FACULTY OF COMPUTING
UTM Johor Bahru

SECD2613-02

SYSTEM ANALYSIS AND DESIGN

Semester 02, 2024/2025

PHASE 3

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1.0 Introduction

The current cafeteria operations at Universiti Teknologi Malaysia (UTM) face significant challenges that impact both service efficiency and resource management. Long queues during peak hours, frequent order inaccuracies, and preventable food waste have become persistent issues in our dining facilities. These operational inefficiencies not only diminish user satisfaction but also result in unnecessary financial losses and resource mismanagement.

To address these challenges, we propose the implementation of a comprehensive Cafeteria Management System. This innovative solution leverages modern digital technologies to transform traditional dining operations into a streamlined, data-driven service. By introducing automated ordering processes and intelligent inventory tracking, the system will significantly enhance operational efficiency while reducing waste and improving the overall dining experience.

This proposal outlines a practical approach to modernizing our cafeteria operations through technological integration. The proposed system represents a strategic investment in operational excellence, promising measurable improvements in service delivery, cost management, and sustainability. Through careful implementation, we can establish a new standard for efficient and responsive campus dining services that meets the evolving needs of our university community.

2.0 Problem statement

Problem statement: Systemic limitations of UTM's Traditional Cafeteria System

1. **Chronic service delays**
   - Inefficient transactions: Manual ordering and cash payments create bottlenecks during pick hours, resulting in:
     - Excessive queue time (particularly 12:00-2:00 PM)
     - Frustrated customers abandoning meals

2. **Outdated customer experience**
   - Menu information gap: Static menu displays failed to show:
     - Real-time sold-out dishes leading to customer disappointment
     - Daily specials resulting in missed sales opportunity
     - Blind visits: Difficult to check cafeteria's status(closure/crowding) before arrival

3. **Operational weakness**
   - Manual order taking(written) can cause:
     - Miscommunication between staff and customers
     - Incorrect meals being prepared, resulting in food waste and rework
   - Data deficiency: Lack of automated tracking for:
     - Most and least popular items on the menu
     - Peak demand periods leading to poor staffing and food prep planning

3.0 Proposed solutions

Proposed Digital Cafeteria System Solutions

1. **Smart Ordering Platform**
   - **Online Pre-Orders:**
     - Customers order meals via UTM's existing app or web portal
     - Scheduled pickups to eliminate queues (example: "Ready by 12:15 PM")
   - **Digital Queue Management:**
     - Real-time updates on order status (example: "Preparing the meal")

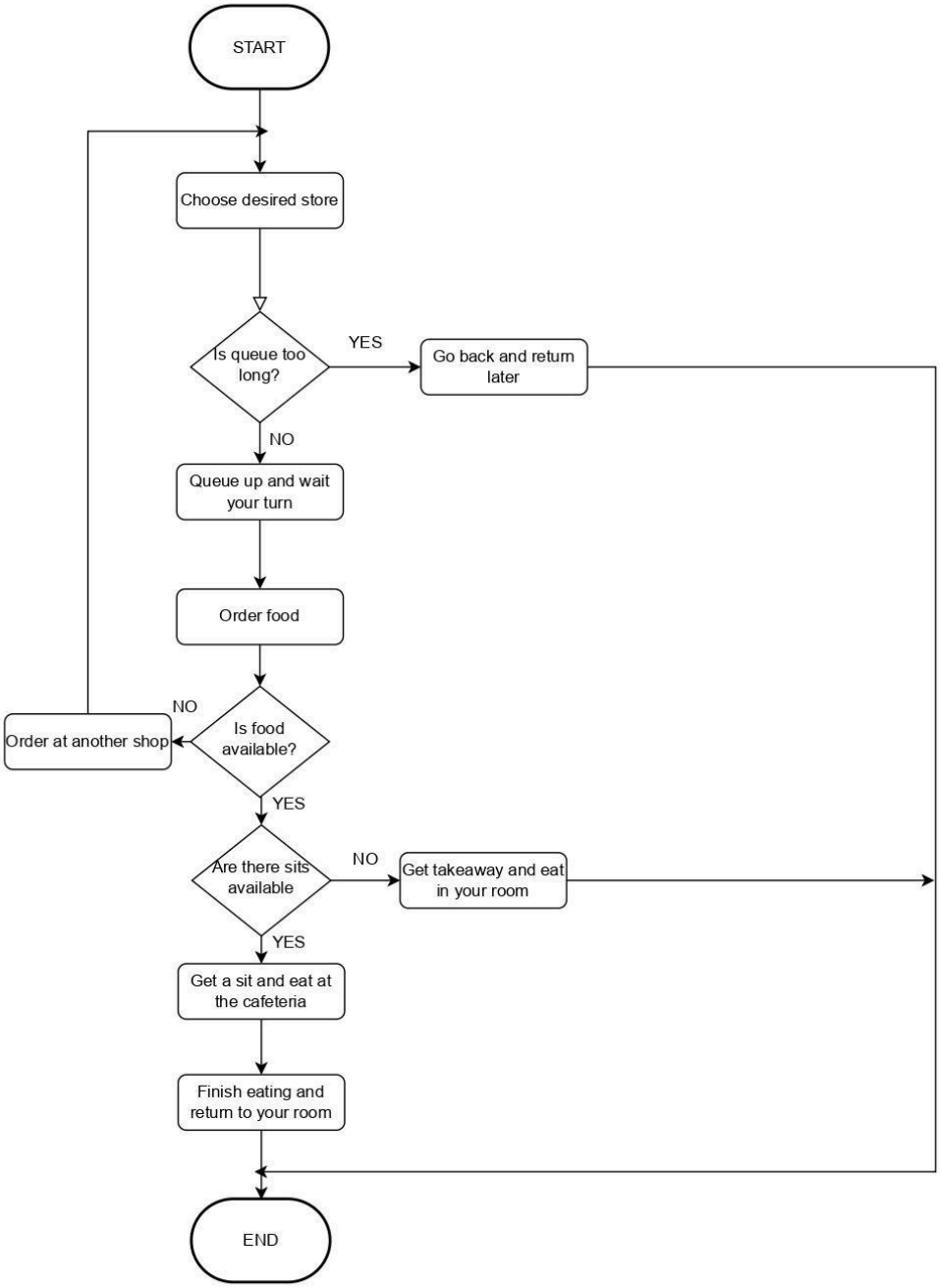
2. **Dynamic Menu Management**
   - **Live Menu Updates:**
     - Automatically marks sold-out items (synced with inventory)
     - Highlights daily specials and promotions
   - **Dietary Filters:**
     - Tags for halal, vegan, vegetarian
     - Allergy warnings (example: "Contains nuts")

3. **Automated Kitchen Workflow**
   - **Direct-to-Kitchen Orders:**
     - Orders print/prepopulate in kitchen display system
     - Reduces miscommunication from handwritten notes
   - **Integrated Payment:**
     - Cashless via student ID/QR code (eliminates cashier delays)

4. **Data-Driven Operations**
   - **Sales Analytics Dashboard:**
     - Tracks top-selling items by time/day
     - Identifies underperforming dishes for menu optimization
   - **Feedback System:**
     - Instant ratings after pickup (example: "How was your meal?")

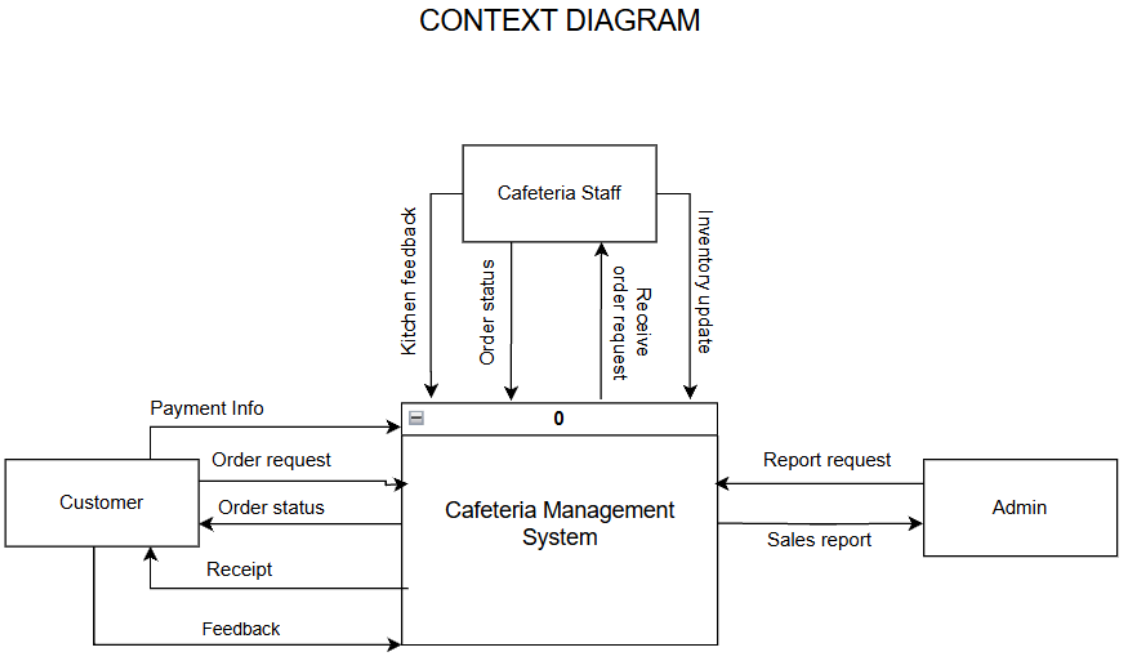
5. **Real Time Cafeteria Status**
   - **Live Occupancy Updates:**
     - Shows crowd levels via colour codes (Green = less than 50% full)
     - Table availability map for dine-in students
   - **Push Notifications:**
     - Alerts for: "Peak hour warning (12:00 PM)", "Chicken Rice sold out", "Flash sale: 2PM to 3PM"

4.0 Current Business Process/Workflow

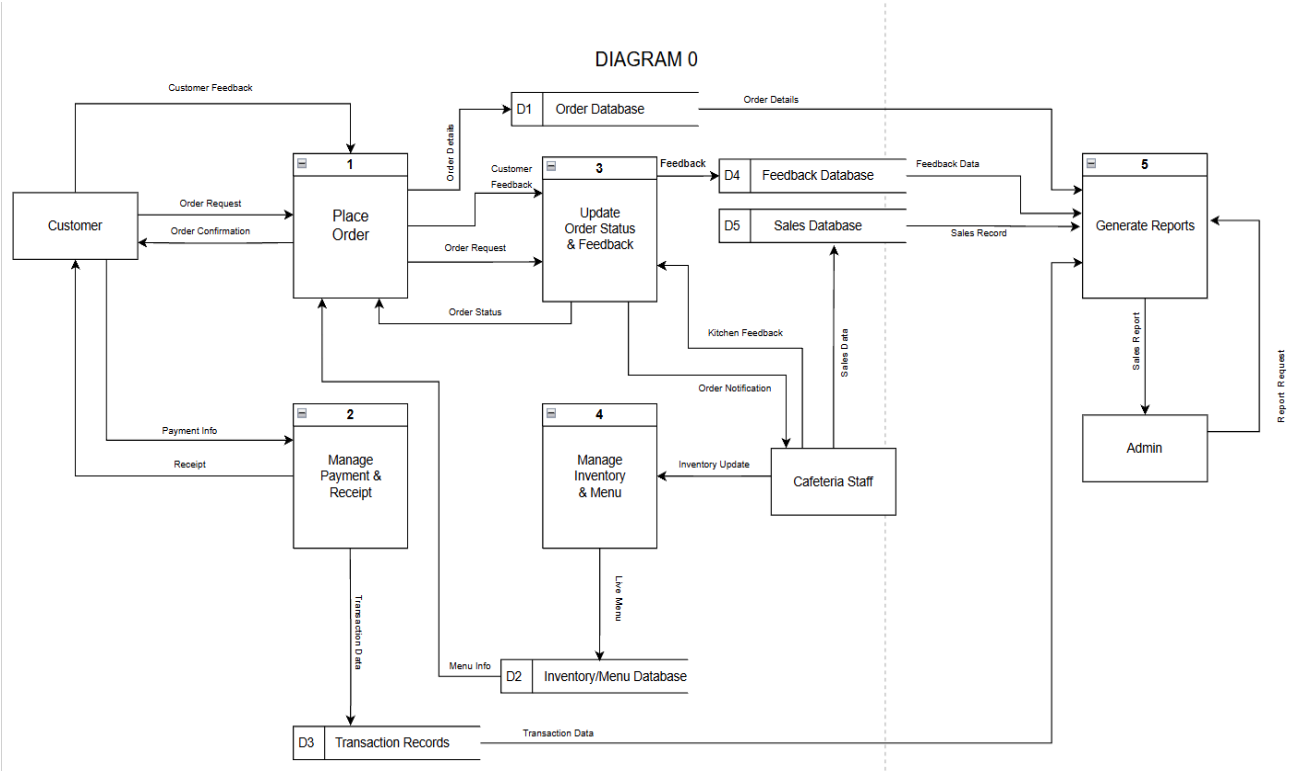


5.0 Logical DFD (AS-IS) System

5.1 Context Diagram



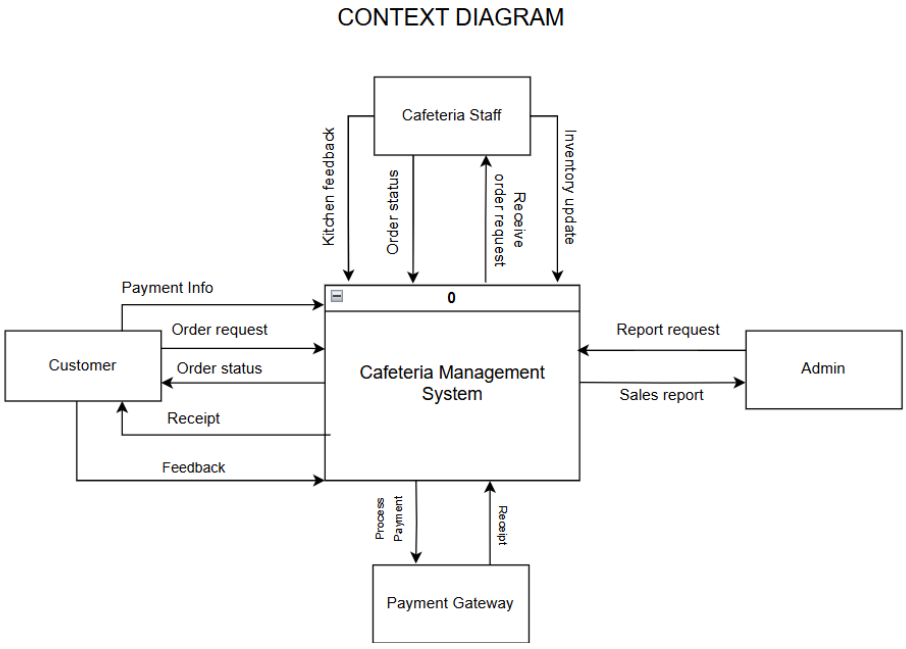
5.2 Diagram 0



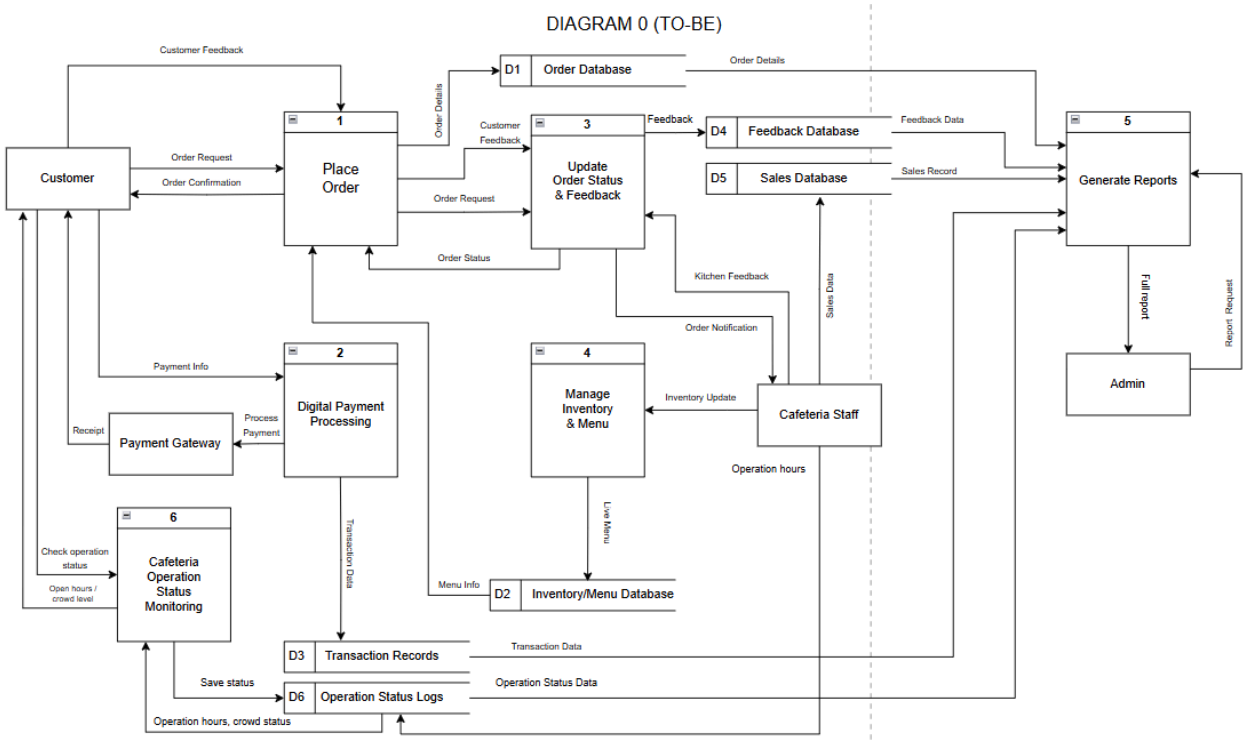
Link for clearer picture: [SAD-Project-DFD-Page-2.drawio (1).pdf]

6.0 System Analysis and Specification

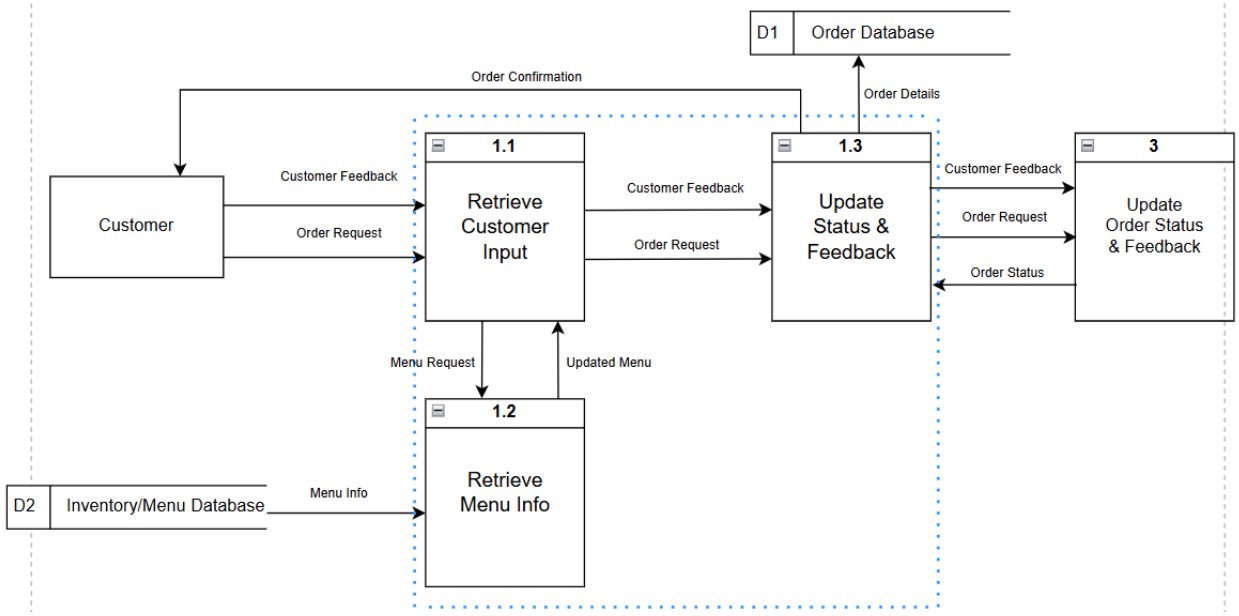
6.1 Logical DFD TO-BE system



Logical DFD TO-BE **Context Diagram**



Logical DFD TO-BE **Diagram 0**



Logical DFD TO-BE **Child Diagram [Process 1]**

6.2 Process Specification

Due to the simplicity of the child diagram of Process 1, process specification, decision tree could not be applied, as it is only used for more complex situations. It's apparent that our

Process 1.1 : Retrieve Customer Input

Structured English

BEGIN
    PROMPT Customer to log in
    DISPLAY Updated Menu from Process 1.2
    PROMPT Customer to select food items
    STORE selected items as Order Request
    PROMPT Customer to optionally submit Feedback
    STORE input as Customer Feedback
    SEND Order Request to Process 1.3
    SEND Customer Feedback to Process 1.3
END

Decision Table

Conditions / Actions	Rule 1	Rule 2	Rule 3	Rule 4
Customer selects food (Order)?	Yes	Yes	No	No
Customer submits Feedback?	Yes	No	Yes	No
DISPLAY Updated Menu from Process 1.2	/	/	/	/
STORE selected items as Order Request	/	/	x	x
STORE input as Customer Feedback	/	x	/	x
SEND Order Request to Process 1.3	/	/	x	x
SEND Customer Feedback to Process 1.3	/	x	/	x

Process 1.2 : Retrieve Menu Info

Structured English

BEGIN

REQUEST access to menu in the Inventory/Menu Database
GET today's current menu items
SEND the updated menu list to Process 1.1

END

Decision Table

Conditions / Actions	Rule 1	Rule 2
System needs menu info	Yes	No
Request access to menu DB	/	x
Get today's menu items	/	x
Send to process 1.1	/	x

Process 1.3 : Update Status & Feedback

Structured English

BEGIN
RECEIVE Order Request and Customer Feedback from Process 1.1
FORWARD Order Request to Process 3 (Update Order Status & Feedback)
FORWARD Customer Feedback to Process 3
WAIT for Order Status from Process 3
IF Order Status is "Confirmed" THEN
STORE Order Details in Order Database (D1)
SEND Order Confirmation to Customer
END

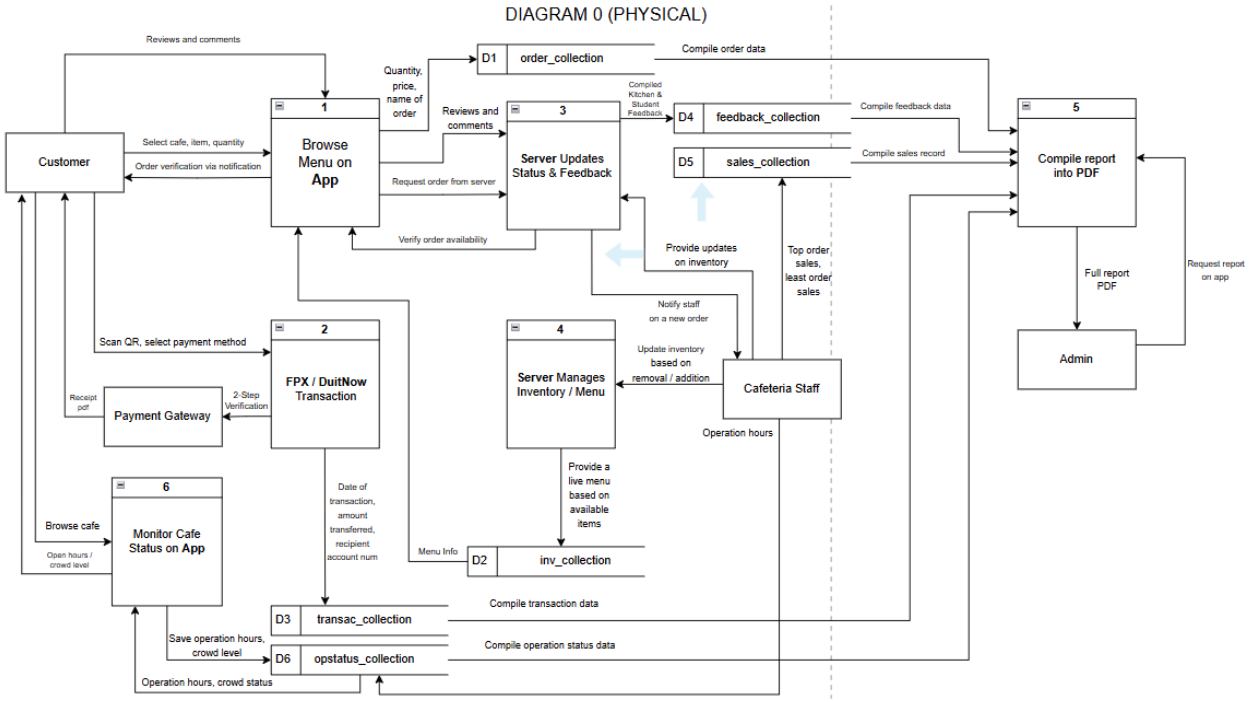
Decision Table

Conditions / Actions	Rule 1	Rule 2
Order status = "Confirmed"	Yes	No
Store order details in DB (D1)	/	x
Send order confirmation to customer	/	x

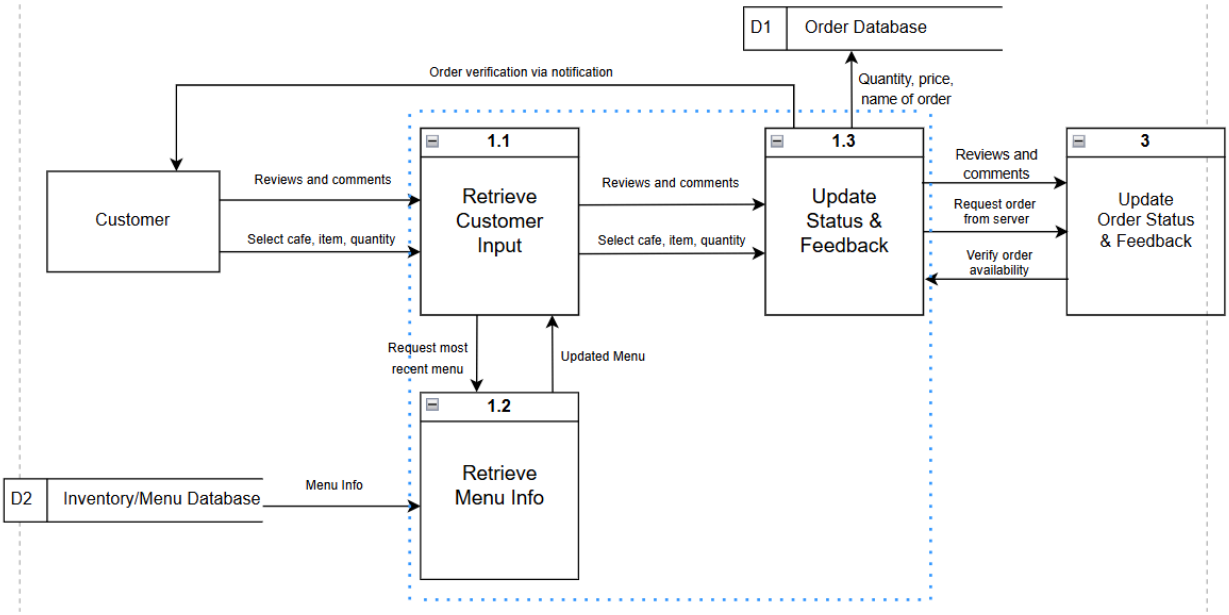
7.0 Physical System Design

7.1 Physical DFD TO-BE system

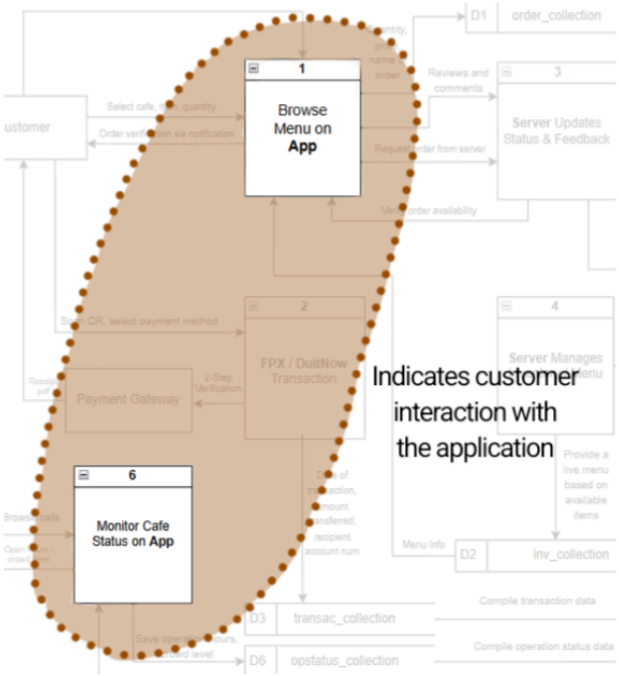
- Diagram 0

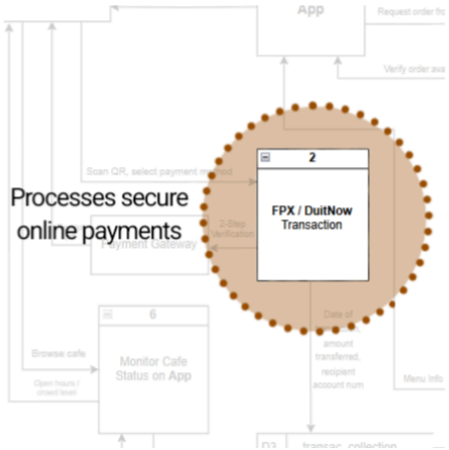


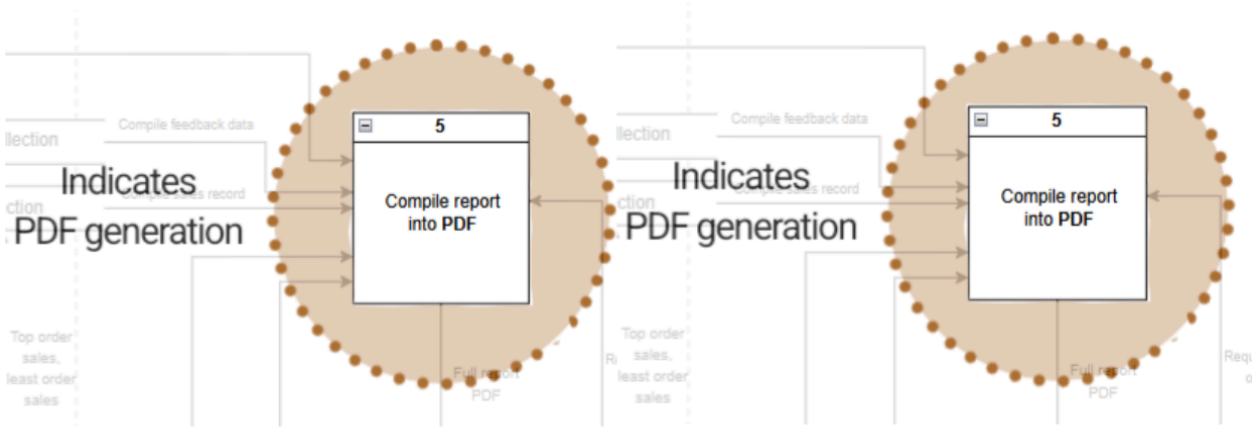
- Child Diagram (Process 1)



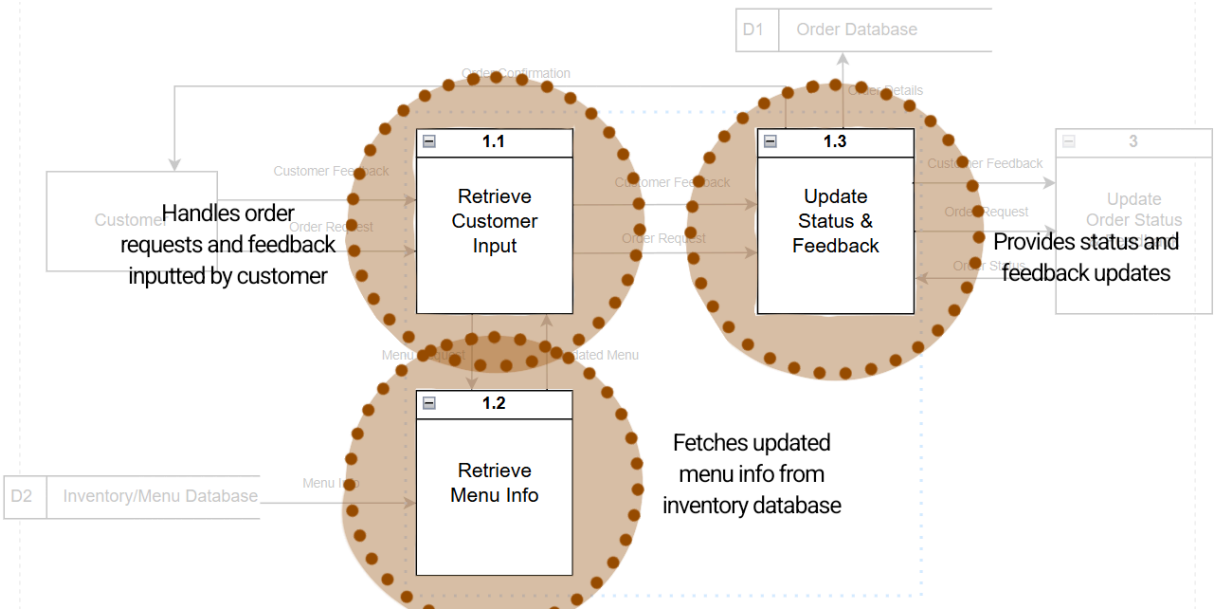
- Partitioning (DIAGRAM 0)







- Partitioning (CHILD DIAGRAM PROCESS 1)



- CRUD Matrix

Activity	Customer	Admin	Cafeteria Staff
Order	C, R, U, D	R	R, U, D
Inventory/Menu	R	R	R, U, D
Transaction Record	R	R	C
Feedback	C, R, U, D	R	R
Sales Record		R	C, R, U

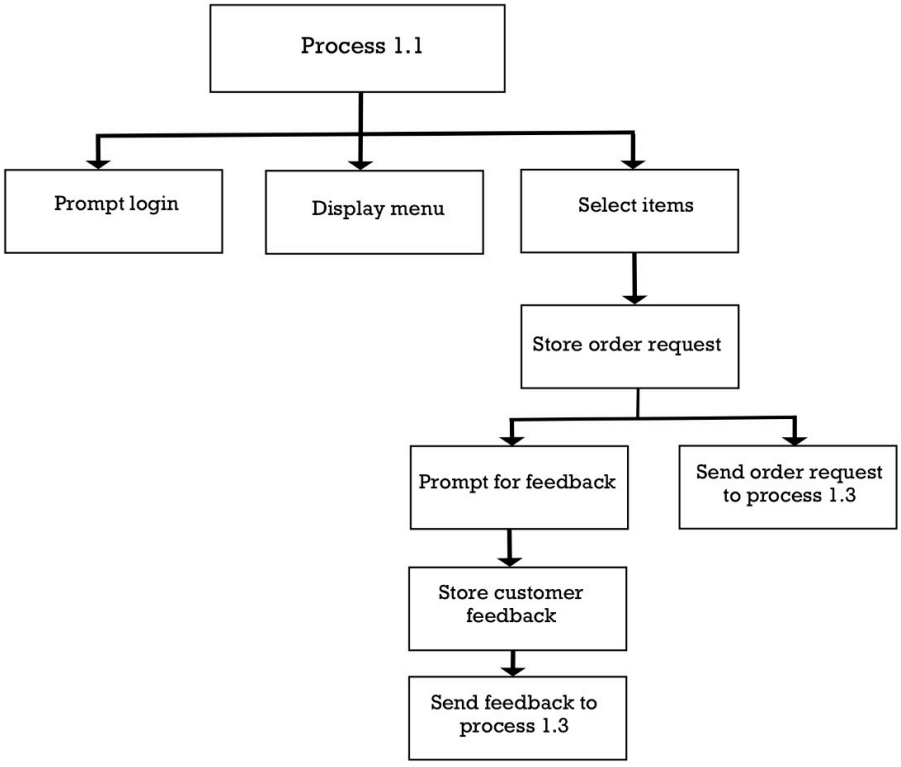
Link: ***Book.xlsx***

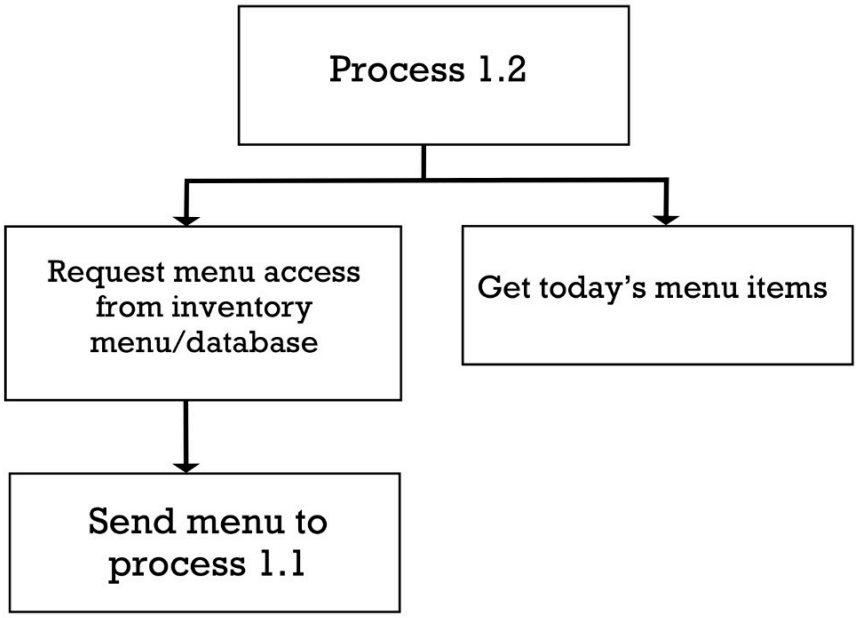
- Event Response Table

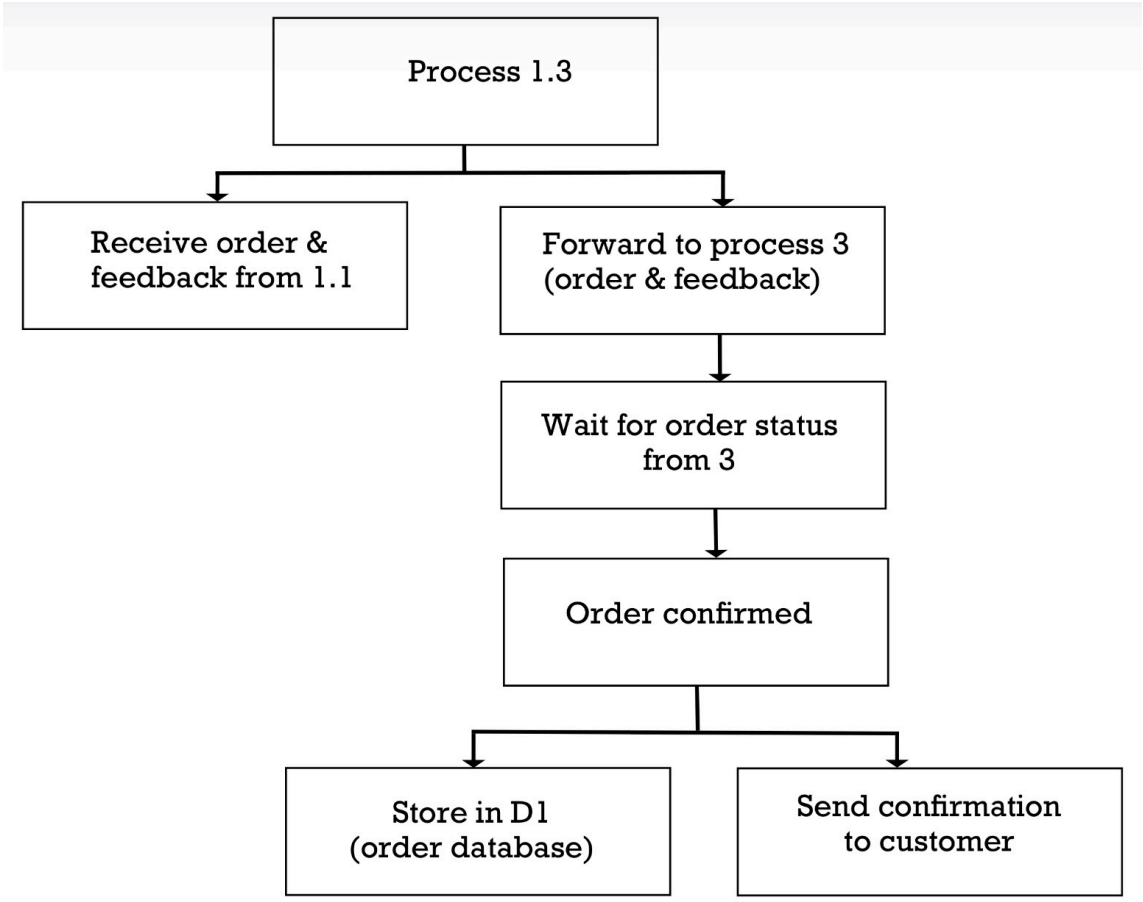
Event	Source	Trigger	Activity	Response	Destination
Customer Places Order	Customer	Customer submits order details	Sends the order details towards the cafeteria staff	Payment Details	Cafeteria Staff
Customer Checks Operation Hours	Customer	Click on "Check Operation Hours" button	Provides the details of the live operation hours of the cafeteria/restaurant	Restaurant Main Page	Customer
Customer Provides Feedback	Customer	Customer provides feedback	Sends feedback messages onto the system.	Restaurant Main Page	Cafeteria Staff
Admin Requests Report	Admin	Click on "Generate Report" button	Provides details for live inventory and record sales for the cafeteria	Full report	Admin
Cafeteria Staff Updates Inventory	Cafeteria Staff	Cafeteria Staff updates the live inventories	Updates the live inventory for the cafeteria	Inventory Page	Admin
Cafeteria Staff Records Sales	Cafeteria Staff	Stores Record Sales	Saves record sales for the day onto the system	Sales Record Page	Admin
Kitchen Status Update	Cafeteria Staff	Cafeteria Staff updates the progress	Updates the kitchen status and provides an estimated time for the customer	Kitchen Status Page	Customer

Link: ***EventResponseTable***

- Structure Chart (Child Diagram)







- System Architecture

Mobile-Based Client-Server Architecture

The Digital Cafeteria System will adopt a mobile-based client-server architecture. Users interact through a mobile application, which sends and receives data from a web server hosted online. This server processes orders, manages menus, and interfaces with a centralized database for data persistence. The system is internet-dependent, leveraging RESTful APIs for communication between the mobile frontend and backend services.

8.0 System Wireframe

Video Demo for UTM Cafe Management Application

https://youtu.be/7_Tpq5UNwx8?si=Qk_e9ob3Tl-sAANs

9.0 Summary of the Proposed System

The proposed Digital Cafeteria Management System for Universiti Teknologi Malaysia (UTM) is a mobile-based solution designed to improve efficiency, reduce service delays, and enhance the overall dining experience. By allowing students and staff to place pre-orders through a mobile platform, the system helps eliminate long queues and manage peak-hour congestion. It features real-time menu updates that reflect sold-out items, highlight daily specials, and provide dietary information, allowing users to make informed choices. Orders are sent directly to the kitchen, reducing miscommunication and speeding up preparation, while integrated cashless payments streamline transactions. Additionally, the system includes data analytics to track sales trends and customer feedback, helping optimize inventory, staffing, and menu planning. Real-time occupancy updates and push notifications further support user convenience and resource management. Overall, the system transforms the traditional cafeteria into a smart, efficient, and user-focused dining environment.