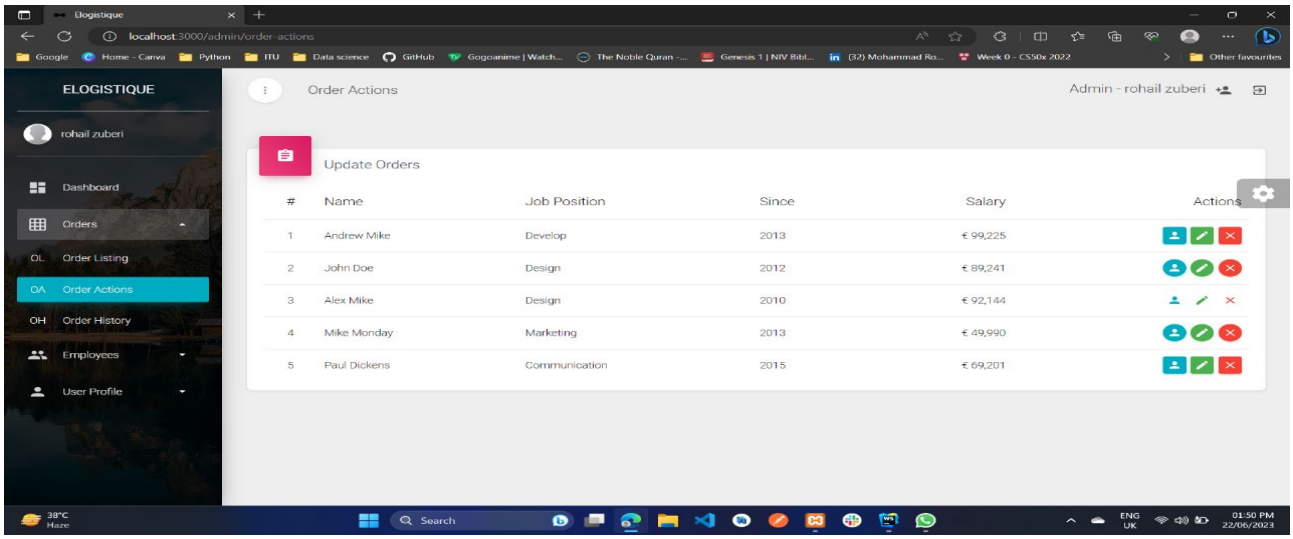
2- Order History:

In this tab all orders that were previously placed are listed.



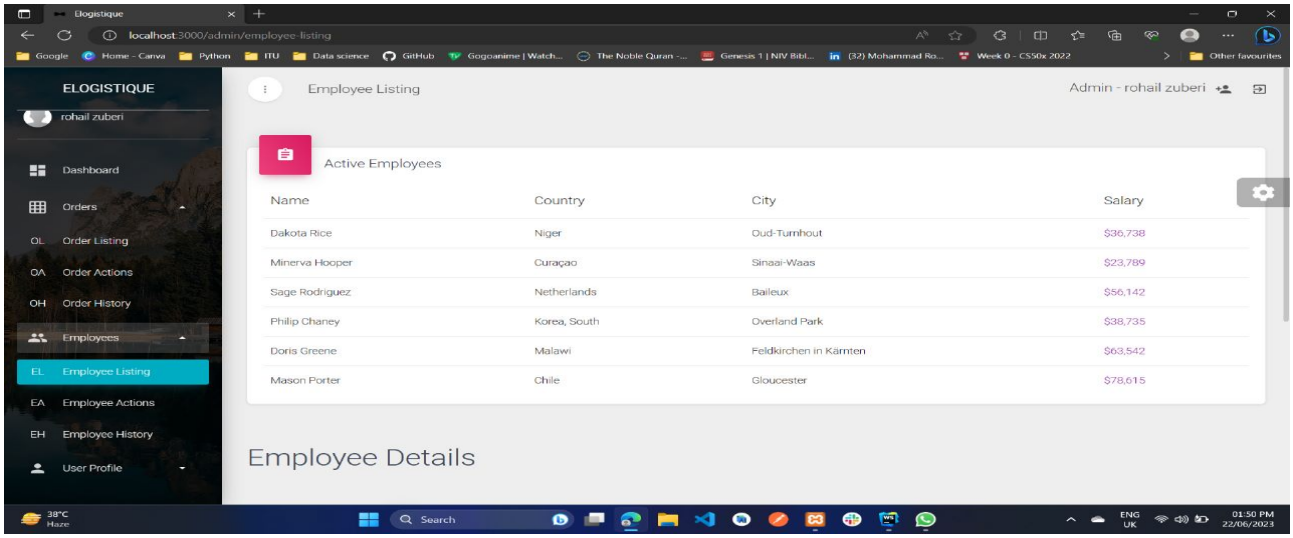
3-Order Actions :

In this tab admin can update the orders as per requirements.



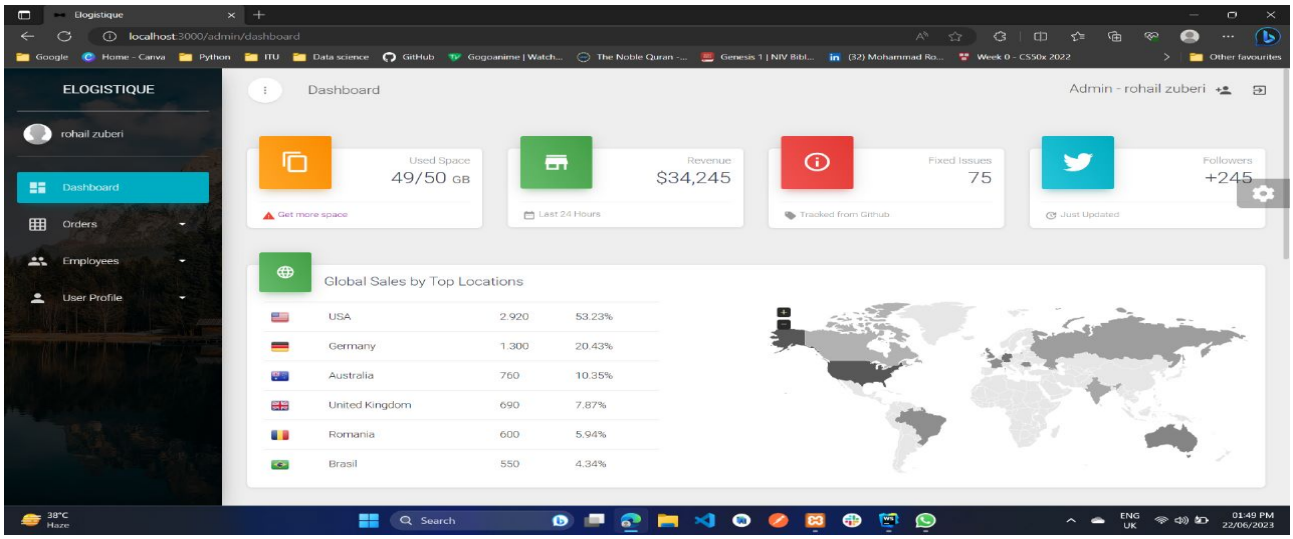
4- Employee listing :

In this tab details of all employees has been listed .



5- Dashboard :

In this tab of dashboard, the summary has been shown



CHAPTER 7

CONCLUSION

7.1 Future Work

After completing this web app, we are also planning to develop a mobile app as well related to this project. We will be subsequently adding more features related to logistics and courier companies and improving our current design to make things more efficient.

7.2 Conclusion

Concluding this report, we will give it our all to complete the scope of our project and successfully build a web app SaaS solution for all companies involved in logistics. There is still work that needs to be done. and we will be dedicating our time after the semester as well. We would once again like to thank our advisor and co-advisor, Mr. Usama Bin Shakeel, and Mr. Umer Farooq for their continuous support and guidance.

In addition, you will also need to have a basic understanding of JavaScript and web development concepts. Familiarity with React and Node.js will also be helpful, but is not strictly required.

REFERENCES

[1] *https://data.worldbank.org/indicator/LP.LPI.OVRL.XQ?locations=PK*

[2] *https://www.pakistangulfeconomist.com/2019/09/30/pakistan-logistics-and-transport-problems-and-solutions/*

[3] *Moagar-Poladian et al., 2017; Vakulenko et al., 2019*

[4] *https://www.pakistangulfeconomist.com/2020/10/12/economic-importance-and-problems-of-logistics-sector/*

[5] *https://ecommercedb.com/markets/pk/all*

[6] *https://www.officetimeline.com/gantt-chart/how-to-make/powerpoint*

[7] *https://www.coursehero.com/*

[8] *https://www.coursehero.com/*

[9] *https://www.grin.com/en/*