

INFS1200/7900 Information Systems

Assignment (30 Marks)

Due 5.00 PM Friday, 29 May 2009 (Week 12)

This assignment consists of design and development of an information system. The first part of the assignment consists of the design, which includes construction of an ER diagram, mapping to the relational schema and further normalization of the relational schema if required. The necessary information for schema design is given in the Universe of Discourse (UoD) described below. In the second part of the assignment, the designed schema will be implemented in *MS Access*. The implementation will include creating forms, queries and reports for the system. The functionality of these forms and reports is also given below.

1 Universe of Discourse: *Product Provenance*

Radio Frequency Identification (RFID) is a wireless communication technology that uses radio-frequency waves to transfer information between tagged objects and readers without line of sight. This creates tremendous opportunities for linking real world objects into a world of “Internet of things” [1, 2]. In coming years, there will be billions of RFID tags living in the world tagging almost everything for tracking and identification purposes. Since all man-made items can be RFID tagged, we can track and trace a product in its life time. This project is to create an information system for users to inquiry about a product for its provenance.

A product is a man-made item. It has information about the manufacturer, item name, item category, production date, product description, expiry date, EPC (Electronic Product Code – used to identify a product, see <http://www.epcglobalinc.org/home>), etc.

A product can be in different categories and a category has different products. A category can have sub-categories. A category is described by its category ID, name, description, etc.

A tracking record can record information about where, when, and what product is detected by an RFID reader. It is a ternary tuple: (RFID-Reader ID, Timestamp, and EPC).

A tracing record is a sequence of tracking records about a product from the time when the product is manufactured to the current time.

A location has its latitude and longitude recoded and the description about the location such as the country name, the street address, and/or building name, etc.

Every RFID reader is associated with a network IP address. An RFID reader can either be a fix reader or a mobile reader. A fixed RFID reader is associated with a location. A mobile reader is associated with its current location automatically updated by the network communications. Every RFID reader is owned by an owner who can be a company or an individual person. No two companies or individuals can own the same RFID reader.

A company can be a manufacturer, a product distributor, or a retailer. A company is identified by a company ID, name, description, company trademark, the type of business (manufacturer, distributor, retailer), the locations (including countries and addresses within each country), and contact details (e.g., contact numbers, persons, and website). A location may have multiple RFID readers.

An individual person who could have zero or many RFID readers to read tagged items must be registered with the name, contact details, the valid time period that the user is registered, the ownership of the readers, and the ownership of any number of RFID tagged items.

A product must be owned by either a company or by an individual. There is no joint ownership at any given time. A product can be read by any reader at any time at any location. The ownership of a product at any given time point can be inferred by using the range of timestamps.

A company or an individual can log into the system with the user name and password to issue queries to trace the history of products. A company or an individual can also insert, delete, and update their own details after they logged in. The RFID tracking data is assumed to be automatically loaded into the system by network communications connected to the readers. The ownership of products is assumed to be automatically updated by the communications network. The ownership of RFID readers can be updated manually.

REFERENCES

- [1]. Quan Z. Sheng, Xue Li, Sherali Zeadally (2008), [Enabling Next-Generation RFID Applications: Solutions and Challenges](#), *Computer* (IEEE), 41(9): 22-29, September 2008.
- [2]. John P.T. Mo, Quan Z. Sheng, Xue Li, Sherali Zeadally (2009), [RFID Infrastructure Design: A Case Study of Two Australian National RFID Projects](#), *Internet Computing* (IEEE), Jan/Feb Issue 2009, pp.14-21.

2 Schema Design (PART I)

Quality and correctness of schema design is a significant part of this assessment (see assessment below). The following describe what is expected in the design part of the assignment.

2.1 ER Diagram

Create an ER diagram to represent the conceptual schema described by the Universe of Discourse. For cardinality and participation dependencies you may use either standard notation, or the alternate (min, max) notation, but not both.

State clearly any assumptions you make regarding your design approach. Please note that you cannot make assumptions to simplify or compromise the completeness of the Universe of Discourse. If there are any points that need clarification, in the specification of the Universe of Discourse as given above, you must first attempt to clarify them with your tutor and/or lecturer. As far as possible, refrain from making your own assumptions.

2.2 Mapping

Map the ER diagram created in 2.1 to a relational schema. Document the mapping steps. The final schema should be given in the notation as given in your lecture notes, e.g. R1 (keyattr, attr1, attr2, ...). In order to identify referential integrity constraints, be sure to either use the same names of the referenced/referencing attributes, or write this separately e.g. R1(attr1) references R2(somekeyattr). You can also use a schema diagram which identifies referential integrity constraints through arrows.

2.3 Normalization

All relations resulting from the ER-Relational mapping should be normalized (when required) up to the third normal form (3NF). Document your reasons for normalization, clearly stating the normal form of the original relation, and of the resulting relation(s).

Tip. It is highly likely that the relations in the schema you come up with at the end of the ER-Relational mapping (see section 2.2) are already in 3NF. However, you still need to write the (non-trivial) FDs between the attributes of each of the relations you designed, and demonstrate that the relation is actually in 3NF by running the 3NF test on it.

3 Implementation (PART II)

The following describe the scope and requirements of the information system to be developed in MS Access:

3.1 Forms

Your system should include at least the following forms/screens that allow the user to add, remove, find and modify the records:

- A user data entry form for a company or an individual person.
- A form to enter new RFID readers and their owners.
- A form for querying on the ownership of RFID readers.
- A form for querying on the ownership of products.
- A form to query a product data about its current status.
- A form to query the tracking history of a product (e.g., a tracing record of a product).

The user data entry form should include 4 command buttons: “Add Record”, “Delete Record”, “Find Record” and “Close Form”.

At least one form should contain a sub form.

One of the forms should include a combo box.

3.2 Reports

The following set of reports is to be developed:

- User Report: This report is to be generated for each user either a company or an individual person (user details appearing as page header), listing the details of its current ownerships about RFID readers and product items. A report should be able to print our report in multiple pages with proper header and footer on each page.
- Product History Report: For a given product print out its history in the order of the timestamps that the product has been tracked by RFID readers and list the locations details.
- RFID Reader Report: For a given RFID reader, print out the products that the reader has ever tracked. The products details should be given and sorted according to the timestamps of readings.

3.3 Constraints

The system should enforce basic constraints, such as:

- Referential integrity. Multiple referential integrity constraints can be extracted from the specification.
- Domain. Attribute values are restricted to the allowed data types.
- Key and Entity integrity constraints.
- Semantic constraints as given in the Universe of Discourse.

4 Notes

4.1 User Interface

Use very few (if any) pieces of clip art or fancy images to keep your resulting *MS Access* database file as small as possible. Basic graphical user interface (GUI) constructs, e.g., buttons, can be used. Do not spend too much time on improving the screen layout, e.g., the positioning of fields on the screen. The assessment of this assignment will focus more on the correctness and functionality of your forms and reports. Keep screen/report layouts simple, ensuring only that all label and data fields are completely displayed.

4.2 Sample Data

Populate the database with enough meaningful sample data to allow us to test the functionality offered by your information system. There will be penalties if no data is displayed for the required query functions. ~~No table should contain more than 30 sample records.~~ Please compact your database using the *MS Access* utility before submission. At least 6 companies (2 for manufactures, 2 for distributors, and 2 for retailers) must be recorded in the database. At least 2 individual users should be recorded. At least 20 different RFID readers should be used in the database. At least 30 different products of different categories should be recorded. For a Product History Report, at least one record should have more than 5 readings that were read in different times at different locations by different RFID readers.

4.3 Backups

Students are advised to create back-up copies of their assignments. Hardware and software can fail (or be lost) for many reasons and it happens quite frequently. Students should also retain paper-based assignments in the event that the original paper version is lost or damaged. No extension will be given for the accidents such as corrupted files or loss of files.

4.4 Modifications to this assignment

There may be changes made to this specification, and the assignment in general. Any clarifications and announcements relating to the assignment will be posted on the course web site.

4.5 Tutorial Support

You may seek tutorial support to clarify your understanding of the Universe of Discourse. You may also discuss the concepts behind ER modelling and mapping, in general, with your tutor. Questions during the labs should be limited to *MS Access* and implementation issues.

5 Submission

Late submissions will not be accepted at all, or if accepted, will incur a penalty of 20% reduction each date late. Students who believe they have sound reasons for late submission should see the course coordinator as soon as possible.

5.1 Guidelines for Submission of Design part:

A template for the submission of Part 1 of this assignment is given on the course web site. You are to download this (Assignment1-SubmissionTemplate.doc) file and prepare your assignment using the template document.

When completed, you are to submit your ER diagram and documented steps of the ER-to-Relational mapping process as hard copy in the designated submission box on level 1 in GP South Building.

All submissions must be accompanied by the appropriate assignment cover sheet (group or individual).

5.2 Guidelines for Electronic Submission of Implementation part:

Your submission should be a single file. If you have more than one file to submit, you need to compress them into a single *.ZIP* file (by *WINZIP*) for the submission. The single file name for the submission should be named as “s3345678.zip”, where s3345678 is your email account name.

Submission Procedure

You should submit your file for your assignment through the ITEE Submit system which will be available at <http://submit.itee.uq.edu.au> closer to the submission date.

1. Select INFS1200/7900 from the list of available subjects and then click on the “Yes” button in the ‘Available’ column. Then use your Userid and Password to authenticate yourself to the system.
2. Select the files you wish to submit by using the ‘Browse’ button. Select the relevant file and click on ‘Send File’. Note that this **DOES NOT** mean that your assignment has been submitted.
3. In order to complete the submission process you will need to acknowledge the Plagiarism Statement. Click on “Submit Assignment” and you will be shown a confirmation screen, which you should print out (or note down) and keep.
4. After submitting your assignment you may still make further submissions until the deadline. Your latest submission will be considered when marking.

More details with screen-shots about the on-line submission can be found on the website: <http://submit.itee.uq.edu.au/student-guide.pdf>.

6 Assessment

The assignment is worth 30 marks, which will be allocated as follows:

Design	15 marks
Implementation	15 Marks

This assignment targets the following assessment criteria of this course:

- Extract (simplified) specifications to create basic conceptual data models
- Map basic conceptual data models to relational database schema
- Reason with the logical foundation of the relational data model
- Understand the fundamental principles of correct relational database design
- Construct simple computer-based information systems given a complete specification

Group Work

Design Part: You are encouraged to discuss the concepts behind ER modelling and mapping, in general, with your classmates (including the newsgroup). You are also allowed (not required) to work in groups of not more than three to discuss the creation of the ER diagram or the relational schema for this assignment. However, all discussions should be confined with in the group, and all group members must be identified in the submission as

given in the *Assignment1-SubmissionTemplate.doc*. Students working in a group will submit only ONE copy of the solution, which can be done through the account of any chosen member of the group. *All students working in a group will be given a common mark.*

Implementation Part: You are also encouraged to discuss the *MS Access* techniques necessary to construct an arbitrary form or a report. However, you must not discuss the construction of forms or reports for this assignment. *Every student must submit individual work for the implementation part of this assignment. MS Access 2007* edition is expected to be used in this assignment.

7 Planning the Work

Below are *guidelines* for you to follow, so that the work required in this assignment can be accomplished effectively in the available time.

Work	Complete by
1. ER	9 April
2. Mapping and Normalization	21 April
3. Setting up the database (Tables, Relationships, Constraints)	28 April
4. Enter meaningful sample data	5 May
5. Forms	18 May
6. Reports	25 May
7. Testing in the lab and online submission	29 May

Late submissions will not be accepted at all, or if accepted, will incur a penalty of 20% reduction each date late. Students who believe they have sound reasons for late submission should see the course coordinator as soon as possible.

8 Collaboration

The University has strict policies with regard to plagiarism. Penalties for engaging in unacceptable behaviour can range from cash fines or loss of grades in a course, through to expulsion from the University.

You are required to read and understand the School Statement on Misconduct, available on the ITEE website. This Statement includes advice on acceptable levels of collaboration.

If you have any questions regarding collaboration, please see either the lecturer or your tutor for guidance. Remember that ignorance is not a defence!