CSCI4333 Database Project

Swarm Robot Trajectory Database

Swarm robots are tiny robots that can perform programmed actions independently without human interference. These tiny robots are crucial for many real-world tasks (e.g. resource foraging). Yet, ensuring robot swarm system is working properly can be challenging. Robots may damage and gradually lose control for various reasons such as mechanism failures.

In this database project, you aim to design a data analysis system to help detect potential weird issues existed in the system. In the first step, you design database is similar to the simulation of the interaction presented in the real world. Here are some basic data files:

1. *robot.csv*: Each robot has an id and name.
2. $t1.csv$ to $t5.csv$ For each robot, a sensor reading will record robot location (x-axis, y-axis, measured by cm) at each time stamp (measured by second). Each row in the file indicates a specific time stamp starting from 1.
3. *target_interval.csv*: Each row in this file represents a time interval (defined by start time and end time) highlighted the target time interval. Each interval is described by *start_time*, *end_time*, *event_type*.

You need to design the database to help the researchers to check robot status.

Task 1: (5 pt) Write a ER Diagram and the relational schema to design database. Note that the original storage format is not optimal for the database. You need to redesign tables based on the ER Diagram that you think is the best fit for the data.

Task 2: (5 pt) Build a database (named as *robot.db*) via Python and SQLite and import the data in the CSV file into the database.

Task 3: (5 pt) Using SQL, return the following information related to meta-info of the data (print out the query result is sufficient).

1. A table consists of the names of robots and the maximal x-axis, minimum x-axis reached by this robot.
2. A table consists of the names of robots and the maximal y-axis, minimum y-axis reached by this robot.

Task 4: (5 pt) Using SQL, write code to analyze the following info related to robot trajectory:

1. Suppose we define two robots are close with each other if 'both x-axis and y-axis' difference is smaller than 1 cm. Return all the regions (measured by x_min, x_max, y_min, y_max) that robot "Astro" and "IamHuman" are closed with each other.

2. For the same robots, measured how many secs that they are close with each other.

3. (bonus) For all the target interval, calculate if the average robot moving speed is smaller than 0.2 cm/s. You code should print out a table that each row consists the interval id, and the answer (Yes or No). Feel free to use python to print out this table.