KG Canteen Management System

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**Abstract— This project offers a user-friendly online application that is intended to improve convenience for both users and canteen administrators by streamlining the food ordering procedure in college canteens. Canteens frequently experience crowding during busy times, which causes delays and annoyance for patrons. Additionally, some canteens’ lack of a formal queuing system might make ordering food confusing and ineffective. In order to overcome these obstacles, our web application enables customers to place online orders based on real-time inventory updates, explore the range of food selections, and check food availability. Through an easy-to-use admin dashboard, the canteen staff may handle incoming orders after they are placed. Users receive a message when their order is ready for pickup, and they can scan their RFID-enabled ID card or confirm their order ID to pick up their food. This technique enhances the overall dining experience by cutting down on crowding and wait times. Although the suggested program was created especially for college canteens, it can be modified for other settings where ordering food quickly is essential. Keywords: Web technology, Embedded System, IoT, Communication Protocols, Content Management System**

I. INTRODUCTION:

The Canteen Management Application is a cutting-edge tool made to make ordering food for students and canteen employees easier. This app uses technology to offer a smooth and effective way to order, track, and manage meals in a canteen setting. Long lines and manual order tracking are no longer an issue thanks to this digital solution that serves both administrators and users. The software provides a userfriendly interface for students to buy food online and select from simple payment methods, such as cash on delivery or online transactions. Transparency and convenience are ensured by allowing users to track the status of their orders via several stages: pending, preparing, ready for pickup, and completed. Users can pick up their orders at the canteen by either scanning an RFID tag for instant verification or showing their unique order ID. The app’s administrative interface gives canteen employees the ability to effectively oversee operations. In addition to maintaining precise stock counts, administrators can add or modify menu items, verify orders, alter order statuses, and clear completed orders. The platform enables administrators to create and download order summaries in PDF or DOC format to guarantee thorough record-keeping and data accessibility. This software is a vital tool for contemporary canteen management since it not only streamlines the ordering procedure for students but also increases the operational effectiveness of the cafeteria personnel. The application serves as a complete solution for administrators and users alike with its combination of real-time order tracking[1], online payment integration, and administrative management.

II. EXISTING SYSTEM:

The manual procedures used in the present cafeteria order management system are ineffective and inconvenient for both staff and students. In order to place their orders, students usually form lines in the canteen, which frequently results in long waits, disorganized lines, and annoyance because there isn’t a streamlined procedure[2]. Under this arrangement, students must wait in line to place their orders and pay, often for long stretches of time. This causes needless delays, especially during busy times when the canteen is packed. Student unhappiness frequently results from problems like the unordered or misplaced delivery of food products caused by the lack of an organized order management system. The absence of a clear and up-to-date menu display is another major issue, which makes it challenging for students to know what is available before placing an order. The problem is made worse when products run out of stock after orders have been placed, resulting in lost time and inconvenience. Transparency and accountability in order processing are also lacking in the current system. Due to the inability to track their orders, students are unsure of the stage of preparation or the anticipated time of pickup. Confusion and discontent are further increased by the occasional mistakes made when orders are distributed manually, such as meal exchanges or duplicate delivery. These restrictions demonstrate the urgent need for a more methodical and effective approach to canteen operations, one that uses technology to overcome the drawbacks of the current setup. Students usually submit their food orders manually in traditional university cafeteria systems, which creates a number of problems that reduce productivity and user happiness. These problems are most noticeable during busy times when a lot of people visit the canteen. Students frequently have to wait in long, disorganized lines, making the lengthy wait times one of the biggest issues. These inefficiencies are demonstrated by a case study carried out in a public university canteen in Sri Lanka, which found that average wait times at service counters ranged from 2.35 to 3.03 minutes. Students become frustrated as a result, and they have less time for personal or academic pursuits. The issue is made worse by the lack of a methodical approach to queue management[3]. Students frequently find themselves in crowded, disorganized queues, which can cause discomfort and arguments. Additionally, the manual order-taking procedure is prone to mistakes, such misplaced orders or meal exchanges, which can leave consumers unhappy.

sThe irregular service rate is another major flaw in the conventional system. Staff productivity might fluctuate based on workload and peak hours, resulting in erratic wait times that make it challenging for students to efficiently manage their schedules. Another persistent problem is the menu options’ restricted visibility. Students’ ability to make educated judgments is hampered by physical menus, which are frequently positioned close to the counters yet do not fully display all of the food options. Students are forced to make last-minute changes to their selections due to this lack of transparency and sporadic supply shortages, which further causes delays and confusion. The critical need for a modernized system to improve service delivery, streamline operations, and improve the entire dining experience in university canteens is highlighted by these combined inefficiencies.

1. *Disadvantages:*

Time delays occur due to manual order placement and waiting in queues, especially during peak hours. Lack of realtime inventory tracking leads to stock unavailability, causing inconvenience when desired menu items are out of stock. Absence of an organized queue management system results in inconsistencies in order placement and distribution, creating confusion and frustration. Inefficient handling of multiple orders arises due to the lack of a proper queue system, causing disorder. Limited menu visibility restricts students from exploring all available options and making informed decisions. These issues highlight the need for a technologyenabled solution to improve the canteen experience.

III. PROPOSED SYSTEM

The suggested approach overcomes the drawbacks of the manual system by introducing a complete and userfriendly canteen management application that makes use of contemporary technology. The purpose of this application is to increase transparency, streamline the ordering procedure for meals, and boost the general effectiveness of canteen operations. The system’s primary function is to enable online food ordering, allowing users (students) to peruse the menu and place orders via an easy-to-use interface[4]. To accommodate a range of customer preferences, the system includes flexible payment options that let consumers choose to pay with cash on delivery or online using digital methods like UPI and cards. The system’s ability to track orders in real time is one of its key features[5]. Using predefined statuses like Pending, Preparing, Ready for Pickup, and Completed, users are constantly updated on the status of their orders. This lowers uncertainty and improves the user experience by guaranteeing that users have clear visibility into their orders. The app’s numerous verification options further streamline the pickup procedure. For fast and precise order retrieval, users can either use RFID scanning or submit their unique order ID, removing the inaccuracies frequently found in manual distribution. The suggested solution has strong management capabilities from an administrative perspective. By verifying orders, updating their preparation status, and clearing finished orders, administrators can manage orders effectively. Admins may add new items, maintain stock levels, and remove unavailable items with ease thanks to the system’s seamless stock management features. The system ensures orderly record-keeping and facilitates audits by offering the ability to generate and download comprehensive reports in PDF or document format after orders are finished. In addition to addressing the shortcomings of conventional canteen procedures, this approach offers an organized, open, and effective paradigm for canteen management. The suggested method greatly improves user happiness while lessening the strain for canteen employees by automating crucial procedures and offering real-time updates. Better time management, less manual errors, better order organization, increased transparency, and streamlined processes are some of this system’s benefits. The suggested canteen software offers a revolutionary way to updating canteen administration with its cutting-edge functionality and user-focused design.

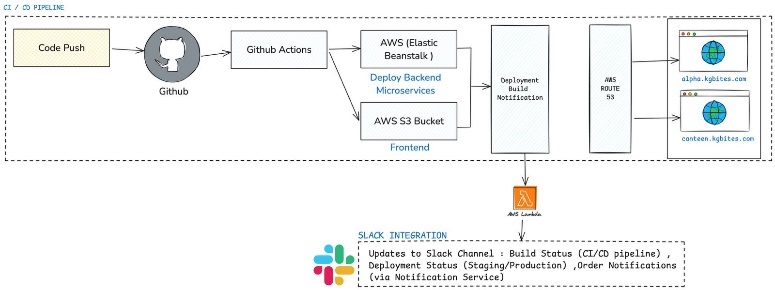
1. *BENEFITS*

In addition to providing user-friendly features like simple RFID scanning or distinct order IDs for pickups, a strong system may boost operational efficiency and transparency. Flexible payment options increase consumer convenience, and automated record-keeping and better stock management reduce errors and speed processes. This method also contributes to a more efficient and seamless workflow by lowering queue congestion. It offers a strong basis for long-term success by improving customer satisfaction and guaranteeing scalability for future expansion[6].

1. *SYSTEM DESIGN*

The proposed system design focuses on creating a scalable online application for college canteens that enhances user convenience and streamlines food ordering processes. The architecture will leverage cloud technologies, particularly AWS, to ensure scalability, reliability, and performance. User Interface (UI) Frontend Framework: React.js (responsive, scalable, and user-friendly).

Food menu display with real-time inventory updates. Order placement, order status tracking, and order history. RFID scanning and order confirmation interface[7]. Endpoints: alpha.website.com for alpha testing, beta.website.com for beta testing.



**API Gateway**

It acts as a central entry point for frontend and external apps to interact with backend services. Routes requests to the appropriate microservices. Supports throttling and caching. Authentication and authorization via AWS Cognito.

**Microservices Architecture**

To guarantee modularity, scalability, and fault isolation, every function is contained within a separate microservice.

The administration of user accounts and roles, including administrators and users, is under the purview of the User Management Service. Developed using Node.js and AWS DynamoDB, it facilitates functions like storing RFID[8] associations with user profiles and allowing users to register and log in using AWS Cognito for authentication. Developed with AWS DynamoDB and Python (FastAPI), the Menu Management Service is primarily focused on inventory and food item management. CRUD operations for menu items via an admin dashboard, with endpoints like GET /menu for obtaining menu items and POST /menu for adding or editing items, are among its features, along with real-time inventory changes driven by AWS IoT Core. The entire order lifecycle is managed by the Order Management Service, which was developed using PostgreSQL (RDS) and Java Spring Boot. Placing new orders, monitoring order statuses, alerting customers via Amazon SNS when items are ready, and managing fulfilled and cleared orders are some of the main functions. Orders may be placed via POST /order, order details can be retrieved by GET /order/{id}, and order statuses can be updated with PATCH /order/{id}. The goal of the Python-based Notification Service with AWS SNS/SQS is to alert users via push notifications, email, or SMS when the status of their orders changes. In the event of a system overload, it also queues messages for delayed alerts. Last but not least, the Admin Dashboard Service offers a Python Flask backend API and a React.js frontend for the canteen employees. Staff may check and manage incoming orders, update order statuses (like cleared, fulfilled, or ready for pickup), and keep an eye on inventory via restock reminders thanks to its capabilities. Flexibility, dependability, and effective management across all capabilities are guaranteed by this modular microservice design.   
 **Database Design**

The system manages user profiles and regularly updated data, including menu and inventory items, using AWS DynamoDB, a NoSQL database. AWS RDS with PostgreSQL is used for order transactions and history, guaranteeing dependable and consistent transactional data processing.

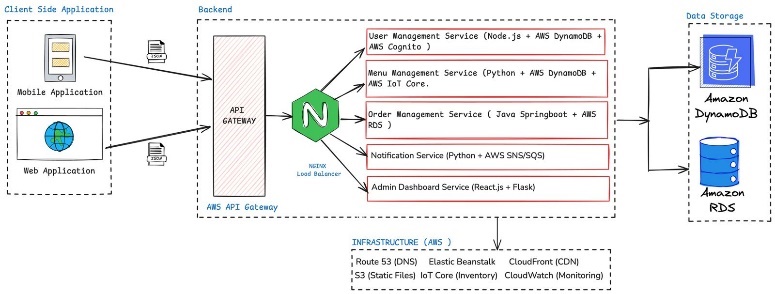
**Infrastructure**

The system makes use of a number of AWS services to guarantee scalability and effective functioning. Alpha.website.com and beta.website.com are examples of subdomains that are routed via Route 53 for DNS management, while traffic is distributed to backend microservices using the Elastic Load Balancer (ELB). AWS Elastic Beanstalk makes it easier to deploy and maintain backend microservices, while AWS Lambda manages serverless tasks like RFID processing. AWS CloudFront acts as a CDN for the quick and safe distribution of web assets, while AWS S3 houses static assets like frontend files and food photos. While AWS CloudWatch offers monitoring and logging, Amazon SNS/SQS facilitates asynchronous communication and notifications. Furthermore, AWS IoT Core guarantees real-time inventory management updates.

**Security**

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**CI/CD Pipeline**



The deployment process is streamlined by automating the CI/CD pipeline with AWS CodePipeline and GitHub Actions. A build in AWS CodeBuild is triggered by CodePipeline when code is pushed to the GitHub repository. The microservices are deployed to Elastic Beanstalk or AWS Lambda after a successful build. In order to guarantee that the most recent assets are served, the CloudFront cache is invalidated after the frontend is deployed to S3. The application is deployed to alpha.website.com for testing, and automated tests are conducted. The application is deployed to beta.website.com for additional validation prior to the final release following approval and successful completion of the tests. By reducing human labour and facilitating seamless transitions between development stages, this workflow guarantees a consistent and dependable deployment procedure.

**Scalability and Fault Tolerance**

High availability and scalability are built into the system. For backend services, auto-scaling is built with AWS ECS (Fargate), enabling them to scale automatically in response to demand. By utilizing on-demand scaling, DynamoDB can adapt its capacity to accommodate fluctuating traffic. The RDS database is spread across many availability zones (Multi-AZ), offering redundancy and failover capabilities, in order to guarantee high availability. By ensuring that static assets are dispersed throughout the world, CloudFront improves the availability and speed of content delivery. In order to guarantee smooth failover and little downtime, Route 53 health checks are also configured to automatically reroute traffic in the event of failures.

IV. WORK FLOW

*A.USER SIDE*

Homepage The main page greets users as soon as they arrive on the website. By selecting the Register button and entering the necessary information, customers can create an account if they don’t already have one. By choosing the Login button and providing their login information, users who already have an account can log in. This guarantees that the ordering system can only be accessed by authenticated users[9].

**Placing an order**

After logging in, users can browse through the menu of available food items displayed on the home page. Each item is accompanied by an Add to Cart button, which users can click to include the desired items in their cart. This allows consumers to quickly select all the food items they want to order.

**Viewing and Confirming the Order**

After adding all of their selected items, consumers can click the View Cart button to check their choices. An overview of the chosen foods, their amounts, and the overall cost are given on this page. Users have the ability to alter quantity or remove things as needed. Users can confirm their order and move on to the payment step after checking their cart.

**Payment options**

For ease, the payment procedure is incorporated into the system. Users can choose their preferred payment method on the cart page, including safe online choices like credit/debit cards or UPI. Online payments are handled instantly, guaranteeing a safe and easy transaction. As an alternative, customers may decide to pay with cash when they pick up their orders.

Order Confirmation and Status Tracking Users can track the status of their orders after they are placed by going to the My Orders section. From there, they can see real-time updates on the order status as it moves through different stages, such as Pending, Ready, or Completed, which informs users when their food is ready for pickup. Order pickup For order collection, users need to verify their identity. They can either present the Order ID linked with their purchase or utilize the RFID tag assigned to them. The RFID tag can be read at the collection location for quick and seamless verification. Users can pick up their food after their identity has been verified, finishing the process.

A seamless and effective user experience is guaranteed by this organized procedure[10], which makes account creation, order placement, payment, and food collection easier while preserving convenience and security at every turn.

1. *ADMIN PANAL ACCESS*

Accessing the Admin Page and Logging In: Start by going to the specified website and logging in using the given username and password. After correctly entering your credentials, you will be able to access the site as an administrator. After successfully logging in, you will be sent to the homepage, which offers a number of features. The most noticeable of these is the Admin Dashboard, which is situated in the window’s lower-right corner and will only be accessible by administrators. Only admin users are allowed access to this area, guaranteeing safe access to vital administration tools.

**Using the Administrator Dashboard:**

Find the Admin Dashboard button in the lower-right area of the screen after logging in and arriving at the homepage. You will be taken to the Admin Dashboard page when you click this button. You can carry out crucial administrative duties like adding or removing food products, changing stock levels, and handling customer orders in this section, which acts as a control center[11]. The platform’s administration of all food-related operations is made easier with the help of the intuitive Admin Dashboard.

**Handling Food Products:**

There is a specific area in the Admin Dashboard for handling food products. Clicking the "Add Item" button will direct you to a page specifically designed for this purpose, where you can add new food items or edit ones that already exist. You can enter information about the food item you want to add on this page, such as its name, price, and picture. Click the "Add Food Items" button to confirm and save the addition after entering these details.

**Changing Stock Levels:**

A food item’s initial stock amount must be specified after it has been properly added. To save the stock level, enter the desired quantity and click the yellow update button. You can keep up-to-date stock information on the platform thanks to this feature. Changes are instantly reflected in the system whenever the stock is changed. You can watch a thorough instructional video on the website that shows you how to add or change food items effectively if you want a more thorough understanding of this procedure.

**Managing Items That Are Out of Stock:**

A food item will immediately become grayed out on the homepage when it runs out of stock. Users are prevented from placing orders for unavailable items by this visual indicator. You still have complete authority over stock management, though, as an administrator. You can access the Admin Dashboard, change the quantity, and re-make the item available for purchase after it has been refilled. By guaranteeing that users only view and purchase things that are available, this method expedites the ordering process and avoids needless cancellations.

*C. ORDER MANAGEMENT*

One of the main features of the Admin Dashboard is order management, which enables administrators to effectively track and handle client orders. The steps that follow provide a detailed explanation of the procedure, guaranteeing that the order management system is understood.

**Examining Orders:**

By choosing the View Orders option in the Admin Dashboard, you may view the orders that a user has placed. You can view all of the pending orders on the order management page by clicking this button. This page offers a thorough summary of all new orders that need to be processed, along with order items, quantities, and customer details.

**Handling Purchase Orders:**

Click the "Packed" button next to the order to start processing it. The order will be transferred to the "Ready Orders" tab after this step is completed. The purpose of this tab is to distinguish between orders that are ready for pickup or delivery. This easy step guarantees openness in the preparation process and keeps the order flow organized. Finishing Orders: In the "Ready Orders" tab, click the Completed button next to the order once it has been successfully delivered or picked up. By choosing the "Completed Orders" option in the upper-right corner of the Admin Dashboard, you may access the Completed Orders page, where the order data are transferred.

**Examining and Handling Fulfilled Orders:**

Click the View Order button next to any order on the Completed Orders page to see its details. You can review order details, such as customer information, items ordered, and order dates, using this option. The Admin Dashboard also offers the following capabilities for effective completed order management: Clear Orders: If necessary, you can use this option to delete specific completed orders from the record.

**Download Summary:**

A reportformatted summary of all completed orders is available for download, which makes it simple to monitor sales, examine patterns, or keep track of documentation for bookkeeping needs.

V. CONCLUSIONS

The proposed canteen management system is a comprehensive solution designed to modernize and enhance the operational efficiency of college canteens. By addressing the limitations of traditional systems, the platform provides an efficient, user-friendly, and transparent food ordering experience. The integration of cutting-edge technologies such as cloud computing, IoT, and real-time notifications ensures seamless operations and an enhanced user experience. Through features like RFID-enabled pickup, real-time inventory updates, and adaptive payment methods, the system not only reduces manual errors and queue congestion but also improves order accuracy and satisfaction for both users and administrators. Additionally, its scalable architecture, robust security measures, and modular microservices design enable it to adapt to future growth and technological advancements. This solution not only streamlines canteen management processes but also paves the way for implementing similar technology-driven systems in other fast-paced service environments[12]. By leveraging innovation and automation, the proposed system redefines the dining experience, making it more efficient, reliable, and enjoyable for all stakeholders.

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