UTM

UNIVERSITI TEKNOLOGI MALAYSIA

UNIVERSITI TEKNOLOGI MALAYSIA

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PROJECT 2

Database Conceptual Design (ERD)

SECD2523: Database

SECTION 01

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1.0 Overview of the Project

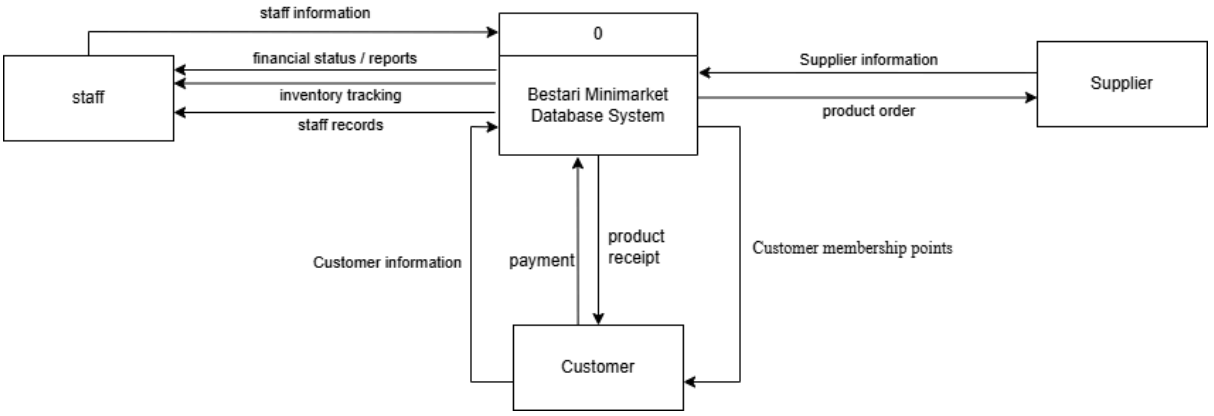
In today's fast-paced retail environment, operational efficiency, accurate inventory management, and customer satisfaction are critical to the success of any business, including small-scale operations like minimarts. BESTARI Mini Mart has relied on manual processes to manage its operations. This includes everything from tracking stock levels and managing sales to handling customer interactions and maintaining supplier relationships. However, such manual methods, while cost-effective in the short term, are prone to inefficiencies and errors. As the business has grown in size and scope, these processes have become increasingly time-consuming, leading to stock mismanagement, delays in reordering supplies, and difficulties in tracking financial performance.

To address these challenges and improve the minimart's overall operational efficiency, the development of a comprehensive BESTARI Minimart Database System has been proposed. The system will digitise and automate key aspects of the business, ensuring real-time data availability and better management of resources. By implementing this database system, BESTARI Minimart aims to transform its operations and enhance its ability to serve its customers effectively. A database system allows businesses to store, manage, and retrieve data efficiently. In the case of BESTARI Minimart, the database system will serve as the backbone of the store's daily operations, automating and integrating several key functions such as inventory management, financial tracking, staff scheduling, and supplier interactions.

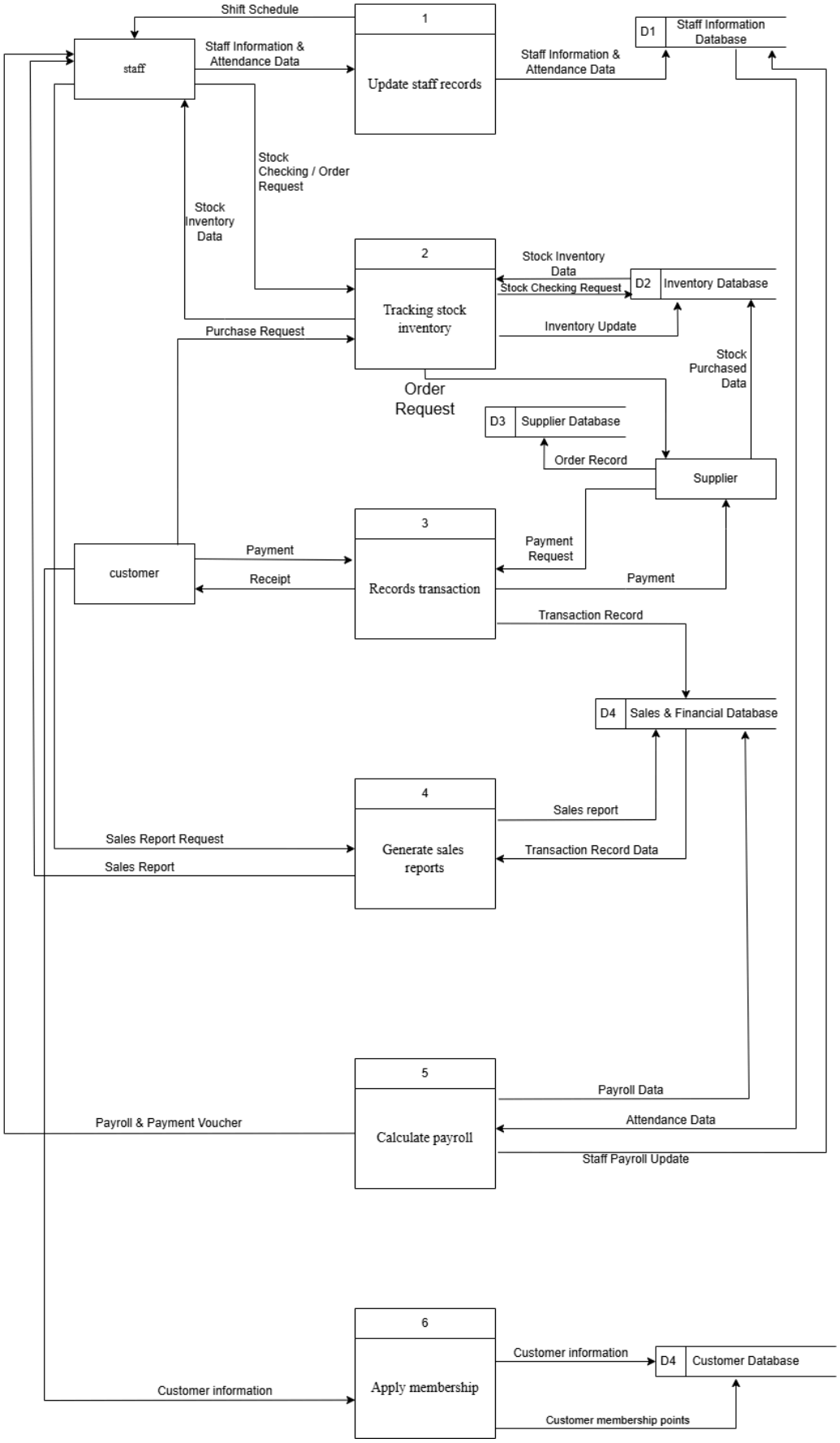
In conclusion, by automating key processes such as inventory management, financial tracking, staff scheduling, and customer engagement, the system will drastically reduce the time and effort required to run the store. It will also provide management with the tools and insights they need to make informed decisions, improving the store's overall performance and profitability. As the minimart continues to grow, the database system will play a crucial role in ensuring that it can meet the demands of its customers efficiently and effectively. Ultimately, the BESTARI Minimart Database System will serve as a foundation for the store's long-term success.

1.1 DFD (to-be)

Context diagram

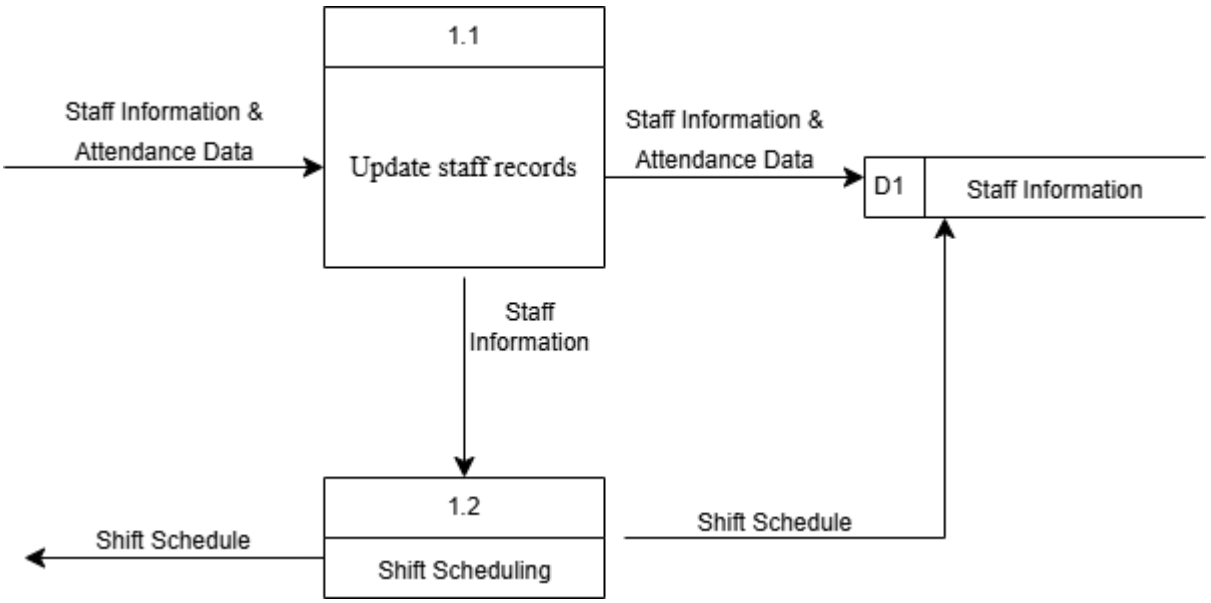


Level 0 diagram

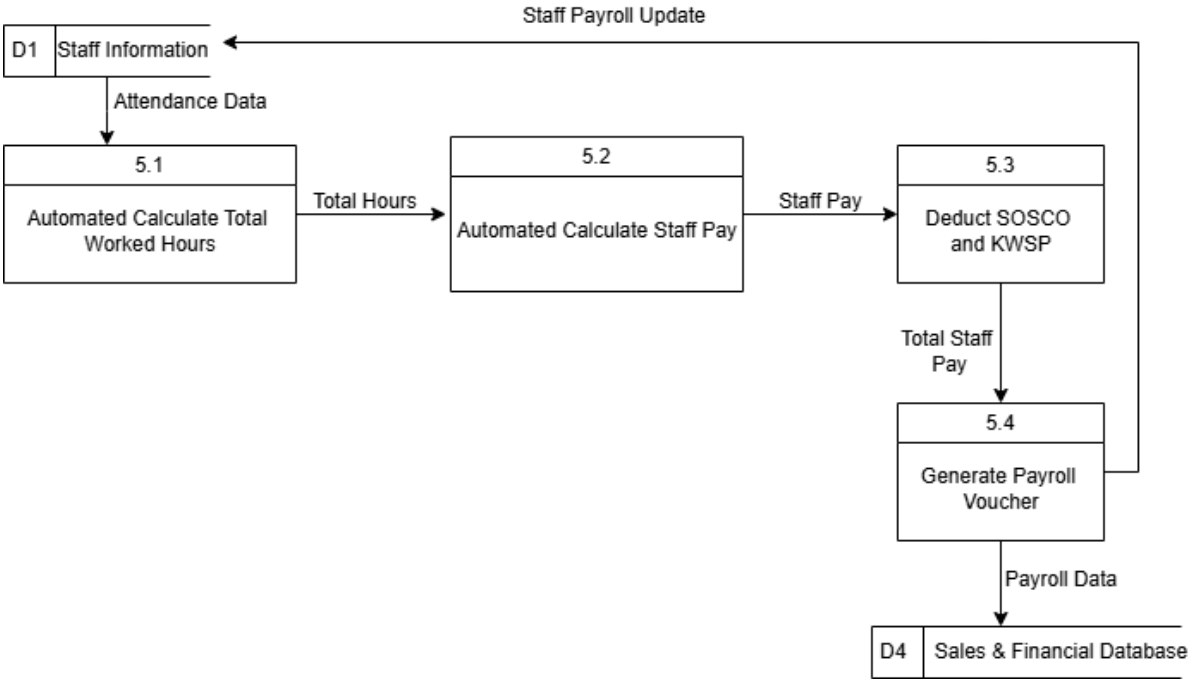


Child diagram

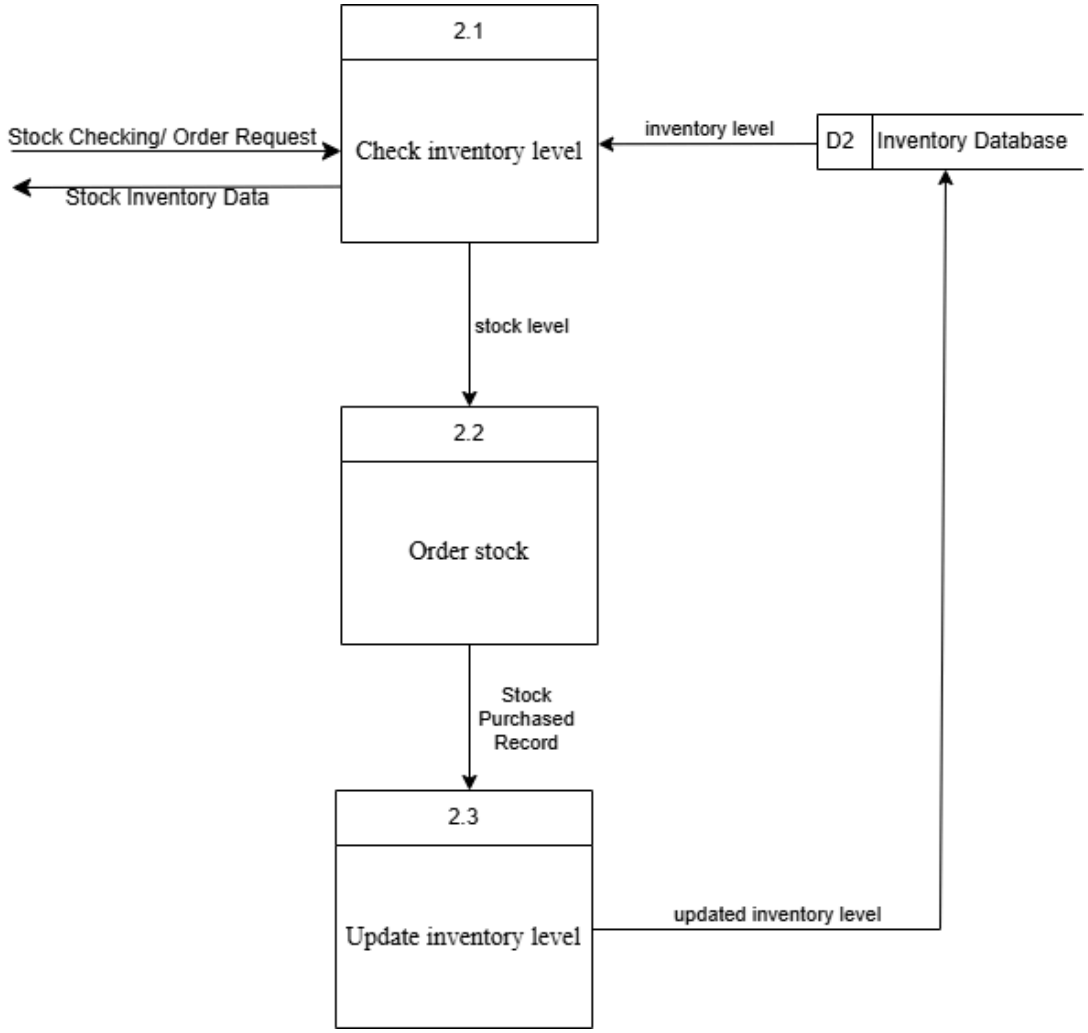
Staff



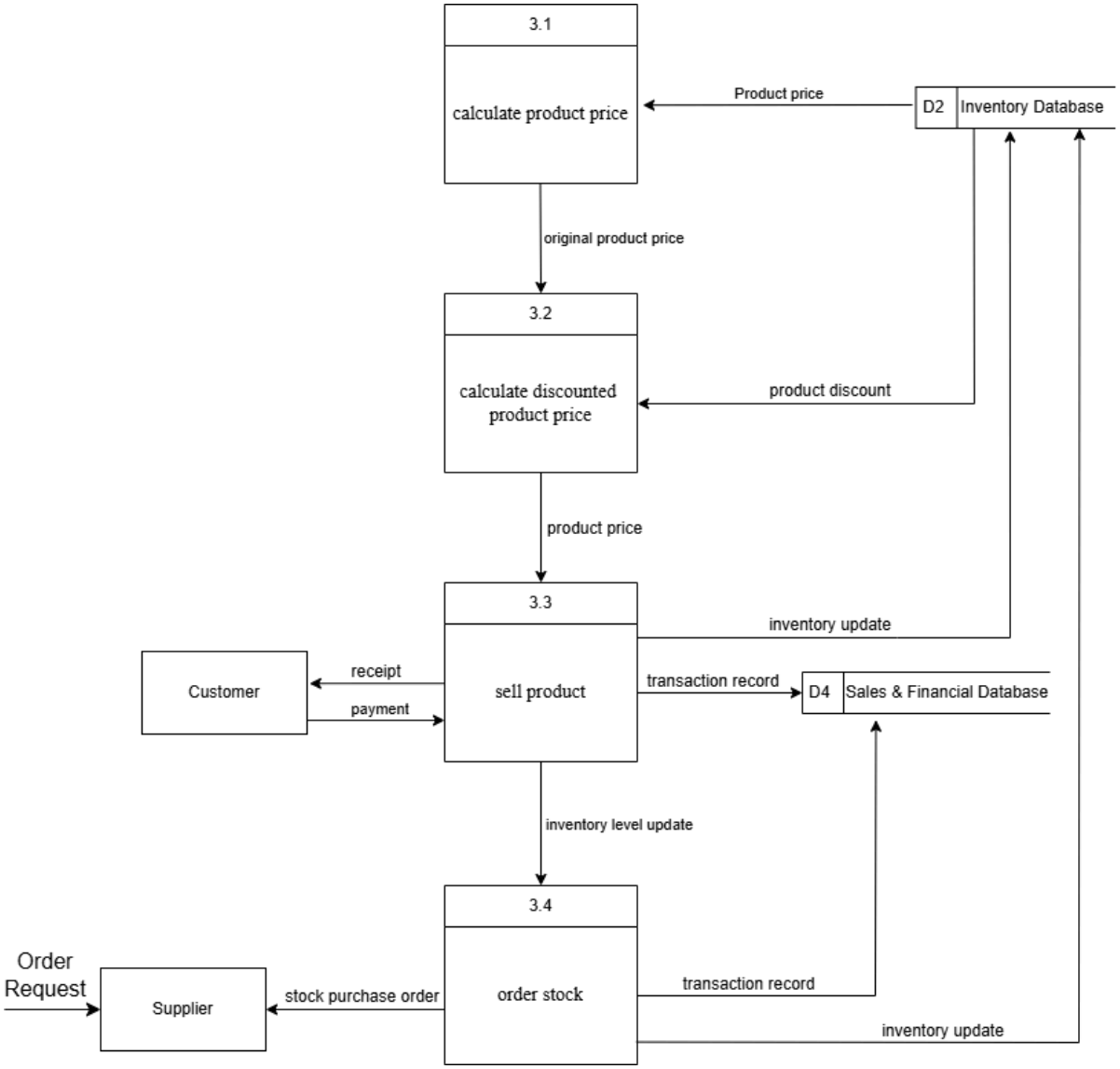
Payroll



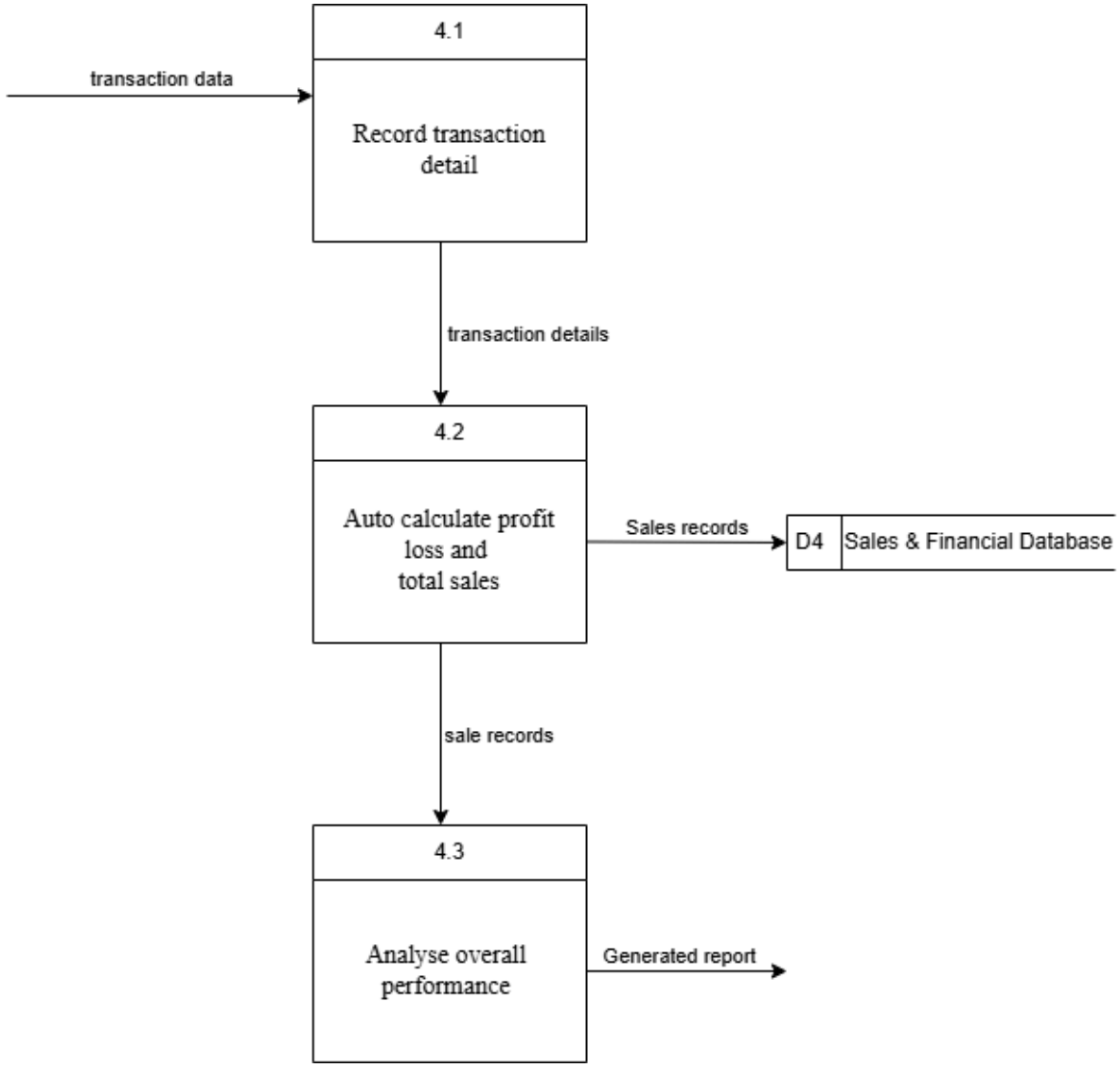
Inventory


2.1
Check inventory level
Stock Checking/ Order Request
Stock Inventory Data
inventory level
D2
Inventory Database
stock level
2.2
Order stock
Stock Purchased Record
2.3
Update inventory level
updated inventory level

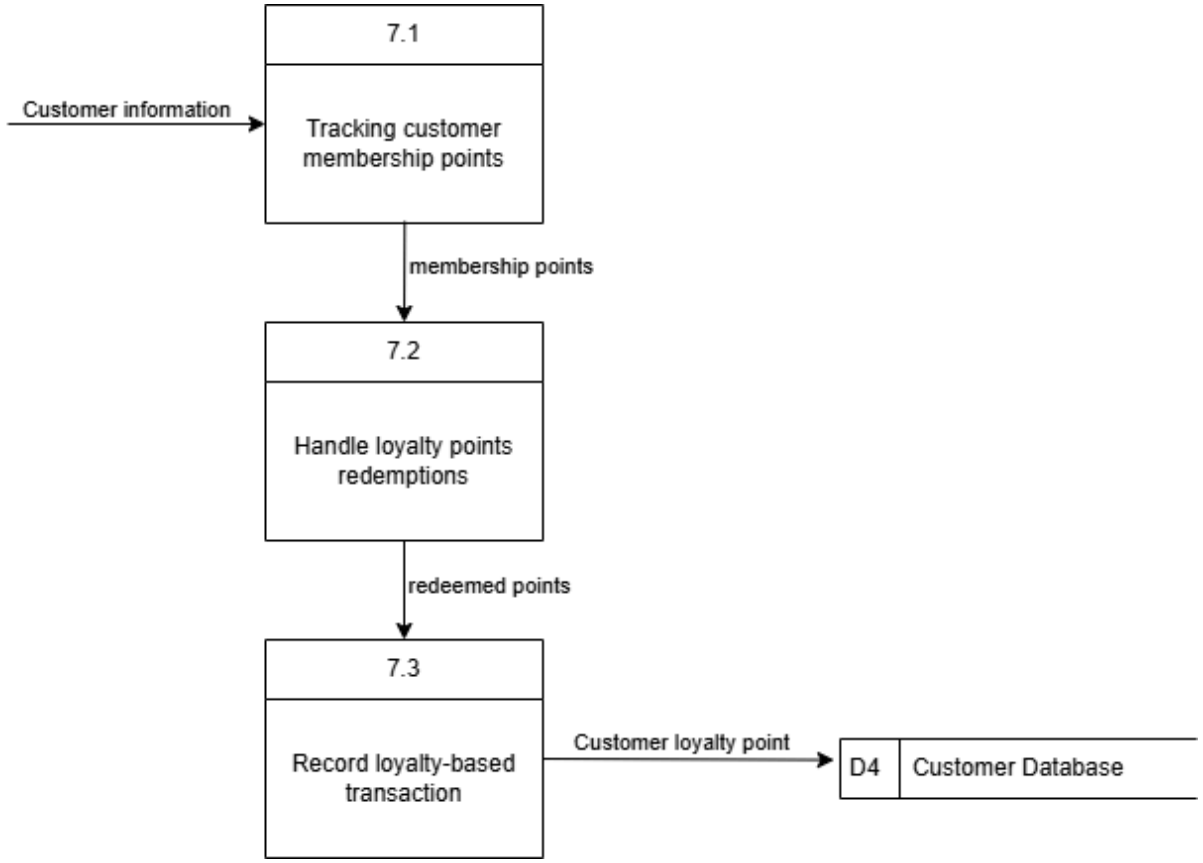
Transaction



Report


4.1
transaction data
Record transaction detail
transaction details
4.2
Auto calculate profit loss and total sales
Sales records
D4
Sales & Financial Database
sale records
4.3
Analyse overall performance
Generated report

Membership


7.1
Customer information
Tracking customer membership points
membership points
7.2
Handle loyalty points redemptions
redeemed points
7.3
Record loyalty-based transaction
Customer loyalty point
D4
Customer Database

1.2 Data & Transaction Requirement

1.2.1 Data Requirement

Inventory and product

The inventory and product data requirements are crucial for tracking all items in the BESTARI mini mart's stock. Each of the products must have a unique identifier, a name and a category. The system will store the unit price, cost piece and the current stock quantity.it must also track suppliers linked to each product, reorder levels to trigger restocking alerts and expiration dates for perishable goods. Moreover, it will keep a history of stock movements including purchases, restocking and sales to ensure the accurate stock management.

Sales

To track every transaction, the system must capture comprehensive sales data. Each sale must be recorded with a unique transaction ID along with the product details like product ID and quantity sold as well as the total sale amount. The system should also capture the date and time of the sale, payment methods used and any applied discounts or promotions. It will track the cashier who processed the sales to ensure accountability and monitor performance. This data enables the real-time updates of inventory levels and supports sales reporting and trend analysis.

Customer

For managing customers and loyalty programs, the system must store the details of customer information. Each customer will have a unique membership ID with the records of their name, contact information and address. The system will track their purchase history and for loyalty program members, it will manage loyalty points and monitor their status in the program. This allows the business to offer personalised promotions and build stronger customer relationships.

Supplier

The system's supplier data requirements are focused on managing supplier relationships and orders. Each supplier will have a unique ID along with their company name, name of person in-charge, contact information and also physical address. The system will also store a list of the products supplied by each vendor and keep track of order histories including dates, quantities and also payment made. The supplier performance data such as delivery times and product quality will also be recorded to support decision-making about future orders and supplier evaluations.

Staff

Managing staff requires comprehensive employee data. The system must assign each employee a unique ID with their full name, role and hire date. It will track their salary for full-timer or hourly rate for part-timer, work schedules and attendance including overtime. Access levels based on the employee's role must be monitored to maintain system security and ensure that employees can only access functions relevant to their job responsibilities.

Financial

The system must manage and process financial data to ensure accurate accounting and reporting. The system must track all revenue generated from sales along with the expenses such as product purchases, employee wages and operational costs. It will also generate the profit and loss statements to assess the business's financial performance. Besides, the system will also capture the tax data for compliance purposes and track payments made to suppliers including the payment amounts, dates and methods. The financial reports will be generated regularly to support management in making informed decisions.

Reporting and analytics

To support business decision-making, the system must gather and organise data for generating detailed reports. Sales reports, categorised by product, employee or customer will be generated to analyse business performance. Inventory reports will help to monitor stock levels, identify trends and manage reorder points. Customer reports will provide insights into purchasing behaviour and loyalty program engagement while supplier reports will assess vendor performance and delivery accuracy.

1.2.2 Transaction Requirement

Data Entry:

1. Enter the details of the owner
2. Enter the details of staff
3. Enter the details of the store member
4. Enter the details of customers
5. Enter the details of supplier
6. Enter the details of inventories/products
7. Enter the details of sales transactions
8. Enter the details of payment
9. Enter the details of promotion and discounts

Data Updates/Deletion:

1. Update/delete the details of the owner
2. Update/delete the details of staff
3. Update/delete the details of customers
4. Update/delete the details of customer loyalty points
5. Update/delete the details of supplier
6. Update/delete the details of inventory levels
7. Update/delete the details of product price
8. Update/delete the details of product expiry dates
9. Update/delete the details of payment

Data Queries:

1. List the details of customer
2. List the details of product availability
3. List the details of supplier performance
4. List the details of payment/ purchase history
5. List the details of inventory turnover
6. List the details of expired products
7. List the details of customer segmentation

1.3 Proposed Business Rules

1. Customer

- Each customer must have a unique customer ID to identify their purchase history, preferences and loyalty points.
- Customer data including name, contact details and membership status should be securely stored and updated as needed.
- Customer enrolled in the loyalty program earn points for eligible purchases which can be redeemed according to the program's policies
- Only one active loyalty membership is allowed per customer and points expire after a designed period if unused.

2. Staff

- Each staff member must have a unique employee ID and records must include their role, work schedule and attendance history.
- Employee performance and attendance records should be regularly reviewed and used as part of the staff evaluation process.

3. Supplier

- Each supplier must have a unique supplier ID and the database should store contact information, supply terms and the list of products supplied.
- Each of the deliveries must have an associated order number.
- Payments to suppliers should only be made once products are received and verified as accurate against the order details.

1.4 Proposed Data and Transactional

Transactions are referred to the operations in a database which are data entry, data delete/updates and data queries. In our project there are several transactions requirement:

Data Entry:

1. Enter the details of owner
2. Enter the details of staff
3. Enter the details of customers
4. Enter the details of supplier
5. Enter the details of payment
6. Enter the details of inventories/products
7. Enter the details of membership points and reward tiers for customers.
8. Enter the details of supplier contract terms, including pricing agreements and delivery schedules.
9. Enter the details of automated reorder points and minimum stock thresholds for inventory items.
10. Enter the details of integrated payment methods, including digital wallet and credit options.

Data Updates/Deletion:

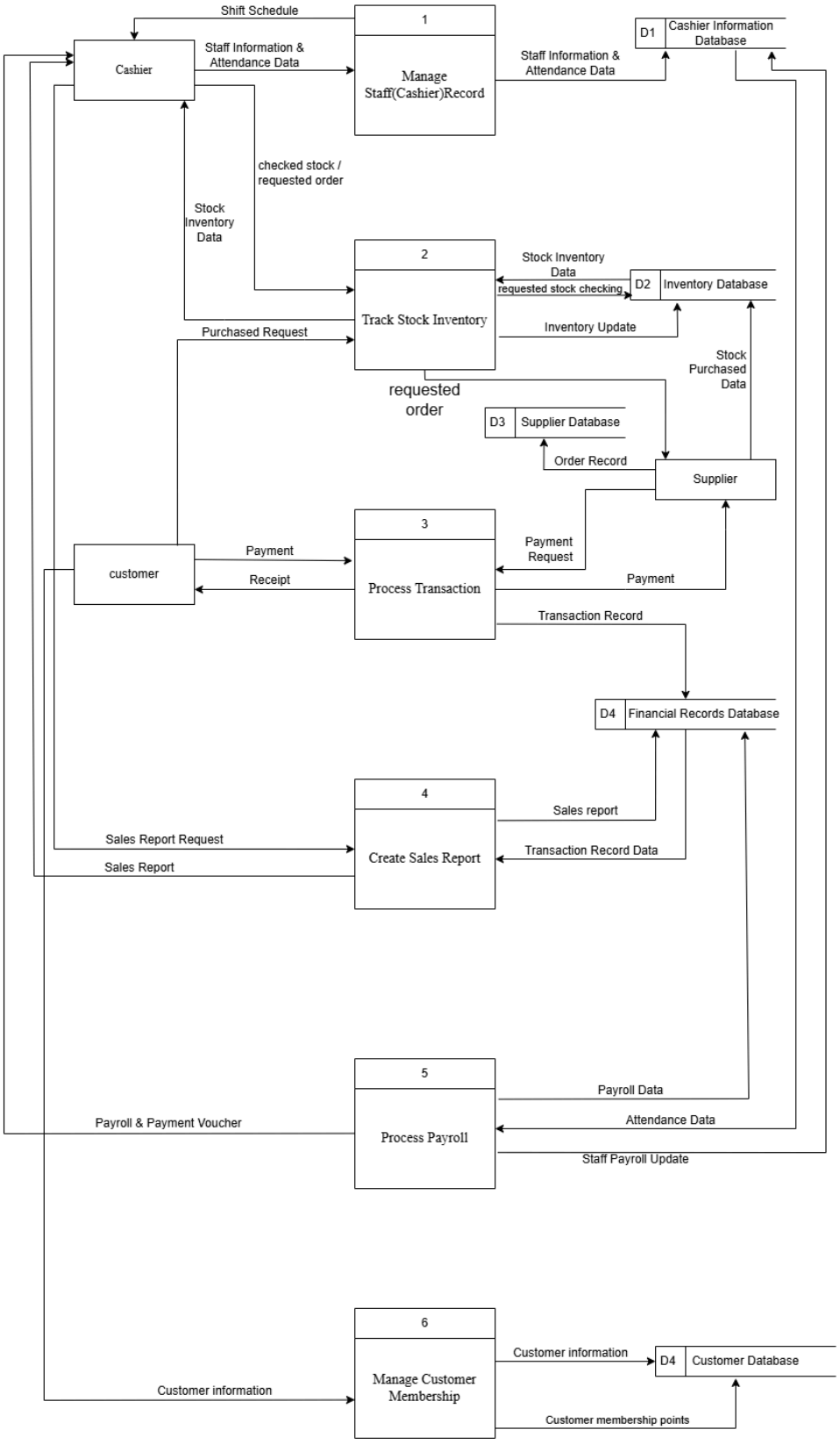
1. Update/delete the details of staff
2. Update/delete the details of customers
3. Update/delete the details of inventory levels
4. Update/delete the details of product price
5. Update/delete the details of payment
6. Update/delete the details of bulk inventory prices during sales or promotions.
7. Update/delete the details of customer loyalty levels automatically based on spending patterns.
8. Update/delete the details of supplier relationship status based on recent performance.
9. Update/delete the details of product expiry dates and automatically remove expired items from active inventory.

Data Queries:

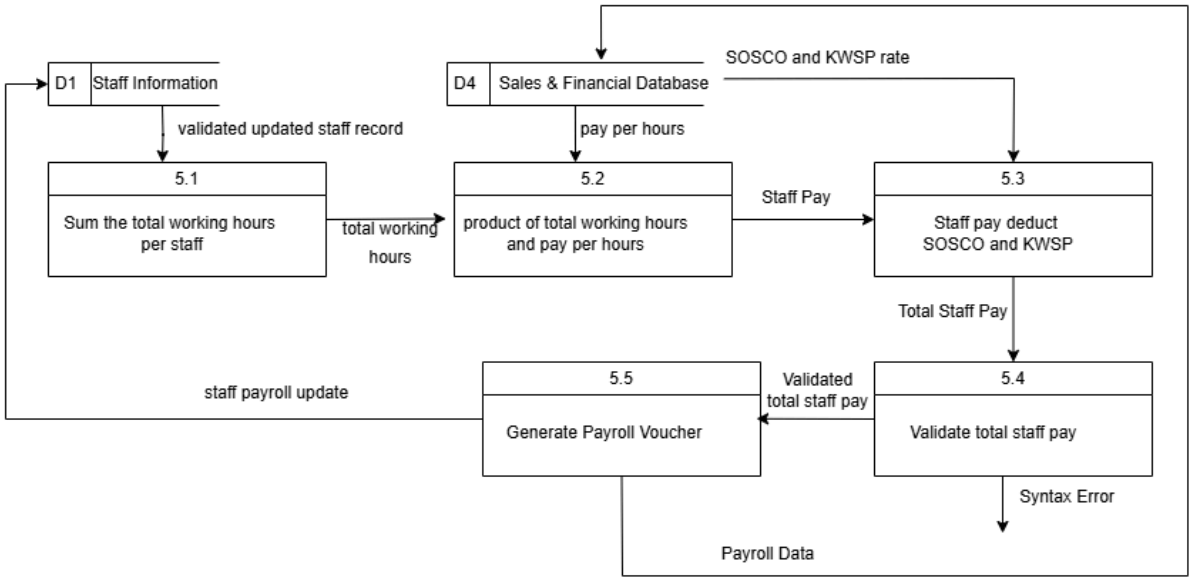
1. List the details of sales trends, including seasonal trends and top-selling products.
2. List the details of customer purchase behaviour, with segmentation by demographics or spending levels.
3. List the details of real-time inventory status, highlighting low-stock and fast-moving products.
4. List the details of product availability
5. List the details of supplier performance, including delivery accuracy and product quality.
6. List the details of customer feedback, linked to individual purchases for service improvement.

2.0 System Analysis and Design

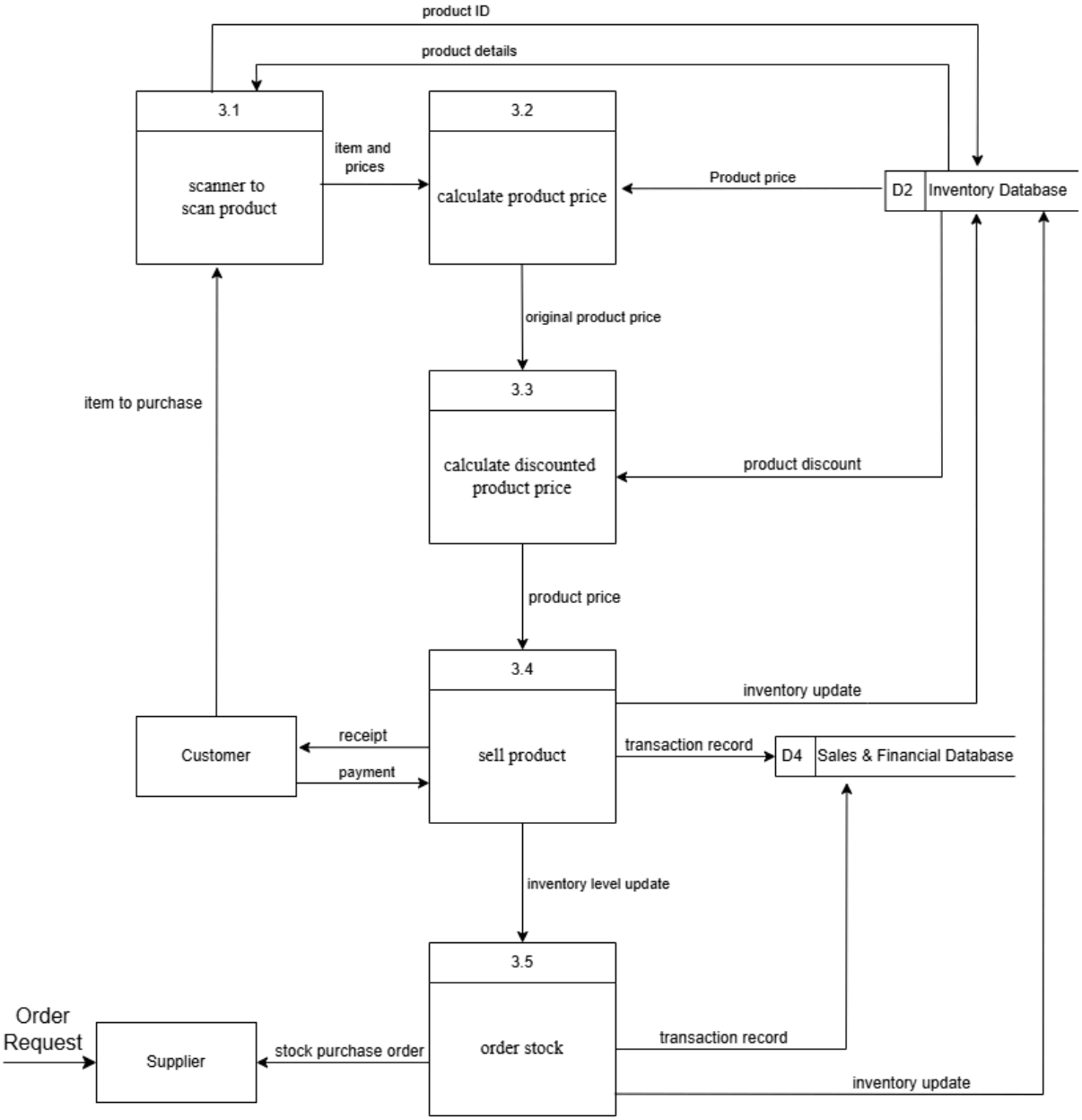
2.1 System Design - Physical DFD of the To-Be-System



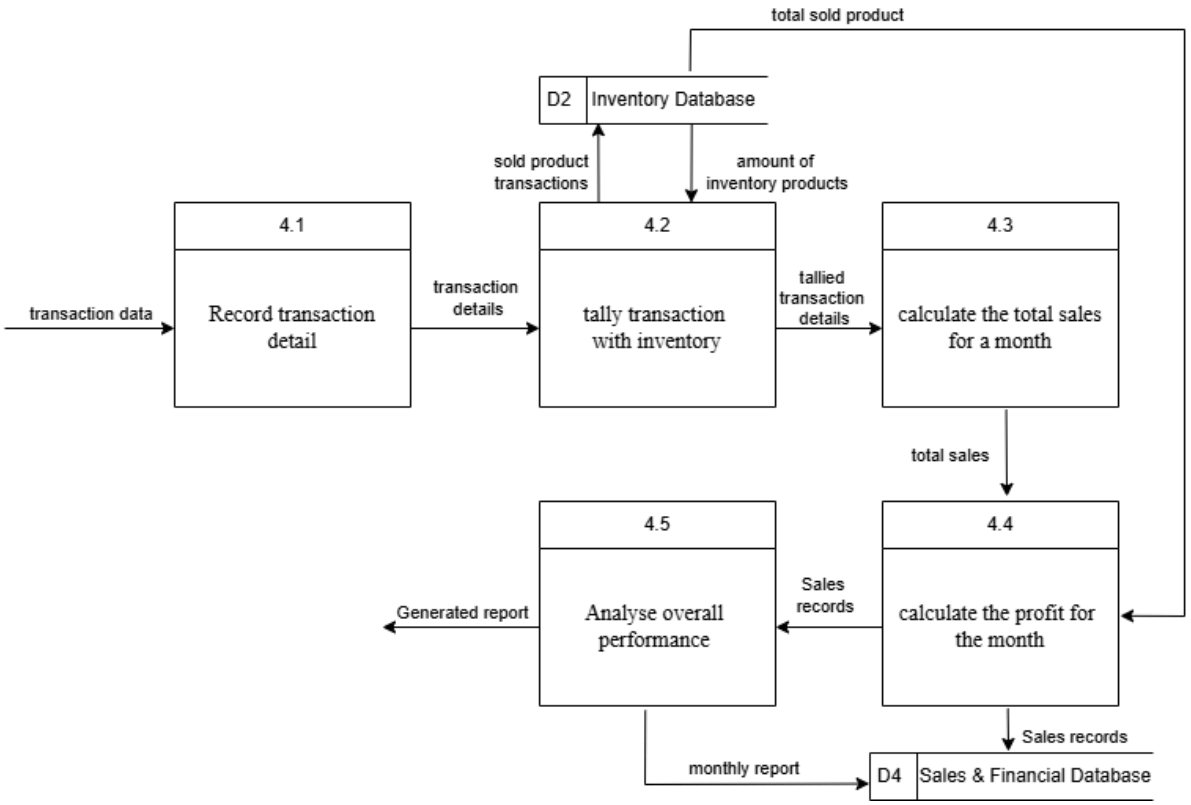
Physical DFD of the To-Be-System: Level 0 Diagram



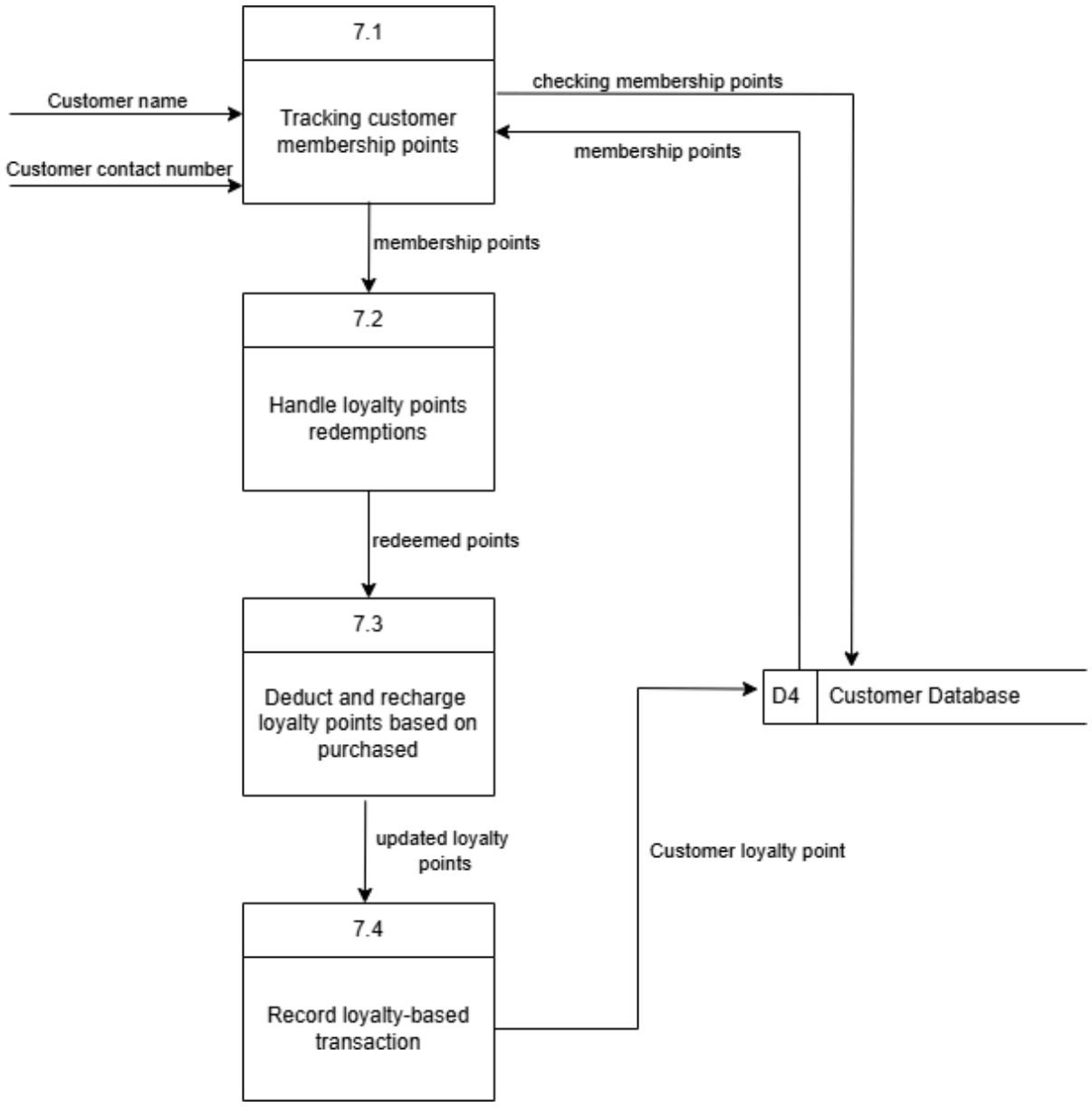
Physical DFD of the To-Be-System: Payroll Child Diagram



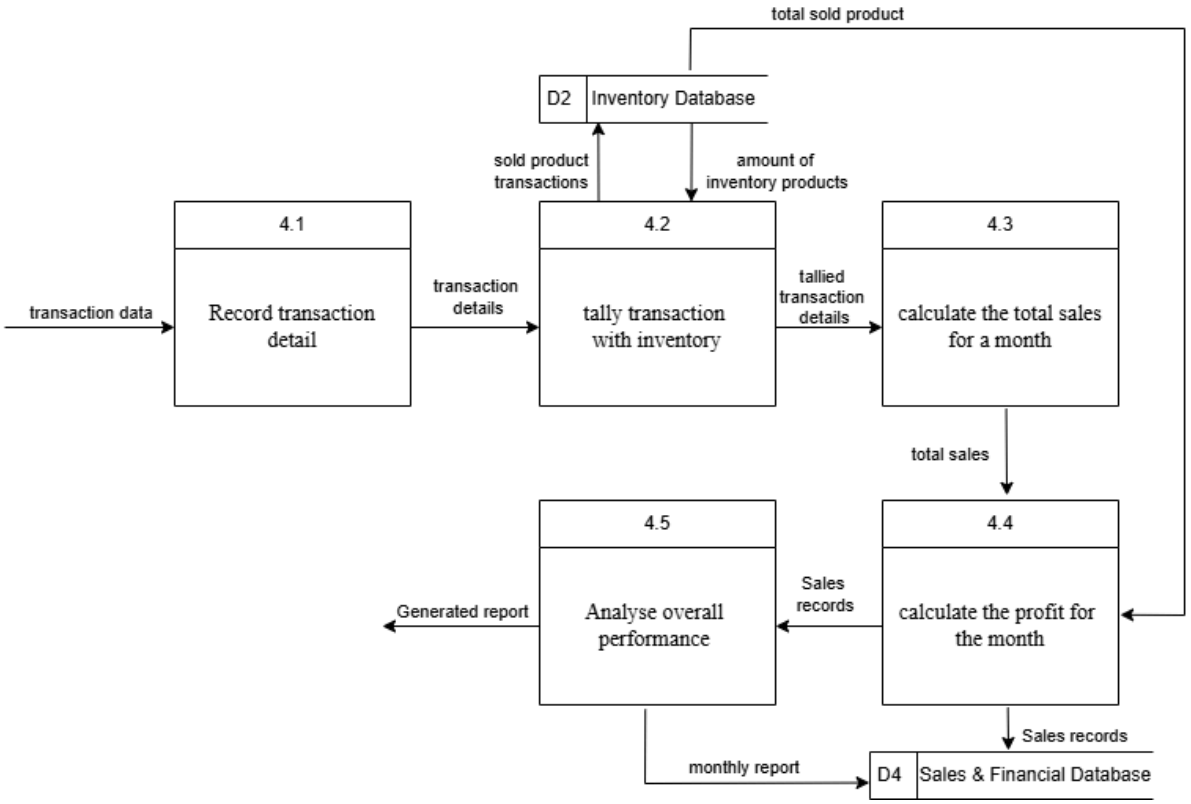
Physical DFD of the To-Be-System: Inventory Child Diagram



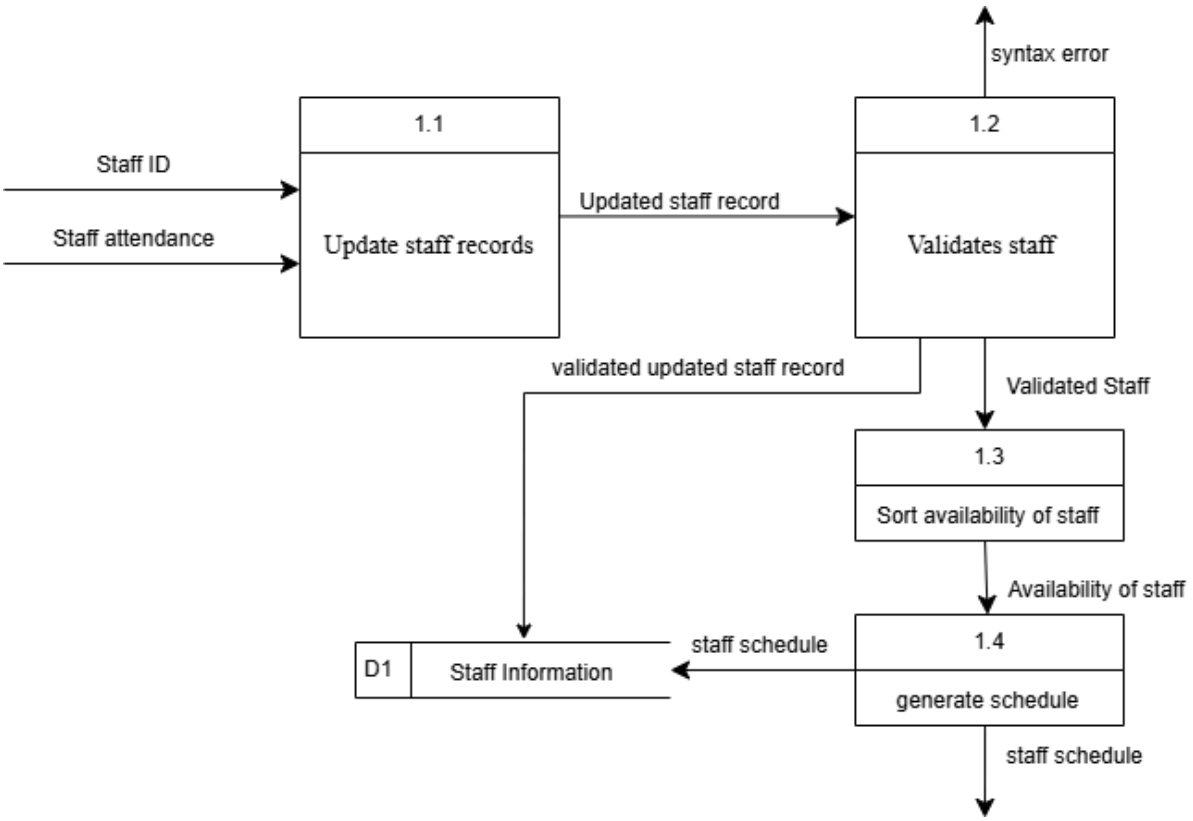
Physical DFD of the To-Be-System: Transaction Child Diagram



Physical DFD of the To-Be-System: Membership Child Diagram



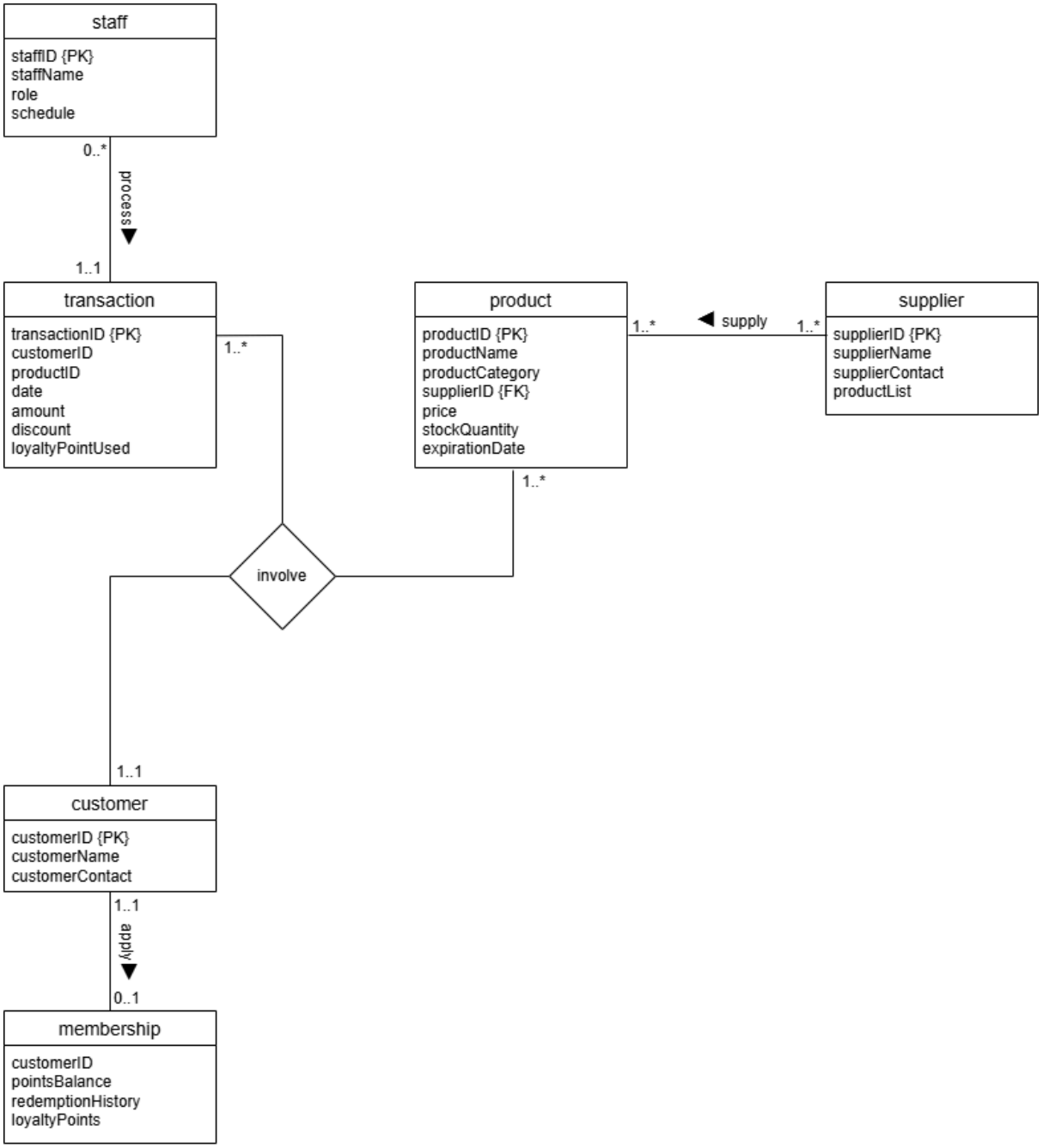
Physical DFD of the To-Be-System: Report Child Diagram



Physical DFD of the To-Be-System: Staff Child Diagram

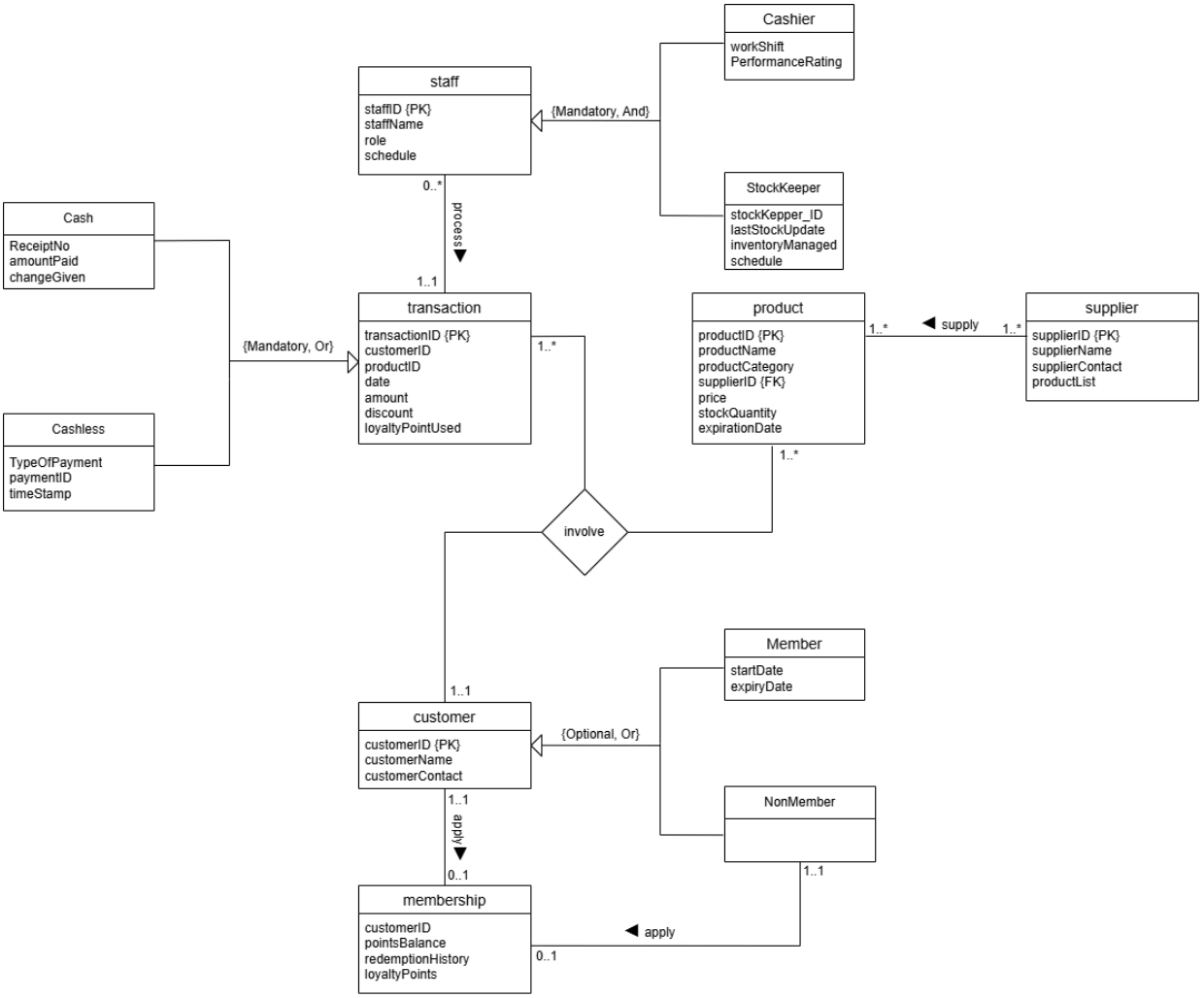
3.0 Database Conceptual Design

3.1 Conceptual Entity-Relational Model(ERD)



Conceptional Entity-Relational Model (ERD)

3.2 Enhanced ERD



Enhanced Entity-Relational Model (EERD)

4.0 Data Dictionary

4.1 Description of Entities

Entity	Description	Purpose
Inventory	Tracks all products available in the minimart. It includes details such as the product name, category, price, quantity in stock, reorder level, and expiration date for perishable goods.	To maintain accurate records of stock levels and product details, facilitating effective inventory management and minimising stock outs or overstocking.
Sales	Logs each transaction conducted in the minimart. It gives the details of every transaction the store made,including payment method, and the cashier handling the transaction.	To record sales transactions, update inventory levels automatically, and provide data for sales reporting and trend analysis.
Supplier	Contains records of suppliers who provide products to the minimart. It includes the supplier's company name, contact person, contact information, products supplied, and the date of the last order.	To organise supplier details and streamline the reordering process, ensuring timely and reliable product restocking.Can manage the sales transaction through sales module
Customer	It stores information about minimart customers, including contact information, membership status, loyalty points, and total purchase value.	To manage customer relationships, track loyalty program engagement, and enable targeted marketing efforts.
Staff	It holds information about minimart employees, including their roles, salary details, work schedules, and attendance records. The staff is used for payroll calculations, shift management, and monitoring staff productivity.	To manage employee data, calculate payroll, and monitor attendance, ensuring efficient scheduling and workforce management.
Financial Transaction	It records the financial activities of the minimart, capturing data on revenues, expenses, and calculated profits or losses. Besides that, it keeps track of payroll of the staff.	To maintain records of all financial transactions, providing insights into profitability and supporting financial decision-making.

4.2 Description of Relationship

Entity	Multiplicity	Relationship	Multiplicity	Entity
Staff	1..1	Processes	0..*	Transaction
Transaction	0..*	Appears in	1.. *	Product
	1..*	Processed by	0..*	Staff
Customer	1..*	Makes	0..1	Transaction
	1..1	Applies for	1..*	Membership
Supplier	1..*	supplies	1..*	Product

4.3 Description of Attributes

Entity	Attribute	Description	Data Type	Constraint	Multi-valued
Staff	staffID	Unique identifier for a staff	Integer	Primary key	No
	staffName	Name of staff	Varchar(100)	Not Null	No
	role	Position/job of the staff	Varchar(50)	Not Null	No
	schedule	Work shift for the staff	Varchar(50)	Not Null	No
Transaction	transactionID	Unique identifier for every transaction	Integer	Primary Key	No
	customerID	The customer who made the transaction.	Integer	Foreign Key	No
	date	Date when the transaction	Date	Not Null	No

		took place			
	amount	The total amount of each transaction	Decimal(10,2)	Not Null	No
	discount	Discount applied to the transaction	Decimal(5,2)	Defaulty = 0	No
	loyaltyPointUsed	Loyalty point redeemed by the customer	Integer	Default = 0	No
Customer	customerID	Unique identifier for each customer	Integer	Primary Key	No
	customerName	Name of the customer	Varchar(10)	Not Null	No
	customerContact	Contact details for the customer	Varchar(50	Not Null	No
	loyaltyPoints	Accumulated loyalty points for customer	Integer	Default = 0	No
Membership	customerID	Link to the associated customer in the customer entity	Integer	Primary Key, Foreign Key	No
	pointsBalance	Total balance of the customers' loyalty point	Integer	Default = 0	No
	redemptionHistory	History where the loyalty points is redeemed by the customer	string	Nullable	Yes

Inventory	productID	Unique identifier for each product	Integer	Primary Key	No
	productName	Name of the product	Varchar(100)	Not Null	No
	productCategory	Category or type of the product (e.g., beverage, stationery).	Varchar(50)	Not Null	No
	supplierID	Links to the supplier who provides this product.	Integer	Foreign Key	No
	price	Price of the product.	Decimal(10,2)	Not Null	No
	stockQuatity	The quantity of the product in stock.	Integer	Default = 0	No
	expirationDate	Expiration date of the product	Date	Nullable	No
Supplier	supplierID	Unique identifier for each supplier.	Integer	Primary Key	No
	supplierName	Name of the supplier	Varchar(100)	Not Null	No
	supplierContact	Contact details for the supplier.	Varchar(50)	Not Null	No
	productList	List of products supplied	string	Nullable	Yes

5.0 Summary

In conclusion, the proposed BESTARI Minimart Database System has addressed the current operational challenges while incorporating valuable feedback from the users of the existing system. The key features of the current system are retained and the new functionalities have been added to enhance user experience and to improve the business efficiency. This includes the real-time inventory tracking, customer loyalty program, automated supplier management and the comprehensive reporting. All these are designed to streamline the processes and ensure reliable data management.

As a result, we anticipate that the updated BESTARI Minimart Database System will provide substantial benefits, enhancing the productivity and satisfaction of customers, employees and also suppliers. This improvement in operational efficiency and data accuracy will lead to a more responsive and customer-friendly environment that supports the minimarket's growth objectives.