Teaching Case

Electronic Pigeons: A Drone Delivery Database

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Abstract

Electronic Pigeons (EP) is a database design and management case study. EP is a drone delivery service company requesting students to develop a database in order to track their drones, deliveries, and the associated products. Developed for use in a Database Management course, it enhances student's ability and learning of entity relationship diagram (ERD) and SQL coding skillsets. It is designed as a semester long group project, but may be used for a more advanced individual class assignment. This assignment is currently designed using MySQL Workbench, but may be adjusted for various databases (MS Access, SQL Server, etc). Teaching notes containing suggestions and a possible solution are provided upon request.

Keywords: Database Design, SQL, Database Management, Pedagogy, ERD, MySQL Workbench

1. CASE INFORMATION

Electronic Pigeons (EP) is a delivery service specializing in product delivery using drones. The service is focused on the delivery of physical goods, in competition with the postal service or FedEx. In conjunction with a custom application and mobile app to be developed separately, the owners need a database to keep track of the drones, products, and deliveries.

The company owns a fleet of drones that are tracked by their FAA registration number, their brand, model number, weight, delivery capacity in pounds, distance limit in miles per flight, and an optional nickname. Currently, there are 25 drones in the fleet, but the company expects to ultimately have over 200 drones at multiple locations. Also, we need to know when a drone was placed in service and when it is retired.

Delivery Process
A delivery is initiated by the end customers (*not the store from which the product is delivered*). The customers first place an order for delivery of a product. An order can be split into multiple deliveries, since each drone can only carry a certain maximum weight per flight. However, each delivery is associated with a single order (in other words, a drone cannot deliver goods from multiple orders on a single flight). EP needs to track the name, billing address, phone, email address, and other appropriate information. Some customers are members of the "PigeonPlayers" club, a preferred customer club which entitles them to discounts on deliveries and more. Customers pay extra for this service, which lasts for one year. EP needs to know who these members are, and when their membership expires.

For each delivery, the owner needs to know which drone was involved, the scheduled delivery date and time, the actual date and time when the delivery was made, the current status of the order, and any comments that need to be made regarding the delivery. The status refers to the current state of the order, such as cancelled, in process, in flight, delivered, etc. We also need an estimate of the round trip distance flown by the drone on the delivery.

Stores and their Products
The company ships products for ten stores at this point in time. However, they expect to expand rapidly. For the purpose of this project, feel free to select a specific type of product of your choosing for now. For example, your group can choose to specialize in hardware stores, book stores, pharmacies, office supplies, or any other non-food oriented business. (No restaurants, beer deliveries, groceries, etc.) Eventually, the service will include a variety of products and stores, but the company is focusing on specialization for now.

Each product is stocked from a particular store, which may stock numerous products. Since EP is responsible for the actual inventory and sales, they do not need to track this inventory nor product sales other than the delivery charges in the database – that is the responsibility of the stores themselves. However, we definitely need to track the name, location, and contact information for each store from which we deliver. For each product, we need to track the product ID number, the store's model number or product ID (which may differ from EP's product ID), description, color (if appropriate), shipping weight in pounds, and other attributes where appropriate, such as size, brand, and manufacturer. The retail price of each item is also tracked for insurance purpose.

Each order may include as many products as a customer wishes to purchase from each store, in whatever quantity they desire.   An order contains the delivery address, the date ordered, the delivery charge, payment information (cash or credit, along with appropriate confirmation numbers), and any other pertinent information EP may wish to track. Keep in mind that the delivery address may differ from the customer's billing address. Also, the confirmation for credit payments needs to be tracked as well. However, EP does not track individual credit cards or associated information. Instead, the payments are processed through a processing service for security purposes.

2. REQUIRED DATABASE FUNCTIONALITY

EP needs the following functionality from their database. Please make sure that these needs are met to satisfaction.

Data Input Capability (Input Forms)
EP needs the ability to enter new data to the database, based on forms included in the application front ends. Specifically, this includes the following:
1. Add new customer
2. Add new order for a given customer, along with the products on each order
3. Add new stores
4. Add new products for a given store
5. Add and schedule a delivery for a given order
6. Add new drones to the fleet.

Modification and Update Capabilities (Application Forms)
EP needs the ability to modify information in the tables. For instance,
7. What if we need to change the drone registration?
8. What if we change an order's status?
9. How do you cancel a delivery?
10. How do you change the delivery charge?
11. How do you delete a customer?

Required Outputs (Queries and Reports)
12. List of product IDs and descriptions for a given store
13. List of customers, including names and customer ID numbers
14. List of names and customer IDs for preferred customers.
15. List the name of all drones currently in service
16. List info for all deliveries on a given date (specifically, include at least the delivery id, date of delivery, and order number)
17. The total number of miles flown by a given drone in its' service life.
18. The id and date for all cancelled deliveries
19. The delivery id and order id for all open (undelivered) deliveries
20. List info (delivery id, order id, and zip code) for all deliveries by zip code
21. List the name and id of all customers placing 5 or more orders
22. List the name and id of the customers placing the most orders
23. The total number of orders by store
24. List all relevant information for a complete order, including the customer, product, store, drone, and delivery information

25. Total delivery revenues by store
26. Total revenues by month delivered
27. Average number of days between order and delivery
28. List the id and total weight for each delivery
29. Average, maximum, minimum, and total weight for all deliveries (also: by drone)

3. REQUIRED DELIVERABLES

Timeline and Intermediate Deliverables
Throughout the semester, there will be opportunities to meet and ask questions with the instructor. There are tentative due dates (see Appendix, Fig 1) in which each group should have completed or are near completion with this portion of the assignment to meet the final deadline. During these times, students should be drafting/revising an ERD, creating a data dictionary and SQL code, entering sample data

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and addressing any requirements or concerns requested by EP.

Final Deliverables
The following items are an overview of the items required for your final deliverable:

- Detailed data model in 3rd normal form. The data model cannot include M:N relationships, and must have all keys clearly identified. Complete this data model using MySQL Workbench.
- Complete SQL code to create the database. Code should include sufficient comments to explain any ambiguous or unclear parts.
- Complete SQL code to include sample data in sufficient quantities to generate the required outputs. Data is to be created randomly as needed to demonstrate functionality

Appendix

Event	Date	Items Due
Checkpoint 1	[INSERT SAMPLE DATE]	First Draft of ERD
Checkpoint 2	[INSERT SAMPLE DATE]	Data Dictionary SQL CREATE, INSERT Statements
Final Deliverables	[INSERT SAMPLE DATE]	1. Final ERD 2. Data Dictionary 3. Complete SQL: • CREATE • INSERT • SELECT • All other outputs

Figure 1. Checkpoint Table