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Online Catering System for College Canteen using Firebase

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Abstract: *Although they have long been a well-liked option for quick and practical meals, cafeterias are not without problems. Customer dissatisfaction can be caused by long lines, sluggish payments, a lack of food options, and lengthy preparation periods, which can also have an impact on the cafeteria business's overall effectiveness and profitability. In order to address these issues, this survey paper outlines the creation of a cafeteria application utilising Flutter and Firebase as a backend and a recommendation system. This study investigates how Flutter and Firebase can be used to develop a scalable, reliable, and effective application that offers users a smooth experience. The article also looks at how integrating a recommendation system might improve customer happiness and loyalty by enhancing the customer experience.*

Keywords: *Cafeteria, Flutter, Firebase, Android Studio, Payment Gateway*

I. INTRODUCTION

Our daily lives have been significantly impacted by cafeterias, which give us a quick and practical eating alternative. Customers have a number of difficulties when visiting cafeterias, including lengthy lines, sluggish payment processes, a lack of their preferred goods, and protracted preparation periods. Customers become dissatisfied as a result of these issues, and the cafeteria industry's general effectiveness and profitability are also impacted. An efficient solution to these problems may be found by creating a cafeteria application with a recommendation engine that uses Flutter and Firebase as a backend. Customers will be able to order and pay for their meals using the application conveniently, without having to stand in long lines or worry about cash transactions. The application may deliver real-time updates on the availability of food products by utilising Firebase's real-time database functionality, lowering consumer dissatisfaction and raising overall customer happiness. This survey report will cover the creation of a cafeteria application that can handle the numerous problems that patrons encounter, such as long lines, sluggish payments, a lack of food options, and protracted preparation periods. The paper will look at how Flutter and Firebase may be used to develop a scalable, reliable, and effective application that offers users a frictionless experience. The presentation will also look at how integrating a recommendation system might improve customer happiness and loyalty by enhancing the customer experience.

II. BACKGROUND AND CONTEXT

The creation of mobile applications has fundamentally changed how companies run their operations, and the food industry is no different. Mobile applications that give customers a quick and easy method to order and pay for their meals have become increasingly popular, especially in cafeterias. The first mobile food ordering applications were released in the early 2000s, which marks the beginning of the history of mobile applications in the food business. These early applications weren't extensively used because of their restricted capability. The need for mobile applications in the food industry has grown dramatically as a result of technological advancements, the introduction of new development frameworks, and the widespread use of smartphones. Cafeterias are creating their own mobile applications today to provide customers greater services.

The mobile application development framework Flutter, introduced by Google in 2017, enables programmers to construct visually appealing and high-performing applications for both iOS and Android platforms. Launched in 2011 by Firebase Inc. and later purchased by Google, Firebase is a platform for building mobile and web applications. It offers a variety of backend services, including cloud storage, real-time databases, and authentication. The creation of a cafeteria application with a recommendation engine and a backend using Flutter and Firebase has the potential to completely change how cafeterias run in the context of the cafeteria business.

III. LITERATURE REVIEW

In [1] the article "Machine Learning: Algorithms, Real-World Applications and Research Directions" explores the critical function of machine learning in the modern world.

It emphasises how crucial it is to create intelligent, automated applications employing a variety of data sources, including cybersecurity, IoT, and mobile data. The author gives an overview of numerous machine learning algorithms and their practical uses in a variety of industries, such as marketing, finance, healthcare, and transportation. Along with deep learning methods like CNNs and RNNs, the paper discusses the operating principles of supervised, unsupervised, and reinforcement learning algorithms. The discussion of future machine learning research prospects, notably in fields like explainable AI, ethical AI, and privacy-preserving AI, marks the paper's conclusion.

In [2] a unique food ordering system for college canteens is proposed. It is termed "Food Ordering Management using Recommendations." The system features an electronic menu for ordering and bill computation, but it distinguishes itself by using the Apriori algorithm to provide consumers customised cuisine recommendations. This system finds things that are commonly ordered and makes personalised recommendations. In order to properly manage inventories and create menus, managers can also use the system to analyse customers' culinary preferences.

The suggested solution can streamline the ordering process, enhance the customer experience, and give administrators useful information because college canteen clients are a diversified and continuously shifting customer base. The design of the system is also presented, and the study uses several criteria to assess its performance. Overall, the suggested system has the capacity to change how food is produced.

In [3] "Online Food Ordering Application Using ML and Android Studio," Rajat Deshmukh et al. suggest a system that makes use of JSP, JAVA, HTML, and Oracle to build a reliable platform for customers to buy food from eateries. An online menu, order tracking, order feedback, and customised hotel recommendations based on user ratings are just a few of the services offered by this system.

The system's objective is to improve the client experience by offering a quicker and more customised ordering procedure. Restaurants may improve their menu and better understand their consumers by using the system's personalised recommendations, which are based on client preferences and generated by machine learning algorithms. Furthermore, using Android Studio offers a user-friendly interface that makes placing an order simple.

In [4] the paper shows significance of a recommendation system for food delivery applications based on the frequency of orders for various food items, time of day, and day of the week is emphasised in the academic paper titled "Recommendation System for a Delivery Food Application Based on Number of Orders" by Claudia N. Sánchez, Julieta Domnguez-Soberanes, Alejandra Arreola, and Mario Graff.

For the development of such systems, previous studies have suggested hybrid or machine learning models; one study even created a model based on the frequency of orders for different food products and the day/week of the week. According to the authors, creating a recommendation system based on these elements might greatly improve how users interact with food delivery systems. This customised system can increase client happiness and loyalty as well as deliver useful information.

In [5] the paper proposes an Intelligent Canteen Ordering System that utilizes machine learning algorithms to enhance the ordering process in canteens.

The system allows customers to place their orders through a mobile application, which uses machine learning techniques to predict the customers' preferences based on their previous orders. The system also includes a recommendation engine that suggests popular or highly rated menu items to customers. The proposed system aims to reduce the waiting time for customers and enhance their overall experience while also providing canteen operators with valuable insights on customer preferences and trends. The authors conducted a case study to evaluate the system's efficiency and concluded that the system enhanced the ordering process and increased customer satisfaction.

In [6] the significance of responsive design and social media integration in online meal ordering systems has been examined in earlier studies. Md. Muminur Rehman covers the development of a social media-integrated, responsive online meal ordering application in this article.

Social media involvement increases client satisfaction and loyalty, according to studies. Users of food delivery applications can quickly share their orders, offer feedback, and interact with other customers by incorporating social media into the apps. Additionally, responsive design is essential for guaranteeing usability and accessibility on various devices. Social media integration into responsive online meal ordering platforms can help to raise engagement levels, increase consumer happiness, and eventually increase sales.

Food service businesses may offer a more personalised and user-friendly experience by utilising the power of social media and responsive design.

In [7] the article examines the potential uses of AI and ML in the food sector, emphasising several applications for these technologies in areas like product creation, quality assurance, and food safety. Reducing waste and enhancing food safety and cleanliness are all benefits of using AI and ML in the food business. In order to identify tainted food goods, the paper describes how AI may be utilised for food image identification and categorization.

In order to forecast food demand and decrease food waste, the authors also cover how ML can be utilised for predictive modelling. The authors conclude by highlighting the significance of AI and ML for the food industry's future and urging more study in this field to improve food quality.

In [8] this essay explores the drawbacks and advantages of meal delivery applications as well as potential technological solutions to these drawbacks. Applications for food delivery provide consumers more control over their food choices, but issues with food safety continue to be a problem.

According to the paper, using AI, ML, and blockchain can increase order accuracy and data privacy. Additionally, these technologies can help to increase food safety and decrease food waste.

The research concludes that technological improvements and the rising need for more effective and quick meal ordering systems will define the future of food delivery applications.

In [9] the study introduces a recommendation system for online food ordering that employs machine learning and decision trees to offer users customised menu suggestions. The system was created to solve the shortcomings of current systems, which frequently do not consider the popularity of goods or personalised food recommendations. To solve this problem, the system uses collaborative filtering to group users who have similar ordering histories and preferences together. The best menu items for each user are then predicted using decision trees based on their past selections. The proposed solution, according to the paper's conclusion, can dramatically raise user happiness and boost the proportion of loyal clients who use online meal ordering platforms again and again.

In [10] the research suggests a machine learning and image recognition-based online ordering system for meals. Customers can take pictures of the food products they want to order using the system, and the food items are recognised by the system after processing the images. The system obtains a respectable level of accuracy in identifying food items, according to the authors' evaluation of the system's performance using a collection of food photos. The method can be improved, according to the authors, but additional effort is necessary to increase the system's accuracy. The study offers a novel method for clients to order meals online that could potentially enhance their ordering experience.

IV. PROPOSED METHODOLOGY

There are numerous stages to the suggested process for creating the cafeteria application utilising tools like Android Studio, Flutter, Firebase Storage, Firestore Database, and others:

- 1) *Requirement Analysis*: The development team will thoroughly analyse the requirements for the cafeteria application at this phase, taking into account elements like order placement, scheduling, payment gateways, earnings, and user interfaces.
- 2) *Design*: The development team will produce a thorough design for the application based on the requirements analysis. The user interface design, navigational flow, database schema, and other technical information will be included.
- 3) *Development*: During this stage, the development team will begin constructing the application with Android Studio and Flutter. They will put the intended user interface into practise and incorporate the necessary functionality, including payment gateway, Firebase Storage, and Firestore Database.
- 4) *Testing*: The development team will carry out extensive testing when the application is completed to find and fix any bugs or performance problems. They will guarantee that the application performs as anticipated and complies with the stated standards.
- 5) *Deployment*: The development team will put the software on the Google Play Store when it has been extensively tested and any problems have been fixed, making sure it complies with all regulations and standards.
- 6) *Maintenance*: After the programme is released, the development team will continue to provide support and maintenance, including as-needed upgrades and bug fixes.
- 7) *User feedback*: To identify any areas for improvement or new features that could be introduced to improve the application, the development team will collect user feedback.
- 8) *Continuous Improvement*: The development team will continuously update the programme based on user feedback, adding new features and additions to make sure it satisfies the changing requirements of users and the cafeteria business.

A. Architecture

A cafeteria application's architecture can be broken down into different parts as follows:

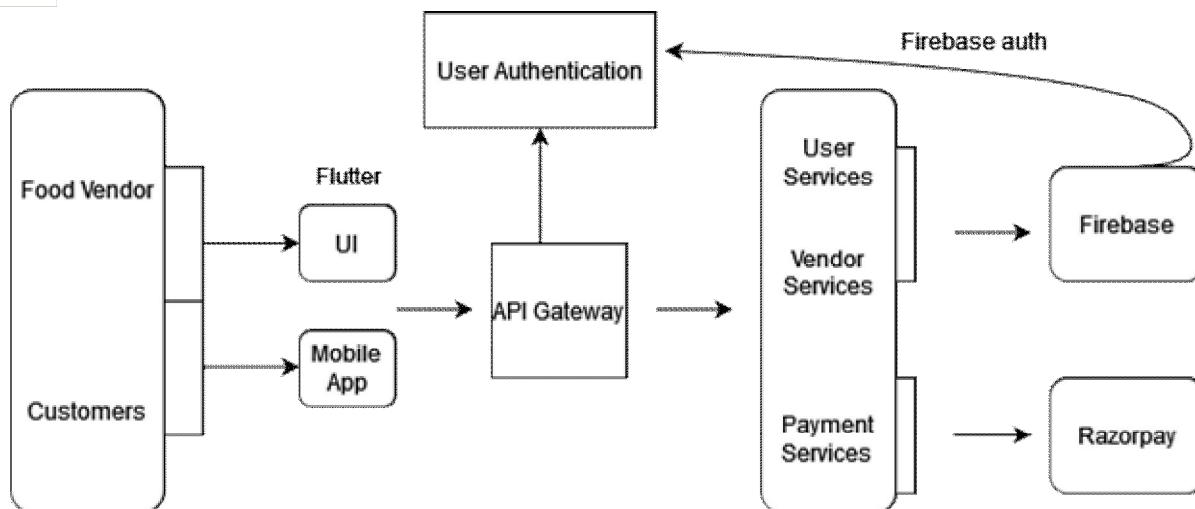


Fig. 1 – Architecture

- 1) *User Interface (UI)*: The user interface part of the application is in charge of designing an easy-to-use and aesthetically pleasing user interface. Users should be able to place orders, schedule orders, make payments, and monitor their earnings with ease thanks to the UI's design.
- 2) *Application Logic*: This part of the application is in charge of carrying out the essential operations of the application, such as responding to user queries, processing orders, maintaining the database, and liaising with third-party services like payment gateways.
- 3) *Data Management*: The data management component is in charge of storing and controlling the data needed by the programme. Any database technology, including Firebase Firestore, may be used to implement the data storage.
- 4) *Payment Gateway*: The payment gateway component is in charge of processing user payments for orders. The payment gateway ought to be trustworthy, safe, and simple to use.
- 5) *Recommendation Engine*: Based on users' past orders, reviews, and preferences, the recommendation engine component of the programme can optionally be incorporated to offer customers personalised recommendations for food products.

B. Process Flow

The working of the cafeteria application can be explained as follows:

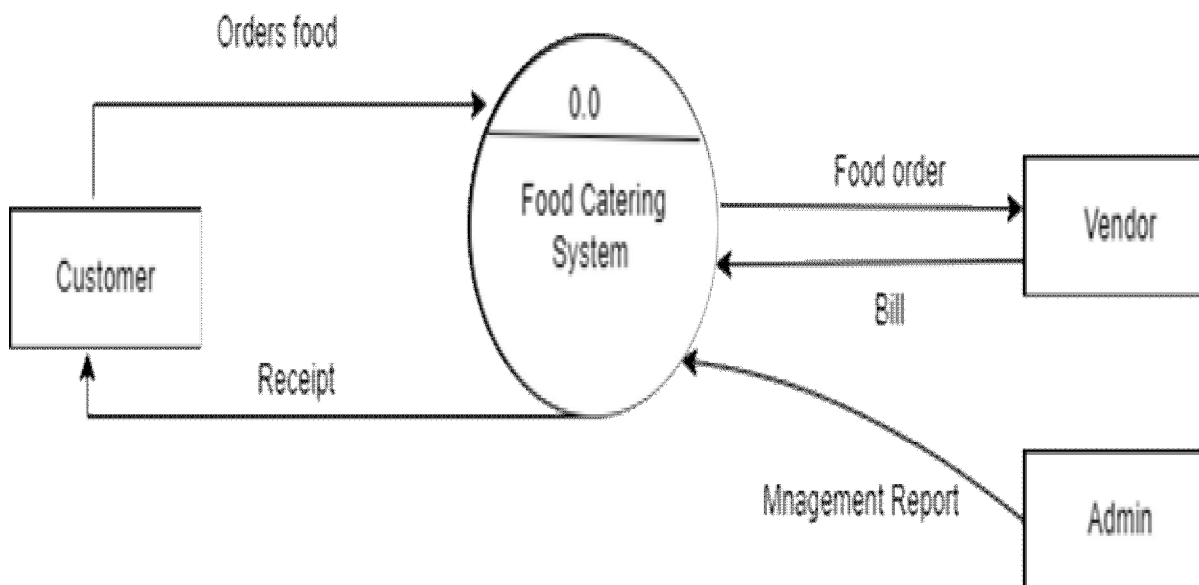


Fig. 2 - DFD Level 0

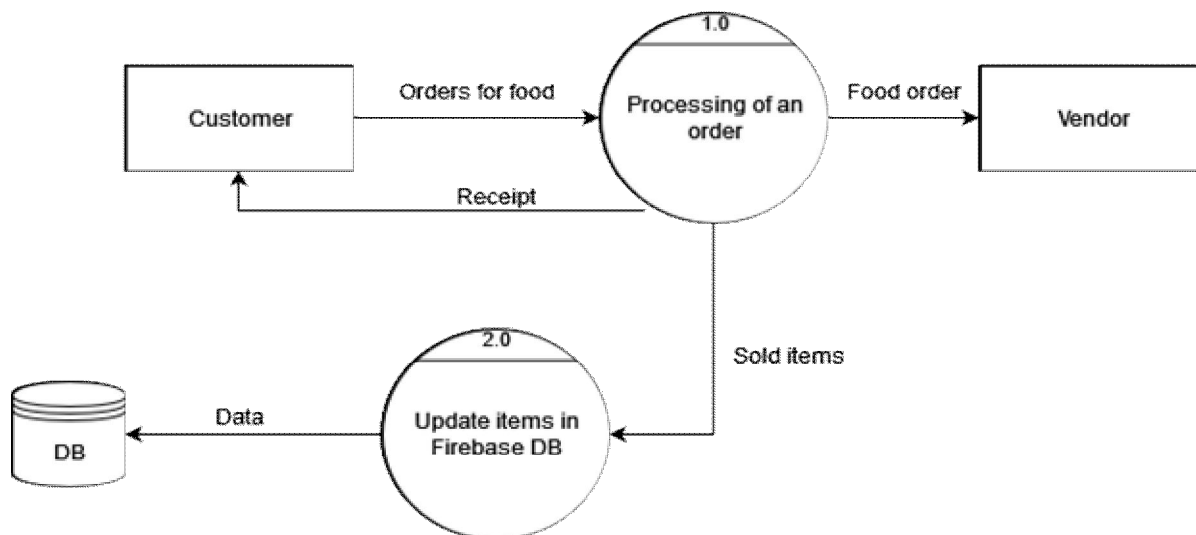


Fig. 3 - DFD Level 1

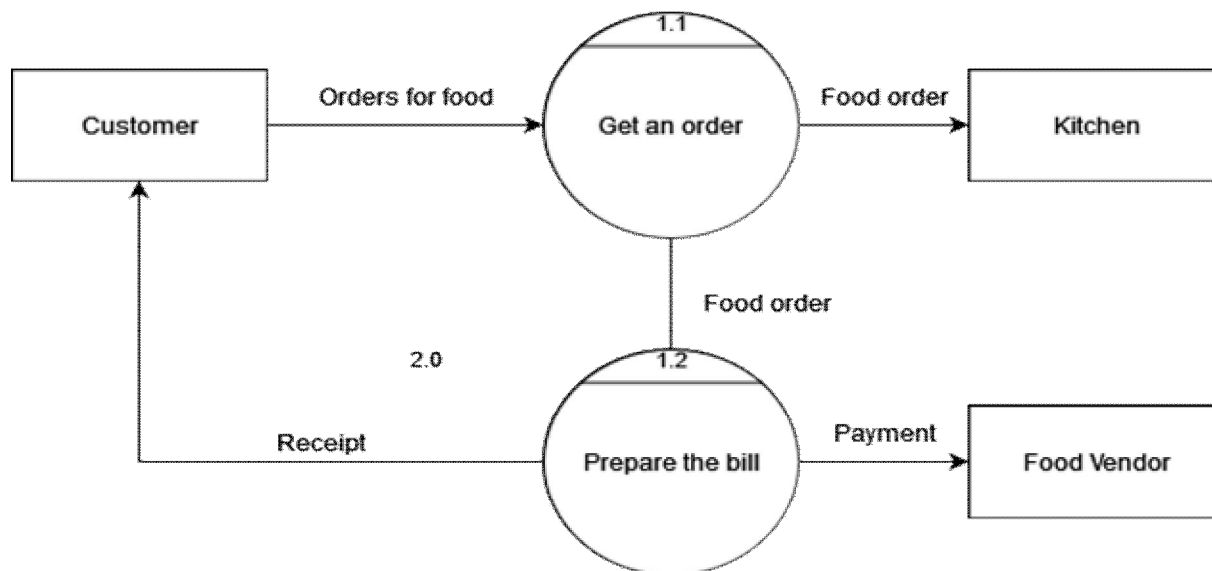


Fig. 4 - DFD Level 2

- 1) The user launches the application and enters their login information.
- 2) The application interface is displayed to the user, who can then place orders, schedule orders, make payments, and monitor their earnings.
- 3) The user can look through the menu options and choose the dish they want to order.
- 4) The application logic component processes the order after the user places it and puts the processed order data in the database.
- 5) When a scheduled order is selected by the user, the application logic component records the information about the scheduled order in the database and notifies the user when the order is prepared for pickup.
- 6) The payment gateway component executes the payment and notifies the application logic component of the payment status if the user decides to make a payment.
- 7) The application logic component changes the earnings data in the database, and the user can view their profits from the application interface.
- 8) Users may elect to receive personalised food item recommendations from the recommendation engine component based on their past orders, reviews, and preferences.

V. RESEARCH GAPS AND OPPORTUNITIES

Even if there are numerous mobile applications for ordering and receiving food, there are still holes in the research that need to be filled. There is fewer functionality, unreliable payment methods, difficult-to-use online apps, and terrible user interfaces in many older programmes. Due to these restrictions, these applications have a low adoption rate, which makes it difficult for cafeterias to improve the customer experience.

To fill these knowledge gaps, a cafeteria application using Flutter and Firebase as a backend is being developed. Customers may enjoy a seamless and effective experience thanks to the application, which can address issues like long lines, hold-ups with payments, food shortages, and protracted preparation periods. This technology may also give cafeterias up-to-the-minute availability notifications for food items, helping them manage their inventory and cut waste. The cafeteria industry offers a huge breadth of possibility for this application. The suggested application may make it possible for cafeterias to offer patrons a more practical and effective method of ordering and paying for their meals. Furthermore, the app can offer insightful data on consumer behaviour and preferences, helping cafeterias better understand their patrons and offer more specialised services. The creation of such an application could improve cafeterias' productivity and financial success while giving their patrons a better overall experience.

VI. FUTURE OUTLOOK

With an emphasis on enhancing the user experience and correcting the shortcomings of more established applications, the development of a cafeteria application utilising Flutter and Firebase as a backend has a lot of potential for the future. Firstly, by shortening wait times, streamlining the ordering procedure, and offering real-time information on food availability, the proposed application can increase the effectiveness and profitability of cafeterias. Additionally, the programme can offer insightful information on consumer behaviour and preferences, helping cafeterias better understand their patrons and adjust their offerings to suit their needs. The proposed application can also aid cafeterias in remaining competitive as the use of mobile applications increases by giving patrons a quick and easy way to order and pay for their meals. Customer loyalty may be increased and the overall customer experience improved by integrating elements like discounts and reward programmes. To further improve the recommendation system and customise the user experience, it may be possible to investigate integrating cutting-edge technology like AI and machine learning as the proposed application develops. The incorporation of these payment options can also give clients more convenience and security as the use of cryptocurrencies and digital payments increases.

VII. CONCLUSION

The creation of a cafeteria application with Flutter and Firebase as a backend offers the chance to overcome the difficulties that cafeterias encounter, like long lines, sluggish payments, a lack of food options, and protracted preparation periods. By offering a straightforward and intuitive user interface, real-time updates on food availability, and a variety of features to boost convenience and personalisation, the suggested application seeks to improve the entire customer experience. The suggested application can considerably decrease wait times and boost cafeteria efficiency by automating the ordering process, offering real-time information on food availability, and allowing users to plan orders in advance. Convenience for cafeterias and their patrons can both be improved by the integration of payment methods and earnings tab. Overall, the building of a cafeteria application with Firebase and Flutter as a backend offers a chance to make customers' experiences more effective, practical, and pleasurable while boosting the cafeterias' profitability and competitiveness. The suggested application has the potential to revolutionise the cafeteria business and enhance the general customer experience by addressing the difficulties faced by cafeterias and utilising the capabilities of contemporary technologies.

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