

Smart Canteen Management System

Innovating Efficiency and Productivity in Food Services
GROUP 01

Introduction



Content

- Motivation Requirements Objectives
- High-level Organization Solution Architecture Data generation, Flow and control
- Solution Infrastructure Design Choices Some UML Diagrams
- Security & Data concerns Budget Timeline
- Demonstration Plan

Requirements

Merchant requirements :

- Easier transactions
- Automated calculation of food cost
- Check history
- Identify ordering patterns for being cost effective
- Day to day expense tracking



Proposed Solution

A Smart Counter management System

- Cashless Pay - Card based payment
- Online Service - Mobile app
- Front Desk - Digital E menu
- Designated Scanner
- Fingerprint Scanner - Authentication

How ?



Motivation

- Long Queues
- Inefficient Transactions
- User Experience
- Impact on Productivity / Productivity of Cashless systems

But from where exactly ?



Requirements

User requirements :

- Easier transactions
- Online service
- Solution to no change
- App to keep track of usage
- Alert system for congestion and ordering
- Easier food selection



Viability

- Leverages existing technology
- Cloud based solution
- Relatively easy integration
- Viable for modern expectations
- Design concepts
- Easier to adopt



Content

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Motivation
Requirement
Objectives
Solutions
Viability

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High level Organization
Solution Architecture
Data generation, Flow and control

3

Solution Infrastructure
Hardware
Design Choices
Some UML Diagrams

4

Security & Data concerns
Budget
TimeLine

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Demonstration Plan

Motivation

- Long Queues
- Inefficient Transactions
- Unavailability
- Impact on Productivity
- Productivity of Cashless systems

But from where exactly ?



Requirements

Merchant requirements :

- Easier transactions
- Automated calculation of food cost
- Crowd identification
- identify ordering patterns for being cost effective
- Day to day expense tracking



Requirements

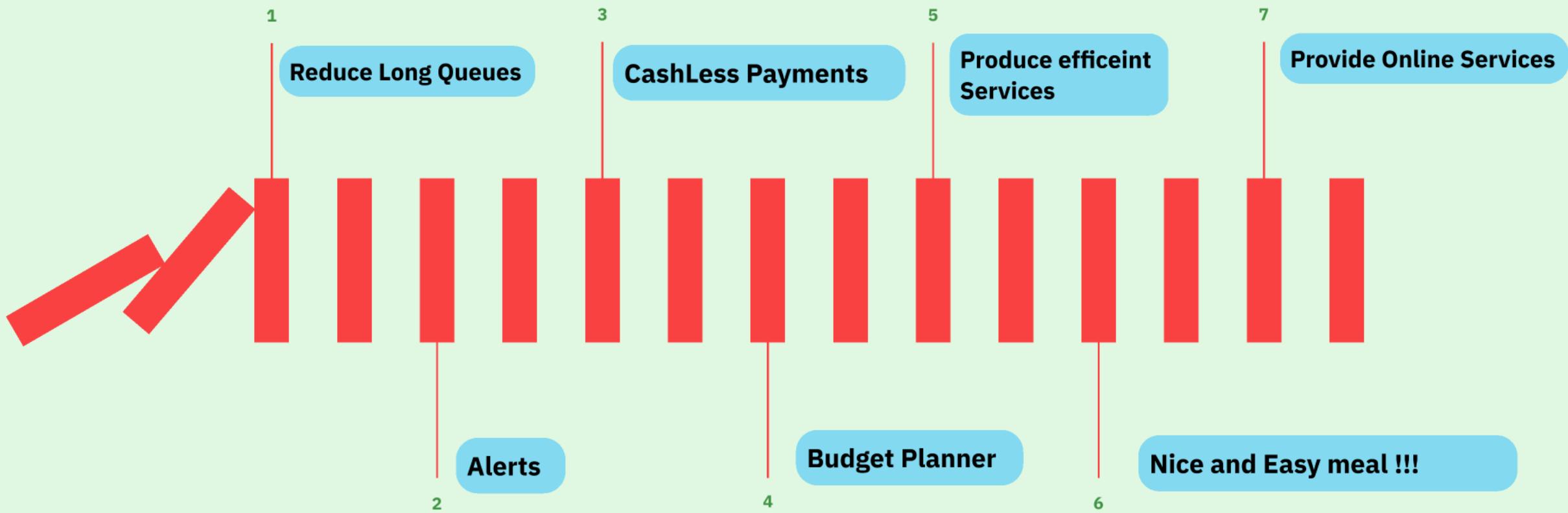
User requirements :

- Easier transactions
- No long queues
- Solution to no change
- App to keep track of usage
- Alert system for congestion and ordering
- Easier food selection



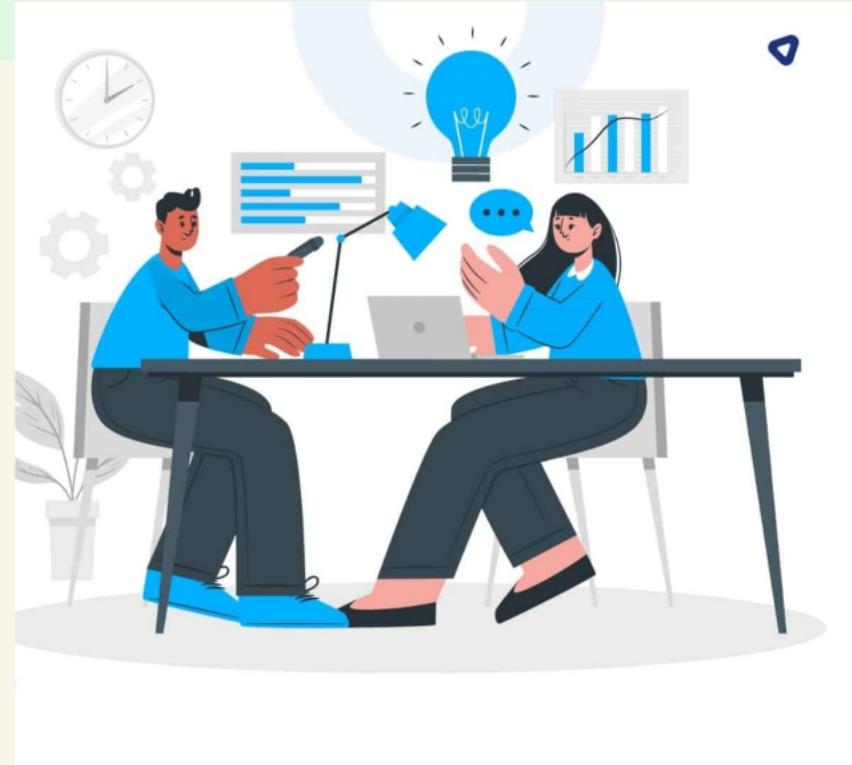
What are we trying to accomplish ?

Objectives



Viability

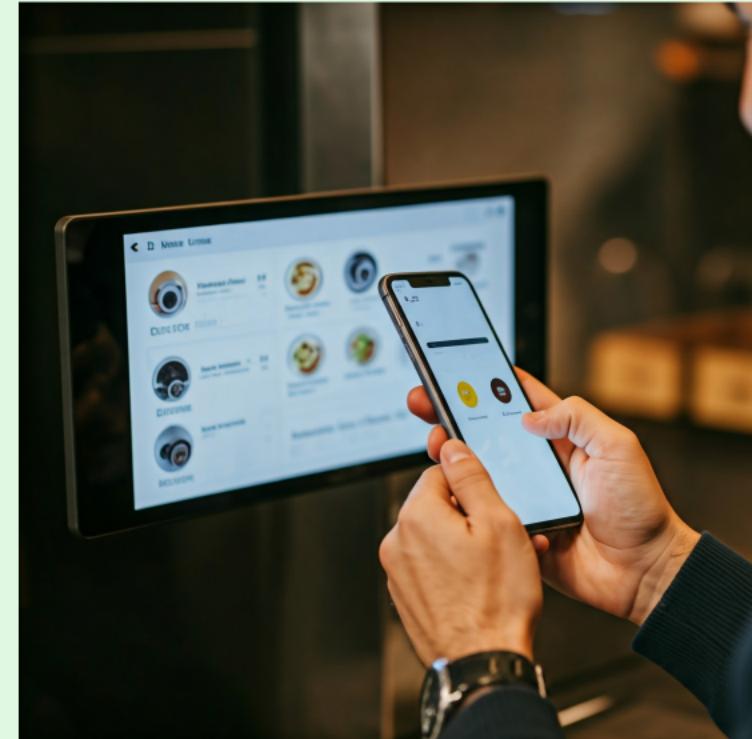
- Leverages existing technology
- Scalable - Cost effective
- Relatively easier integration
- Viable for modern expectations
- Already familiar concepts
- Easier to adapt



Proposed Solution

A Smart Canteen management System

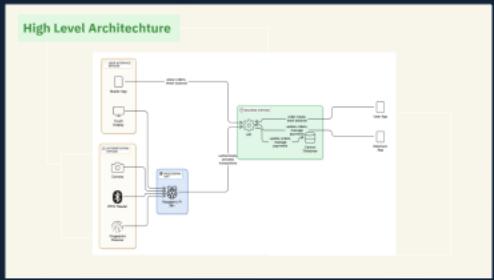
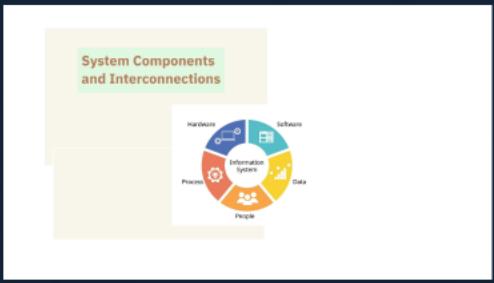
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- Online Services - Mobile app
- Front Menu - Digital E menu
- Congestion - Camera
- Fingerprint Scanner - Authentication



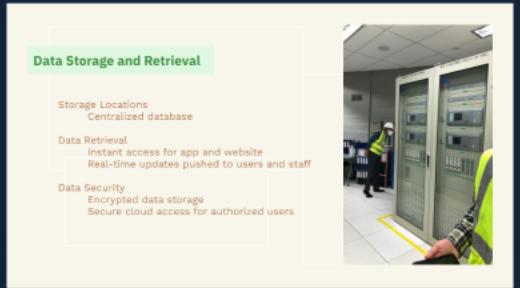
How ?

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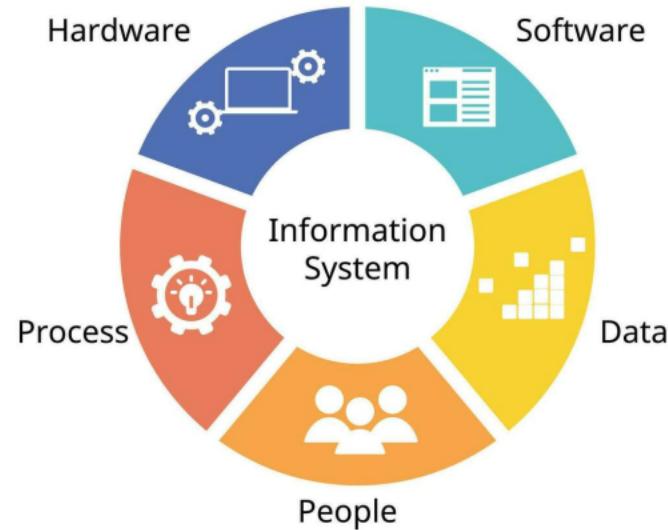
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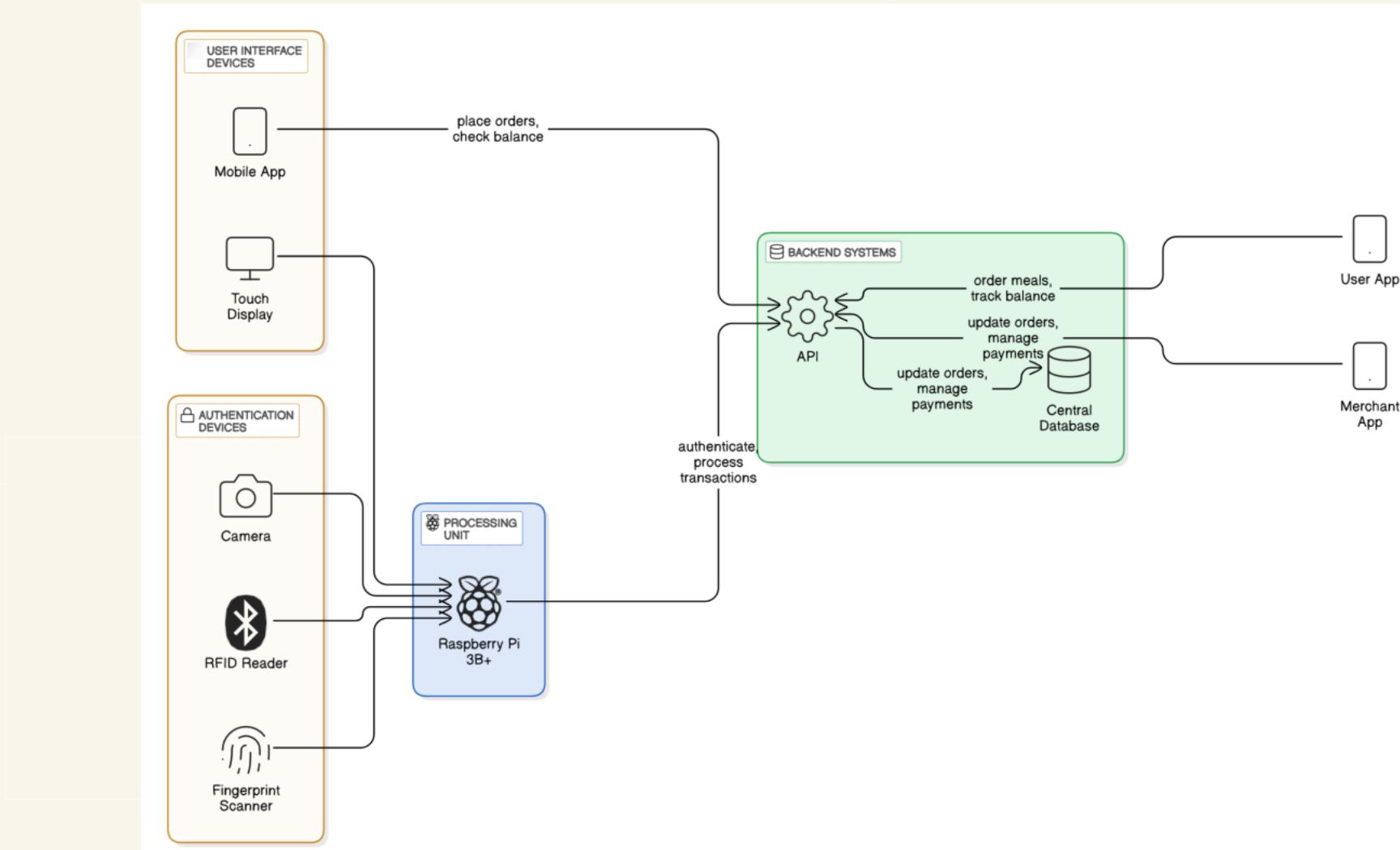
Solution Architecture



System Components and Interconnections



High Level Architecture



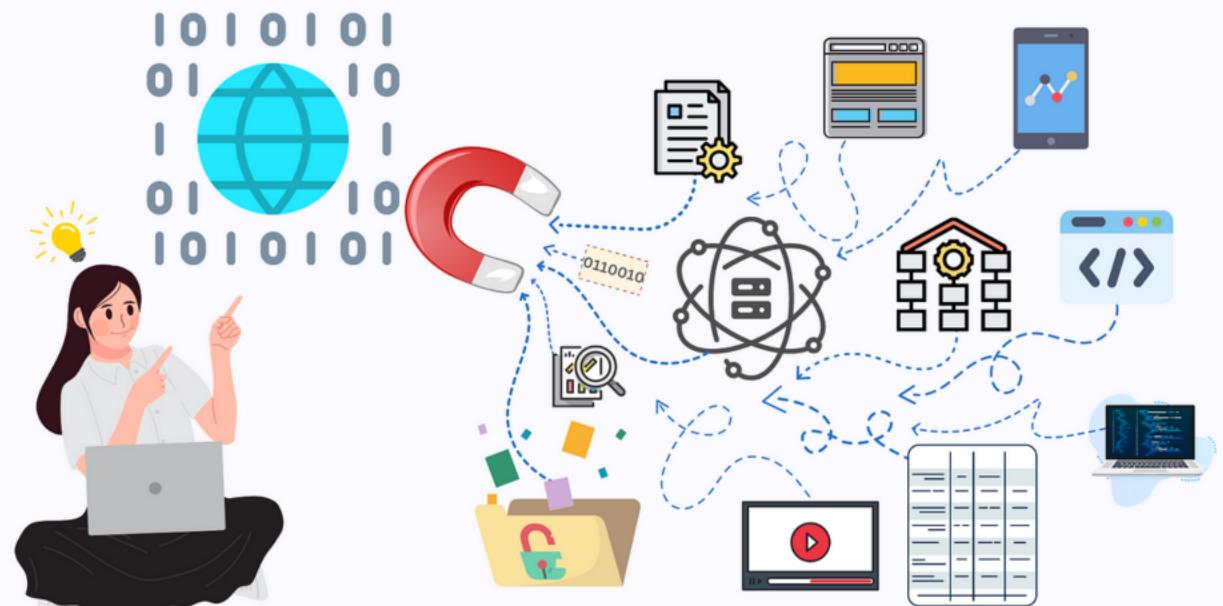
Data Generation

Key Data Generated:

- Customer Orders
- Payment Data
- Inventory Levels
- Sales Transactions
- Customer Feedback

Data Storage :

- Temporary data
- Permanent data



Flow Of Data

How information moves

Data Sources: App, website, cameras

Data Processing: API syncs, processes orders

Data Storage: Central database

Data Output: Real-time updates to users & canteen staff

Data Storage and Retrieval

Storage Locations

Centralized database

Data Retrieval

Instant access for app and website

Real-time updates pushed to users and staff

Data Security

Encrypted data storage

Secure cloud access for authorized users



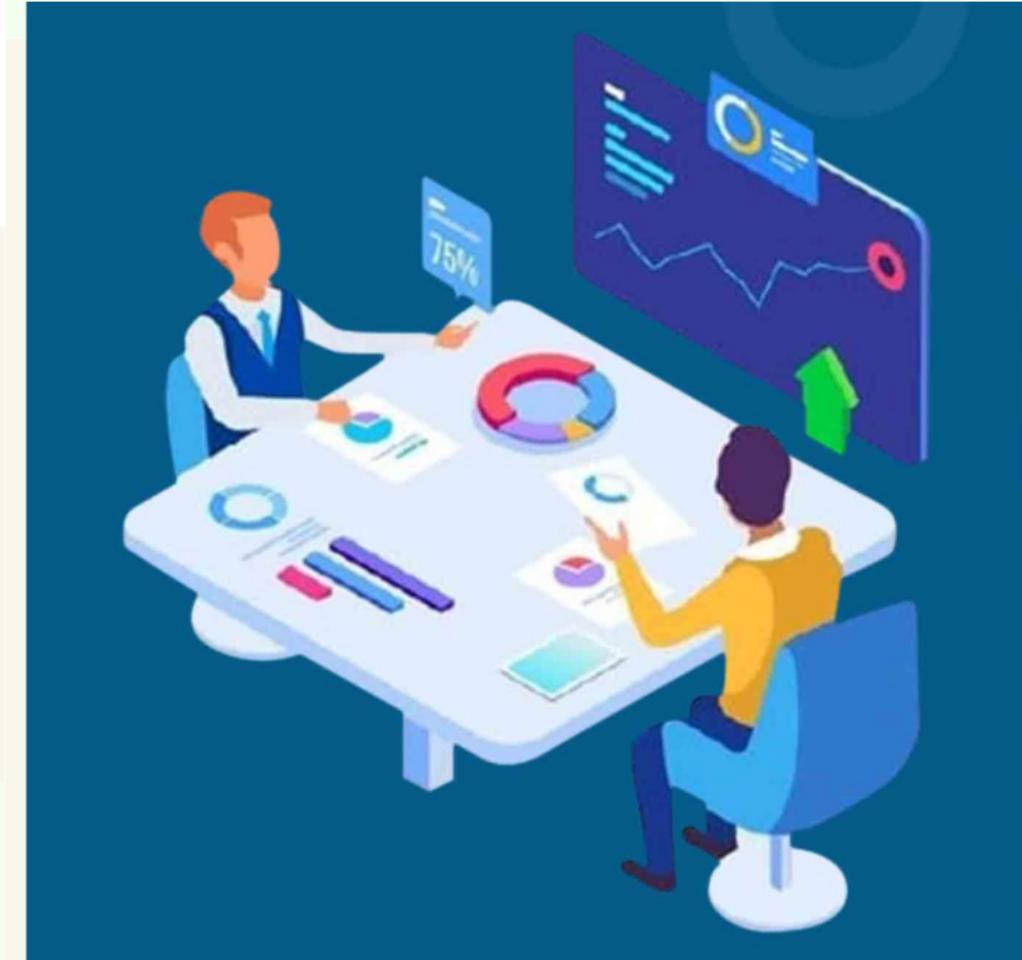
Control Decisions

Order Processing – Item is in stock?

Payment Processing – Enough balance?

Congestion Monitoring – Crowded?

Notification – Order prepared?



Flow Of Control

- User Actions (app/website)
- Canteen Operations (inventory update)
- System Automation (congestion, API syncs data)
- Notifications & Updates (to users and staff)

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Solution Infrastructure



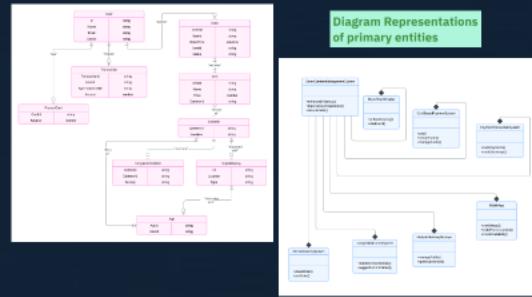
Why These Components?

Raspberry Pi Camera: • Small and low-cost • Supports computer vision tasks like queue detection	Fingerprint Sensor: • Enhances security through biometric authentication • Identifies customers without requiring cards
RFID Reader & Tag: • Enables quick and contactless payments • Provides a secure transaction method	Raspberry Pi & Display: • Capable of running a user-friendly menu interface • Supports touch functionality
16x2 LCD Display: • Simple and energy-efficient • Sufficient for displaying order amounts	



Performance Improvement

Raspberry Pi Camera • real-time queue detection • reduce the wait time	Fingerprint Sensor – Quickly identifies customers, improving authentication speed.
RFID Reader & Tag – Provides fast, contactless payments, reducing transaction time.	Raspberry Pi & Display – Handles menu display and processing efficiently, ensuring smooth user interaction.
16x2 LCD Display – Instantly updates order amounts with minimal power consumption.	



Analysis and Visualization for Stakeholders

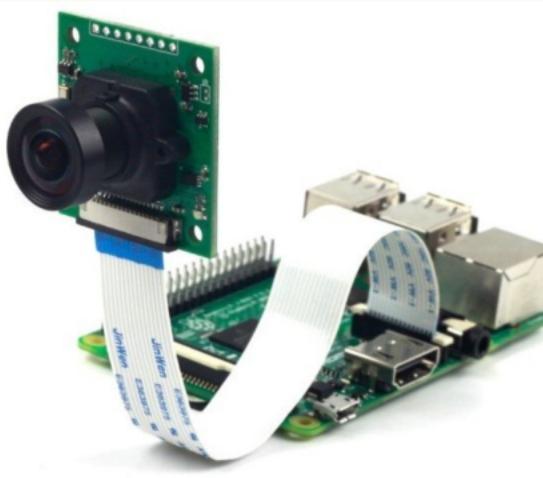
Queue & Customer Flow Analysis 1. Real-time dashboards - to show the queue lengths and wait times. 2. Heatmaps - to show peakhours	Transaction & Payment Insights 1. Reports on daily, weekly, and monthly sales trends. 2. Customer spending patterns to improve inventory management.	Customer Identification & Preferences 1. Data on frequent customers using RFID and fingerprint logs. 2. Personalized insights on favorite items and ordering habits.
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Design Choices

Hardware Elements



1. RFID Reader and TAG



2. Raspberry Pi Camera



3. 16x2 LCD display



4. Fingerprint Scanner



5. DSI ISP Touch Screen



1. Raspberry pi 3b

Why These Components?

Raspberry Pi Camera:

- Small and low-cost
- Supports computer vision tasks like queue detection

RFID Reader & Tag:

- Enables quick and contactless payments
- Provides a secure transaction method

16×2 LCD Display:

- Simple and energy-efficient
- Sufficient for displaying order amounts

Fingerprint Sensor:

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Performance Improvement

Raspberry PI Camera

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- reduce the wait time

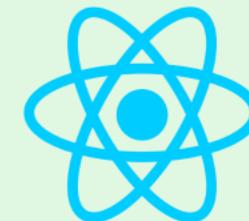
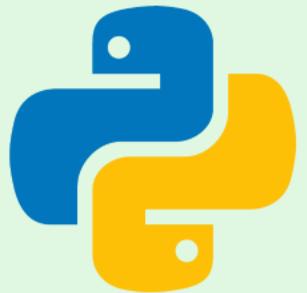
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Design Choices



Analysis and Visualization for Stakeholders

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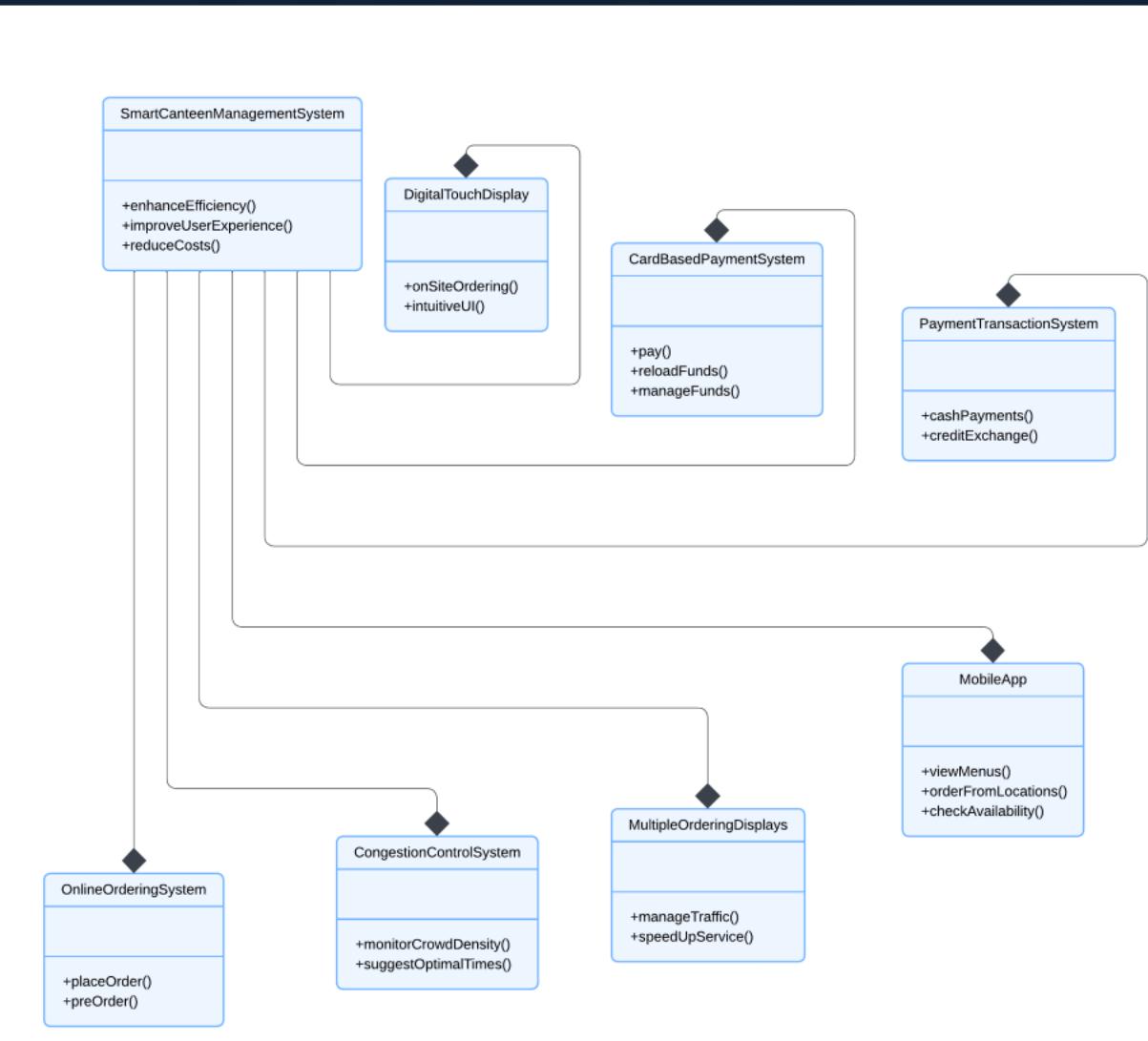
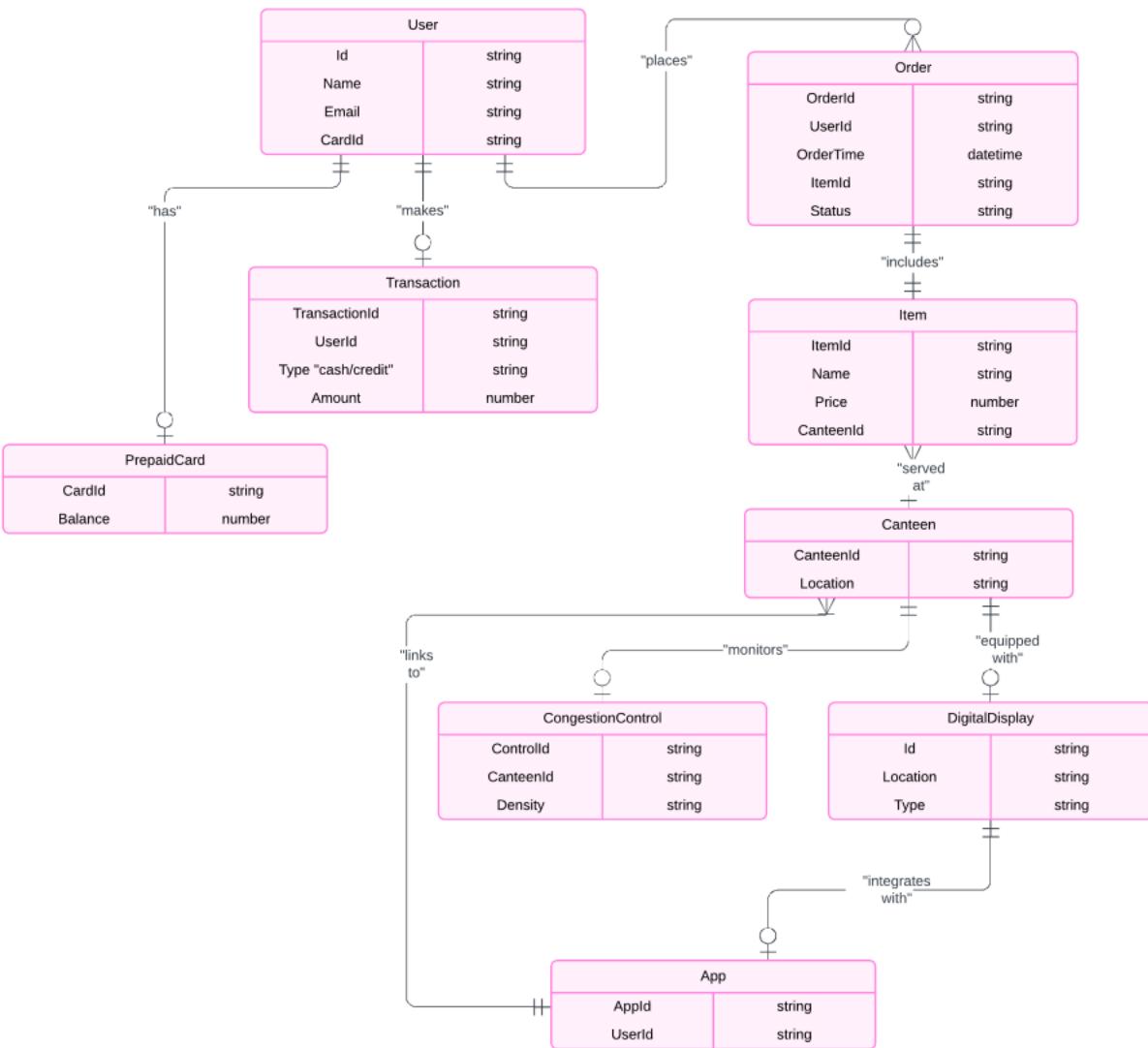
Transaction & Payment Insights

1. Reports on daily, weekly, and monthly sales trends.
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Customer Identification & Preferences

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Diagram Representations of primary entities



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Security and Privacy Considerations

The collage consists of five screenshots arranged in a grid-like pattern:

- Identifying Security Risks:** Shows a close-up of a blue and red circular device, likely a sensor or camera. Below it is a list of risks:
 - User Authentication & Authorization
 - Secure Payment Processing
 - Protection against Cyber Threats
 - SQL Injections and Database Key Risks
 - User Data Breach
 - Fraudulent orders and payments
- Measures against Threats:** Shows a hand holding a yellow key fob over a keyboard. Below it is a list of measures:
 - Payment Fraud Prevention
 - User Data Protection
 - Unauthorised Access Prevention
 - AAA (Authentication & Database Security)
 - RFID/RFPC Screening Prevention
 - Malware & Hardware Protection
- Budget:** A table showing the budget breakdown for the system:

Item	Cost
Raspberry Pi 3B +	1800.00
Touch Display	12000.00
Raspberry Pi 3B camera module	1600.00
Fingerprint Scanner	3480.00
RFID scanner and Reader	2900.00
Other expenses(emergency case)	6000.00
Total	30580.00
- Milestone timeline:** A Gantt chart showing the timeline for project milestones, spanning from week 1 to week 16.
- Surprise pairing* funny and healthy food:** A smartphone screen displaying a meal planning app. It shows a "Strawberry exotic fruit Salad" with 134 kcal, a "Health control" section with a green circle progress bar (1530/2000kcal), and a "Bill of fare" section with a "Take orders" button.

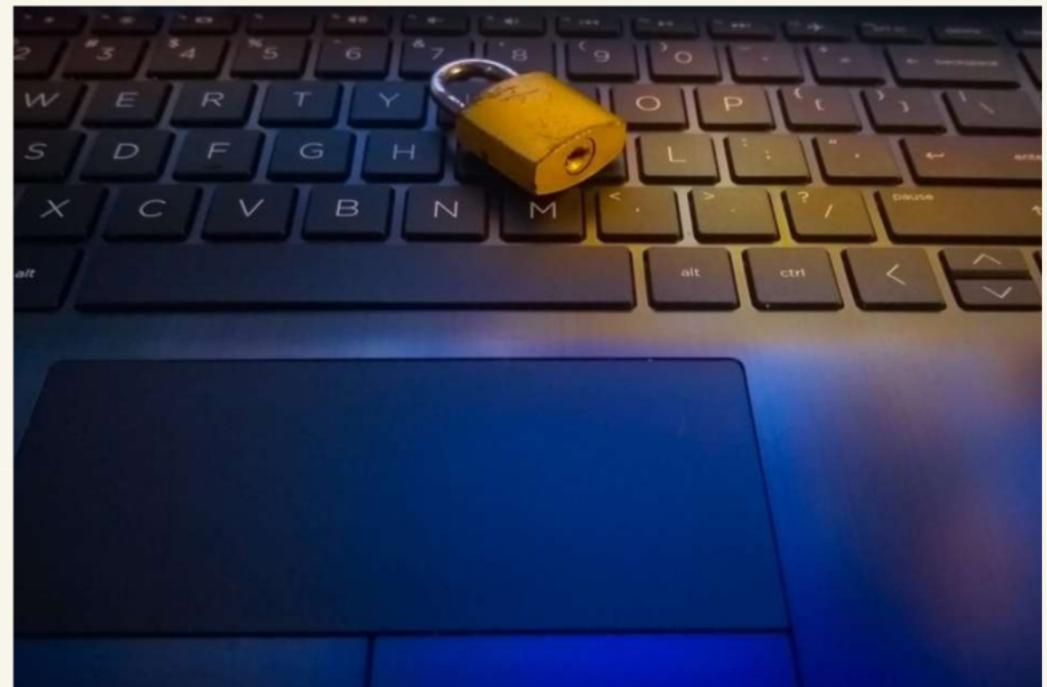


Identifying Security Risks

- User Authentication & Authorization.
- Secure Payment Processing
- Protection Against Cyber Threats
- SQL injects and Database Exploits
- User Data Breach
- Fraudulent access and payments

Measures against Threats

- Payment Fraud Prevention
- User Data Protection
- Unauthorized Access Prevention
- SQL Injection & Database Security
- RFID/NFC Skimming Prevention
- Malware & Ransomware Protection



Power & Performance Requirements

- Touchscreen Kiosks – Fast response (<50ms), low power (10W–30W).
- RFID/NFC System – Secure (AES-128), quick scans (<100ms), minimal power.
- Mobile App – Lightweight, fast transactions (<1s).
- Backend Server – High performance (5000+ transactions/sec), <100ms API response.
-



Power & Performance Requirements

- Communication (NFC, Bluetooth, Wi-Fi) – Fast connectivity, low power usage.
- Embedded Controllers (Camera) – Quick image processing (<500ms), minimal power.
- Digital Menu Boards – High-resolution (1080p/4K), smooth refresh rate (60Hz–120Hz).
-



Efficiency

- Fast Transaction Processing
- Optimized Network Usage
- Minimal Power Consumption
- Automated Workflows
- Scalable Design

Reliability

- Data Backup & Recovery
- Secure & Encrypted Transactions
- Real-time Monitoring & Alerts
- High Uptime

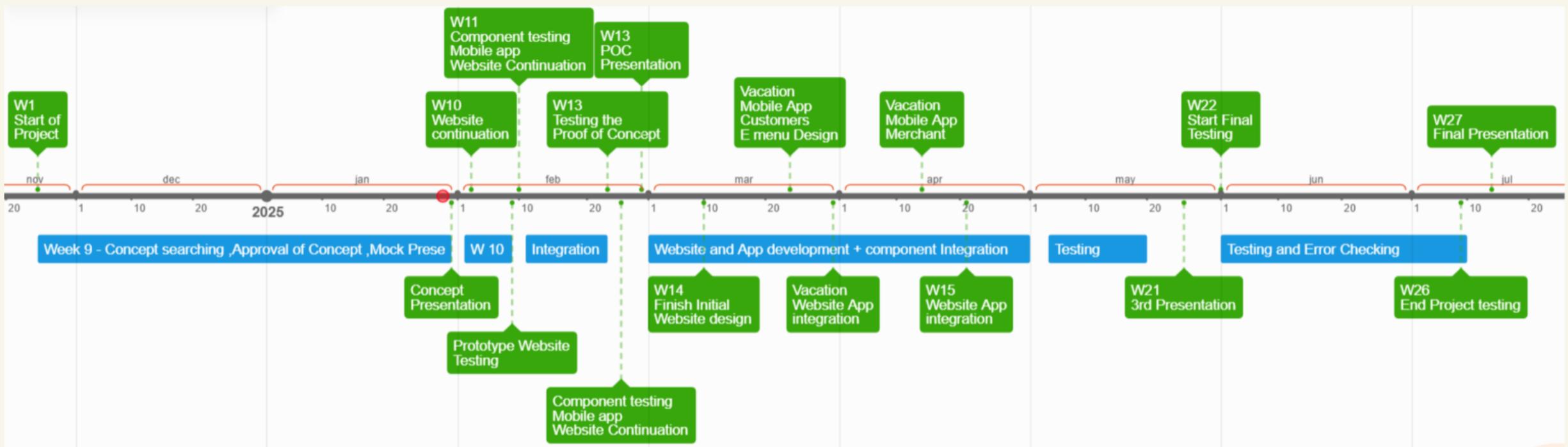


Budget

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System

		LKR
01	Rasberry Pi 3B +	11800.00
02	Touch Display	13000.00
03	Raspberry PI 3B camera module	1400.00
04	FingerPrint Scanner	3480.00
05	RFIC Scanner and Reader	2900.00
06	Other expenses(numberPad,case)	6000.00
		38580.00

Milestone timeline



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Demonstration Plan

We will provide demonstration of each main component

- UpFront
 - Cashless pay
 - Mobile Application
 - Touch Screen
- A video
 - Congestion Control
 - Alerts
- User Experience
 - Cashless pay
 - Mobile Application
 - Touch Screen
 - Alerts
 - Transactions



Thank You !



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E/20/121



E/20/259



E/20/376