

Smart-Tiffin

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Abstract - Students living away from home frequently struggle to access affordable, hygienic, and authentic home-cooked meals, often relying on expensive or unhealthy commercial food delivery options. To address this gap, this paper presents Smart Tiffin, a comprehensive three-panel software platform designed to connect students directly with local home cooks. Developed using modern frameworks such as SpringBoot, the system architecture is divided into three distinct modules.

The Student Panel facilitates location-based discovery, allowing users to manage both one-time meal orders and ongoing monthly tiffin subscriptions.

The Cook Panel empowers local vendors to efficiently manage daily menus, track inventory, and handle automated subscription rosters without requiring extensive technical expertise. Finally, the Delivery Panel optimizes logistics through real-time route navigation and secure delivery verification. By integrating live order tracking and automated dispatching, the platform ensures seamless end-to-end operations.

The implementation of Smart Tiffin not only promotes healthier and more accessible dining options for the student demographic but also provides local culinary entrepreneurs with a streamlined digital infrastructure to scale their micro-businesses effectively.

Key Words: Tiffin Service, Three-Panel Architecture, Subscription Management, Real-Time Tracking, Automated Dispatching, Spring Boot

1. INTRODUCTION

Students migrating to educational hubs frequently struggle to access affordable, hygienic, and authentic home-cooked meals [1]. While commercial food delivery applications dominate the market, they primarily cater to expensive, one-time restaurant orders rather than sustainable daily subscriptions [2]. Conversely, traditional unorganized tiffin services often suffer from poor communication, inflexible menus, and a lack of real-time tracking. To resolve these operational inefficiencies, this project introduces "Smart Tiffin," a digitized platform that connects students directly with local home cooks through a structured, three-panel ecosystem [3].

Developed utilizing dynamic Backend frameworks like SpringBoot, Smart Tiffin provides tailored interfaces for

each stakeholder. The Student Panel enables users to seamlessly discover nearby kitchens, customize preferences, and manage monthly meal subscriptions. Simultaneously, the Cook Panel equips local culinary entrepreneurs with intuitive tools for daily roster and inventory management. Finally, the Delivery Panel optimizes the logistics network through automated dispatching, location routing, and secure delivery handoffs [4]. Ultimately, this project aims to foster a healthier dining lifestyle for students while providing a scalable digital infrastructure for local home-based kitchens.

2. LITERATURE REVIEW

The evolution of food delivery systems has significantly transformed urban dining; however, existing solutions rarely cater to the specific daily nutritional and financial requirements of the student demographic. A review of current literature and existing market models reveals three primary approaches to food delivery, each with notable limitations that the Smart Tiffin platform aims to resolve.

2.1 Commercial Food Delivery Aggregators

Modern on-demand food delivery platforms have established robust technological frameworks featuring real-time tracking, algorithmic dispatching, and seamless digital payments [5]. While highly efficient, these platforms are predominantly restaurant-centric. Research indicates that frequent reliance on restaurant-prepared meals contributes to increased monthly expenses and poor dietary habits among students [6]. Furthermore, these applications are designed for sporadic, one-time orders rather than recurring, localized meal subscriptions, making them unsustainable for daily student consumption.

2.2 Traditional Tiffin and Mess Services

Conversely, traditional local tiffin services and hostel mess facilities offer the affordability and home-cooked quality that students require [7]. However, these conventional models suffer from severe operational inefficiencies. They largely operate offline, relying on manual bookkeeping, cash transactions, and informal communication channels like phone calls or messaging apps [8]. Studies on informal food distribution networks highlight that this lack of digital infrastructure leads to inflexible menus, an inability to pause or manage subscriptions dynamically, and a

complete absence of transit transparency or delivery tracking for the end user [9].

2.3 Digitized Subscription Models

Recent academic proposals have explored the digitization of tiffin services; yet, many of these systems are structurally incomplete. Most proposed architectures focus solely on a two-node relationship (Customer and Vendor), frequently neglecting the logistics layer [10]. Without a dedicated, integrated delivery panel, cooks are forced to manage their own logistics, which severely limits their operational radius and scalability.

2. SYSTEM DESIGN AND ARCHITECTURE

The proposed "Smart Tiffin" platform operates on a robust, multi-tier client-server architecture designed to handle real-time data synchronization across multiple user types. The system is structurally divided into a dynamic frontend interface, a centralized backend server, and a cloud-based database to ensure high availability and seamless communication.

3.1 Frontend Architecture (Client-Side)

The user interface is developed utilizing ReactJS, a component-based JavaScript library that ensures a highly responsive and scalable single-page application (SPA) experience. The frontend is segmented into three distinct operational panels:

- **Student Panel:** Focused on discovery and transaction management. It features location-based filtering, allowing users to query local cooks within a specific radius. The interface integrates state management to handle shopping cart logic, separating logic for one-time meal processing and 30-day recurring subscription plans.
- **Cook Panel:** Functioning as a vendor dashboard, this interface is optimized for order and inventory management. It utilizes real-time data fetching to update the "Active Orders" and "Daily Subscription Roster" screens dynamically. Cooks can toggle item availability, which immediately updates the database and reflects on the Student Panel.
- **Delivery Panel:** Designed for logistical efficiency, this mobile-responsive interface relies on geolocation APIs. It features an online/offline availability toggle, a task acceptance board, and integrated map routing to guide the rider from the cook's kitchen to the student's drop-off location.

3.2 Backend and Database Management (Server-Side)

The core engine of the platform acts as the intermediary between the database and the three frontend panels via RESTful APIs. It is responsible for authentication, session management, and algorithmic dispatching. The database uses a relational or document-based structure to map complex relationships, such as linking a specific Order ID to a StudentID, a CookID, and a DeliveryID simultaneously.

3.3 Real-Time Workflow and State Management

A critical component of the system design is the real-time order state machine, which dictates the flow of information:

1. **Initiation:** A student places an order, updating the database status to *Pending*.
2. **Preparation:** The cook accepts the order via their panel, triggering a state change to *Accepted/Preparing*, which reflects instantly on the student's live tracking screen.
3. **Dispatch Algorithm:** Once the cook marks the food as *Ready*, the backend algorithm queries the database for the nearest available rider and pushes a notification to their Delivery Panel.
4. **Verification and Handoff:** To ensure security, the system employs a two-step verification process. The rider verifies the order ID with the cook upon pickup and must enter a unique One-Time Password (OTP) provided by the student upon final delivery to mark the task as *Completed*.

4. FUNCTIONALITY OF THE SYSTEM

The Smart Tiffin platform integrates multiple interconnected features across its three panels to ensure a frictionless food delivery ecosystem. The functional requirements are categorized based on the respective user modules.

4.1 Student Module Functionalities

- **Location-Based Discovery:** Upon authentication, the system utilizes the student's geographical coordinates to populate a list of nearby home kitchens.
- **Dynamic Ordering System:** Students can browse daily menus (for example, standard meals like ladyfingers with roti) and choose between placing an immediate, one-time order or subscribing to a recurring 30-day tiffin plan.

- **Subscription Management:** Users have the flexibility to pause, resume, or cancel their monthly meal plans, accommodating sudden schedule changes or weekend travel.
- **Real-Time Tracking:** The interface provides live updates on the order state, tracking the progression from kitchen preparation to active transit, culminating in final delivery.

4.2 Cook Module Functionalities

- **Digital Menu and Inventory Control:** Home cooks can seamlessly update their daily offerings, adjust pricing, and toggle the availability of specific items to reflect real-time kitchen inventory.
- **Unified Order Queue:** The dashboard segregates incoming requests into distinct categories: New Orders, Active Preparation, and Ready for Pickup, streamlining kitchen operations.
- **Automated Subscription Roster:** The system automatically aggregates the number of recurring subscription meals required for the day, allowing cooks to prepare bulk quantities efficiently without manual bookkeeping.

4.3 Delivery Module Functionalities

- **Algorithmic Task Assignment:** Delivery personnel can toggle their active status to "Online." The system automatically pushes delivery tasks to the nearest available rider once a cook marks an order as ready.
- **Integrated Navigation:** The application provides turn-by-turn GPS routing, directing the rider first to the kitchen's location and subsequently to the student's registered address (such as a specific college gate or hostel block).
- **Secure Delivery Verification:** To prevent order misplacement, the system enforces a mandatory One-Time Password (OTP) verification. The rider must input the code provided by the student to successfully close the active task.

4.4 Administrative and Core Functionalities

- **Automated Dispatching Engine:** The centralized backend continuously monitors order states and driver proximities to minimize delivery wait times.
- **Payment Routing:** The system securely processes digital transactions at checkout and

tracks the proportional revenue splits for the cook's earnings and the rider's delivery fee.

SIMPLE DATA FLOW DIAGRAM: SMART TIFFIN PLATFORM FUNCTIONALITY

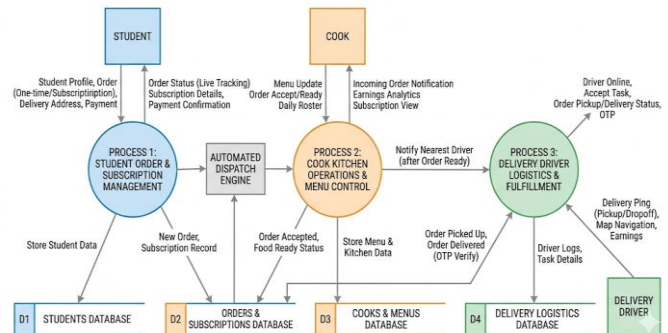


Fig -1 : Functionality Of The System

5. DATABASE DESIGN

The database architecture of the Smart Tiffin platform is designed to handle highly relational, real-time data efficiently. To ensure data integrity across the three distinct user modules (Student, Cook, and Delivery), the system employs a Relational Database Management System (RDBMS) approach. This structure maps the complex, multi-layered associations required for order tracking, subscription management, and automated dispatching without data redundancy.

5.1 User Management Entities

The database schema categorizes user data into three primary entities to manage profile information. The **Student Entity** is uniquely identified by a primary key (StudentID) and stores essential customer details, including full name, contact information for authentication, precise GPS coordinates for delivery routing, and specific dietary preferences. The **Cook Entity**, identified by a CookID, stores vendor information, including the kitchen's display name, operational status, and exact location coordinates for driver pickup routing. Finally, the **Delivery Entity** utilizes a unique RiderID to track logistics personnel, logging their registered vehicle numbers and real-time operational status, such as whether they are currently online, offline, or on a delivery trip.

5.2 Operational and Transactional Entities

To manage the dynamic, day-to-day functions of the platform, the database employs specific operational tables. The **Menu Items Entity** utilizes an ItemID to manage kitchen inventory, acting as a foreign key linked to a specific CookID. It tracks the item's name and its real-time availability status, allowing cooks to seamlessly toggle items between in-stock and sold-out. For long-term user engagement, the **Subscriptions Entity** manages recurring

30-day meal plans through a unique SubID. It links a subscribed student to a specific providing kitchen and tracks the plan's initiation date along with its current status (active, paused, cancelled, or expired).

5.3 Core Relationships and Order Management The functional core of the database is the **Orders Entity**, identified by a unique OrderID, which acts as the central hub connecting all three platforms. It contains foreign keys linking to the specific StudentID placing the request and the CookID preparing the meal. Crucially, the RiderID field within this entity initially remains null until the automated dispatch engine successfully assigns an available delivery partner, at which point the logistical tracking begins. The entity also tracks the real-time order progression—from pending to delivered—and stores a secure four-digit One-Time Password (OTP) required for the final delivery handoff. This structure establishes a robust one-to-many relationship, where a single student or cook can be associated with multiple unique orders over time, ensuring complete transactional transparency across the entire ecosystem.

6. PROBLEM STATEMENT

With the increasing migration of students to urban educational centers, securing daily, nutritious, and affordable meals has emerged as a significant logistical and financial challenge. Currently, the student demographic is forced to navigate a polarized food delivery market. On one end are commercial food delivery aggregators; while technologically advanced, these platforms primarily cater to expensive, one-time restaurant orders, making them financially unsustainable and nutritionally inadequate for daily consumption. On the other end are traditional local tiffin services, which offer the necessary home-cooked quality but operate almost entirely offline.

This reliance on informal, unorganized operational models creates severe inefficiencies for both the consumer and the provider. For students, the lack of digital infrastructure results in highly inflexible monthly subscriptions, manual cash tracking, and a complete absence of real-time transit transparency, leading to frequent miscommunications regarding food delivery. From the vendor's perspective, local home cooks struggle to scale their micro-businesses due to the overwhelming administrative overhead of manually managing daily rosters, tracking inventory, and coordinating independent delivery logistics.

Therefore, the core problem is the absence of a unified, technology-driven ecosystem tailored specifically to the localized meal subscription model. There is a critical need for a comprehensive digital platform that seamlessly bridges the gap between students seeking affordable daily meals and local culinary entrepreneurs needing an

accessible, structured infrastructure to manage their operations and automated logistics.

7. ADVANTAGE

The implementation of the Smart Tiffin platform offers significant operational, economic, and lifestyle benefits, strategically distributed across its three primary stakeholder groups: the consumers, the vendors, and the logistics personnel. By digitizing an inherently unorganized sector, the system introduces enterprise-level efficiency to local micro-businesses.

7.1 Benefits for the Student (Consumer)

The primary advantage for students is consistent access to hygienic, authentic, and affordable home-cooked meals, which directly combats the nutritional and financial drain of relying on commercial restaurant aggregators. The digital interface eliminates the friction of traditional tiffin services by providing a transparent, flexible subscription management system. Students can seamlessly pause or modify their 30-day meal plans in real-time, completely bypassing the need for manual tracking or uncomfortable offline communication. Furthermore, the integration of live GPS tracking and OTP-based secure delivery handoffs provides unprecedented reliability and peace of mind.

7.2 Benefits for the Cook (Vendor)

For local home chefs, the platform serves as a powerful digital infrastructure that drastically lowers the barrier to entry for establishing a scalable culinary micro-business. The major advantage is the complete automation of administrative overhead. By utilizing the automated daily roster and inventory toggles, cooks are freed from manual bookkeeping and can focus entirely on food quality and preparation. Additionally, the system eliminates the vendor's burden of managing independent logistics, as the automated dispatch engine seamlessly connects their kitchen to an on-demand fleet of delivery riders.

7.3 Logistical and Systemic Advantages

From a systemic perspective, the three-panel architecture ensures that data remains synchronized and accurate across all nodes in real-time. Delivery personnel benefit from algorithmic dispatching and integrated turn-by-turn navigation, which optimizes their travel routes and maximizes their earning potential by reducing idle wait times. Overall, the platform effectively bridges the gap between the affordability of the informal tiffin sector and the technological convenience of modern food delivery applications, creating a sustainable, scalable ecosystem.

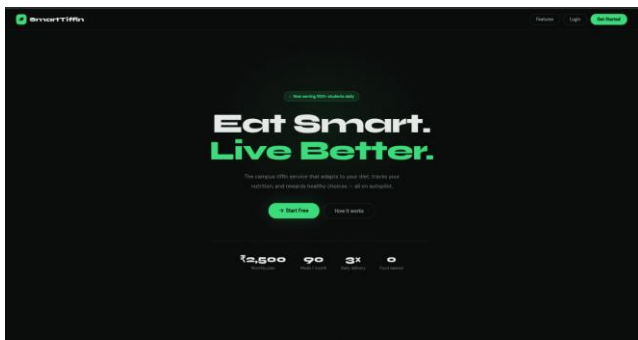


Fig 1 : Home Page

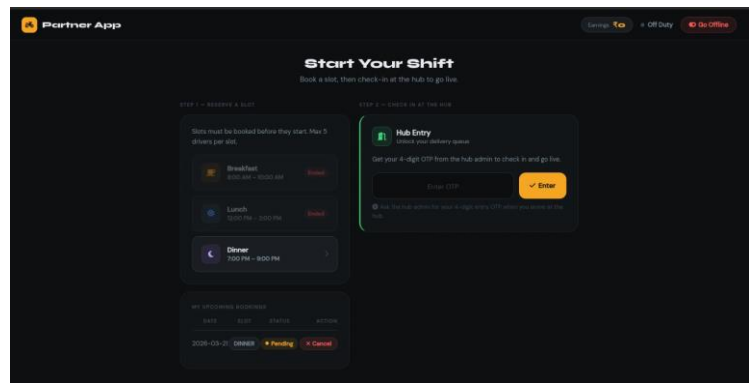


Fig 4 : Delivery Man Dashboard

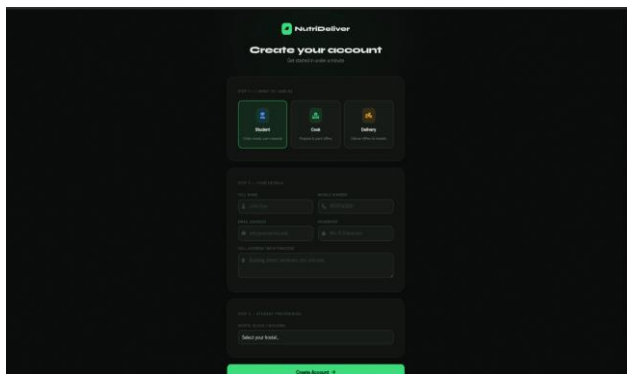


Fig 2 : Registration Page

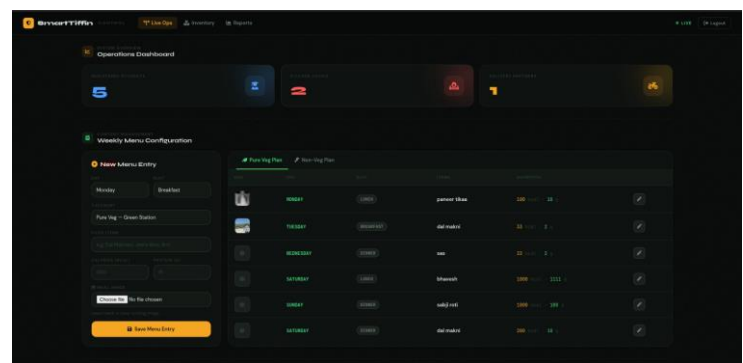


Fig 4 : Weekly Plan Module

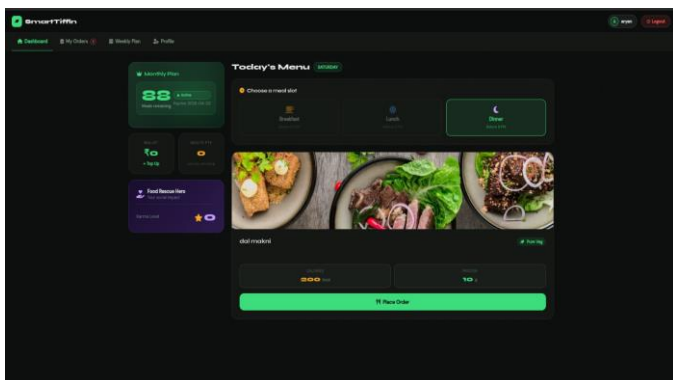


Fig 3 : Student Dashboard

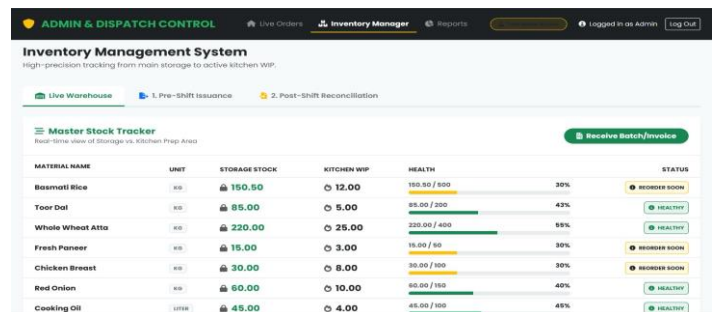


Fig 5 : Inventory Manager Page

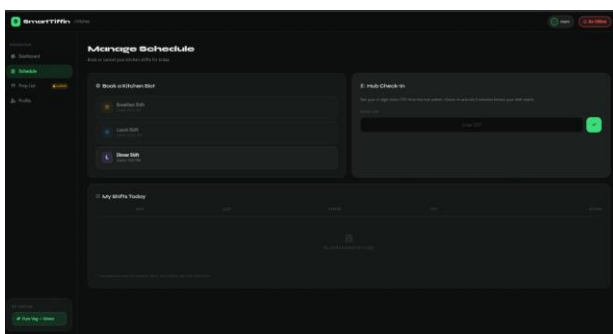


Fig 3 : Cook Dashboard

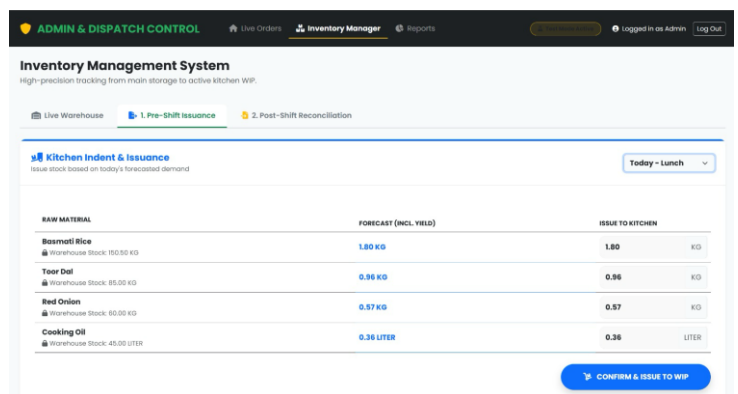


Fig 6 : Resources Credentials

8. CONCLUSIONS

The "Smart Tiffin" platform successfully addresses a critical gap in the localized food delivery ecosystem by providing a highly structured, technology-driven solution tailored to the daily nutritional needs of the student demographic. By transitioning the traditional, unorganized tiffin service model into a digitized, three-panel architecture, the system eliminates inherent operational inefficiencies. The ReactJS-driven frontend, coupled with a centralized relational database, ensures seamless real-time synchronization across the Student, Cook, and Delivery modules. The implementation of enterprise-level features—such as automated logistical dispatching, dynamic subscription management, and secure OTP-based delivery handoffs—democratizes advanced food-tech capabilities for local culinary micro-businesses. Ultimately, Smart Tiffin not only fosters a healthier and more reliable dining lifestyle for students but also establishes a scalable, transparent, and economically viable digital infrastructure for home cooks.

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