

# University Canteen Smart Queue & Token Management System – Project Proposal

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## Executive Summary

Managing student rush during breaks is a major challenge in universities, especially at food courts and canteens. Students waste significant time standing in queues and lack visibility on waiting times across outlets. The **Smart Queue & Token Management System** addresses this by digitizing queues, introducing online tokens, and providing real-time insights into wait times, queue lengths, and vendor performance. This solution optimizes student time, reduces overcrowding, and provides better management for vendors and administrators.

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## Problem Statement

- Long queues at canteens lead to wasted break time.
  - Students cannot estimate waiting times before reaching distant food courts.
  - No centralized system for managing queues across multiple vendors.
  - Vendors struggle to manage student flow and face crowding issues.
  - Administrators lack visibility into vendor performance and student behavior.
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## Objectives

1. Provide an **online token system** for students to avoid physical queues.
  2. Show **expected waiting time** and **queue length** dynamically for each student and each outlet.
  3. Provide **real-time queue updates**, notifications, and reports for vendors and administrators.
  4. Establish a system of accountability with reporting, analytics, and logs.
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## Core Features

### ◆ Student Experience Features

- **Token Generation:** Students receive tokens online without entering details repeatedly (fetched from profile).
- **Expected Time Display:** Each student can view their estimated waiting time.
- **Queue Position:** Shows how many students are ahead in the queue for all food courts.
- **Queue Map View:** Estimated wait time displayed on a campus map for each outlet.
- **Turn Notifications:** Alerts (web/mobile push) when a student's turn is near.
- **Grace Period & Auto-Cancellation:** Tokens auto-cancel if the student doesn't arrive within a fixed grace time.
- **Multiple Outlet Selection:** Students can compare vendors and choose the least crowded one.
- **Favorites & History:** Students can mark vendors as favorites and track past token history.

### ◆ Vendor Features

- **Queue Dashboard:** Live token management with student details and token numbers.
- **Analytics Dashboard:** Daily/weekly reports on total students served, busiest hours, and average waiting times.
- **Priority Handling (Optional):** Vendors can issue priority tokens (e.g., for faculty or emergency needs).
- **Reporting Students:** Vendors can report misconduct or misbehavior by students to the admin.

### ◆ Admin Features

- **Single Super Admin:** Only one admin can create vendor accounts; vendors cannot self-register.
- **Reports Dashboard:** All student/vendor reports categorized (e.g., fake tokens, misconduct, late arrival).
- **Complaint Analytics:** Track trends of frequent offenders or problem vendors.
- **Role-Based Access:** Admin can assign sub-admins/moderators (future scalability).
- **Audit Logs:** Record every critical action (token removal, block, report resolution).

### ◆ System Features (Tech & UX)

- **Geo-fencing (Future Upgrade):** Tokens expire if students are not near the canteen when called.
- **Dark Mode & Accessibility:** UI optimized for accessibility and user preference.
- **Crowd Heatmap:** Live heatmap of food courts (green = free, red = crowded).
- **Feedback & Rating System:** Post-token rating system for students to review vendors; results visible to admin.

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## Technology Stack

- **Frontend:** React.js / Next.js with TailwindCSS for responsive UI.
- **Backend:** Node.js with Express.js for API handling.
- **Database:** MongoDB for tokens, user details, and logs.
- **Authentication:** JWT with OTP verification via student email ID.
- **Notifications:** Firebase / Web Push for real-time turn alerts.
- **Mapping & Heatmaps:** Google Maps API / Leaflet.js.
- **Analytics & Reports:** Chart.js / Recharts integration in dashboards.

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## Data Model Overview

- **Users (Students):** { uid, name, phone, email, profile\_image, favorites, history }
- **Vendors:** { vendor\_id, name, outlet\_location, analytics, reported\_students }
- **Tokens:** { token\_id, student\_id, vendor\_id, queue\_position, status, issued\_time, expected\_time }
- **Reports:** { report\_id, reported\_by, target\_id, type, description, status }
- **Audit Logs:** { log\_id, action, actor\_id, timestamp }

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## User Flows

1. **Student Registration** → Sign up with student email → OTP verification → Profile created.

2. **Token Booking** → Select vendor → System fetches profile data → Token generated → Queue position shown.
  3. **Queue Updates** → Real-time expected time + number of people ahead → Notifications sent.
  4. **Vendor Dashboard** → View active queue, serve next student, analytics reporting.
  5. **Admin Dashboard** → Manage vendors, review reports, view audit logs.
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## Implementation Roadmap

**Phase 1 (MVP):** - Student registration + OTP verification - Basic token booking & queue updates - Vendor dashboard with queue list - Admin vendor account management

**Phase 2:** - Notifications (turn alerts, cancellations) - Analytics dashboards for vendors & admin - Report management system

**Phase 3:** - Map view with estimated waiting times - Favorites, history, feedback & ratings - Heatmap integration

**Phase 4 (Future Upgrades):** - Geo-fencing - AI-powered wait time prediction - Role-based admin controls

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## Expected Outcomes

- Students save valuable break time with accurate queue estimates.
  - Reduced overcrowding in food courts.
  - Vendors benefit from organized student flow and analytics.
  - Administrators gain visibility and control over student and vendor activities.
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## Conclusion

The **University Canteen Smart Queue & Token Management System** is a scalable, modern full-stack solution to streamline food court operations. By combining tokenization, real-time insights, and advanced admin controls, the system improves efficiency, fairness, and student experience while laying a foundation for future smart campus automation.