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MealMap: Hostel Food Management

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Abstract: Managing hostel food services effectively is a complex task that involves meal planning, inventory control, and user satisfaction. Traditional manual methods often result in inefficiencies such as food wastage, inaccurate inventory tracking, and limited coordination between stakeholders. MealMap is a technology-driven solution that streamlines hostel food management by integrating automated meal adjustments, real-time inventory monitoring, and a structured feedback mechanism. Through role-based access for students, kitchen staff, and administrators, MealMap ensures a well-organized, data-driven approach to food service management.

By leveraging real-time data analytics, MealMap optimizes resource utilization, minimizes waste, and enhances operational efficiency. Students can view meal plans and provide feedback, while administrators and kitchen staff can efficiently manage stock levels and adjust meal quantities as needed. The system's structured approach improves accuracy, transparency, and sustainability, ultimately enhancing the overall dining experience in hostel environments. Future developments could incorporate AI-driven meal planning and mobile integration to further refine its impact on hostel food services.

Keywords: Meal Planning, Inventory Management, Automation, Feedback System, Sustainability

I. INTRODUCTION

Food management is a critical aspect of hostel operations, directly affecting student satisfaction, resource utilization, and sustainability. However, traditional manual methods for managing hostel food services often lead to inefficiencies such as food wastage, inaccurate inventory tracking, and lack of communication between stakeholders. These inefficiencies not only impact the quality of meals provided to students but also contribute to financial losses and operational difficulties for hostel administrators.

In many hostels, meal planning and inventory management are conducted manually, relying on paper records or basic spreadsheets. This conventional approach is often error-prone, time-consuming, and lacks the ability to adapt dynamically to changing demands. Moreover, in larger hostel setups, coordinating between kitchen staff, suppliers, and administrators becomes increasingly challenging, leading to over-purchasing, food shortages, or unnecessary wastage.

To address these issues, MealMap is introduced as a comprehensive Hostel Food Management System that leverages technology to streamline meal planning, inventory control, and user feedback. The system integrates automation, real-time data tracking, and a structured communication framework to ensure efficient hostel food service management.

MealMap operates on a role-based access system, allowing different stakeholders to interact with the platform based on their responsibilities. Students can view meal schedules and provide feedback, kitchen staff can monitor inventory levels and meal preparation, while administrators have the authority to track stock usage, update meal plans, and analyze performance metrics. By providing an interconnected and data-driven approach, MealMap enhances coordination and decision-making in hostel food management.

The key objectives of MealMap are:

1. To develop a digital platform for managing hostel food services efficiently.
2. To implement real-time inventory tracking and automated meal planning to reduce food wastage.
3. To integrate a structured feedback system that enables students to share meal preferences and quality assessments.
4. To analyze system performance and ensure scalability for various hostel sizes and meal demands.

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II. LITERATURE SURVEY

1. "Hostel Mess Food Management System"
International Research Journal of Modernization in Engineering Technology and Science (IRJMETS), February 2025
This study emphasizes the role of technology, such as pre-booking meals and real-time inventory tracking, in optimizing food management within hostel messes. The research highlights how smart meal planning systems can reduce food wastage by aligning food preparation with actual demand.

2. "Development of an E-Based Hostel Management System"
ResearchGate Publication, July 2024
This research focuses on creating an efficient and reliable hostel allocation system that automates manual tasks. The system includes features like inventory management and access control mechanisms, enhancing the overall efficiency of hostel operations.

3. "Inventory Management in the Hospitality Industry"
International Journal of Business and Management Invention (IJBMI)
This paper discusses the importance of conducting physical inventory in food service businesses, recommending regular checks to prevent issues like stockouts and overstocking. It underscores the necessity of proper storage conditions and inventory practices to maintain operational efficiency.

4. "Assessment of Food Wastage in Hostel Messes"
ResearchGate Publication, November 2024
This study assesses the patterns of food wastage by students in hostel messes and their awareness regarding its consequences. It provides insights into the extent of food wastage and suggests measures to mitigate it, contributing to better food management practices in hostels.

5. "Design and Implementation of a Web-Based Canteen Management System using PHP and MySQL"
ResearchGate Publication, March 2023
This paper presents the development of a Mess Management System offering features like menu planning, food ordering, inventory management, and billing. The system aims to reduce the workload on mess staff, increase efficiency, and minimize errors in the mess management process.

III. PROPOSED ALGORITHM AND METHODOLOGY

The MealMap system follows a structured algorithm to streamline meal planning, inventory tracking, and feedback processing through its app, ensuring efficient hostel food management.

1. Hostel Type and Operational Scale:

- Type of institution: Mostly hostels at colleges and universities.
- Capacity: Provides all three meals to 850 students every day.
- Kitchen Staff: 20–25 people working in the kitchen, such as cooks, assistants, and inventory managers
- Dining Schedule: Meal Timings
  - Breakfast: 7:45 AM – 10:30 AM
  - Lunch: 12:00 AM – 2:30 PM
  - Snacks: 5:00 - 6:00 PM
  - Dinner: 7:45 PM – 9:30 PM

2. Meal Preferences and Menu:

- Cuisine Type: Mostly vegetarian regional Indian meals (with option of non-veg days). Rice, chapati, dal, sambar, and curd are among the staple foods.
- Variety of Meals: Weekly or monthly meal plans that rotate.

3. Inventory Categories and Stocking Patterns:

- Staples Threshold: ≥ 1200 kg,

i. Such as rice, atta, and dal (toor, moong), kept in bulk storage facilities.
ii. Used to prepare all meals on a daily basis.
iii. Restocked every week.

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- Non-perishable goods Threshold: ≥ 300 kg,

i. Such as spices, sugar, salt, and oil.
ii. Replenished every 10–14 days.
iii. Kept in a dry, pest-free environment.
iv. Includes products with a long shelf life that are used in measured amounts.

- Items that are perishable Threshold: ≥ 600 kg,

i. Such as milk, curd, and vegetables.
ii. Replenished every day or every other day.
iii. Need to be kept in a cold environment and are constantly watched to avoid spoiling.
iv. Amount based on two to three fresh meals a day.

The proposed algorithm consists of two key modules: Meal Preparation & Inventory Management and Feedback Processing.

1. Meal Preparation & Inventory Management Algorithm

Step 1: Kitchen staff logs into the MealMap app and retrieves the daily meal schedule.
Step 2: The app displays the required ingredients for the scheduled meals and checks real-time inventory levels.
Step 3: If all required ingredients are available, the app confirms the meal plan, and kitchen staff proceeds with meal preparation.
Step 4: If some ingredients are unavailable, the app suggests alternative ingredients based on available stock.
Step 5: After meal service, kitchen staff updates stock levels directly through the app.
Step 6: The app automatically checks stock levels against predefined thresholds (Staples: 200kg, Non-perishables: 50kg, Perishables: 100kg). If stock is low, the app generates an alert for kitchen staff to restock. If stock is high, the app suggests meal plans that optimize ingredient usage to prevent wastage.
Step 7: All inventory updates are logged within the app for tracking and future meal planning.

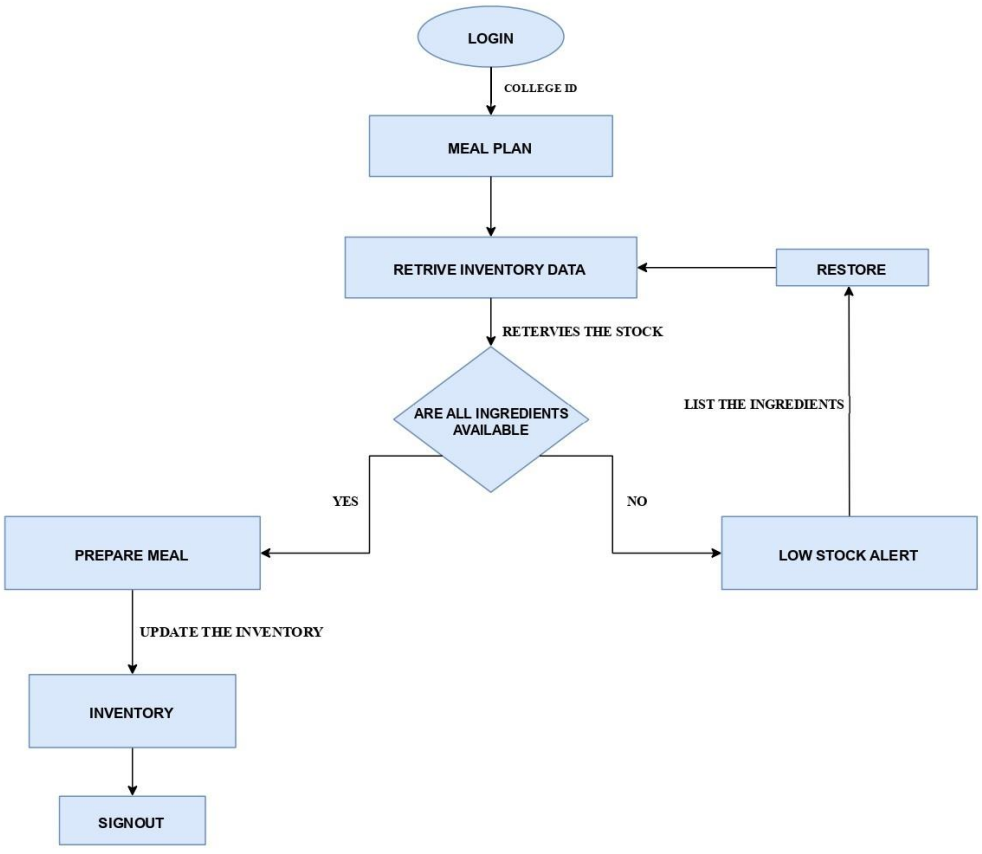

Figure 1: Meal Preparation and Inventory Management

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2. Feedback Processing Algorithm

Step 1: Students Log in and Submit Feedback

- **Action:** Students use their web portal or mobile devices to access the MealMap app after each meal, be it breakfast, lunch, or dinner.
- **Details:** They log in using their institutional credentials or enter their registered student Id. A list of the dishes served at that meal is displayed by the app, it is automatically loaded from the daily meal schedule.

Students provide feedback by:

i. Rating each dish (1 to 5 stars).
ii. Selecting predefined comments (e.g., too spicy, undercooked, great taste).
iii. Writing optional suggestions.

Step 2: App Categorizes Feedback

- **Action:** Once feedback is submitted, the MealMap app classifies and stores it using rule-based logic.
- **Details:** Three buckets comprise the sorting of feedback:

i. Positive → Ratings ≥ 4
ii. Negative → Ratings ≤ 2
iii. Ideas → Text input with suggestions

Step 3: Trigger Alerts for Repeated Negative Reviews

- **Action:** The app runs a daily check to detect dishes with multiple negative reviews.
- **Details:** A threshold is defined (e.g., ≥ 50 negative reviews OR ≤ 2.0 average rating)

- If triggered, an alert is sent to:

i. Kitchen staff
ii. Inventory/quality control manager

Notification includes:

i. Dish name
ii. Number of negative reviews
iii. Common complaints (e.g., "too oily", "undercooked")

The staff is advised to:

i. Review the recipe
ii. Modify preparation method
iii. Replace or rotate the dish if needed

Step 4: Recommend High-rated Dishes

- **Action:** The system also tracks consistently performing dishes.
- **Details:** The app notes a dish if it keeps ≥ 4.5 average rating for three plus consecutive meal cycles.

Suggestions call for: Add more frequency to the dish in weekly rotation.

Step 5: Generate Weekly/Monthly Feedback Reports

- **Action:** It analysis reports compile all of the input.
- **Details:**

i. Top five approved and disapproved dishes.
ii. Average ratings for dishes.
iii. Most often mentioned grievances and recommendations.

These automatic generated reports are distributed to:

i. Hostel Head
ii. Kitchen supervisor
iii. Committee on meal planning

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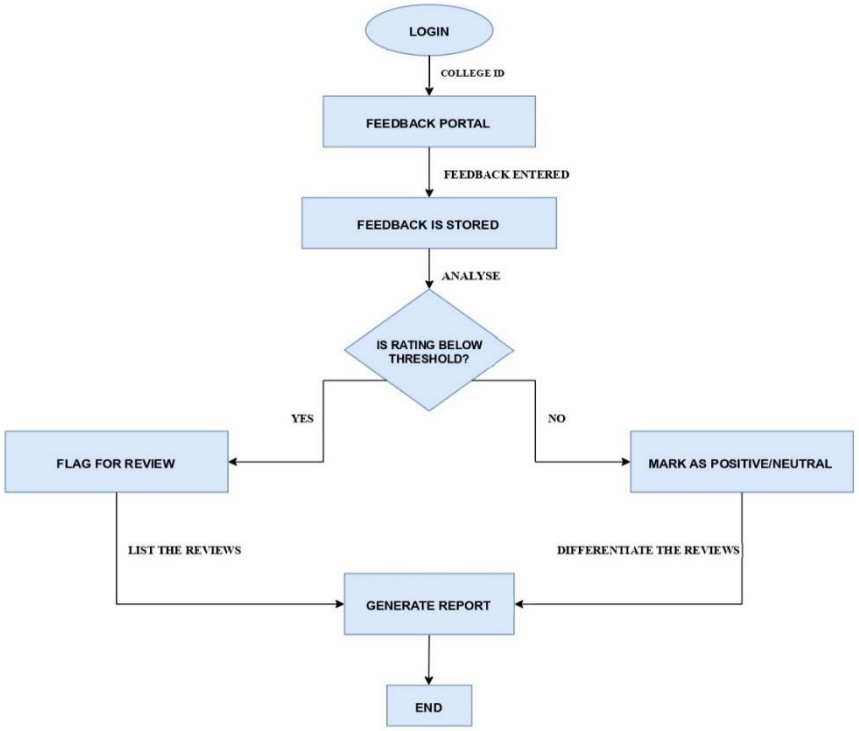

Figure 2: Feedback Processing Algorithm Flowchart

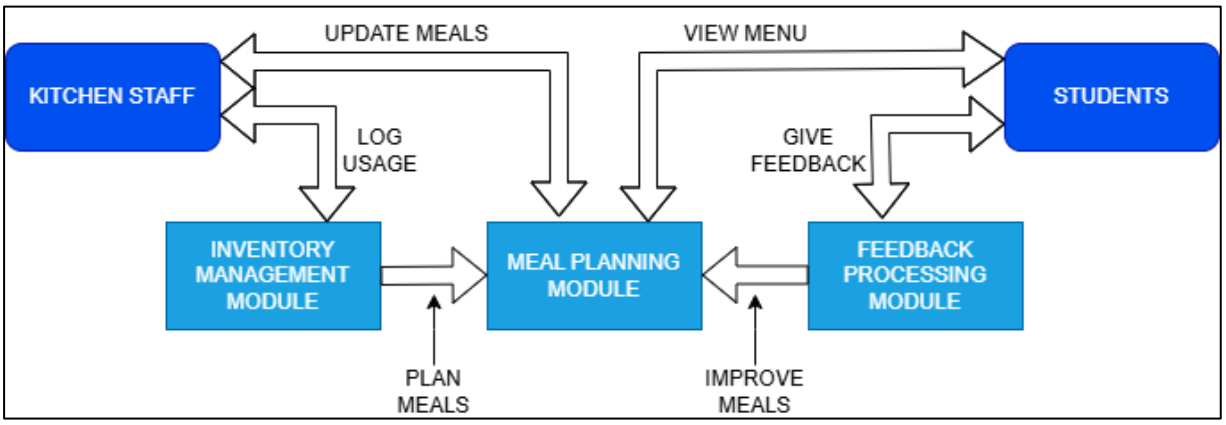

Figure 3: Interaction Between Modules and Users

IV. APPLICATION REQUIREMENTS

Hardware Requirements

1) Server / Admin System (for hosting backend and managing data)

- **Processor**: The server must have a strong Processor to effectively manage several concurrent staff and student requests.
  - Intel Core i5 or higher / AMD Ryzen 5 or higher
- **RAM**: A server with sufficient RAM can manage daily data and user activity with ease, guaranteeing steady performance during peak hours and report generation.
  - Minimum 8 GB (16 GB recommended for scalability)
- **Storage**: Quick access to meal data and feedback guaranteed by fast, dependable SSD storage helps to minimize delays and support real-time updates in the busy hostel.
  - 256 GB SSD or more (to ensure quick data access and backups)
- **Internet**: Stable high-speed internet connection

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- **Optional**: UPS backup for continuous uptime during power outages. Power outages are common in many hostels. By preventing unexpected server shutdowns, a UPS guards against data loss and maintains service availability during brief power outages.

2) Client Devices (Kitchen staff & students): The majority of devices are covered by these versions, which guarantee the app operates safely and smoothly while supporting all contemporary features without any compatibility problems.

- **Smartphones/Tablets** (for accessing the app):
  - Android 8.0+ or iOS 13+
  - At least 2 GB RAM
  - 4G internet connectivity or Wi-Fi
- **PCs/Laptops** (for admin or kitchen use):
  - Basic system with i3/Ryzen 3 or better
  - 4–8 GB RAM
  - 128 GB HDD or SSD

Software Requirements

1) Operating System

- **Server**: Linux (Ubuntu 20.04 LTS or later) or Windows Server
- **Client** (Admin/Kitchen PCs): Windows 10 or later / Linux
- **Mobile Devices**: Android 8.0+ or iOS 13+

2) Frontend

- **Framework**: React.js is favored due to its robust community support and component-based architecture.
- **Languages**:
  - HTML5 for structured content
  - CSS3 for styling and layout
  - JavaScript (ES6+) for dynamic and interactive features
- **Design**: To guarantee that the application functions flawlessly on a range of screen sizes, including desktops, tablets, and smartphones, responsive design is used.

3) Backend

- **Language:** Python combined with Flask (a lightweight and adaptable micro-framework) or Django (a fully functional framework with integrated admin and ORM)
- **Framework**: Express and Node.js (for a non-blocking, event-driven server environment appropriate for scalable applications)
- **API Type**: RESTful APIs allow for modular and scalable integration by standardizing front-end and back-end communication.

4) Database

- **Primary**: MySQL or PostgreSQL
- **Alternative**: Firebase (if using serverless architecture)

5) Version Control

- **Tool**: Git
- **Platform**: GitHub / GitLab / Bitbucket (for team collaboration)

6) Other Tools & Services

- **Authentication**: Firebase Auth / Django Authentication system
- **Notifications**: Firebase Cloud Messaging (FCM) for mobile alerts
- **Deployment**: Heroku, Render, or AWS (depending on budget/scale)

7) Testing Tools

- **Frontend Testing**: Jest / React Testing Library
- **Backend Testing**: PyTest / Postman for API testing

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V. CONCLUSION

MealMap was developed to address the inefficiencies in hostel food management by digitizing meal planning, inventory tracking, and feedback collection. Traditional methods of managing hostel meals often lead to food wastage, stock shortages, and lack of structured feedback, making it difficult for kitchen staff to optimize meal preparation. With MealMap, these challenges are significantly reduced by introducing an automated system that enhances coordination between kitchen staff and students.

One of the key benefits of MealMap is its real-time inventory management system, which allows kitchen staff to track ingredient usage and receive alerts for low-stock items. This reduces the likelihood of food shortages and prevents over-purchasing, leading to better resource utilization and cost savings. Additionally, the meal planning feature enables staff to schedule meals based on available stock, ensuring that meals are well-balanced and aligned with ingredient availability.

The feedback collection module empowers students to express their meal preferences, provide ratings, and suggest improvements. This data-driven approach ensures that meal quality is continuously monitored and adjusted based on student satisfaction. By analyzing feedback trends, kitchen staff can make informed decisions about menu modifications, leading to an improved dining experience.

MealMap also enhances transparency and efficiency by providing role-based access, ensuring that students can only view and rate meals while kitchen staff handle inventory updates and menu planning. The structured workflow eliminates the delays and miscommunication commonly found in manual hostel food management.

In summary, MealMap effectively streamlines hostel food services by integrating automated meal planning, intelligent inventory control, and structured feedback processing into a single platform. By leveraging technology, it optimizes kitchen operations, reduces food wastage, and enhances student satisfaction, making it a valuable tool for hostel food management.

VI. ACKNOWLEDGEMENT

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