Automotive Parts Manufacturing Database System

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Table of Contents

Project Description:

The Automotive Parts Manufacturing Database System project is dedicated to revolutionizing the way automotive manufacturing companies manage their operations. This comprehensive database system is designed to address the unique challenges and complexities faced by automotive parts manufacturers, such as the quality of automotive components, what suppliers provide components, what parts are delivered to distributors and the inventory of products.

The Automotive Parts Manufacturing Database will manage better the manufacturing process, allowing the product manager keep track what automative components are produced, technical information and quality of products. Also, the distributors can orders automative parts, ensuring a smooth flow of materials and components, reducing procurement lead times, and enhancing collaboration throughout the supply chain. In addition, consumers can use this database to check information of automative parts and list of sellers if they want to replace any parts in their car.

In summary, the Automotive Parts Manufacturing Database System project represents a significant step forward for the automotive industry. By using this system, manufactories always make sure to have right parts on hand, keeping the smooth supply chain. Meanwhile, Automotive Parts Manufacturing Database System can help general consumers finds automative parts easier.

Use Cases:

1) Use case 1: Delays in Automobile Manufacturing

   Actor: Manufacturing Manager (Ana)

   Description: Ana is a Manufacturing Manager at a automative parts manufactory. She is having problems since she does not meet the production target. There is a machine maintenance in the seat belt production step, leading to less seat belts being created. As a result, the delays in seat belt production step slow down the production of car seat, make Ana and manufacturing team fail to reach the production goal. Ana needs a better way to manange amount of every products to make sure she will meet target. Also, she needs a system that provide her overview of ongoing production processes, production targets, and the status of different automotive components in production to avoid the delay in the process.

   The Automotive Parts Manufacturing Database System will help Ana — the Manufacturing Mananger — by keeping track the production targets and the status of production. Since the database system has information of how many components are created everyday, Ana can set up a plan to produce more, which in this case is seat belt, per day. As a result, even the machine maintanence happens, she can have enough seat belts to produce car seat without slow down the whole process. Besides, having an overview of ongoing production processes help Ana avoid the domino affect that a delay in just one section of the production chain can slow down other manufacturing steps.

2) Use case: Poor Quality Manufacturing

Actor: Quality Control Team Leader (John), Manufacturing Manager (Ana)

Description: John is the Quality Control Team Leader at the manufactory. He face the challenge of consistently achieving and maintaining high-quality standards for a wide range of components, which can be time-consuming and prone to human error. He has to face complaints from boss that he did not effectively monitoring and verifying the quality of products, leading to product return from customers. He needs a system that help him set up quality control parameters to ensure that every automative components meet their acceptance criteria. Also, he needs to make sure that all products are checked before they are delievered.

The Automotive Parts Manufacturing Database System will help Quality Control Team Leader — John — by keeping track the quality of products. Because the database system has quality control data, such as material inspections and dimensional measurements, if any deviations from quality standards are detected, John and his member are immediately informed and promptly address the issues. All quality control data, including inspection results, images, and detailed test reports, is automatically stored in the system. This documentation serves as a record of component quality and is easily accessible for audits and traceability. Once defects occur, John can use the system to conduct root cause analysis, pinpointing the source of production issues and implementing corrective actions. Additionally, once John can effectively perform quality check, he can update on time with Ana about how many products do not meet the standards. Therefore, Ana can manage the manufacturing to produce more components to meet the target.

3) Use case: Inventory Shortages

Actor: Inventory Manager (Hue), Manufacturing Manager (Ana)

Description: Hue is the Inventory Manager at a manufactory. She is dealing with the issue of inadequate inventory, impacting customer commitments and operational efficiency. After the COVID-19 pandemic, people's demand for mobility has increased. This increased demand has also led to a rise in car purchases. However, the automotive parts manufacturing industry was frozen for two years during the COVID-19 pandemic, resulting in a shortage of essential components for the car production and assembly process. Inventory shortages can also result in downtime, affecting production targets, managed by Ana. Hence, Hue needs a system helping her ensure that the right automotive parts are readily available.

The Automotive Parts Manufacturing Database System will help Hue, as a the Inventory Mananger, to track the real-time inventory. With up-to-date information of what and how many components are created, how many of them are delivered, the database system enables Hue to keep an eye on which components are in stock and their quantities. The system also has automated reorder feature, which proactively notice Hue and Manufaturing Manager (Ana) when inventory levels fall below specified thresholds. Ana benefits from the system's integration with production scheduling, allowing for seamless coordination between inventory levels and production schedules to minimize downtime. This prevents stockouts and minimizes disruptions. Futhermore, with a wide range of products information, the system supports strategies for stock rotation, ensuring that older parts are used first to reduce the risk of obsolescence.

4) Use case: Distributors' Difficulty in Ordering Automative Parts

Actor: Supply Chain Manager (Dave), Distributors, Inventory Manager (Hue)

Description: Dave is the Supply Chain Manager at a manufactory. He and his team have to handle a large volume of distributor orders after the Covid. Some orders can not be completed due to inventory shortages. For other large orders, Dave need to make sure to process numerous orders from various distributors promptly and accurately. Delays or errors can lead to distributors dissatisfaction and impact their commitments. Hence, Dave and his team need a system that provide detail order, as long as status of inventory so he can has proper response to each order.

The Automotive Parts Manufacturing Database System will help Dave — Supply Chain Manager— and his team to process incoming orders timely and accurately. Distributors, as users of the system, access the platform to place orders for required automotive parts. They provide specific details, including quantities and preferred delivery options. With the order data, the system can automatically checks for inventory availability and send order confirmations to distributors. Dave can now prepare orders based on these accurate information. He is able to send distributors real-time updates on order status through the system. Once the order is complete, Hue can use these order information to update the current inventory status, preventing overcommitment and reducing the risk of stockouts.

5) Use case: Lack of Product Information for Consumers

   Actor: A Random Consumer (Mark), Distributors

   Description: Mark is a driver with his Toyota Corolla. He needs to replace the brake pads on his Corolla. He can either search for an online auto parts store or visit a local parts store, where the local mechanic will contact a distributor to have the brake pads delivered. However, in both situations, he won't receive an Original Equipment Manufacturer part. This is why he require the capability to identify the appropriate brake pads for his car based on its year, make, and model or by accessing a reference website that provides a replacement option for that specific part model number. Therefore, he needs a system that provide the most accurate information of the automative parts that he will buy, because, in most cases, distributors can not resell auto parts once a customer has attempted to install them and discovered they do not fit.

   The Automotive Parts Manufacturing Database System will help Mark become a smart buyer by providing him accurate information of automative components. The system has all technical information of any part the manufactory produces. In addtion, the system may suggest a list of vehicles that fits for the purchased part. This supports Mark to choose the right component and helps distributors save some money.

Functional Database Requirements

1. General User

    1.1. General user is a unregistered user, registered user, or manager roles

    1.2. A general user shall be able to create at most one account with an unique email.

2. Manager Role

    2.1. A role shall be used by many manager accounts.

3. Database System Manager

    3.1. Database System Manager has the manager role.

    3.2. Database System Manager is the only and only user that can edit the roles.

    3.3. Database System Manager is the only and only user that can add new roles to an user.

    3.4. Database System Manager is the only and only user that can remove the roles

4. Manufacturing Manager

    4.1. Manufacturing Manager has the manager role.

    4.2. Manufacturing Manager can keep track the production process of zero to many products

    4.3. Manufacturing Manager is the one and only one can access the production process.

    4.4. Manufacturing Manager can keep track the product quantity of zero to many products.

    4.5. One and only Manufacturing Manager can edit the product quantity.

    4.6. Manufacturing Manager can see zero to many inventory quantity.

5. Product Manager

    5.1. Product Manager has the manager role.

    5.2. Product Manager can edit zero to many product information.

5.3. Product Manager can create new product information.

5.4. Product Manager can see zero to many inventory quantity.

5.5. Product Manager can remove product information.

6. Quality Control Team Leader

6.1. Quality Control Team Leader has the manager role.

6.2. Quality Control Team Leader is the one and only one can edit the quality of the product.

7. Inventory Manager

7.1. Inventory Manager has the manager role.

7.2. Inventory Manager can change zero to many inventory quantity of different products.

7.3. Inventory Manager is the only and only user that can edit inventory quantity.

8. Supply Chain Manager

8.1. Supply Chain Manager has the manager role.

8.2. Supply Chain Manager can send notification to many distributors and suppliers.

8.3. Supply Chain Manager can see zero to many inventory quantity.

9. Supplier

9.1. Supplier is a registered user

9.2. Supplier can receive notifications from zero to many manager roles.

10. Distributor

10.1. Distributor is a registered user.

10.2. Distributor shall place zero to many orders.

10.3. Distributor can receive zero to many messages related to stock status.

10.4. Distributor can subscribe zero to many products.

11. Consumer

    11.1. Consumer is an unregistered user or registered user

    11.2. Consumer can create at most one accounts

    11.3. Consumer can keep track zero to many warranty information.

12. Registered User

    12.1. A registered user is a general user.

    12.2. A registered user has one and only one account.

    12.3. A registered user can login into their account from many devices.

13. Unregistered User

    13.1. An unregistered user is a general user.

    13.2. Unregistered user can see zero to many product information

    13.3. Unregistered user can save zero to many product information in their list

    13.4. Unregistered user can find zero to many distributor at their local.

14. Notifications

    14.1. Notifications shall be send by many manager roles.

    14.2. Manager roles can send out many notifications

    14.3. Notifications shall be recieved by many manager roles and distributors and suppliers.

15. Account

    15.1. An account shall belong to only one user

    15.2. An account shall be associated with only one unique email.

    15.3. An account shall be associated with only one unique phone number.

    15.4. An account can have only one role.

15.5. An account shall have only one profile.

16. Order

16.1. An order shall be place by only one distributor.

16.2. An order shall be kept track by Supply Chain Manager and distributor.

17. Product Information

17.1. Product information shall be displayed to registered and unregistered users and manager roles.

17.2. Product information shall be edited by only one product manager role.

18. Inventory Quantity

18.1. Inventory quantity shall be displayed to many manager role.

Non-functional Database Requirements

1. Security

   1.1. Only encrypted passwords shall be supported by the database system

   1.2. Regular database backups shall be performed at least once a day

2. Scalability

   2.1.The system can handle many user tasking at a time.

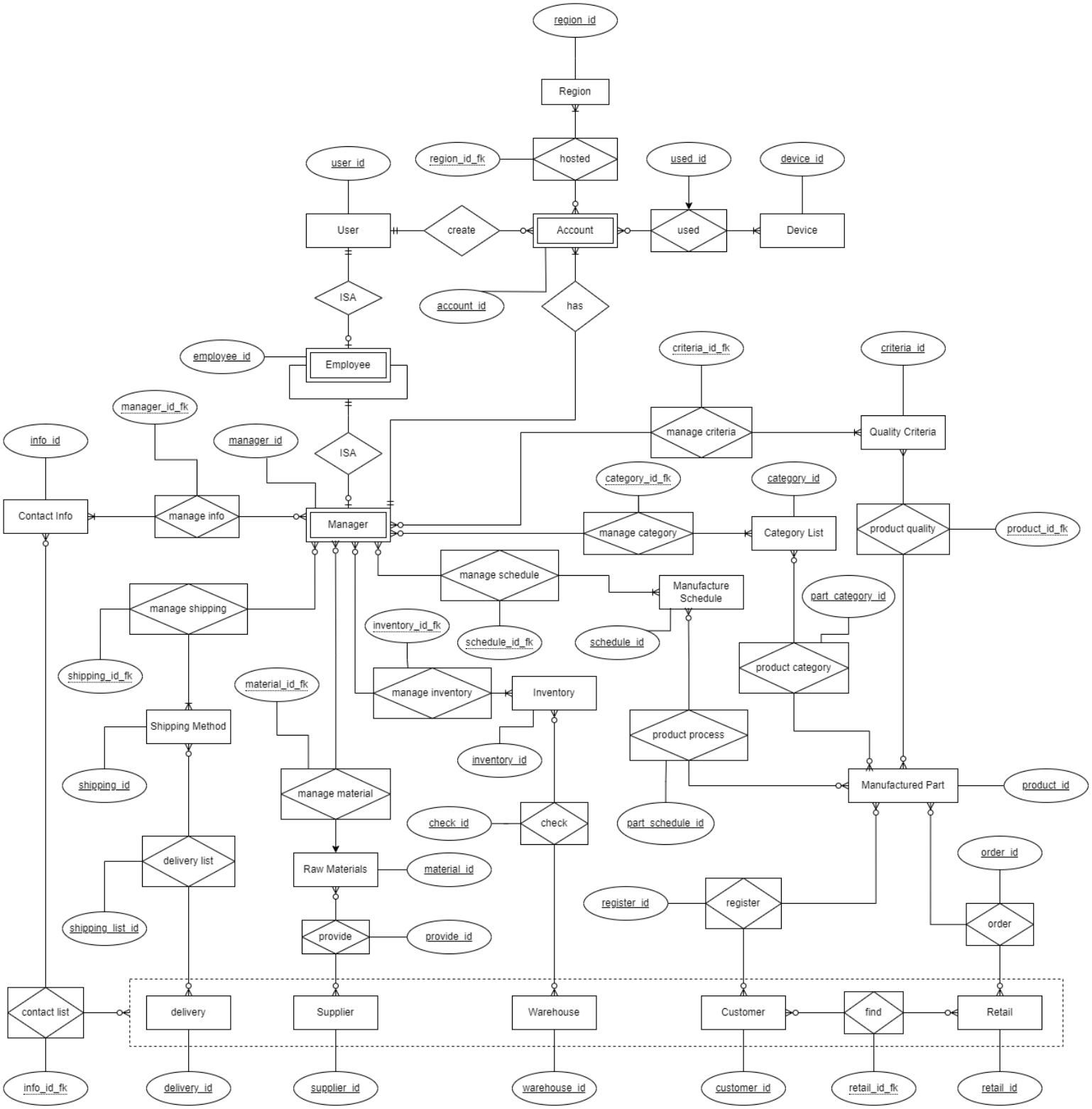
   2.2.The system can handle large data volumes.

3. Compatibility

   3.1.The database system shall be compatible with many browser and devices

   3.2. The system shall be accessible to many type of users

Entity Relationship Diagram (ERD):



Entity Description:

1. User (Strong):
    - user_id: key, numeric
    - username: composite, alphanumeric
    - dob: multi-value, timestamp
2. Account (Weak)
    - account_id: key, numeric
    - user_id: foreign key, numeric
    - create: timestamp
    - manager_account_id: foreign key, numeric
3. Region (Strong)
    - region_id: key, numeric
    - location: composite, alphanumeric
    - area_code: numeric
4. Device (Strong)
    - device_id: key, numeric
    - device_type: alphanumeric
    - device_ip: alphanumeric
5. Employee (Weak)
    - employee_id: key, numeric
    - users_id: foreign key, numeric
    - employee_name: composite, alphanumeric

6. Quality Criteria (Strong)
    - criteria_id: key, numeric
    - criteria_description: alphanumeric
    - criteria_category: alphanumeric
7. Category List (Strong):
    - category_id: key, numeric
    - category_name: alphanumeric
    - category_type: alphanumeric
8. Manufacturing Schedule (Strong)
    - shedule_id: key, numeric
    - schedule_time: multi-value, timestamp
    - manufacture_amount: numeric
9. Inventory List (Strong)
    - inventory_id: key, numeric
    - inventory_name: alphanumeric
    - inventory_date: timestamp
10. Raw Materials (Strong)
    - material_id: key, numeric
    - material_name: alphanumeric
    - material_description: alphanumeric
11. Shipping Method (Strong)
    - shipping_id: key, numeric
    - shipping_type: alphanumeric

- shipping_date: timestamp

12. Contact Info (Strong)
    - info_id: key, numeric
    - info_type: multivalue, alphanumeric
    - detail_information: alphanumeric
13. Manufactured Parts (Strong)
    - part_id: key, numeric
    - part_name: alphanumeric
    - part_desciption: alphanumeric
14. Supplier (Strong)
    - supplier_id: key, numeric
    - supplier_name: alphanumeric
    - supplier_location: alphnumeric
15. Delivery (Strong)
    - deliver_id: key, numeric
    - deliver_name: alphanumeric
    - deliver_location: alphanumeric
16. Warehouse (Strong)
    - warehouse_id: key, numeric
    - warehouse_name: alphnumeric
    - warehouse_location: alphanumeric
17. Customer (Strong)
    - customer_id: key, numeric

- customer_name: alphanumeric
- customer_location: alphanumeric

18. Retail Company (Strong)
    - retail_id: key, numeric
    - retail_name: alphanumeric
    - retail_location: alphanumeric
19. Hosted (Weak)
    - region_id: foreign key, numeric
    - account_id: foreign key, numeric
    - host_id: key, numeric
20. Used (Weak)
    - account_id: foreign key, numeric
    - used_id: key, numeric
    - device_id: foreign key, numeric
21. Manager (Weak)
    - employee_id: foreign key, numeric
    - manager_id: key, numeric
    - manager_name: alphnumeric
22. Locate (Weak)
    - region_id: foreign key, numeric
    - product_id: foreign key, numeric
    - product_category: foreign key, alphnumeric
23. Product Quality (Weak)

- product_id: foreign key, numeric
- product_name: foreign key, alphanumeric
- quality_status: foreign key, numeric

24. Product Category (Weak)

- product_id: foreign key, numeric
- category_id: foreign key, numeric
- category_type: foreign key, alphanumeric

25. Process Status (Weak)

- product_id: foreign key, numeric
- product_shedule: foreign key, numeric
- product_time: timestamp

26. Product Inventory (Weak)

- product_id: foreign key, numeric
- inventory_id: foreign key, numeric
- product_amount: numeric

27. Product Information (Weak)

- product_id: foreign key, numeric
- description_id: foreign key, numeric
- category_ id: foreign key, numeric

28. Provide (Weak)

- material_id: foreign key, numeric
- supplier_id: foreign key, numeric
- provide_date: timestamp

29. Track (Weak)

- material_id: foreign key, numeric
- supplier_id: foreign key, numeric
- material_quantity: numeric

30. Delivery List (Weak)

- product_id: foreign key, numeric
- shipping_bill: foreign key, numeric
- shipping_type: foreign key, alphanumeric

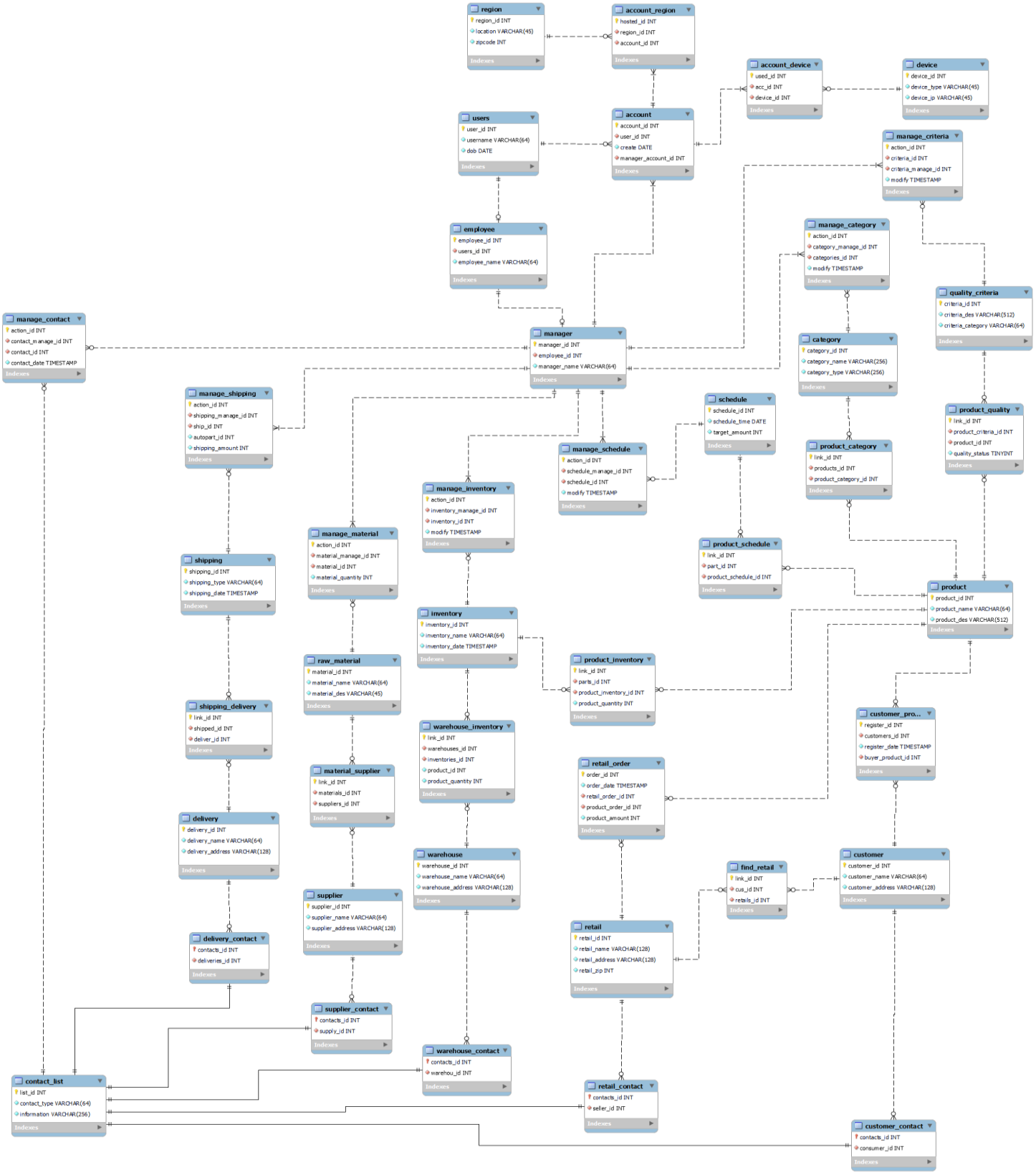
31. Message (Weak)

- info_id: foreign key, numeric
- date: timestamp
- sender_id: foreign key, numeric
- receiver_id: foreign key, numeric

32. Contact List (Weak)

- info_id: foreign key, numeric
- contact_type: alphanumeric
- reciever_type: alphanumeric

Entity Establishment Relationship Diagram (EER)



Constraints Description

TABLE	FK	ON DELETE	ON UPDATE	COMMENT
account	user	CASCADE	CASCADE	If a user is deleted, then the account from that user must also be deleted
account	manager	CASCADE	CASCADE	If a manager is deleted, then the account from that manager must be deleted as well
account_region	region	CASCADE	CASCADE	An update/delete in region will update/delete account_region entity
account_region	account	CASCADE	CASCADE	An update/delete in account will update/delete account_region entity
account_device	account	CASCADE	CASCADE	An update/delete in account will update/delete account_device entity
account_device	device	RESTRICT	RESTRICT	If a device is removed, the account still exist
employee	user	CASCADE	CASCADE	If a user is deleted, then the employee role from that user must be deleted as well
manager	employee	CASCADE	CASCADE	If an employee is removed, then the manager role of that employee must be deleted
manage_criteria	criteria	CASCADE	CASCADE	If a criteria is removed, there's no quality criteria to manage
manage_criteria	manager	RESTRICT	RESTRICT	If a manager role is deleted, the criteria still exist to be managed by other managers
manage_category	category	CASCADE	CASCADE	If a category is removed, there's no category to manage
manage_category	manager	RESTRICT	RESTRICT	If a manager role is deleted, the product category still exist
manage_schedule	schedule	CASCADE	CASCADE	If a schedule is removed, there's no schedule to manage
manage_schedule	manager	RESTRICT	RESTRICT	If a manager role is deleted, the schedule still exist to be managed by other managers
manage_inventory	inventory	CASCADE	CASCADE	If a inventory is remove, there's no inventory to manage
manage_inventory	manager	RESTRICT	RESTRICT	If a manager role is deleted, the product inventory still exist to be managed by other managers
manage_material	material	CASCADE	CASCADE	If raw materials is removed, there's no materials to manage
manage_material	manager	RESTRICT	RESTRICT	If a manager role is deleted, the materials still exist to be managed by other managers
manage_shipping	ship	CASCADE	CASCADE	If shipping method is remove, there's no method to choose
manage_shipping	manager	RESTRICT	RESTRICT	If a manager role is deleted, the shipping method still exist
manage_contact	contact	CASCADE	CASCADE	If contact information is removed, there's no information to keep track

manage_contact	manager	RESTRICT	RESTRICT	If a manager role is deleted, the contact info list still exist to be managed by other managers
product_quality	criteria	CASCADE	CASCADE	If a criteria is removed, products do not have quality criteria to check
product_quality	product	CASCADE	CASCADE	If a product is removed, there's no product to check quality
product_category	category	CASCADE	CASCADE	If a category is removed, products do not have category describing the product
product_category	product	CASCADE	CASCADE	If a product is removed, there's no product in the category
product_schedule	schedule	CASCADE	CASCADE	If a schedule is removed, products do not have schedule to manufacture
product_schedule	product	CASCADE	CASCADE	If a product is removed, there's no manufacturing schedule for that product
product_inventory	inventory	CASCADE	CASCADE	If a inventory is removed, theres's no inventory for products
product_inventory	product	CASCADE	CASCADE	If a product is removed, there's product for inventory
warehouse_inventory	warehouse	CASCADE	CASCADE	If a warehouse is removed, theres's no warehouse to do inventory
warehouse_inventory	inventory	CASCADE	CASCADE	If a inventory is remove, theres's no inventory in the warehouse
material_supplier	material	CASCADE	CASCADE	If a material is removed, theres's no materials provided by supplier
material_supplier	supplier	CASCADE	CASCADE	If a supplier is removed, theres's no supplier provide materials
shipping_delivery	deliver	CASCADE	CASCADE	If a deliver company is removed, there's no service provide shipping option
shipping_delivery	shipping	CASCADE	CASCADE	If a shipping method is removed, there's no shipping option available
delivery_contact	contact	CASCADE	CASCADE	If a contact info is removed, there's no contact info for the deliver company
delivery_contact	deliver	CASCADE	CASCADE	If a deliver is removed, there's no company to contact
supplier_contact	contact	CASCADE	CASCADE	If a contact info is removed, there's no contact info for the supplier
supplier_contact	supplier	CASCADE	CASCADE	If a supplier is removed, there's no company to contact
warehouse_contact	contact	CASCADE	CASCADE	If a contact info is removed, there's no contact info for the warehouse
warehouse_contact	warehouse	CASCADE	CASCADE	If a warehouse is removed, there's no company to contact
retail_contact	contact	CASCADE	CASCADE	If a contact info is removed, there's no contact info for the retail
retail_contact	retail	CASCADE	CASCADE	If a retail is removed, there's no company to contact

customer_contact	contact	CASCADE	CASCADE	If a contact info is removed, there's no contact info for the customer
customer_contact	customer	CASCADE	CASCADE	If a customer is removed, there's no company to contact