Plant Nursery Database Documentation

Aaron Reamer

A.

This project involves the creation of an application utilizing a database for a company. First, I must create a conceptual design of the database and justify my design choices. This involves the creation of an Entity-Relationship diagram that will be able to fulfill the necessary requirements. Next, I design the tables for all entities and relations by mapping the design onto a relational data model. Next, I create the database and the scripts needed for it. Additionally, I will need to design the user interface for the application. Next, I need to finalize the application in a Jupiter notebook that satisfies the user requirements. Finally, I create a user guide for the application.

The user will require an application for their business. They will need to track what kind of plants they have, all the pots a what plants are in them, the trays that contain those pots, and micro-weather stations that measure the conditions of the area. The user needs to be able to access this data and add new data appropriately. I need to decide how certain logs are stored in the database and how items such as pots and measurements are stored in the database based on how many items that entity tracks. This applies to the logs for the pots which can have any number of entries, the number of pots in a tray which is a max of 12, and the weather measurements which keep only the 10 most recent.

B.

Below is the current E-R diagram designed for the database concept. The datatype constraints are listed with the attributes, and the primary keys are labeled with a key symbol. Below are also justifications for the design and further constraints when necessary.

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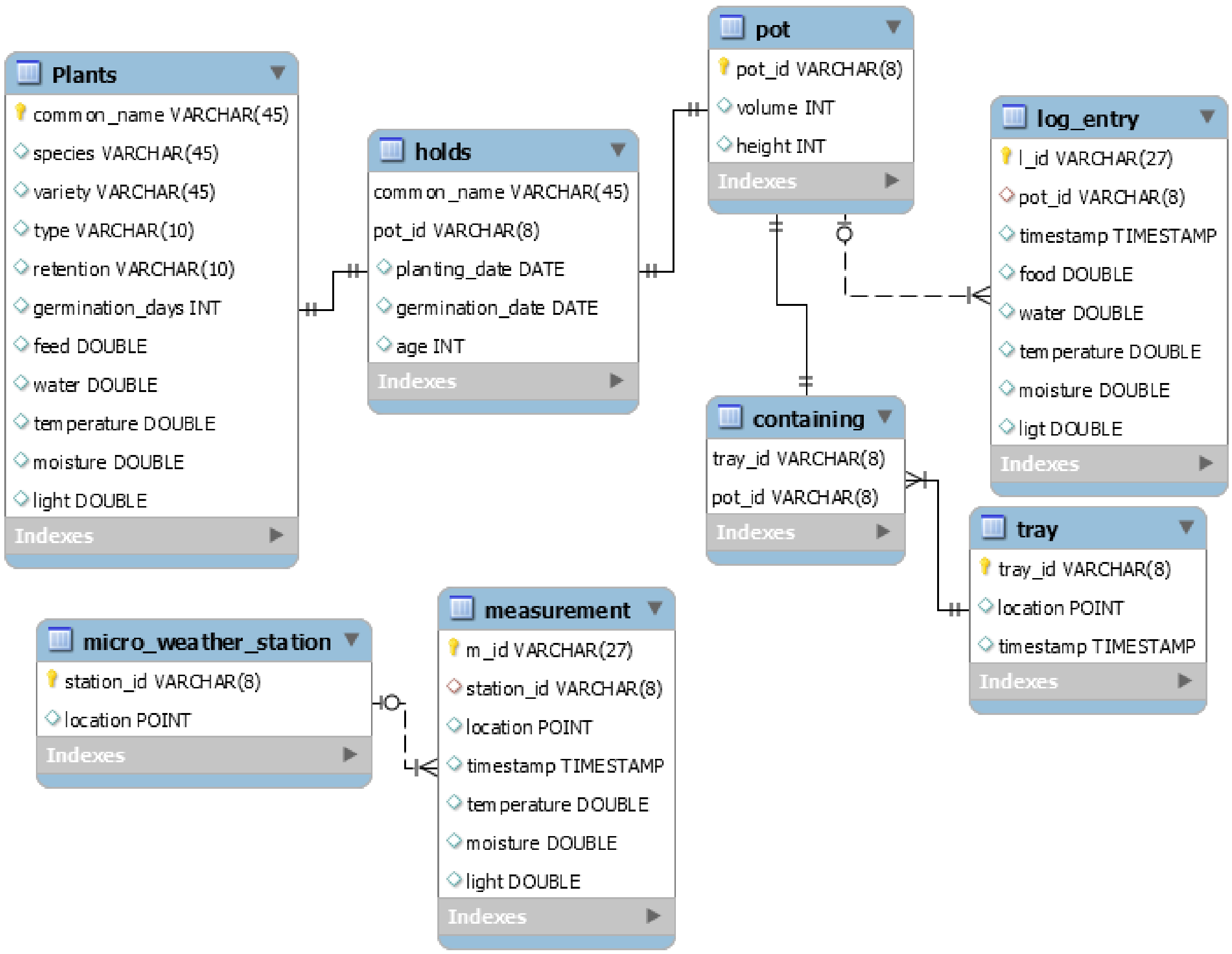

- **plants**
  - **common_name** – Unique to each plant so it was set to the primary key.
  - **species variety**
  - **type** – This is restricted to “herbs”, “vegetables”, or “flowers”.
  - **Retention** – This is restricted to “annual” or “perennials”.
  - **germination_days.**
  - **feed**
  - **water**
  - **temperature**
  - **moisture**
  - **light**

- **pot**
  - **pot_id**

  - **Volume** – Restricted to 1, 2, 3, 4, 5, 7, 10, 15, and 25.
  - **Height** – Restricted to 3, 4, 5, 6, 6.5, 7, 8, 12, and 14.

- **log_entry**
  - **l_id** – Individual id
  - **pot_id** – Foreign key
  - **timestamp**
  - **food**
  - **water**
  - **temperature**
  - **moisture**
  - **light**

- **tray**
  - **location**
  - **timestamp** – Time of last action on the tray.

- **Micro_weather_station**
  - **station_id**
  - **location**

- **measurement**
  - **m_id** – Individual id
  - **station_id** - Foreign key
  - **location**
  - **timestamp**
  - **temperature**
  - **moisture**
  - **light**
- **holds**
  - **common_name** - Foreign key
  - **pot_id** - Foreign key
  - **planting date**
  - **germination_date**

  - **age** – Will be generated from an expression that takes the difference between the current date and the date of germination.
- **Containing**
  - **tray_id** - Foreign key
  - **pot_id** - Foreign key

General restriction choices:

Restrictions of all instances of food/feed, water, temperature, moisture, and light were set as doubles since each is an amount of a unit of measurement that is unspecified. This allows the value to have numbers with decimals which the user may want for their measurements. Other instances had fixed possibilities and the length was set to the largest possible value. Locations are restricted to (x,y) point since the shop is on a xy-Cartesian Coordinate Reference.

Relations:

holds: Will provide what plant a pot holds. One pot holds one plant. Additionally, contains individual information on that instance of a potted plant.

contains: Will provide what pots a tray holds. Will be restricted to 12. One tray contains Up to 12 pots.

log_entry: Is associated directly with a pot. Each instance contains one entry of a log since there can be any number of activity log entries.

measurement: Is associated directly with a micro-weather station. Each one contains the data for one measurement. The maximum number of these associated with each station will be 10. Those 10 will be the ones with the most recent timestamp, deleting the least recent one when the number of measurements would surpass 10.

C.

The logical design utilizes the information in the E-R diagram in part B.

Entities:

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pot_id, station_id, tray_id: The IDs here use 8-character strings. This is convenient since many items will be similar and this allows the user to create a naming scheme without taking up too much data.

m_id, l_id: The IDs for measurements and logs are their own entities. They are made from the ID of pots or stations respectively and the timestamp. This makes each unique since multiple measurements/logs during the same exact second from the same entity should not happen since those would be the same log/measurement.

common_name, species, variety: Theses have a larger character length. No plant species have a name that passes 45 characters and the variety is usually in the common name, so it shouldn't be longer than the common name. Even so, any shortened words should not be confused with each other if they ever become necessary.

Other variables are given types accordingly. Food, water, and weather variables are doubles to allow for decimals. Other variables are dates, timestamps, and ints to fit the requirements for the information.

Views:

holds: The virtual table "holds" is a view with the actual data held in a table called "holds_data". The table "holds_data" contains "planting_date" as well as the foreign keys. The table also has the calculated variable "germination_date" from planting_date and the germination_days from the table "plants". The view calculates age from the current date and germination_date.

plants: This is simply a virtual table created from the inner natural join of plants, holds, and pots. This join is used a lot, so a view was created to make thing easier.

Other notes:

Many variables are reused but kept separate due to having different limitations on when they may be there.

D.

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The scripts for the database are written to the design. Whenever a measurement is taken, the oldest measurement is deleted if the number of measurements associated with a station is greater than 10. This maintains the restriction on the number of measurements. Whenever any object on a tray is acted on, the tray timestamp updates to the current time. Most functionality is based around procedures with some transactions imbedded to make most uses just requiring a call and inputs.

E.

The Jupyter notebook application was designed to interact with the database. The notebook is used by running blocks of code that perform the specific action. The application is designed to demonstrate the database functions and fulfill feature requirements. Few files are used with just loading sample data and dropping everything. This makes these features easier to implement since these files would be created anyways. The file createAll.sql needs to be ran first on its own in MySQL. This is because if it is run through Jupyter notebook it will create the tables, but not the procedures that are needed to utilize the database.

F.

The user guide is integrated with the Jupyter notebook application. With each code block there are some explanations on using it as well as writing explaining the general application. Additionally, there is a README text file for using all files.