Dragon Restaurant

by

Sushana Islam Mim
22273001

A project submitted to the Department of Computer Science and Engineering
in partial fulfillment of the requirements for the degree of
M.Engg. in Computer Science and Engineering

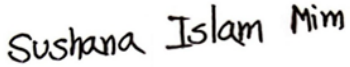
Department of Computer Science and Engineering
Brac University
November 2024

Declaration

It is hereby declared that

1. The project submitted is my own original work while completing degree at Brac University.
2. The project does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The project does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

Student's Full Name & Signature:



Sushana Islam Mim
22273001

Approval

The project titled "Dragon Restaurant" submitted by

1. Sushana Islam Mim (22273001)

Of Summer, 2024 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of M.Engg. in Computer Science and Engineering on 14th November, 2024.

Examining Committee:

Supervisor:
(Member)

Moin Mostakim
Senior Lecturer
Department of Computer Science and Engineering
Brac University

Program Coordinator:
(Member)

Md Sadek Ferdous, PhD
Professor
Department of Computer Science and Engineering
Brac University

Head of Department:
(Chair)

Sadia Hamid Kazi, PhD
Chairperson and Associate Professor
Department of Computer Science and Engineering
Brac University

Abstract

In the current day, restaurants and food delivery companies often have steep competition. With the addition of the internet, now at the fingertips of all customers, the competition has become even more steep and unpredictable. Nowadays, people prefer to order food online and expect all restaurants to have home delivery options. As such, this project "Dragon Restaurant" is made to address the issue of online ordering to selected customers who wish to order food from a distance and get goods delivered at home to enjoy on their own time with their families or friends. Around 2017, this idea became a topic of discussion. By 2019, it struck mainstream business, saw record climbing revenue and saved huge financial burdens from restaurants. Companies, both big and small adopted to the new way of digital order and delivery. This project, aims to show how cost effective and time saving it is to order food online instead of waiting in lines to get a seat at a restaurant. The project came with its set of challenges to overcome and objectives to achieve. Prior works on various other restaurant management systems are looked into, along with reasons for using a different approach - why Java is used instead of HTML and CSS. The requirements, positives, negatives and feasibility - both technical and financial along with model diagrams are elaborated. The database is discussed in detail. All components of the project, each UI/UX component and their functionalities are explained. Implementation shows how project works, how well it functions and how smooth it is. To evaluate the project, JUnit tests for all components are utilized. Conclusions are reached and future updates are discussed.

Keywords: Restaurant Management Application, Online Ordering, Database, Java, Java Swing, JUnit, PHPMyAdmin, SQL.

Acknowledgement

Firstly, all praise to Allah for whom my project has been completed without any major interruption. Secondly, to my Supervisor Md. Moin Mostakim sir for his kind support and advice in my work. He helped me whenever I needed help. And finally, to my parents, without their thorough support it may not have been possible. With their kind support and prayers I am now on the verge of my graduation.

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Chapter 1

Introduction

1.1 Motivation

The motivation behind this project arises from the growing need to significantly enhance the customer experience in the restaurant industry by integrating modern technology. In today's fast-paced world, convenience is a major factor influencing consumer decisions and more people are opting for the ease of online food ordering rather than dining in. This shift in consumer behavior has created a pressing demand for restaurants to adapt to digital transformation or risk losing their competitive edge. Traditional restaurant management practices are no longer sufficient to meet the needs of modern consumers, who expect quick, seamless and personalized service. This project is driven by the vision of providing an efficient, reliable and user-friendly online ordering and delivery system that not only meets customer expectations but also streamlines restaurant operations. By introducing technology into the core of restaurant management, this project aims to help businesses capitalize on the growing trend of online food ordering, enabling them to boost their revenue and optimize workflow. Through the automation of the ordering process, restaurants can reduce wait times, avoid overcrowding and handle more orders in a shorter span of time, all while maintaining a high standard of service.

Additionally, this project is motivated by the desire to ease the workload on restaurant staff. The traditional system of managing in-person dining requires substantial human resources, from seating customers to taking orders and processing payments. By simplifying the ordering process and moving it online, the pressure on restaurant staff can be significantly reduced, allowing them to focus on improving other aspects of service such as food preparation and quality control. Moreover, the system will make it easier for customers to browse menus, customize their orders and schedule deliveries at their convenience, thereby offering a more personalized and enjoyable dining experience. Ultimately, this project is motivated by a commitment to advancing the restaurant industry through digital innovation, offering a solution that benefits both the business and its customers. By leveraging technology to improve operational efficiency and customer satisfaction, the project addresses the evolving needs of the modern dining landscape.

1.2 Problem Discussion

The rise of online food delivery services presents several challenges for restaurants. Traditional restaurant management systems often fail to meet the demands of modern consumers, who expect quick and easy access to menus, the ability to place orders remotely and fast delivery. Moreover, restaurants face difficulties managing real-time inventory, delivery logistics and customer satisfaction. Without an efficient system, restaurants can lose valuable customers to competitors who offer superior online services. Additionally, many existing systems rely heavily on simple web technologies like HTML and CSS, which may not be robust enough to handle the complexity of a full-fledged online ordering platform. This project tackles these challenges by developing a comprehensive management system using Java, offering a more powerful and scalable solution. Furthermore, restaurants often struggle with maintaining smooth operations during peak hours, where high order volumes can overwhelm staff and lead to delayed deliveries or errors. The lack of integration between front-end customer ordering systems and back-end restaurant operations further complicates the process, resulting in miscommunication and inefficiencies. By utilizing Java's robust features, this project aims to bridge these gaps, providing a real-time, streamlined system that enhances order management, delivery coordination and overall customer satisfaction.

1.3 Project Aims

The aim of this project is to develop a "comprehensive restaurant management system" that provides a seamless and efficient platform for "online food ordering and home delivery services". In today's fast-paced, digital-driven society, traditional dining models are evolving rapidly, with a growing number of consumers preferring to order food online rather than visit restaurants in person. This project seeks to cater to this shift in consumer behavior by offering an integrated solution that enhances both the customer experience and the operational efficiency of restaurants. The core objective is to create a "user-friendly system" that allows customers to browse through restaurant menus, place orders and schedule deliveries easily from their mobile devices or computers. The system will eliminate the hassle of long waits, restaurant overcrowding and inefficient ordering processes, making dining more convenient for customers and less resource-intensive for restaurant owners. From a business perspective, the system aims to help restaurants increase their revenue by optimizing the order and delivery process, allowing them to serve more customers in a shorter period of time. By moving much of the traditional restaurant workflow online, the project also intends to "streamline back-end operations", such as inventory management and order processing, reducing errors and improving service quality.

Additionally, the project will emphasize the "cost and time-saving benefits" of online food ordering compared to traditional dining. Customers can enjoy the convenience of receiving their favorite meals at home, while restaurants can reduce overhead costs associated with in-house dining, such as maintaining large dining spaces or hiring additional staff. The system will integrate modern technologies to ensure reliability, scalability and security, offering an efficient way for restaurants to manage orders

and deliveries. By building a system that incorporates inventory updates, secure database management and effective logistics handling, the project seeks to solve common pain points in the food service industry, providing a solution that benefits both restaurants and their customers. Through extensive testing and evaluation, the project also aims to ensure that the system operates smoothly, providing a reliable platform that can be used by businesses of all sizes, from small local eateries to larger restaurant chains. Ultimately, the aim is to create a robust and scalable platform that addresses the growing demand for online food ordering, improves the overall restaurant experience and helps businesses thrive in the increasingly competitive food service industry.

1.4 Project Objectives

The objectives of the project are given below.

1. To develop a User-Friendly Interface: Design an intuitive and easy-to-navigate user interface that allows customers to browse menus, place orders and schedule deliveries effortlessly.

2. Efficient Back-end Management: Utilize Java to build a robust back-end system capable of processing orders, managing delivery logistics and updating inventory in real-time to ensure smooth restaurant operations.

3. Secure Database Management: Create a database management system using PHPMyAdmin and SQL to securely store customer data, order histories and restaurant-related information for efficient record-keeping and operations.

4. Highlight Cost and Time Savings: Demonstrate the significant benefits of online food ordering over traditional restaurant dining in terms of both cost and time savings for customers and restaurants alike.

5. Implement Rigorous Testing: Conduct thorough testing using JUnit to verify that all components of the system work seamlessly and efficiently, ensuring reliability and smooth functionality across different scenarios.

These are the objectives of the project.

1.5 Project Challenges

Developing an efficient online ordering system for restaurants presents several significant challenges that must be addressed to ensure a smooth and effective user experience. Each challenge requires careful planning, integration of advanced technologies and ongoing optimization to meet both customer expectations and restaurant operational needs.

- Delivery Logistics: Coordinating timely deliveries presents another major challenge, particularly in urban areas with varying traffic conditions and geographic constraints. Ensuring that each order reaches the customer on time requires careful management of delivery personnel, efficient route planning

and consideration of external factors like traffic or weather conditions. Furthermore, the system needs to track the availability of delivery drivers in real-time and allocate orders accordingly, preventing delays or miscommunication. Failure to do so can lead to customer frustration, reduced satisfaction and potential losses for the restaurant.

- System Scalability: Scalability is a critical concern, especially as the number of users and orders increases during peak times or special promotions. The system needs to be built with the capability to handle a large volume of simultaneous requests without compromising performance. For instance, during holidays, weekends, or promotional periods, many restaurants experience a surge in online orders. A system that cannot scale effectively may crash or slow down, leading to poor customer experiences and operational disruptions. Ensuring scalability requires designing a back-end architecture that can dynamically manage resources and handle spikes in user traffic efficiently.

- User Experience (UX) Design: Creating an intuitive, seamless and error-free user experience is essential for the success of any online ordering platform. The interface must be easy to navigate, allowing customers to quickly browse through menus, select items, customize orders and complete transactions with minimal friction. At the same time, the system should offer real-time feedback, such as order confirmations, delivery updates and estimated wait times. Designing a user-friendly platform is a complex task that involves constant testing, refining and ensuring that customers can interact with the system effortlessly. Even minor delays or confusing interfaces can lead to abandoned orders or negative reviews.

- Integration of Robust Technologies: In this project, the choice of Java over simpler web technologies like HTML and CSS reflects the need for a more scalable, robust and high-performance system. Java provides the ability to handle complex back-end operations, real-time data processing and secure transactions, which are essential for managing online orders and deliveries effectively. While HTML/CSS may be more accessible for basic web pages, they lack the processing power needed for handling real-time data, managing logistics and integrating advanced functionalities like inventory updates and delivery tracking. Java's object-oriented nature and cross-platform capabilities make it a more suitable choice for building a system that needs to be highly reliable and perform well under heavy usage.

1.6 Organization of the Report

This report is organized in a very coherent manner. The chapters are organized and the contents are explained with all necessary details in each chapter.

- Chapter 1 - Discusses motivation, problem discussion, project aims with objectives and project challenges in detail with report organization.

- Chapter 2 - Explains the literature review and various related works to project. Also explains why Java is chosen over HTML and CSS.

- Chapter 3 - The requirement analysis, computational requirements, positives and negatives. The feasibility report talks of economic and technical prospects.
- Chapter 4 - Explains project workings and implementation of the project. The database software, database, project in NetBeans IDE and project libraries with the GUI and buttons.
- Chapter 5 - Elaborates the testing of the project along with explanations of JUnit, JUnit libraries and test codes. Test start, progress and end is also stated.
- Chapter 6 - Talks about the conclusion and various future updates that will be available. Discussed in detail.

As per above points the project report is organized.

Chapter 2

Literature Review and Related Works

2.1 Literature Review

The rapid expansion of online food delivery services has fundamentally transformed the restaurant industry. In recent years, research has highlighted the increasing preference for digital food ordering, which has become an essential service for restaurants aiming to stay competitive. Several studies and previous works have explored the development of restaurant management systems, online ordering platforms and the challenges associated with integrating these systems into traditional business models. Evolution of online food delivery systems. The rise of the internet and mobile technologies has paved the way for online food delivery services to flourish. Early systems were primarily web-based, offering basic functionality, such as menu browsing and order placement. Research from as early as 2010 recognized the need for such services as consumer behavior shifted towards convenience and quick access to goods and services [3]. However, these early systems were limited in scalability and flexibility, often relying on simple web technologies like HTML and CSS, which proved insufficient for handling real-time data and complex order management. By 2017, the focus had shifted towards more sophisticated systems that not only offered online ordering but also included back-end functionalities such as inventory management and delivery tracking. Researchers such as Ray and Bala, emphasized the importance of real-time inventory systems to avoid discrepancies between customer orders and available stock, a recurring issue with earlier systems [10]. Prior Works on Restaurant Management Systems Several restaurant management systems have been developed over the years, with varying degrees of success. These systems typically involve a combination of front-end and back-end technologies, where customers can place orders while restaurant staff manages operations through an administrative dashboard. Many of these systems relied on web technologies like PHP, HTML and CSS, along with relational databases such as MySQL [6]. While functional, these platforms often lacked the robustness required to scale effectively, particularly during high-traffic periods or promotional events. More recent studies have explored the integration of advanced technologies such as machine learning and artificial intelligence into restaurant management systems [17]. These advancements offer predictive analytics for better inventory management and personalized customer recommendations. However, these approaches come with increased com-

plexity and require a higher level of technological infrastructure, which many small to medium-sized restaurants struggle to adopt.

Java vs Web-Based Technologies A critical review of previous works reveals a recurring debate about the choice of technologies for building restaurant management systems. Traditionally, web technologies like HTML and CSS were used due to their simplicity and ease of implementation. However, as the demand for more dynamic, responsive and scalable systems grew, these technologies began to show their limitations, particularly in handling real-time data, inventory updates and delivery logistics. In response to these limitations, Java emerged as a more powerful alternative for back-end processing, offering greater scalability, security and cross-platform functionality. Java's object-oriented nature makes it ideal for building large-scale applications that require efficient memory management, multi-threading and real-time processing [11]. Java's robustness and ability to integrate with SQL-based databases also provide the necessary framework for handling complex restaurant operations, making it the preferred choice for this project. Database Management in online ordering systems - the role of databases in online food delivery systems is critical, particularly in managing customer information, order history and real-time inventory. PHPMyAdmin and SQL have been widely used in previous projects due to their ease of use and ability to handle relational data. According to Molina and Ullman, relational databases like SQL are well-suited for handling structured data, which is essential for restaurant management systems that deal with multiple entities such as customers, orders and menu items [7]. However, the use of relational databases also comes with challenges, particularly in maintaining data consistency during high transaction volumes. Research indicates that implementing database optimization techniques, such as indexing and query optimization, can significantly improve performance [5]. UX/UI design in restaurant applications - user experience plays a pivotal role in the success of online ordering systems. Studies show that poor UX/UI design can lead to frustration and order abandonment, particularly if the interface is not intuitive or responsive [13]. Many existing systems focus on providing a seamless customer experience by offering features such as easy navigation, customizable orders and real-time updates on delivery status.

Java Swing, used in this project, provides a powerful framework for developing graphical user interfaces that are both responsive and customizable. While web-based technologies like HTML5 and CSS3 are commonly used for front-end development, Java Swing allows for more advanced UI components, offering greater control over the appearance and functionality of the interface. JUnit Testing and System Evaluation Testing is an essential aspect of any software development project, ensuring that the system functions as expected and can handle a variety of use cases. In restaurant management systems, testing is particularly important due to the complexity of integrating multiple components, such as order processing, inventory management and delivery coordination. JUnit, a widely used testing framework for Java, allows developers to create automated tests that verify the functionality of each component and ensure the system performs under different conditions [15]. Previous research emphasizes the importance of comprehensive testing in online ordering systems to prevent system failures, which can lead to significant financial losses for restaurants. Studies also suggest that stress testing and load testing are

crucial for ensuring system reliability during peak hours or promotional events [21].

2.2 Related Works

The development of restaurant management and online food ordering systems has seen significant evolution over recent years. Early systems were primarily POS-based, focusing on in-store transactions and lacking online capabilities [4]. As consumer demand for online ordering grew, web-based platforms like Just Eat and GrubHub emerged, offering customers a more convenient way to place orders and browse menus [18]. However, these platforms often faced limitations in real-time inventory management and scalability, particularly during peak times [22]. Some restaurants developed custom solutions to address these limitations, integrating real-time inventory and order management into their systems. For example, Domino's Pizza implemented a sophisticated platform for real-time order tracking and delivery logistics, enhancing customer experience and operational efficiency [14]. Despite these advancements, many systems still relied on basic web technologies, which struggled with performance and scalability challenges [19]. The adoption of Java-based solutions has provided a more robust alternative, offering better scalability and real-time data processing capabilities compared to simpler web technologies. Java's strengths in handling high concurrency and integrating with databases like SQL make it well-suited for complex restaurant management systems [20]. Additionally, mobile applications for food ordering have gained traction, highlighting the need for systems that can handle diverse devices and real-time updates [12]. This project builds on these developments by using Java for back-end processing and SQL for database management, aiming to create a comprehensive, scalable solution that addresses the limitations of existing systems and enhances the overall efficiency of restaurant operations.

2.3 Why Java Instead of HTML and CSS

In developing the Dragon Restaurant Management System, the decision to use Java rather than HTML and CSS was driven by several key factors related to the requirements of the project:

1. Enhanced Functionality and Performance: Java is a robust, object-oriented programming language known for its performance and scalability. Unlike HTML and CSS, which are primarily used for structuring and styling web pages, Java enables the development of complex back-end functionalities. Java's capabilities in handling multi-threading, real-time data processing and integrating with databases make it suitable for managing the intricate operations of a restaurant management system, such as order processing and inventory management.

2. Scalability and Reliability: As the Dragon Restaurant System aims to support multiple users and handle high volumes of orders, scalability and reliability are critical. Java's architecture supports scalable applications by efficiently managing resources and handling large amounts of data. This is essential for

maintaining system performance during peak periods, which HTML and CSS alone cannot address.

3. Integration with Databases: Java provides seamless integration with various databases through JDBC (Java Database Connectivity). This allows for effective management of customer data, order histories and restaurant information. The system's ability to execute complex queries and updates on the database is facilitated by Java, whereas HTML and CSS do not offer any database interaction capabilities.

4. Customizability and Extensibility: Java offers a high degree of customizability and extensibility, allowing for the development of tailored solutions that meet specific project needs. This flexibility is crucial for incorporating unique features, such as advanced order management, customizable user interfaces and complex business logic, which HTML and CSS cannot accommodate.

5. Robust Security Features: Security is a major concern in online ordering systems, as they handle sensitive customer information and payment details. Java provides robust security features and libraries for implementing secure communication and data protection measures. This ensures that customer data is safeguarded, a feature that is not directly addressed by HTML and CSS.

These are the reasons why Java was utilized instead of HTML and CSS.

Chapter 3

Project Description

3.1 Requirement Analysis

The requirements are all given below.

3.1.1 User Requirements

The primary users of the Dragon Restaurant system include:

1. Customers: They should be able to browse the restaurant's menu, place online orders, customize their orders (e.g., choosing ingredients) and schedule delivery or pickup. Additionally, users should be able to create accounts for faster checkout, view order history and track ongoing deliveries in real-time.

2. Restaurant Staff: They need access to manage incoming orders, update the order status (e.g., "Preparing," "Out for Delivery," etc.), update menu items (including adding, removing, or modifying dishes) and monitor inventory to ensure seamless operation.

3. Admin: The admin role is responsible for overseeing the system as a whole, managing user access and ensuring system integrity. They should be able to view business analytics, customer data and financial transactions.

3.1.2 System Requirements

The system must provide a seamless and user-friendly interface for customers to place orders online. The system should integrate with a secure payment gateway to allow customers to pay for their orders. It must offer real-time tracking of food preparation and delivery. The system should allow multiple users to log in simultaneously and handle a high volume of orders. The system should store all customer data securely and comply with data protection regulations.

3.1.3 Platforms and Tools Utilized

The following programs and tools are utilized.

Table 3.1: Programs and Tools

Project Part	Language
Programming Language	Java
Database	PHPMyAdmin and SQL
Framework	Java Swing
Version Control	Git
Testing Tools	JUnit
Operating Systems	Windows, MacOS and Linux

As per Table 3.1, these are all the required programs and tools for the project. Built in Java, using the Java Swing framework for the user interface. Version control git is used. JUnit for unit testing and the project runs on the operating systems given above.

3.2 Computational Resources Required

The computational resources required are given below.

3.2.1 Hardware Requirements

These are the hardware requirements.

1. Client Devices: The system will require basic client devices such as smartphones, tablets, or desktop computers with an internet connection. These are used for both customers to place orders and restaurant staff to manage orders.

2. Server Requirements: A dedicated server or cloud hosting is required to host the system, manage customer orders and store all data securely. The server should have the requirements given below.

Table 3.2: Recommended Server Components

Server Part	Component
Processor	Quad-core
RAM	Minimum 8 GB
Storage	At least 10 GB SSD
Network	High-speed internet connection

As per Table 3.2, these recommended settings will ensure the project runs smoothly.

3.2.2 Software Requirements

The given software requirements for the project.

Table 3.3: Project Software Requirements

Software	Reason
Java JDK	To compile and run the project
Apache Tomcat	For web hosting
PHPMyAdmin	To manage the SQL database
JUnit	For testing the system and ensuring code reliability
MySQL Database	To store customer details and orders
NetBeans	For development

As per Table 3.3, these are the software requirements and why they are utilized.

3.3 Positives and Negatives

Below the positives and negatives of the project are given.

3.3.1 Positives

1. Efficient Ordering System: Customers can order food from the comfort of their homes, reducing the need to wait in long queues at the restaurant.

2. Increased Revenue: Restaurants can process more orders efficiently, even during peak hours, which leads to an increase in revenue.

3. User-Friendly Interface: The Java Swing interface provides a responsive and intuitive user experience.

4. Real-Time Updates: Customers and restaurant staff can receive live updates on the status of their orders.

5. Data Analytics: The admin can access detailed reports on customer behavior and sales, allowing for data-driven business decisions.

3.3.2 Negatives

1. Initial Setup Cost: Setting up the system and acquiring the necessary hardware and software may have high upfront costs.

2. Learning Curve: Restaurant staff may require training to efficiently use the system, particularly if they are unfamiliar with using digital tools for order management.

3. Potential Bugs: Although Java is a robust language, improper coding can lead to bugs or system crashes, especially under heavy load.

3.4 Feasibility Report

The technical and economic feasibility are given below.

3.4.1 Technical Feasibility

The project is technically feasible. Java and SQL are reliable technologies that can handle the project's scale. Java Swing, while simple, provides a responsive and stable UI/UX interface for users. The tools and platforms utilized (e.g., PHPMyAdmin, JUnit) are well-documented and widely used in the industry, making them suitable for this project.

3.4.2 Economic Feasibility

The economic feasibility of the project is favorable. The initial cost of setup (hardware, software licenses and development) is offset by the increased revenue potential through online orders and reduced operational costs (less reliance on physical infrastructure). Additionally, maintaining the system (cloud hosting and database management) incurs a relatively low monthly expense compared to potential gains.

3.5 Model Diagrams

Use-case, class, data flow and entity relationship diagrams are given. Use case shows user and system interactions, class diagrams shows different building blocks of the management system, data flow shows how data is transferred in the management system and entity relationship shows relations among the data process and components in the management system.

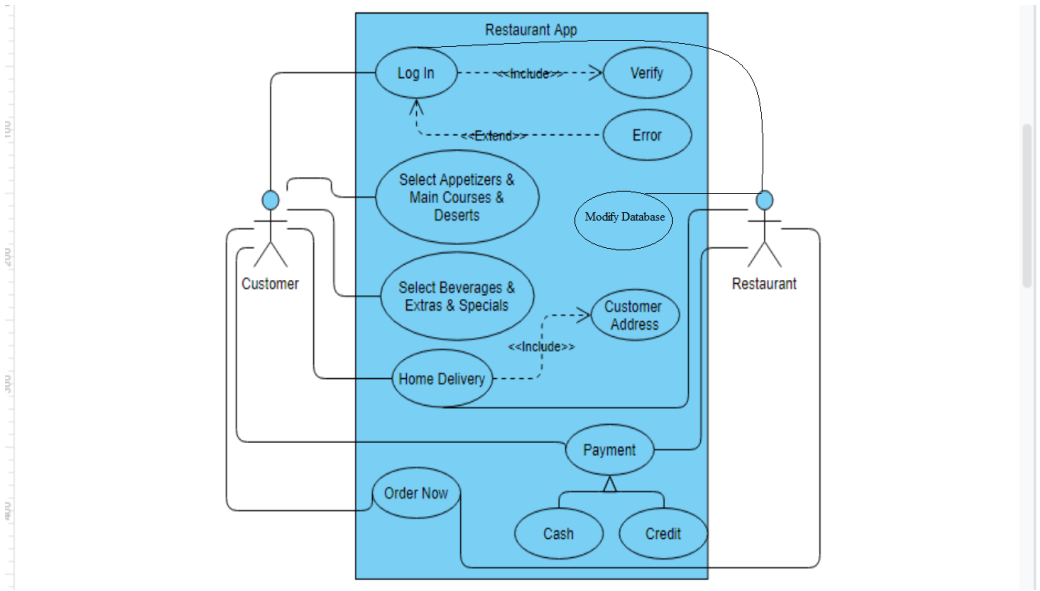

Figure 3.1: Use Case Diagram

As per Figure 3.1, the restaurant is the admin of the restaurant. Both customer and admin must login. Admin can change database of foods. Customer can select foods and fill up table with food. After selecting foods customer can order now and choose home delivery. Modify database has more admin options like customer analytics, restaurant analytics, customer info. Only Admin can access them and modify them.

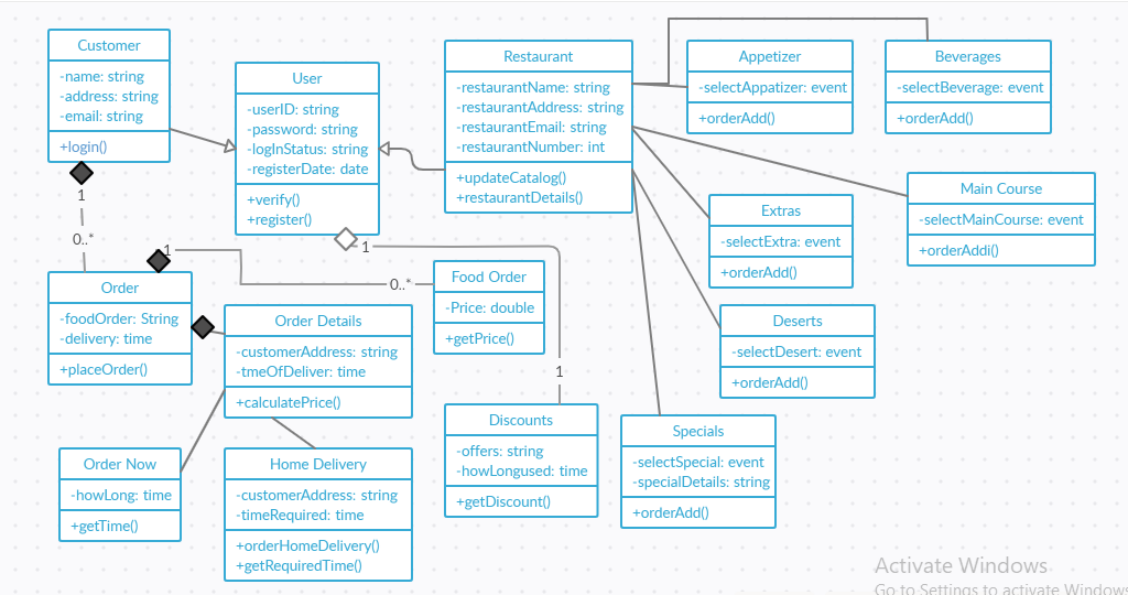

Figure 3.2: Class Diagram

As per Figure 3.2, show the class diagram of the management system. Restaurant is considered the restaurant admin. All classes, their methods and functions are given. Relationships of all classes are also given via arrows and diamond symbols with ratios.

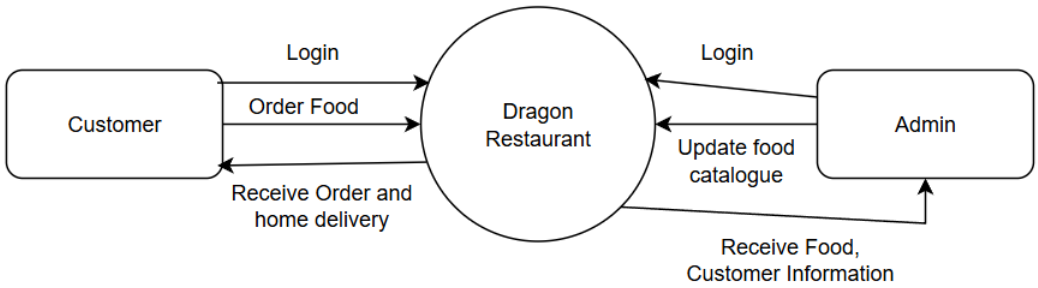

Figure 3.3: Data Flow Diagram Context Level 0

As per Figure 3.3, a level 0 data flow diagram represents just the context level of the data flow. Both customer and admin login data flow to the management system. Customer can order food and receive order and home delivery. Admin has ability to update food database and receive food or customer information. Circle is for process, rounded rectangle for external entity and curved pieces are databases.

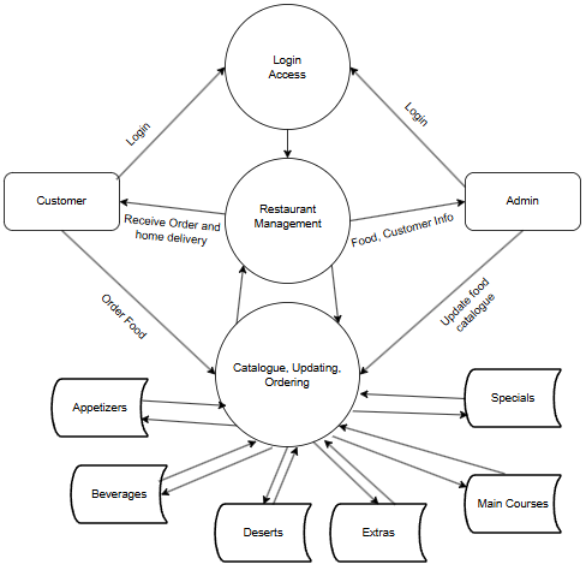

Figure 3.4: Data Flow Diagram Level 1

As per Figure 3.4, the level 1 data flow diagram shows more details of the restaurant management system as it is now consisting of 2 more processes given by 2 more circles. Data flows to and from the catalogue, updating and ordering process to restaurant management process. The catalogue, updating and ordering process can be broken down further but not necessary.

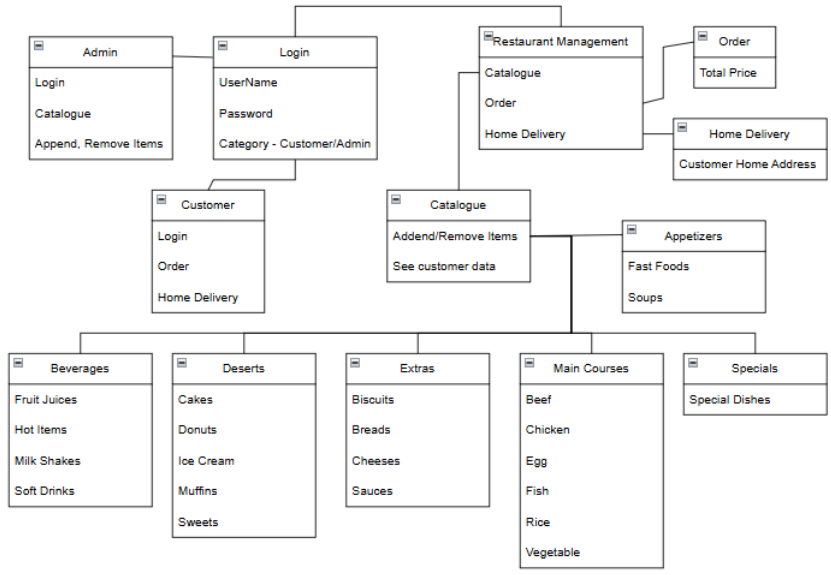

Figure 3.5: ER Diagram

As per Figure 3.5, here the entity relationships are shown of the system. Both admin and customer have to login, only then can they enter the system. Catalogue is connected to all food databases. There is order and home delivery options. Admin also has customer and restaurant analytics which are also part of the management system.

Chapter 4

Analysis and Implementation

4.1 Project Workings with Implementation

The project has been made with all necessary software. The below sections delves into the details of the software programs - the database software and the database as well. The database of the project in the server is discussed as well. The login, main and various menu GUI. Libraries and button functions are discussed.

4.2 Database Software with Apache and MySQL Using XAMPP

To build the database of the project the XAMPP control panel was used to activate Apache and MySQL in the computer. Through a browser the database is set in local-host of PHPMyAdmin. XAMPP stands for Cross-Platform, Apache, MySQL, PHP and Perl. It is a free to use software that allows databases to be run on any computer. Now the two database software can be started. For the project Apache and MySQL are started.

Figure 4.1: XAMPP Control Panel with Selected Software

As per Figure 4.1, the control panel assigns PID and port numbers to the running software. Apache runs on port-80,443 and MySQL on port-3306.

4.3 Database

The software are now set up. The computer, with the software running in the background, the PHPMyAdmin server can be accessed through a browser. The databases are set up and grouped together for easier reading and modification. The various databases are set up.

4.3.1 PHPMyAdmin Server

The PHPMyAdmin server is now accessed through a localhost using the google chrome browser.

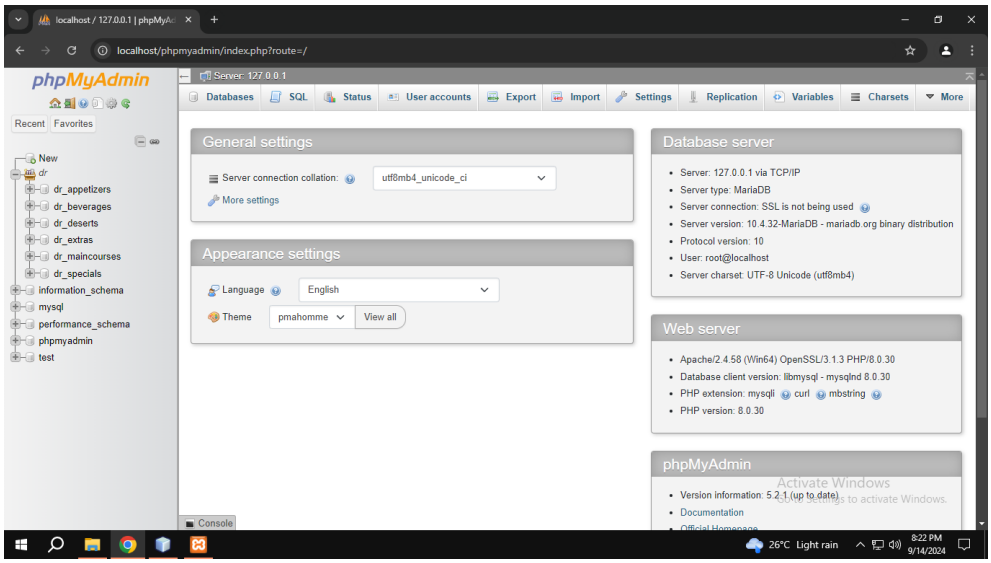

Figure 4.2: PHPMyAdmin Database Server

As per Figure 4.2, all the information is displayed on the web page.

4.3.2 Appetizers and Specials Menus in Database

In the database various databases are there. All are grouped into the “dr” group. In the group there are six databases, five similar except the specials. The six databases are appetizers, beverages, deserts, extras, main courses and specials. Each database has many tables. The tables contain food items and prices. Only specials has just one table.

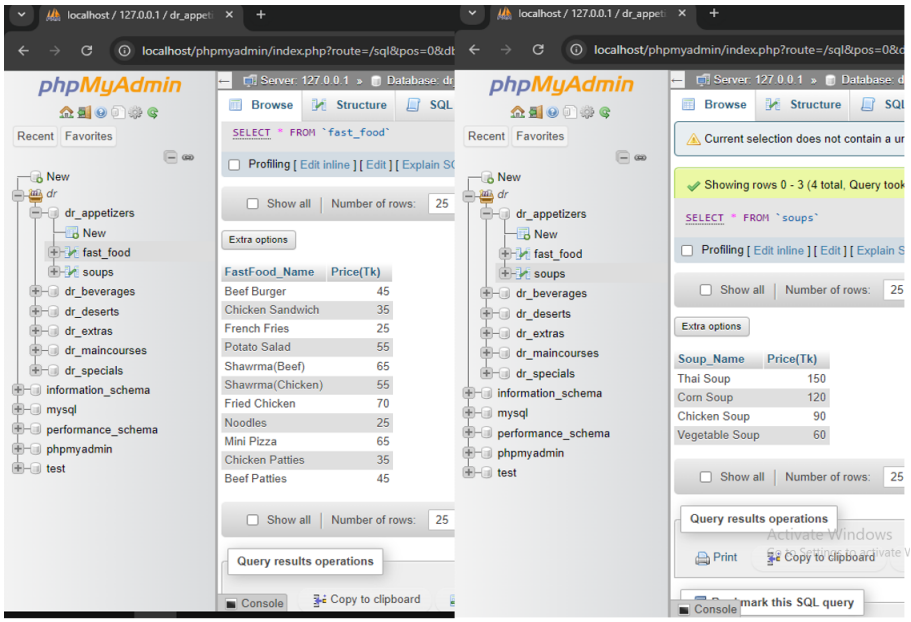

Figure 4.3: Appetizers Menu in the Server

As per Figure 4.3, similarly the beverages, deserts, extras and main courses databases are set. All of them have multiple tables with columns for food name and prices.

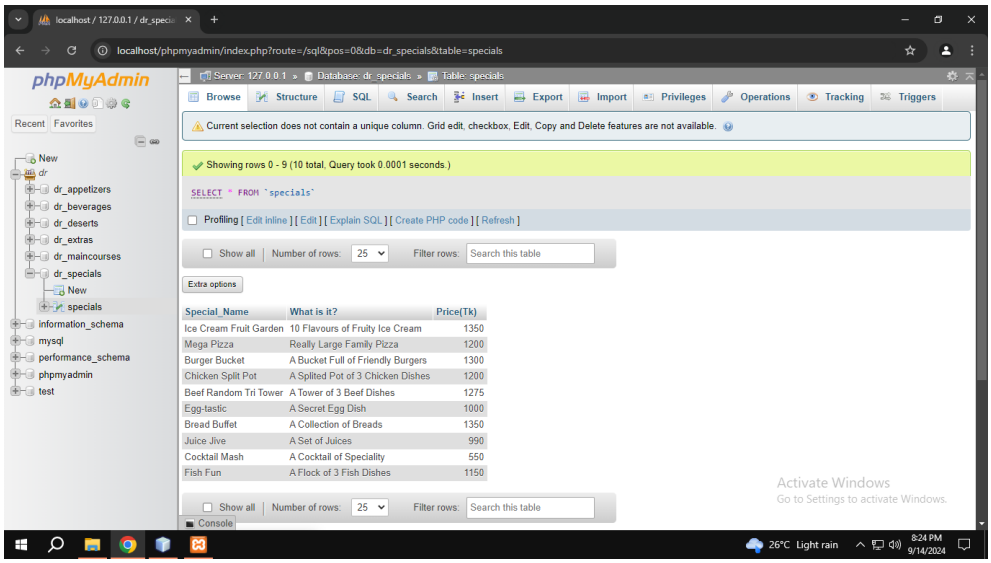

Figure 4.4: Specials Menu in the Server

As per Figure 4.4, the only database with one table.

4.3.3 Database in NetBeans IDE with SQL Code

The databases are also saved in the NetBeans IDE project. The SQL of the databases can be seen in the IDE. They contain all the food names and price values.

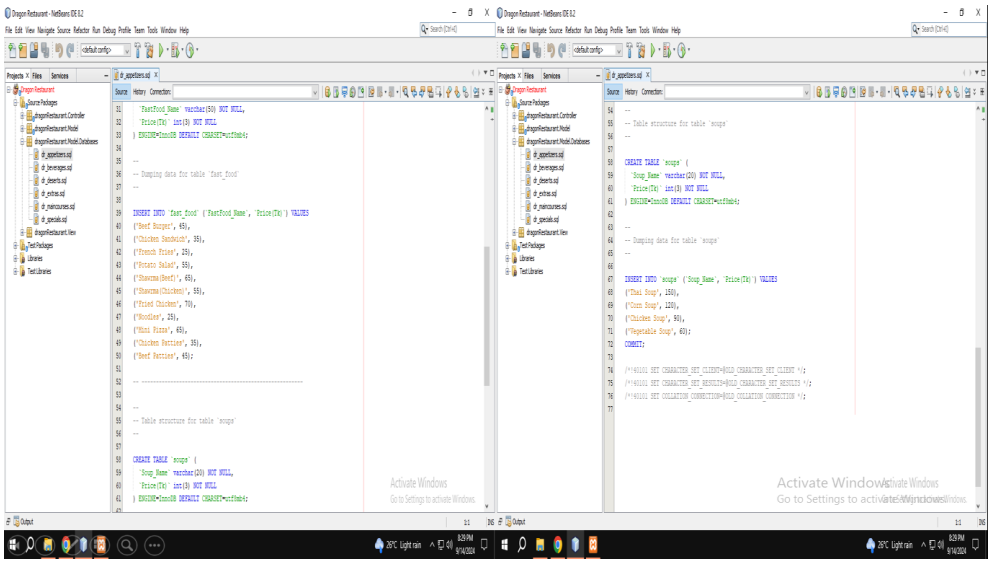

Figure 4.5: SQL of Databases

As per Figure 4.5, the database SQL is shown. Words are color coded. Blue mean functional words, orange are strings, black are values and green are tables and databases.

4.4 Project in NetBeans IDE

The NetBeans IDE is used to build the project from scratch. NetBeans as an IDE for java is very well designed. Here the model, view and controller architecture is utilized. The button codes are displayed. Project Libraries with GUI and buttons are elaborated in detail. All the libraries are discussed and why they were utilized. The menu designs in the IDE are shown. The login, main and all menu GUI are explained. All buttons with respective functionalities are looked into.

4.4.1 Model, View and Controller Architecture

For this project, the model, view and controller architecture is utilized. After careful consideration of various different architectures, for this project the model, view and controller suits best. According to Necula, MVC pattern has an evolving nature which tends to keep up with the popular trends in various sectors [26]. Again according to Ding, Liu and Tang, as object oriented technology develops, the pattern must develop as well [2].

4.4.2 All Project Files in NetBeans

In the NetBeans IDE all the project files are shown. The projects tab shows how the project looks. with all other functionalities such as libraries and other packages. The project is split into model, view and controller parts. The middle shows the controller java files while right shows model, databases and view files.

4.4.3 Button Codes

Now some button codes and the login GUI codes of the controller will be shown and explained in detail. All buttons have similar coding, with minor differences. The GUI menus also have very similar coding. Some more coding than others due to more functionalities.

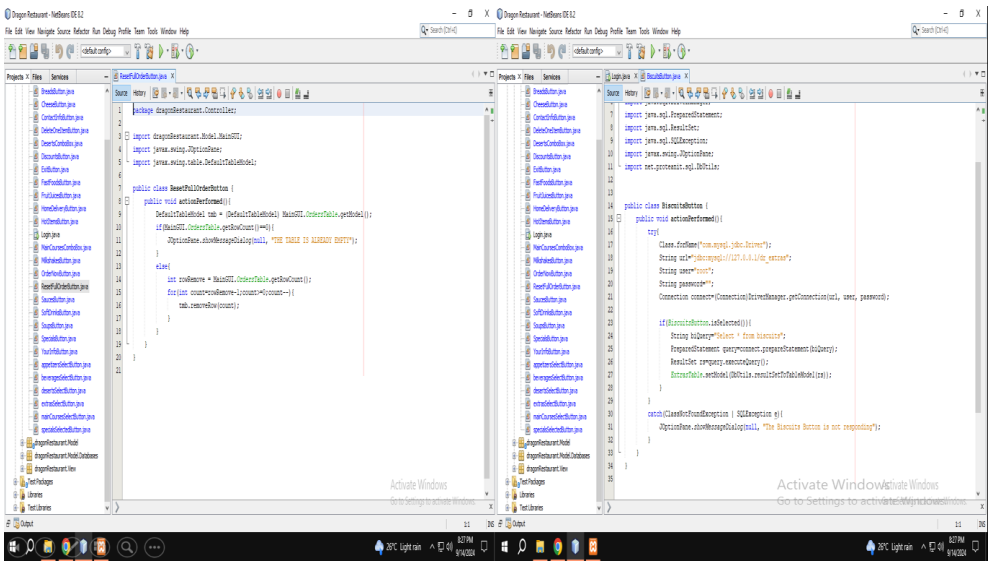

Figure 4.6: Reset Full Order and Biscuits Button Codes

As per Figure 4.6, both buttons have packages imported followed by classes then the action performed method followed by if, else statements. Except for some menus and tables most of the buttons in the controller part have more or less the same codes or code structures.

4.5 Project Libraries with GUI and Buttons

The project libraries will be discussed along with the GUI and the buttons. This project uses various library packages to bring different functionalities. In this case the MySQL Java Data Base Connectivity (JDBC) driver, which connects the java to the SQL database. According to Jhonson, JDBC is a straight forward way to connect to SQL back-end without any extra hassle [9]. Java Development Kit (JDK) 1.8 is running as it is most stable. The library for J-Tables "rs2xml.jar" needed to be added for the formation of menu tables. All the GUI are discussed in detail. All button functionalities are elaborated.

4.5.1 Menu Design

The different food menus are designed in the J-Frame design section of every GUI. Java Swing was utilized here. Various different java containers like - labels, drop boxes, text boxes, inputs, buttons etc are used. Different menus are designed differently to bring variety in project design.

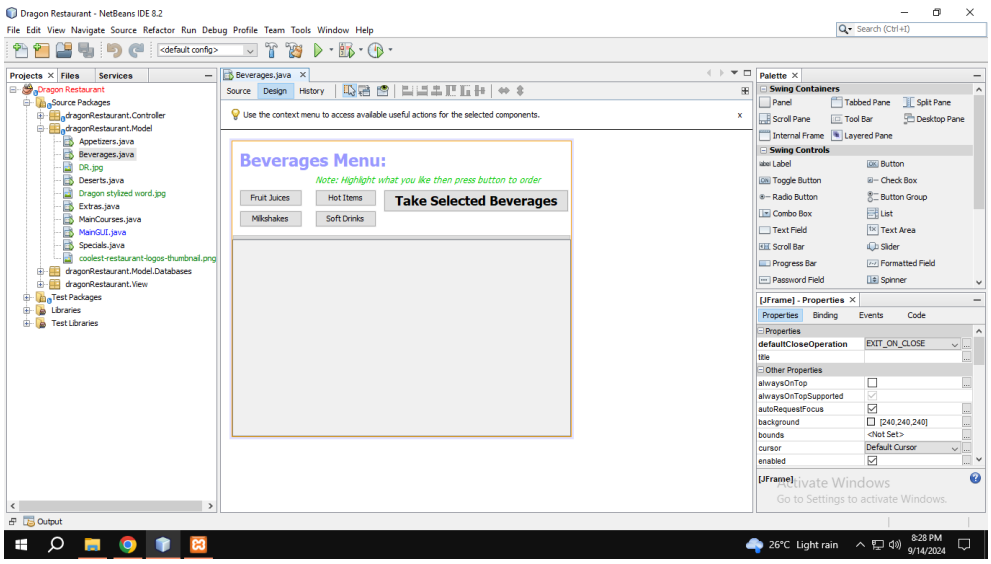

Figure 4.7: Beverages Menu Design in J-Frame

As per Figure 4.7, the design palette, canvas and other functions can be seen. The left contains projects, middle is canvas and right the palette of various containers.

4.5.2 Login GUI

First, when the project is run the login GUI appears, with two text boxes for user name, password, and category selection. There is submit, reset and hint buttons. Hint button reveals the user name and password and reset button resets both text boxes. There is wrong user name and password exception if inputs are wrong or if category if not chosen.

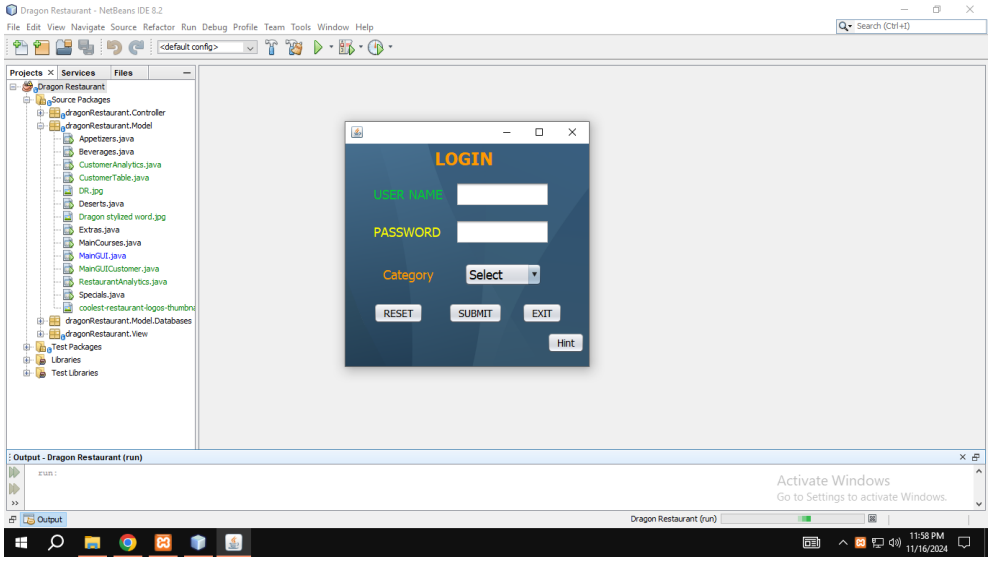

Figure 4.8: Login GUI

As per Figure 4.8, the login GUI. With empty user name, password and no category selection. Submit, reset, hint and exit buttons are there as well.

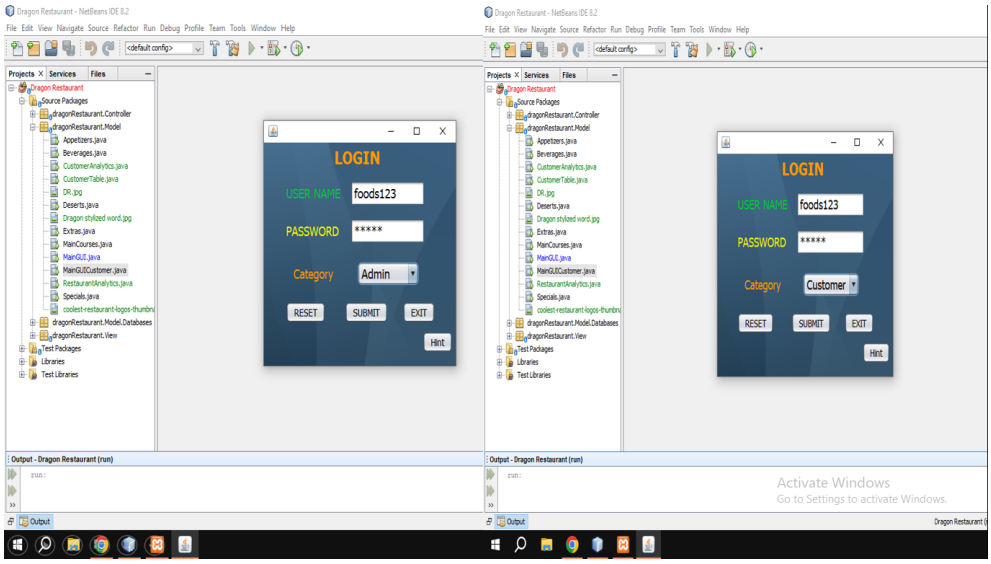

Figure 4.9: Login GUI with Admin (Left) and Customer (Right)

As per Figure 4.9, the login GUI with username, password and both selected categories.

4.5.3 Main GUI - Admin

After the login is successful with admin category selection. The main GUI - admin opens to show food database buttons on left side and information buttons on right side.

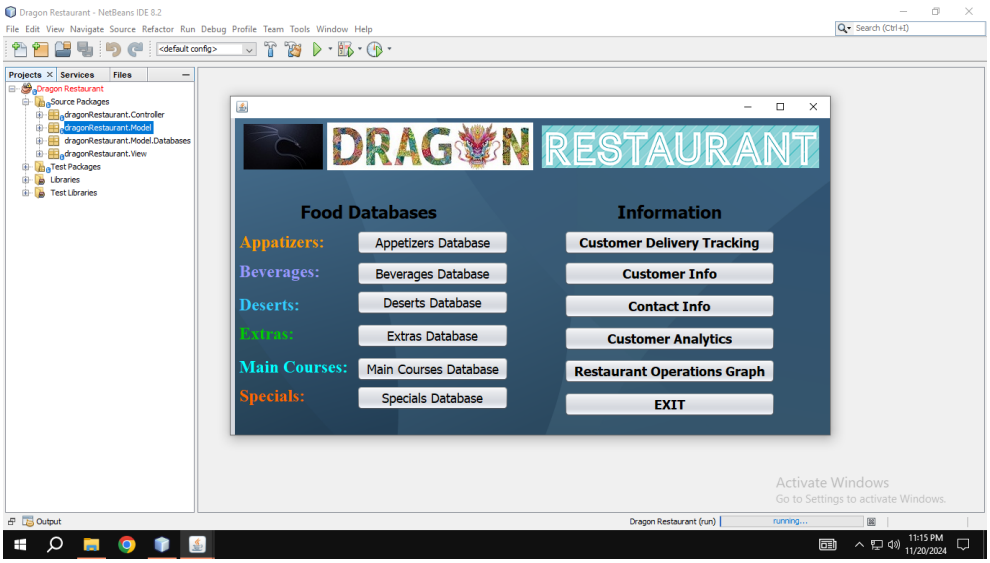

Figure 4.10: Main GUI - Admin After Login

As per Figure 4.10, contains food databases on left side and all information on the right side.

4.5.4 Food and Customer Databases

Pressing the Food databases buttons shows the food databases. Admins can see the menu and go to the back-end database to change catalogue. Pressing customer info button will show customer info with customer ID, email, number of orders and weather they are long term or not.

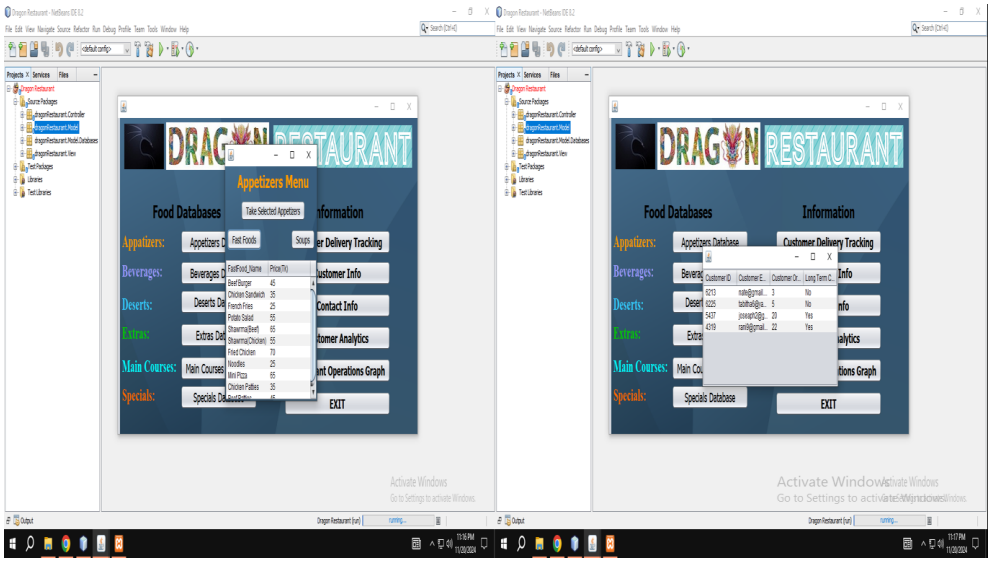

Figure 4.11: Food (Left) and Customer (Right) Databases

As per Figure 4.11, shows food databases and customer information.

4.5.5 Customer and Restaurant Analytics

Pressing the customer analytics button will show the number of customers served per hour. It is a bar graph. Pressing the Restaurant Operations Graph will show restaurant analytics and operations in a line graph.

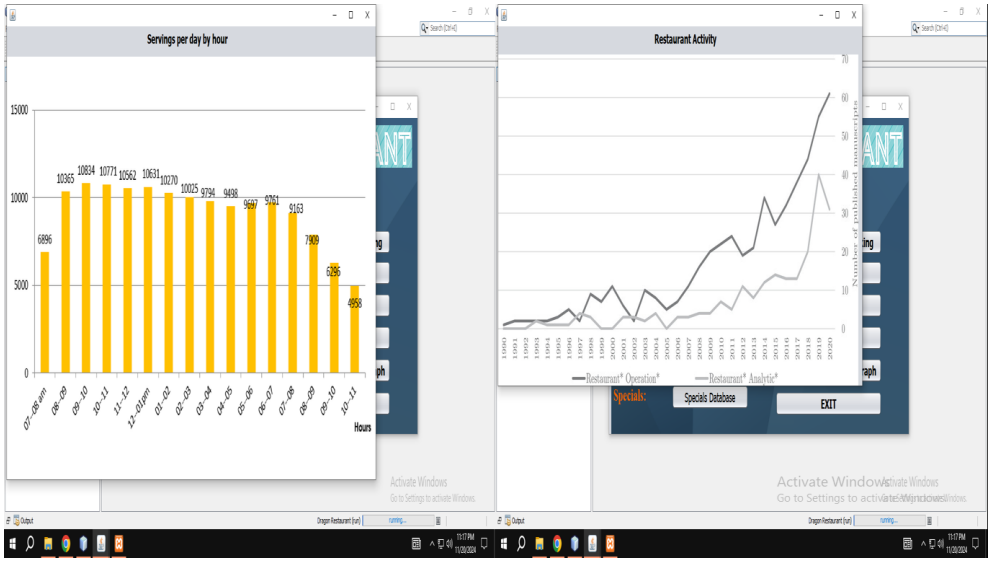

Figure 4.12: Customer (left) and Restaurant (Right) Analytics

As per Figure 4.12, shows customers served per hour and restaurant analytics.

4.5.6 Customer Delivery Tracking

Pressing the customer delivery tracking button will show the customer ID, address, pick up and delivery times.

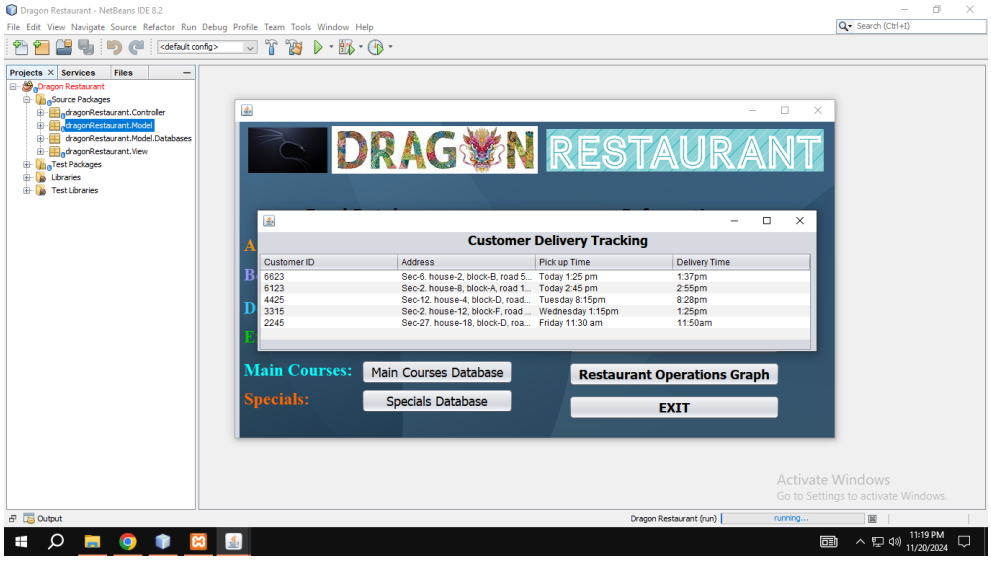

Figure 4.13: Customer Delivery Tracking

As per Figure 4.13, shows customers deliveries being tracked.

4.5.7 Main GUI - Customer

After login is successful with customer selection. The main customer GUI opens.

Figure 4.14: Main GUI Customer After Login

As per Figure 4.14, on the left, the empty table, which will fill up when orders are selected. On the right below, table options. Beside table discounts, order now and home delivery buttons. Exit button below on right side. Above it restaurant contact information and above it customer information and above that one is upgrade.

Above home delivery button is the new offers button and above it recommendations. Food menu buttons are above table and specials below the main courses. Each menu select button opens up a new GUI with the food contents.

4.5.8 Menu GUIs

Clicking on any of the food item buttons will open separate GUI for that food type.

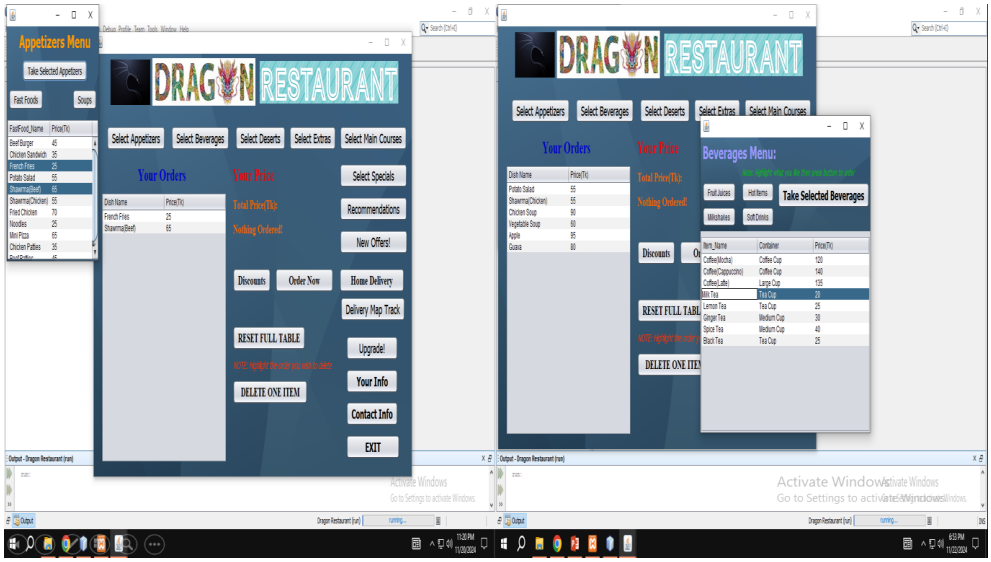

Figure 4.15: Appetizers (Left) and Beverages (Right) Menus

As per Figure 4.15, clicking on appetizers or beverages buttons open their respective GUIs. GUIs have many food types. Foods are highlighted and then "take selected appetizers" or "take selected beverages" button is pressed to transfer the items to the main customer GUI table. Other GUI menus are similar in function but have different designs. Deserts and main courses use combo box while extras and specials have dot button select. All have select button to get food to main table.

4.5.9 Contact Info

To get contact information, email and address of the restaurant the "contact info" button is pressed. Gives pop up dialogue box with restaurant information. Same contact info for both customer and admin as it is restaurant contact.

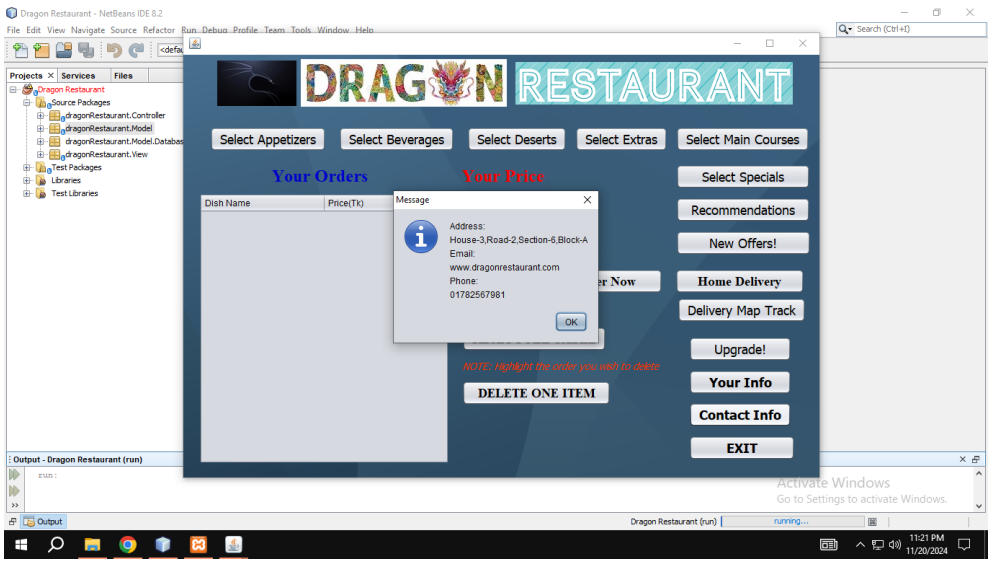

Figure 4.16: Contact Info

As per Figure 4.16, the dialogue box with restaurant information shows. Pressing okay will exit the dialogue box.

4.5.10 User Info

Your Info button shows information of the user in a dialogue box. Contains user ID, email, address and phone number.

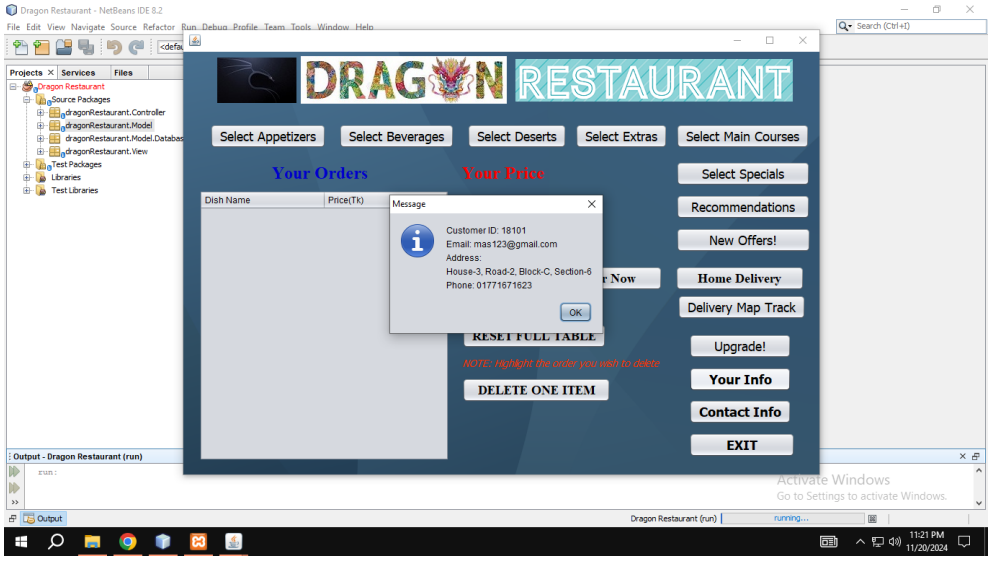

Figure 4.17: User Info

As per Figure 4.17, opens dialogue box with user information. Pressing okay exits the dialogue box.

4.5.11 Discounts Button

The discounts button shows how much discount the customer has. All long term customers get a 10% discount. Pressing button gives dialogue box with information.

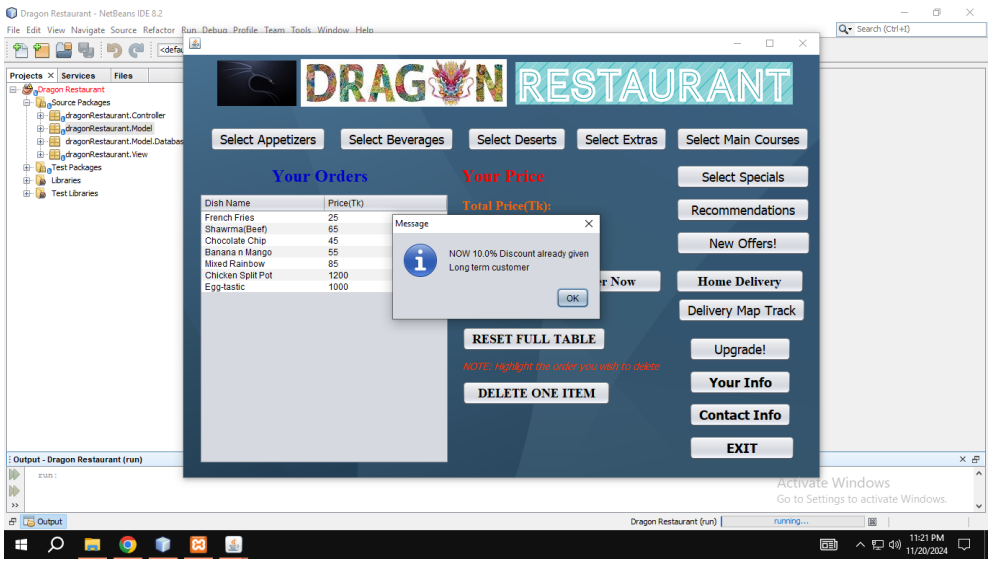

Figure 4.18: Discount Information

As per Figure 4.18, pressing okay closes the dialogue box.

4.5.12 Order and Home Delivery Buttons

The order button orders the selected items and gives a dialogue box of total price. Home delivery button gives information after ordering.

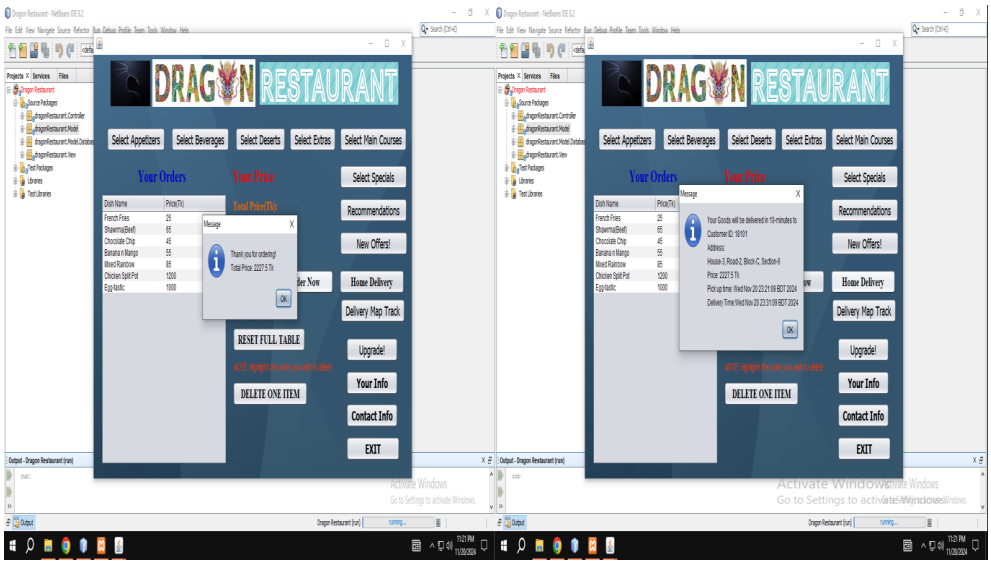

Figure 4.19: Order Button (Left) and Home Delivery Button (Right)

As per Figure 4.19, the order button gives the dialogue box with price while home delivery button gives the dialogue box with its information. Both buttons have exceptions to handle errors. If customers orders an empty table it will first give dialogue box of price zero. Then it will state user cannot order empty table in another dialogue box. Pressing okay will exit the dialogue box. If user presses home delivery first, then a dialogue box will ask user to order something first before pressing the home delivery button first.

4.5.13 GPS Delivery Tracking

After customers order food and go for home delivery, a map of the customers destination from restaurant can be seen by pressing the delivery map track button. Can see the delivery distance via GPS tracking.

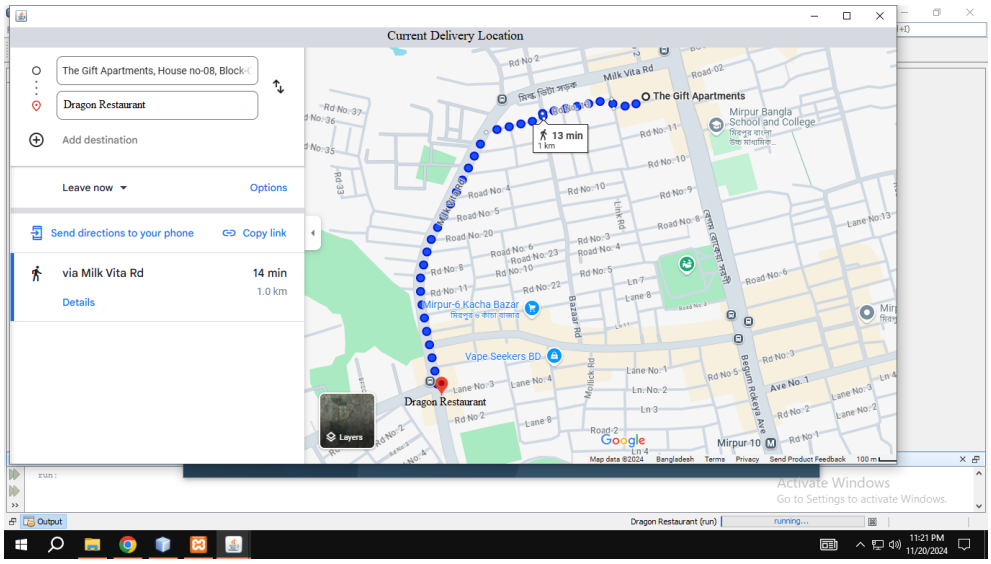

Figure 4.20: GPS Delivery Tracking

As per Figure 4.20, shows map tracking similar to google maps.

4.5.14 Delete Item Button

To delete items in the main GUI table, the items can be highlighted and then one item can be deleted at a time. Users cannot delete multiple items or cannot press delete item button if no selected item is highlighted. Both cases throws exceptions in dialogue boxes.

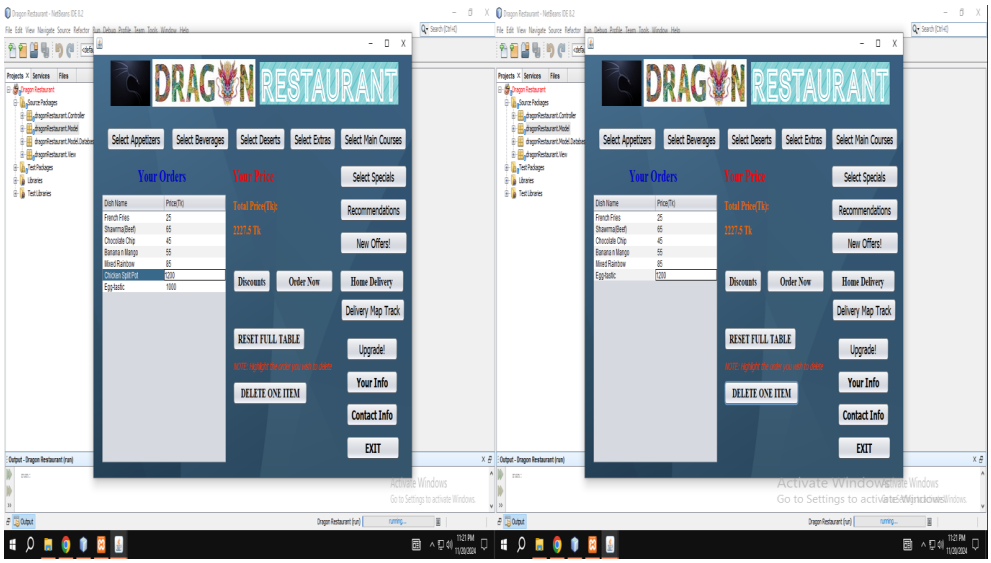

Figure 4.21: Before (Left) and After (Right) Deleting Item with Delete Items Button

As per Figure 4.21, left side shows highlighted item and on right pressing delete item button removes the item from the main table. If user presses delete button with no item selected, dialogue box appears telling user to highlight an item first. If user attempts to delete multiple items at once another box appears telling the user to select only one item.

4.5.15 Table Reset Button

To delete all the items in the main table at once, the reset full table is pressed. Unlike the delete item, this does not require any highlighting of any item or items. Resetting an empty table gives an exception in dialogue box that the table is already empty.

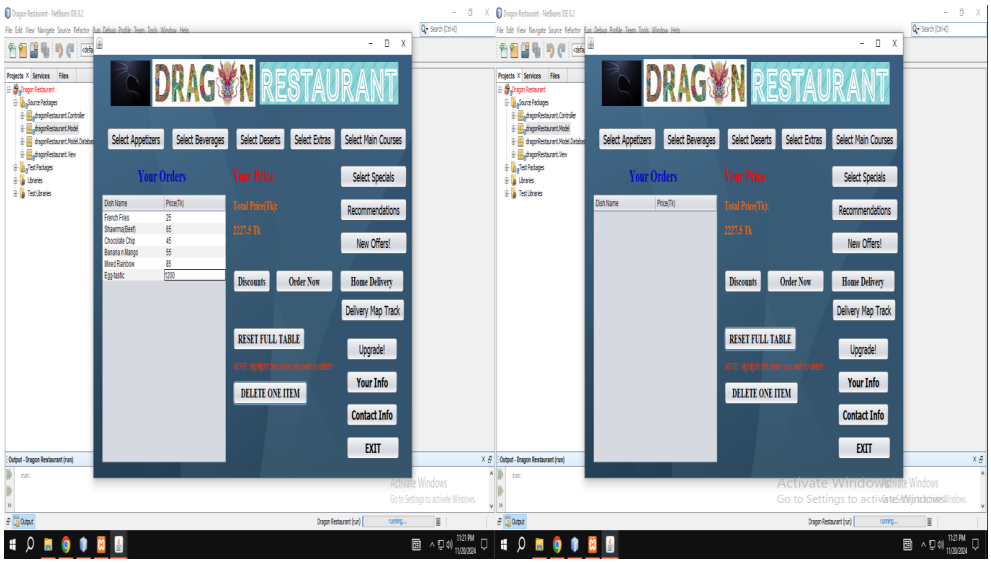

Figure 4.22: Before (Left) and After (Right) Reset Full Table Button

As per Figure 4.22, the full table is reset and the table becomes empty. Resetting an empty table gives exception that the table is already empty. Pressing okay will close the dialogue box.

4.5.16 New Offers and Recommendations

The restaurant often times have new offers. These are special dishes sold at bargain prices. Time to time it is different. Pressing the new offers button shows the current new offerings. There is also customer recommendations. It is based on previous 7-10 orders of the customer. Food is shown with ratings when the recommendations button is pressed.

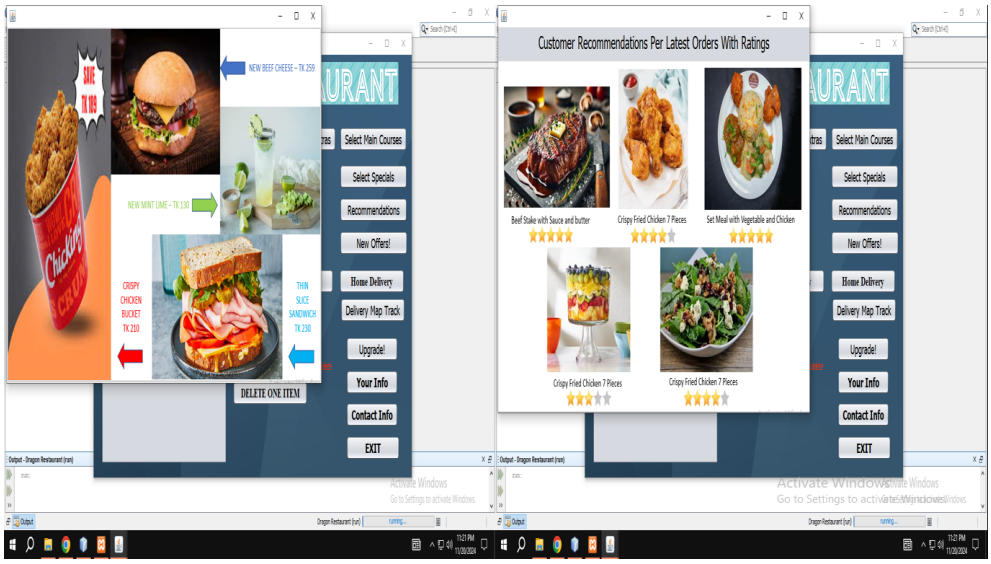

Figure 4.23: New Offers (Left) and Recommendations (Right)

As per Figure 4.23, on left new offers button shows current new offers. On right, recommendations button is pressed and recommendations based on previous customer orders are shown with the customer ratings.

4.5.17 Upgrade

Upgrades button shows software version and newer features will come in the future.

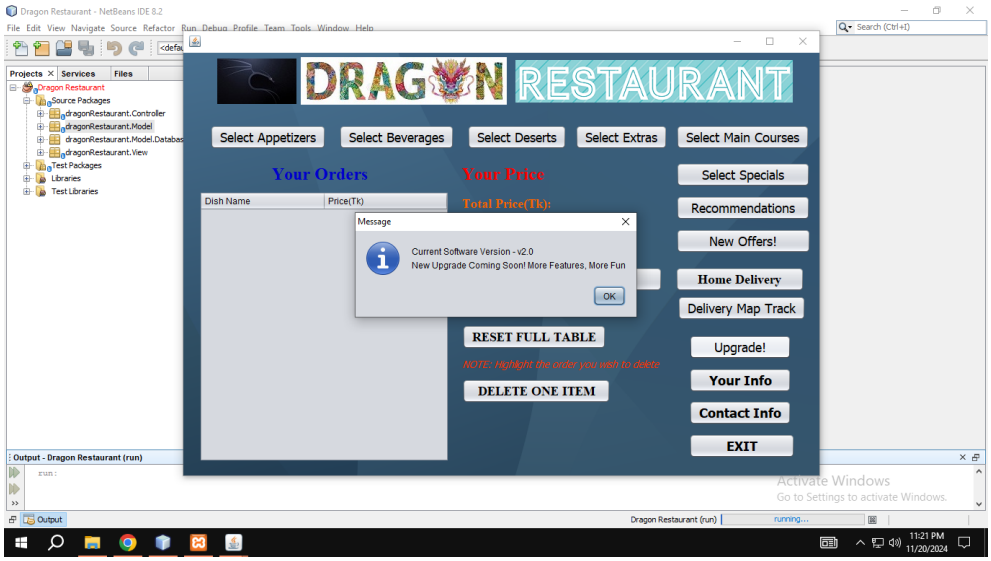

Figure 4.24: Upgrade Information

As per Figure 4.24, shows the software version and newer features in the future.

In this section all the project workings and implementations are discussed. The database software with extensive detail followed by the elaboration of the database. The project in the NetBeans IDE and all the project libraries with the GUI and all button functions with exceptions. The next section deals with testing of project.

Chapter 5

Project Testing

5.1 Java Unit Testing

In this section, the project is tested. In Java programs usually unit tests are performed. The JUnit libraries and packages are utilized for this purpose. According to Venkatesan, Rozario and Fiaidhi, testing software before deployment is a mandatory task in any software project. Testing allows programmers to find any faults in any mechanisms [24]. According to Robillard, unit testing is where code is automatically executed to check if it is working properly or not [16]. Again as per Jain and Gopalani, automated j-unit testing is becoming more prevalent and j-unit is also advancing [8]. Whole project and every component is tested in one single go.

5.2 JUnit Library

The JUnit is utilized to test the project. JUnit allows unit testing of components of the project. According to Wahid and Almalaise, it is the basic learning of unit testing. JUnit is used to test interactive GUI [1]. According to Parsons, JUnit has several assertion type methods to test various erroneous behaviours of different units [23]. Again as per Madeja, Porubän, Chodarev, Sulír and Gurbáľ, in the github community JUnit testing is by far the most utilized and popular in a majority of various projects [25].

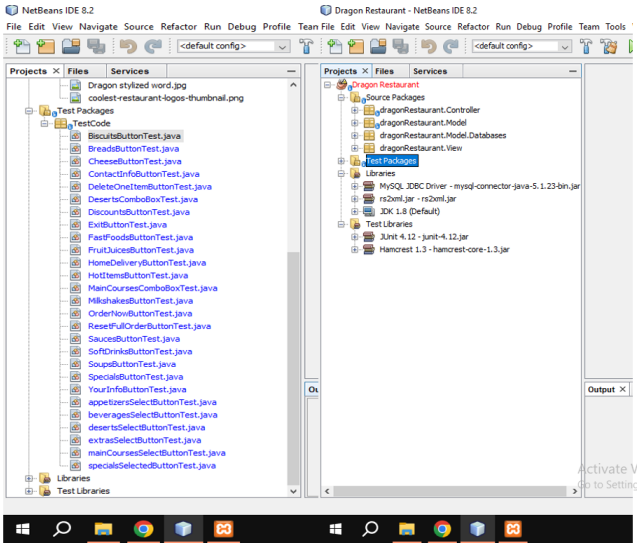

Figure 5.1: JUnit Test Codes and JUnit Libraries

As per Figure 5.1, test codes for each component shown on left, libraries on right.

5.3 Test Code

The test codes of the buttons are shown. All buttons have similar test codes with slight variations.

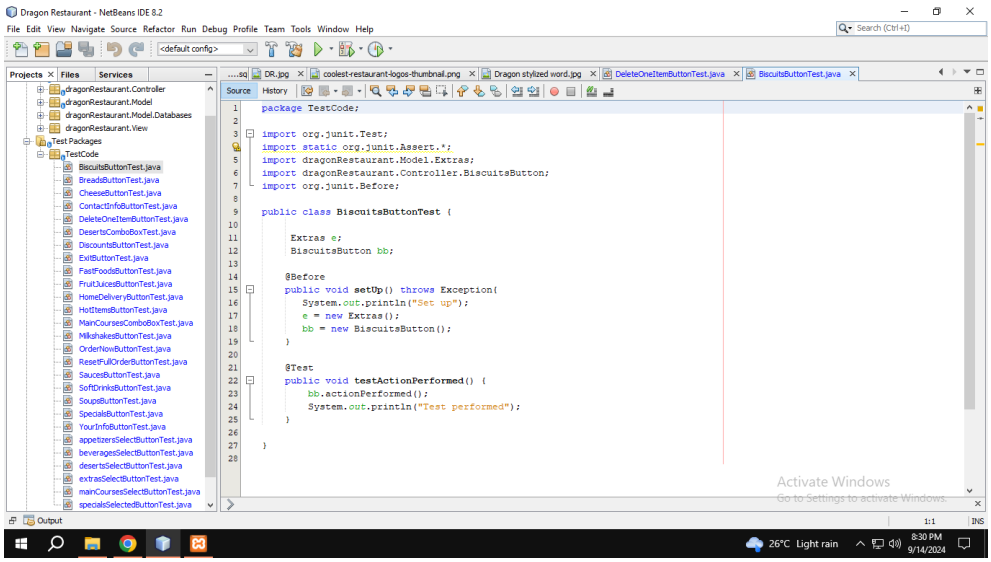

Figure 5.2: Biscuit Button Test Code

As per Figure 5.2, test code has all the imports and class with before and test. Pattern is followed for all other test codes.

5.4 Testing Project

Now to test the project, the project is right clicked and the test option is selected. The test runs and various dialogue boxes show to be working, okay is pressed in

each box or enter is pressed for the test to continue.

5.4.1 Begin Test

The test begins as the test button is clicked.

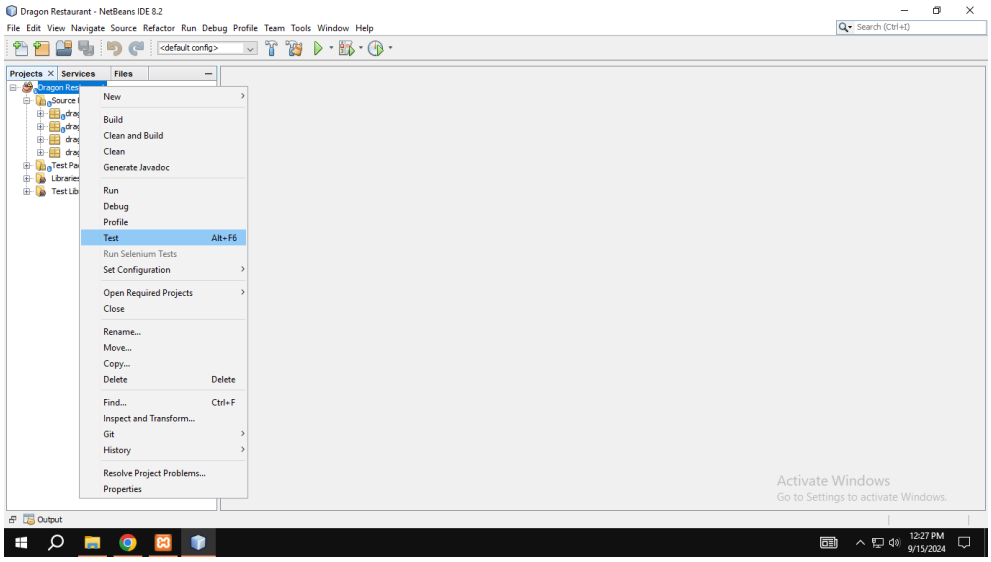

Figure 5.3: Beginning The Project Test

As per Figure 5.3, the project is right clicked and the test begins.

5.4.2 Test Progress

The test progress automatically with each dialogue box popping and and pressing enter, allows the test to continue.

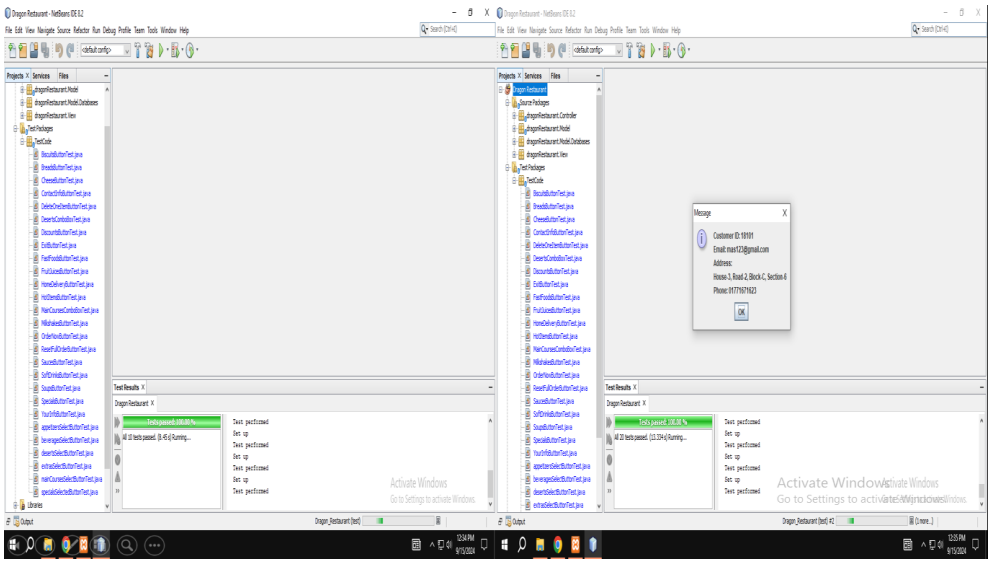

Figure 5.4: 10, 20 Tests Passed and Test Progressing

As per Figure 5.4, at first 10 tests passed then 20 and it will go on. There are total 27 tests.

5.4.3 Test End

Finally, at the end of all 27 unit test cases, all of them passed. It indicates all components of the project is working fine. The test pass is shown with green bar and 100%. So all components of the project work fine.

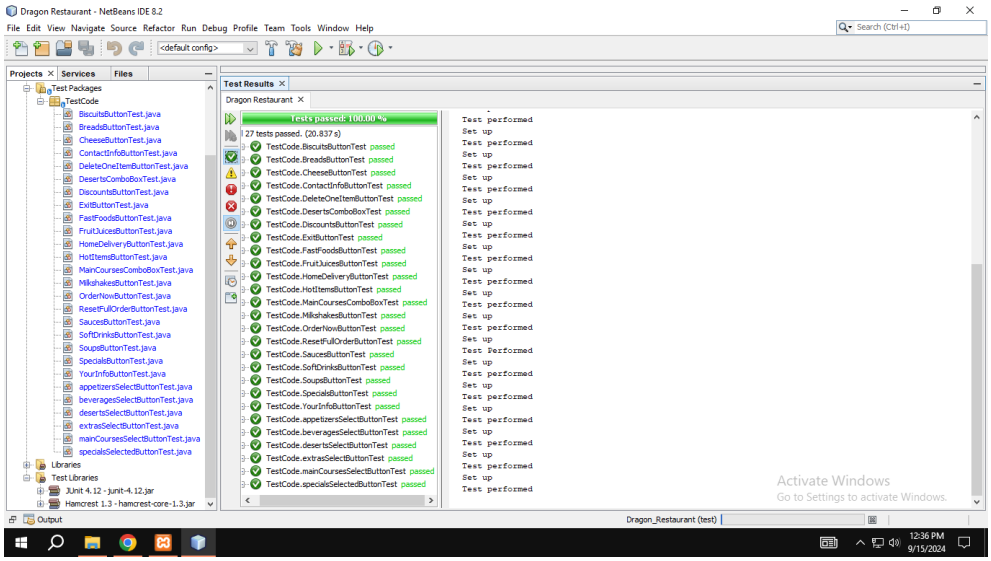

Figure 5.5: All Tests Passed

As per Figure 5.5, it shows all the tests were a success and the project components work as intended. All tests were set up and performed.

Chapter 6

Conclusion and Future Work

6.1 Conclusion

The Dragon Restaurant Management System represents a significant advancement in online food ordering and delivery technology. By leveraging Java for back-end processing and SQL for database management, the system addresses the complexities and demands of modern restaurant operations, offering a robust, scalable and efficient solution. Through the integration of real-time data management, seamless order processing and user-friendly interfaces, the system enhances both operational efficiency and customer experience. The choice of Java over simpler web technologies like HTML and CSS allows for sophisticated functionality like robust data handling and scalable performance which is crucial for managing high volumes of orders and diverse user interactions. The project successfully demonstrates the cost and time-saving benefits of online ordering, streamlining the dining experience by reducing the need for in-person visits and long wait times. The use of advanced technologies and rigorous testing ensures that the system operates smoothly and reliably, meeting the needs of both restaurant staff and customers. While the Dragon Restaurant Management System lays a strong foundation, there are several areas identified for future enhancement, including the integration of delivery tracking, multi-language support and advanced analytics. These improvements aim to further refine the system's capabilities, offering an even more comprehensive solution for managing online food ordering and delivery.

In summary, the Dragon Restaurant Management System not only addresses current industry challenges but also sets the stage for ongoing innovation and development in restaurant management technology. Its successful implementation provides valuable insights and a solid base for future advancements, ensuring that restaurants can efficiently meet the evolving expectations of their customers in a competitive marketplace.

6.2 Future Work

The Dragon Restaurant Management System lays a solid foundation for effective online food ordering and delivery management. However, there are several areas for future development and enhancement that could further improve the system's functionality and user experience:

1. Integration of Delivery Tracking Systems: Implementing real-time delivery tracking would enhance transparency and customer satisfaction. By integrating GPS-based tracking and notifications, customers can monitor their order's progress from the restaurant to their doorstep, providing a more interactive and reassuring experience.

2. Multi-Language Support: Expanding the system to support multiple languages can make it more accessible to a diverse customer base. This would involve incorporating language options in the user interface and ensuring that the system can handle different character sets and regional formats.

3. Enhanced Mobile Integration: Developing a dedicated mobile app for both iOS and Android platforms could improve user accessibility and engagement. A mobile app can offer additional features such as push notifications, location-based services and offline functionality.

4. Advanced Analytics and Reporting: Adding advanced analytics features can provide restaurant managers with valuable insights into customer preferences, order trends and sales performance. This could involve implementing data visualization tools and generating detailed reports to inform business decisions and strategies.

5. AI-Powered Recommendations: Integrating artificial intelligence to offer personalized food recommendations based on customer preferences and ordering history could enhance the user experience. Machine learning algorithms can analyze past orders and suggest relevant items, increasing customer satisfaction and sales.

6. Loyalty Programs and Promotions: Incorporating features for loyalty programs and promotional offers can drive customer retention and engagement. By enabling restaurants to create and manage discounts, special deals and reward programs, the system can contribute to increased customer loyalty.

7. Improved System Scalability: As the system's user base grows, it will be important to enhance scalability to handle increased traffic and data volume. This may involve optimizing database performance, load balancing and implementing cloud-based solutions to ensure smooth operation during peak times.

8. Enhanced Security Measures: Continuously updating and enhancing security features to protect against emerging threats is crucial. This includes implementing advanced encryption methods, secure payment processing and regular security audits to safeguard sensitive customer information.

These are some future prospects that can be possible.

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