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Project Elicitation / Analysis + Conceptual Design
Inventory Management System

Team DB01E 1

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1. Narrative Description:

A business has a warehouse that ships many millions of product units per day. In its current state, it has a large number of employees tasked with tracking the movement of these products on paper. They have to keep track of the product ID, type, dates shipped and received, and numbers of each product. Errors are expected to be minimal. The business has the opportunity of implementing an inventory management system capable of doing this very task with fewer errors and less manpower.

2. Information Needs:

Information needs in this project include current implementations of database systems if any, and current uses of product organization in some warehouses. Given this, we can create a database directly modeled after existing systems, allowing us to more easily transition from the old system of organization to a new one. If this product is being made for a new business, these organization types will need to be created from scratch prior to the database being designed.

3. Relationships / Tables / Schema (Conceptual Design):

PRODUCTS

product_id*	name	price	msrp
12345678	NVIDIA RTX 3080	\$650.57	\$699.99
87654321	AMD Ryzen 9 5900X	\$500.82	\$549.99
01010101	MSI X570 Tomahawk	\$198.83	\$229.99

INCOMING_GOODS

incoming_id*	product_id	date_in	quantity	track_no	employee_no
1	12345678	20210205	8	9400100065430000000000	1029832
2	87654321	20210205	20	9400100054340000000000	9174927
3	01010101	20210205	2	9400100023430000000000	1029832

OUTGOING_GOODS

outgoing_id*	product_id	date_go	quantity	employee_no
1	12345678	20210210	7	1029832
2	87654321	20210210	19	9174927
3	01010101	20210210	2	9174927

CURRENT_STOCK

product_id*	quantity
12345678	1
87654321	1
01010101	0

USERS

user_id*	password	name	username	role
9174927	temp_value	Joseph Dodd	jdodd	Manager
1029832	temp_value	Shane Casiano	scasi	Stock
2039576	temp_value	Jade Spahr	jspah	Admin
1098273	temp_value	John Doe	jdoe	Sales Clerk

TRACKING

order_id*	shipping_status	tracking_id	carrier	customer_add
24671012	Not shipped	1Z999AA10123456784	UPS	123 SomeRoad Ave, InACity, AA, 00000-0000
13579111	Shipped	9999999999999999999	FedEx	123 SomeRoad Ave, InACity, AA, 00000-0000
47585686	Delivered	1Z999AA10123454846	UPS	123 SomeRoad Ave, InACity, AA, 00000-0000

ORDERS

order_id*	customer_fn	customer_ln	customer_add	date	order_items (multi)
-----------	-------------	-------------	--------------	------	---------------------

24671012	Duncan	Hedden	123 SomeRoad Ave, InACity, AA, 00000-0000	20210210	product_id1 product_id2
13579111	Dakarai	Holcomb	123 SomeRoad Ave, InACity, AA, 00000-0000	20210210	product_id1 product_id2
47585686	Daniel	Brestor	123 SomeRoad Ave, InACity, AA, 00000-0000	20210210	product_id1 product_id2

BUDGET

period_id*	date_start	date_end	outgoing	income	net	employee_id
1	20210101	20210131	\$2500	\$2973	\$473	4444444444
2	20210201	20210128	\$3500	\$3728	\$228	4444444444
3	20210201	20210130	\$1598	\$1100	-\$498	4444444444

ACTIVE_INVOICE

order_id*	total_charge	outstanding_balance	date_processed
24671012	\$699.99	\$38.76	20210206
13579111	\$549.99	\$38.34	20210207
47585686	\$239.76	\$0	20210203

INVOICE_HISTORY

order_id*	total_charge	date_processed
24671014	\$699.99	20210201
13579123	\$549.99	20210202
47585665	\$239.76	20210204

EMPLOYEES

employee_no*	user_id*	employee_fn	employee_ln	position	pay	start_date	end_date
9174927	9174927	Joseph	Dodd	Manager	10.00	20210101	20210207
1029832	1029832	Shane	Casiano	Stock	8.25	202101	202102

				clerk		01	08
2039576	2039576	Jade	Spahr	Admin	9.25	20210101	null
1098273	1098273	John	Doe	Sales clerk	7.25	20210101	null

Tables 3.a Tables for database depicting some example elements in schema,

NOTE: Each table displays the entity which it holds above the table, and are collated here for easy viewing.

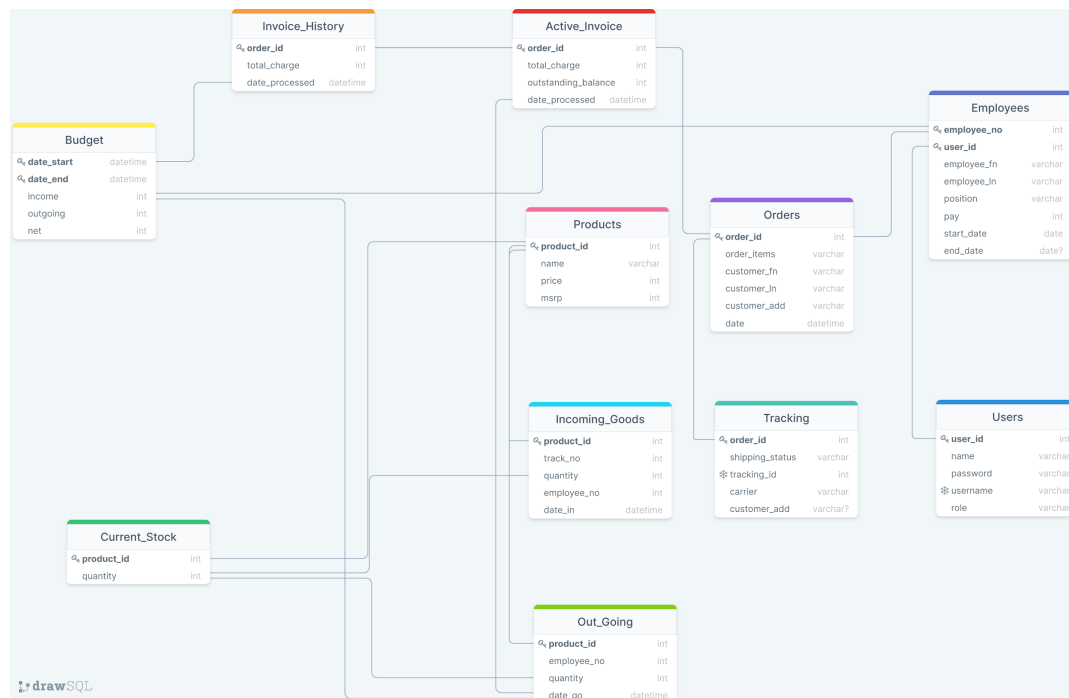


Figure 3.b Schema diagram displaying attribute relations

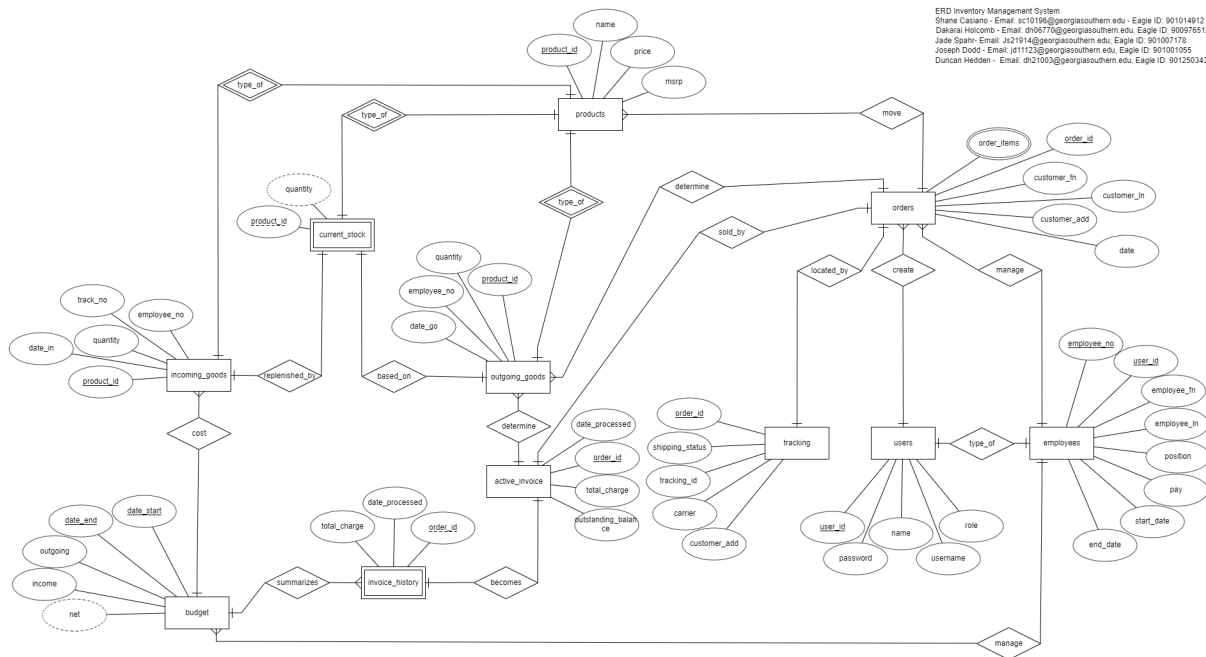


Figure 3.c Modified ERD based on tables 3.a

4. Informal Operations, Additional Views, Constraints:

Authorized personnel who access the database should be able to retrieve any form of data pertaining to the product, including its type, date received, date shipped, as well as the stock of every type of product, updated in real time. Authorized personnel should also be able to update the database by removing a type of product from the database if it is out of stock, recalled, or discontinued. Adding a new type of product and updating it if there are discrepancies in the system caused by human error should follow a similar procedure.

Another company doing business with the warehouse should be able to access (but not edit) the database to run inventory checks. If products are missing, the company should be able to compare the number they have in stock against the number the database listed as having been shipped and received to discover the discrepancies.

Certain integrity constraints that can be enforced on the database can minimize human error. For example, a user should not be able to subtract more from the stock than the current supply or the amount that has been shipped. When a company receives products, it should only add to the amount in stock. String values should not be allowed to be entered in a field that requires an integer value. Null values should not be allowed in the product type or ID fields or any key variable name. Columns that must remain unique include any of the above marked as a key variable. Further constraints in our database include the following. Product ID in all tables must match an existing product in PRODUCTS. Quantity in all tables can not be a negative value. Date must be a formatted

int following YYYYMMDD or YYYY-MM-DD in a DATE variable. Employee number fields must match a current employee. Employee number fields assigned to an order must have the order date fall within the employees start date and end date. Employee end date can be null only if the employee is a current employee. Current stock will be a non-negative value for quantity. Users must have a position regardless of if that position is within the company, from a possible supplier, or customer. Tracking numbers must be formatted according to guidelines by each shipping company Tracking number format will match shipper information. Outgoing goods date will be past an order placement date Net is derived from income and outgoing in budget. Invoice history will contain completed (paid) invoices, an invoice in ACTIVE_INVOICES can not match an invoice in invoice history. Employees must match an active user in USERS.

5. Users:

Employees of a company doing business with the warehouse should be able to use an application with an interface designed for someone not familiar with programming or databases. A manager should be able to access more data than an employee of the manager, though. For example, a cashier should not have access to the dates shipped or received or the actual number of products. They should instead only be notified by the application if they are zeroed out. The manager should be able to keep track of the full supply. This will help the manager with making orders and ensuring the employees are not accidentally or intentionally damaging or stealing products. Distributors of products should be able to fill orders and keep track of supply via invoices. Sales managers should be able to keep up with all the movement and supply of products by distributors so they can ensure the correct number of products is delivered and track any product that may be lost in transit.

6. Architecture:

For this project, we will generally be using MySQL with direct access granted to a JavaFX based program. Database creation and hosting will likely be handled by Microsoft SQL Server. This may change however, to be a system primarily handled by MariaDB instead. These were mainly chosen due to familiarity. These are systems some members of my group have used in the past and wish to expand their knowledge on. Integration between Java and SQL is already implemented in multiple pre-existing libraries that can be used to simplify this project. As far as general architecture goes, we will be following a two tier architecture type where the database is locally hosted and the views are accessed for a particular objective, eg. an employee accessing the budget, access to current_stock, etc. For this project, we believe that this is the most ideal and feasible option to us as the expenses and upkeep for a three-tier architecture are not

possible and a single-tier architecture would not allow us to develop in the way that we want.

6. Wireframes and Model Forms:

The wireframe shows a web browser window for 'InventoryManagementSystem.com'. The browser's address bar is empty, and the page has a navigation menu with links for 'Home', 'Products', 'Company', and 'Login'. The main heading is 'Inventory Management System'. On the left, there is a login form with labels 'Login: Username' and 'Password', each followed by a text input field. Below these fields is a '< Submit' button. To the right of the form is a large square placeholder with a diagonal 'X' inside. Below this placeholder is a block of placeholder text represented by several lines of random characters. The browser window includes standard navigation icons (back, forward, home, etc.) and a search icon in the top right corner.

Figure 7.a Login View

Our inventory Management system will have a login portal similar to the figure above for customers and employees to access and modify the information that pertains to their level of access which can be based on the type of account (ex. Customer, Stocker, Manager, etc).

InventoryManagementSystem/Product_Info.com

[Home](#) | [Products](#) | [Company](#) | [Account](#)

Current Product Reports

Current Product Stock

Customer Orders

A Subtitle

Product Name	Product ID	Quantity	Incoming shipment	Outgoing Shipment	Date of Action	Authorized by(ID)
Oranges	40234666	20	●		02-22-2021	9174927
Cotton	36669908	66		●	02-19-2021	9174927
Butter	46660871	0184	●		01-10-2021	1029832
Television	20193746	48	●		02-7-2021	1029832

2021
Sun, Feb 07

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CANCEL

OK

Update Product information

Page 3

Figure 7.b Product View

Current products that are incoming and outgoing products should be tracked by employees, especially the managers. Each entry on this type of form would show all the product's information, like it's quantity, if it is incoming or outgoing, when the product is expected to go out or come in and the personnel who authorized the product to move. The current product Stock Tab would have a similar set up as the Current Product Reports tab, except it would not report incoming or outgoing goods and their dates and the Employee who would sign off for each product would be the last employee who updated the current stock and date of the update. The Customer orders will just keep track of outgoing shipments with additional customer information, which should only be able to be seen by select individuals. All tabs on this section will show that the shipments coming in and going out can be kept track of on a calendar.

Warehouse Inventory

[Home](#) | [Products](#) | [Company](#) | [Account](#)

Profile Picture

search product

Company Name Customer Company ID

Product Name	Product ID	Quantity in Stock	Packaging type	Price per Item
Cotton	36669908	1029	Bag of 100 Piece	\$1.34
Television	20193746	503	1 Device Per Box	\$150
Oranges	40234666	4020	Per Pound	\$0.50

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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

[CANCEL](#)
[OK](#)

[Update Product information\(Only visible for managers\)](#)

Page 10

Figure 7.c Current Stock View

There will be a way for the customer companies to view products which they can choose from to order. The Managers will be the only ones allowed to change the information on this page using the Update product information form. All other accounts will only be able to reference this information. For employees, there will be an object in the menu items that will allow Employees to report if any product is sold out to a manager or if there are any other discrepancies that can be found within the information on this page.

A Web Page

https://

[Home](#) | [Products](#) | [Company](#) | [Account](#)

Account Information Current Orders

Contact Information

Email Address

Phone Number

Physical Address

Billing Information

Billing Address

Payment Information

Update Information

[Update General Information Link](#)

[Update Security Information](#)

Profile Picture

Company Name

Customer Company ID

☒ Warehouse Supplier

2021
Sun, Feb 07

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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

CANCEL OK

Figure 7.d Account View

Both Employee and Customers will have a profile page. The customer profile will hold basic information needed by the inventory management system including if the customer also supplies the Warehouse with products. Customers in our case are Companies that use or sell products that are sold to them through this warehouse/Inventory Management System which is also stored on this page. There should also be a calendar that will show the incoming and outgoing shipments that the customer has taken part in.

A Web Page
https://

[Home](#)
[Products](#)
[Company](#)
[Account](#)

Profile Picture

Current Orders

Account Information

Company Name
Customer Company ID

Product Name	Product ID	Quantity	Suppling	Receiving	Date of Arrival/Departure	Order ID
Cotton	36669908	66		<input checked="" type="radio"/>	02-19-2021	2019238462
Television	20193746	48	<input checked="" type="radio"/>		02-7-2021	8919374599
Oranges	40234666	20	<input checked="" type="radio"/>		02-21-2021	0298375628

2021
Sun, Feb 07

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FEBRUARY 2021
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S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

CANCEL
OK

Figure 7.e Order View

This tab of the customer account will show the orders the customer is supplying or receiving with a unique order ID, product name and Date of Arrival/Departure. This tab will have the same calendar that is seen on the customer Account Information tab.

This form allows the warehouse to update information pertaining to their incoming, outgoing, and current products. This includes the product ID, MSRP, quantity, and date tracking.

Section 1 of 4

Update Product Information

This form allows the warehouse to update information pertaining to their incoming, outgoing, and current products. This includes the product ID, MSRP, quantity, and date tracking.

What Product Information is being updated? *

1. Incoming goods

2. Outgoing goods

3. Current Stock

After section 1: Continue to next section

Section 2 of 4

Incoming Goods

Description (optional)

Incoming Goods Product ID: *

Short answer text

Product Name: *

Short answer text

Product Price: *

Short answer text

Manufacturer Suggested Retail Price (MSRP): *

Short answer text

Estimated Date of Arrival: *

Month, day, year

Quantity of Shipment: *

Short answer text

Product Tracking Number: *

Short answer text

After section 2: Submit form

Section 3 of 4

Outgoing Goods

Description (optional)

Outgoing Goods Product ID: *

Short answer text

Product Name: *

Short answer text

Product Price: *

Short answer text

Manufacturer Suggested Retail Price (MSRP): *

Short answer text

Date Shipped: *

Month, day, year

Quantity: *

Short answer text

After section 3: Submit form

Section 4 of 4

Current Stock

Description (optional)

Current Product ID:

Short answer text

Product Name:

Short answer text

Product Price:

Short answer text

Manufacturer Suggested Retail Price (MSRP):

Short answer text

Current Quantity:

Short answer text

Figure 7.e Product Update Form

This form is used to update the security information for both employees and customers. Users will have the option to change their password or security questions. They will need to enter their correct current password then input their new password then confirm it by re-entering the new password. Users will have a list of security questions to choose from that they can then answer to add security to their account.

Section 1 of 3

Update Security Information Form

This form is used to update the security information for both employees and customers. Users will have the option to change their password or security questions. They will need to enter their correct current password then input their new password then confirm it by re-entering the new password. Users will have a list of security questions to choose from that they can then answer to add security to their account.

What would you like to change?

☐ Password

☐ Security questions

After section 1

Continue to next section

Section 2 of 3

Change Password

Description (optional)

Current Password *

Short answer text

New Password *

Short answer text

Confirm New Password *

Short answer text

After section 2

Continue to next section

Section 3 of 3

Security Questions

Description (optional)

Customer chosen security question *

Short answer text

Customer chosen security question *

Short answer text

Customer chosen security question *

Short answer text

Figure 7.f Update Security Information Form

This form is used to update information relating to either the customer company or the employee at the warehouse. The warehouse will have the capability to update the customer company's name, user ID, address etc. It will also be able to update information relating to the employees including their name, position and pay.

Section 1 of 3

Update User Information

This form is used to update information relating to either the customer company or the employee at the warehouse. The warehouse will have the capability to update the customer company's name, user ID, address etc. It will also be able to update information relating to the employees including their name, position and pay.

User Type:

☐ Customer Company
☐ Employee

After section 1

Continue to next section

Section 2 of 3

Customer Company

Description (optional)

Company Name

Short answer text

User Name

Short answer text

User ID

Short answer text

User Address

Short answer text

User Phone Number

Short answer text

Physical Address *

Short answer text

Is this Company also a Supplier to our warehouse? *

☐ Yes
☐ No

After section 2

Submit form

Section 3 of 3

Employee

Description (optional)

Employee Number:

Short answer text

User ID:

Short answer text

First Name:

Short answer text

Last Name:

Short answer text

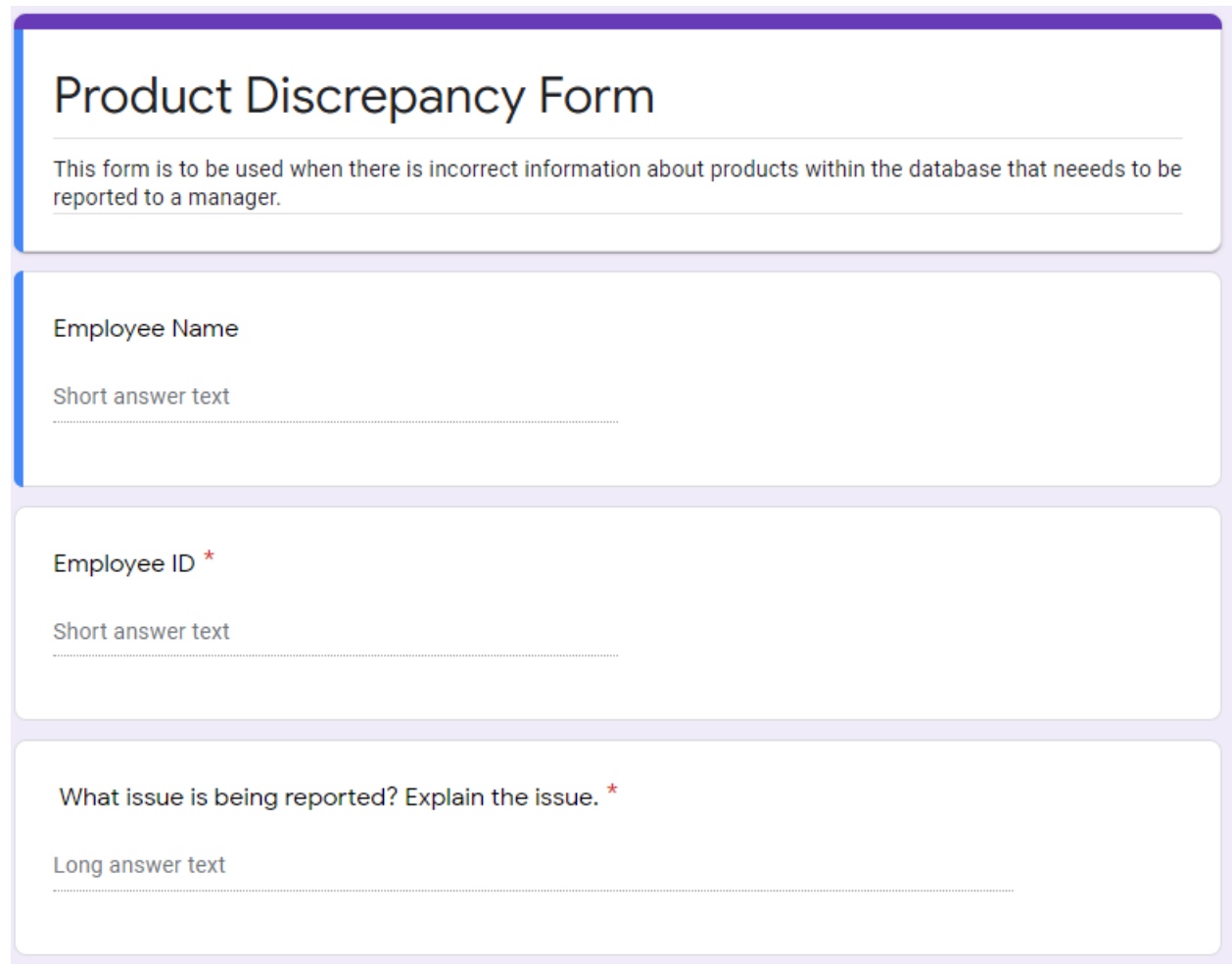
Position:

Short answer text

Pay:

Short answer text

Figure 7.g Update User Information Form

The form is titled "Product Discrepancy Form" in a large, bold, black font. Below the title is a horizontal line, followed by a paragraph of text: "This form is to be used when there is incorrect information about products within the database that needs to be reported to a manager." Below this is another horizontal line. The form is divided into three sections by horizontal lines. The first section is labeled "Employee Name" in a bold, black font, followed by a horizontal line and the text "Short answer text". The second section is labeled "Employee ID" in a bold, black font, followed by a red asterisk, a horizontal line, and the text "Short answer text". The third section is labeled "What issue is being reported? Explain the issue." in a bold, black font, followed by a red asterisk, a horizontal line, and the text "Long answer text".

Product Discrepancy Form

This form is to be used when there is incorrect information about products within the database that needs to be reported to a manager.

Employee Name

Short answer text

Employee ID *

Short answer text

What issue is being reported? Explain the issue. *

Long answer text

Figure 7.h Product Discrepancy Report Form

This form is to be used when an employee that isn't a manager, finds there is incorrect information about products within the database that needs to be reported to a manager.

8. Logical and Physical Design

8.a. Functional Dependencies:

PRODUCTS:

{product_id} ---> {name, price, msrp}

INCOMING_GOODS:

{IPID} ---> {date_in, quantity, track_no}

OUTGOING_GOODS:

{OPID} ---> {date_go, quantity}

CURRENT_STOCK:

{CPID} ---> {quantity}

USERS:

{User_id} ---> {password, name, username, role}

EMPLOYEES:

{Euser_id} ---> {employee_no}

{Euser_id, employee_no} ---> {employee_fn, employee_ln, position, pay, start_date, end_date}

ORDERS:

{order_id} ---> {customer_fn, customer_ln, customer_add, date, Managing_employee}

TRACKING:

{TOrder_id, tracking_id} ---> {shipping_status, carrier}

ACTIVE_INVOICE:

{AOrder_id} ---> {total_charge, outstanding_balance, date_processed}

INVOICE_HISTORY:

{HOID} ---> {total_charge, date_processed}

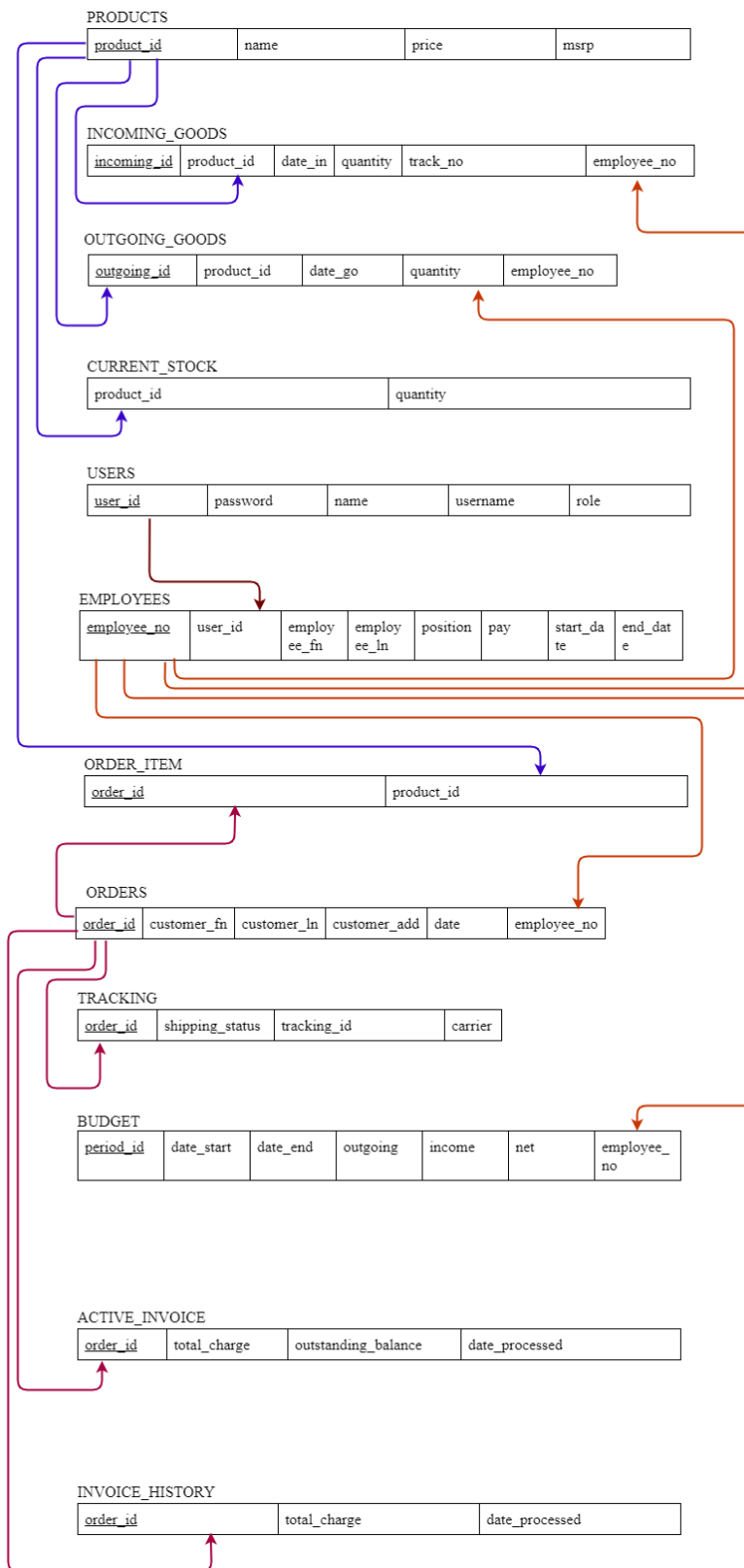


Figure 8.b Relational Schema

8.c. Changes:

No major changes were made to the entity relationship diagram and this elicitation as each of these was made with eventual conversion to a database in mind. There is however, some simplification to the relational schema. Firstly, the schema is now solely based on three separate and distinct sectionals. These are Orders, Products, and Users. Each further table will relay information that is related to one of these three tables by its own primary key. Since all orders are unique, all users are unique, and products listed are assumed to come in with regular intervals, all of these are safe attributes to use as a primary key. They are also directly related back to each prime sectional in the database. Budget is the only table not currently connected to a sectional as its information is mostly derived from other tables. The only unique factors about these is the date it begins and the date it ends. While these do not need to be a composite key, for completeness, it may be better regardless of the redundancy. The only change that was ultimately made was the redefinition of some derived attributes and changes to multivalued attributes. Cust address has remained a single valued attribute as it is simply one string in this context, storage of the segmented address is not needed for this scope and as such has remained the same.