Entity Relationship Diagrams

1. A company has a number of employees. The attributes of EMPLOYEE include Employee ID (identifier), Name, Address, and Birthdate. The company also has several projects. Attributes of PROJECT include Project ID (identifier), Project Name, and Start Date. Each employee may be assigned to one or more projects. A project has one or more employees assigned to it. An employee's billing rate may vary by project, and the company wishes to record the applicable billing rate (Billing Rate) for each employee.

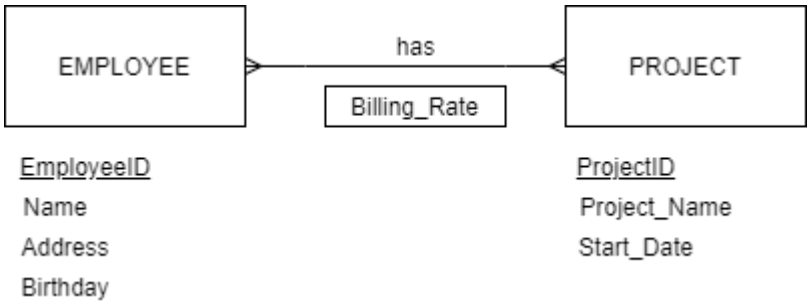

Fig. 1 Company ERD

2. A laboratory has several chemists who work on one or more projects. Chemists also use certain kinds of equipment on each project. Attributes of CHEMIST include Employee ID (identifier), Name, and Phone No. Attributes of PROJECT include Project ID (identifier) and Start Date. Attributes of EQUIPMENT include Serial No and Cost. The organization wishes to record Assign Date—that is, the date when a given equipment item was assigned to a particular chemist. A chemist is assigned to at one or more projects and one equipment item.

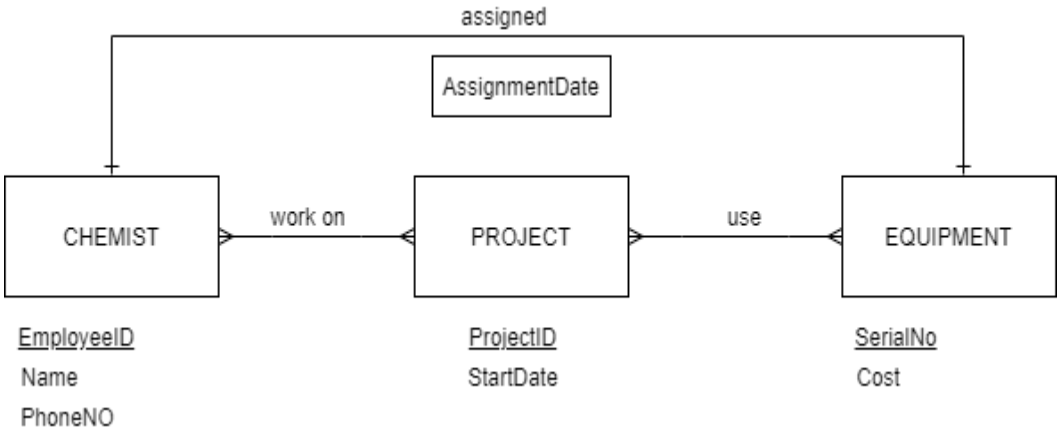

Fig. 2 Laboratory ERD

3. A college course may has one or more scheduled sections. Attributes of COURSE include Course ID, Course Name, and Units. Attributes of SECTION include Section ID (identifier), Section Number and Semester ID.

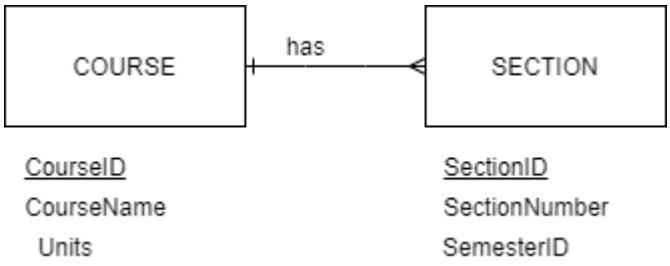

Fig.3 College ERD

4. A hospital has a large number of registered physicians. Attributes of PHYSICIAN include Physician ID (the identifier) and Specialty. Patients are admitted to the hospital by physicians. Attributes of PATIENT include Patient ID (the identifier) and Patient Name. Any patient who is admitted must have exactly one admitting physician. A physician admits one or more patients. Once admitted, a given patient may be treated by one or more physicians. A particular physician may treat any number of patients. Whenever a patient is treated by a physician, the hospital wishes to record the details of the treatment (Treatment Detail). Components of Treatment Detail include Date, Time, and Results. Did you draw more than one relationship between physician and patient? Why or why not? Did you include hospital as an entity type? Why or why not?

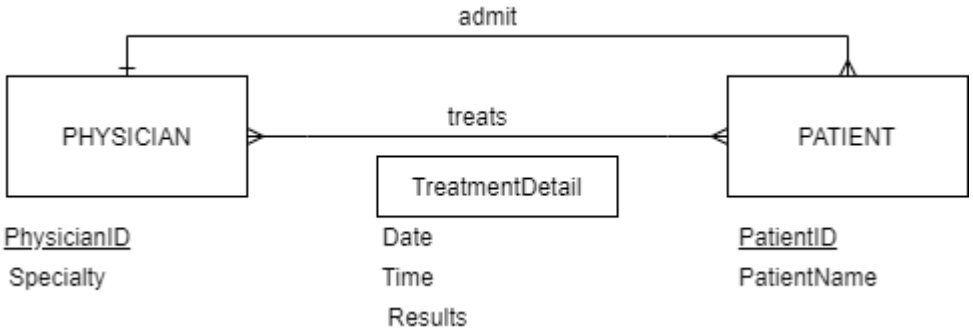

Fig. 4 Hospital ERD

There are two relationships between the physician and the patient. The first relationship shows that a physician can admit more than one patient and the second relationship implies that many patients can be treated by more than one physician. Hospital is not included as an entity because it is the organisation we are creating the database for.

5. The loan office in a bank receives from various parties requests to investigate the credit status of a customer. Each credit request is identified by a Request ID and is described by a Request Date and Requesting Party Name. The loan office also received results of credit checks. A credit check is identified by a Credit Check ID and is described by the Credit Check Date and the Credit Rating. The loan office matches credit requests with credit check results. A credit request is recorded before its result arrives; a particular credit result may be used in support of several credit requests.

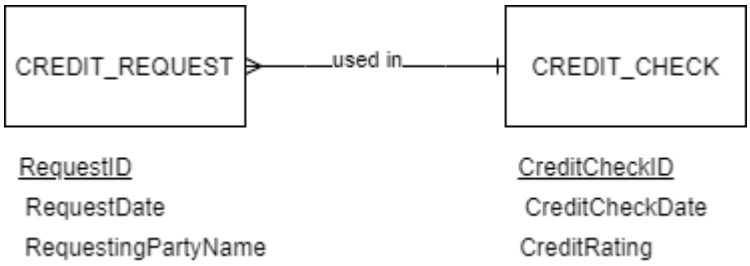

Fig. 5 Loan Office ERD

6. Companies, identified by Company ID and described by Company Name and Industry Type, hire consultants, identified by Consultant ID and described by Consultant Name and Consultant Specialty. Assume that a consultant can work for only one company at a time, and we need to track only current consulting engagements. Draw an ERD for this situation. Now, consider a new attribute, Hourly Rate, which is the rate a consultant charges a company for each hour of his or her services. Redraw the ERD to include this new attribute.

Fig. 6.1 Company Consultant ERD 1

Fig. 6.2 Company Consultant ERD 2

7. Each case handled by the law firm of Dewey, Cheetim, and Howe has a unique case number; a date opened, date closed, and judgment description are also kept on each case. A case is brought by one or more plaintiffs, and the same plaintiff could be involved in many cases. A plaintiff has a requested judgment characteristic. A case is against one or more defendants, and the same defendant may be involved in many cases. A plaintiff or defendant may be a person or an organization. Over time, the same person or organization may be a defendant or a plaintiff in cases. In either situation, such legal entities are identified by an entity number, and other attributes are name and net worth.

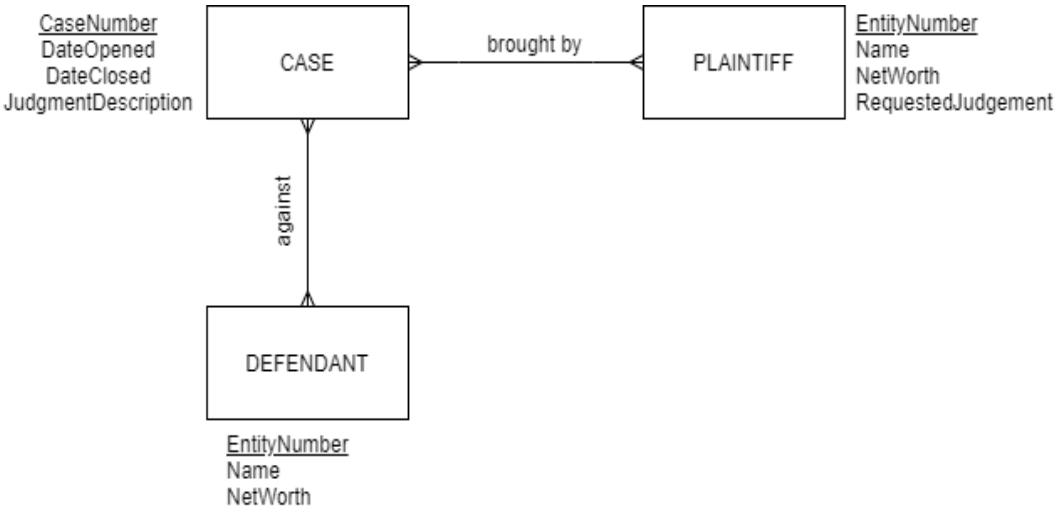

Fig. 7 Dewey, Cheetim and Howe law firm ERD

8. Each publisher has a unique name; a mailing address and telephone number are also kept on each publisher. A publisher publishes one or more books; a book is published by exactly one publisher. A book is identified by its ISBN, and other attributes are title, price, and number of pages. Each book is written by one or more authors; an author writes one or more books, potentially for different publishers. Each author is uniquely described by an author ID, and we know each author's name and address. Each author is paid a certain royalty rate on each book he or she authors, which potentially varies for each book and for each author. An author receives a separate royalty check for each book he or she writes. Each check is identified by its check number, and we also keep track of the date and amount of each check.

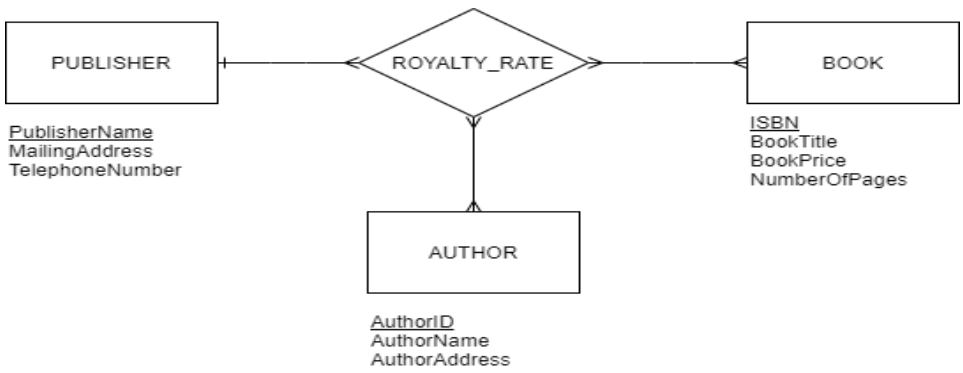

Fig. 8 Publisher ERD

9. Prepare an ERD for a real estate firm that lists property for sale. The following describes this organization:

   a. The firm has a number of sales offices in several states. Attributes of sales office include Office Number (identifier) and Location.

   b. Each sales office is assigned one or more employees. Attributes of employee include Employee ID (identifier) and Employee Name. An employee must be assigned to only one sales office.

   c. For each sales office, there is always one employee assigned to manage that office. An employee may manage only the sales office to which he or she is assigned.

   d. The firm lists property for sale. Attributes of property include Property ID (identifier) and Location. Components of Location include Address, City, State, and Zip Code.

   e. Each unit of property must be listed with one (and only one) of the sales offices. A sales office may have any number of properties listed or may have no properties listed.

   f. Each unit of property has one or more owners. Attributes of owners are Owner ID (identifier) and Owner Name. An owner may own one or more units of property. An attribute of the relationship between property and owner is Percent Owned.

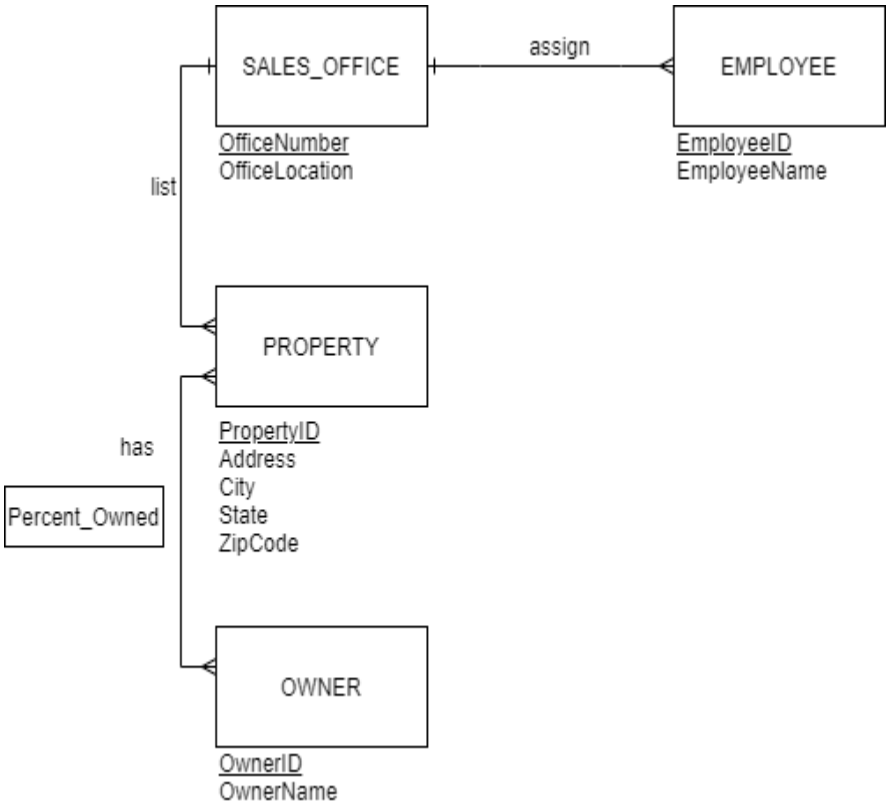

Fig. 9 Real estate firm ERD

10. A database at a college is required to support the following requirements. Create the ERD for the set of requirements below. Use your own experience to determine (and write in your answer) any assumptions you make that are not stated in the problem

    a. For a department, store its number and name

b. For an advisor, store his or her number and name and the number of the department to which he or she is assigned

c. For a course, store its code and description (for example, MTH110 or Algebra)

d. For a student, store his or her number and name. For each course the student has taken, store the course code, course description, and grade received. In addition, store the number and name of the student's advisor. Assume that an advisor may advise any number of students but that each student has just one advisor

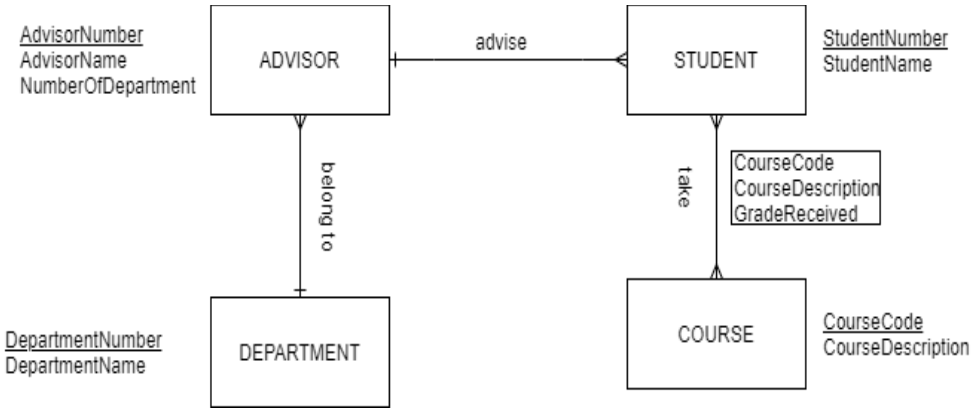

Fig. 10 College ERD

11. Star Hoist is owned by Darth and his wife Ella Vader. The company has had its ups and downs since Darth and Ella built it from the ground up several years ago. The company had some initial difficulties when Darth's brother, Tacksi, was their accountant and got in trouble with the IRS. Finally, the company is doing well, and the owners are ready to expand the business to new heights. Star Hoist sells and installs replacement parts for lifts and similar equipment from a variety of manufacturers. Business can be very competitive, especially from the original manufacturers, which directly sell replacement parts and service to end customers. Darth and Ella need every aspect of their business to work smoothly so that they don't get the shaft in deals with customers. Darth and Ella try to encourage their employees to do the best they can for each customer, which is symbolized by the company motto: "Oh, be the one." There are many rogue competitors, so accurate service is also key for Star Hoist.

You are to draw an ERD for Star Hoist. The fundamental need for Star Hoist is a computer database to keep track of their in-house inventory and of installed parts. Because the business offers negotiated warranties with customers, all parts installed at customer sites need to be tracked. Each part instance is identified by a number assigned by Ella, but because a particular part might come from the original manufacturer or an alternative supplier, the database must record the source of each part and its supplier's part number. In general, a part has a description and standard prices that Star Hoist charges a customer for the part and its installation. Each instance of the part has a cost to Star, based on what the supplier actually charged when Star Hoist acquired that part (many parts, due to their materials, have frequent price changes). Each particular part instance must be tracked, whether it is in inventory or sold to a particular customer. When a part is sold to a customer, there is a

negotiated warranty end date, until which time Star assumes all replacement costs for the part, and an actual selling and installation price. Customers have a name, account number, contact person name, and a code that specifies special terms that have been negotiated with each customer. Each supplier has a name, Star's account number with that supplier, and the phone number for the supplier. Each supplier can supply only certain parts. Because many parts can be sourced from multiple suppliers, each part in inventory or installed at a customer must be associated with its source supplier; in addition, Star also needs to know which suppliers can supply which parts. Because many of the parts are very expensive, Darth has placed a limit on how many part instances of a given part can be held in the company's inventory. The limit is three part instances to be held in inventory. As Darth tells the customers, "May the fourth be with you."

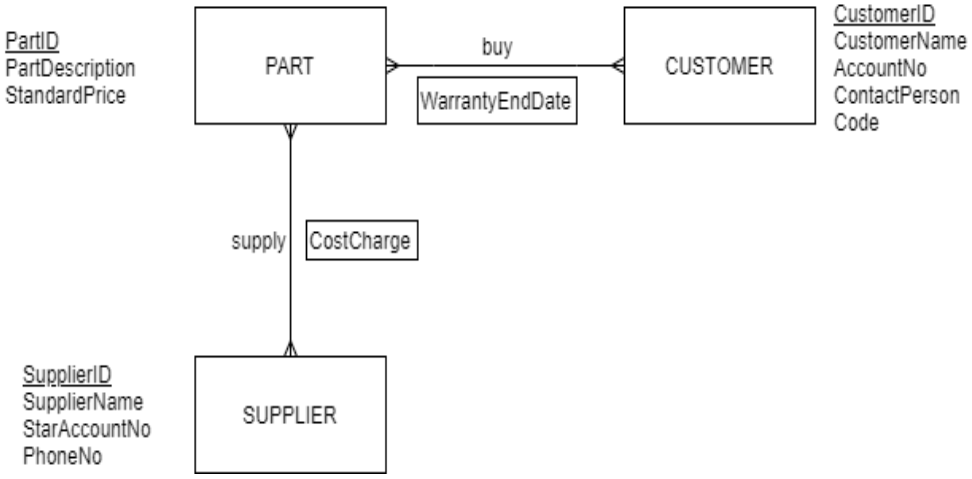

Fig. 11 Star Hoist ERD

12. Draw an ERD diagram for the following situation: The Sensing Building Company (SBC) installs wireless microsensors throughout buildings and building campuses to give building managers, maintenance personnel, and others real-time data about the status of almost any part of a building. Sensors can be placed on doors, trash cans, plumbing fixtures, windows, lighting fixtures, and heating systems—almost any building element. Sensor data are used to create dashboards to indicate when, for example, a plumber needs to be dispatched to fix a leaking pipe in a particular wall of an identified building. In addition, data are analyzed over time to determine, for example, where and when electricity and heating/cooling are used so that measures can be taken to reduce energy consumption costs. All the collected data must be kept in a database, although some data are used to trigger alerts when immediate action must be taken in response to a security or safety issue. Each sensor has various features, depending on its purpose and location. For example, a sensor on a trash can is designed to periodically transmit how full the container is and to immediately send a message when the can is within 5 percent of being full or when the can is no longer upright. In general, each sensor sends periodic as well as critical event messages, the latter of which may cause an alert and immediate action to be taken. The following is a somewhat simplified description of the database requirements. Data must be kept on each sensor, sensor transmission, building

personnel, building, location within or outside a building, alert, and action taken. A sensor has a unique 12 character ID, a title, type, date installed, frequency of transmission, and location. Each sensor transmission includes the sensor ID, time stamp, and one or more readings. Personnel have an ID, name, job title, a set of skills, and a set of locations for which he or she is responsible. Each building has a number, description, and a senior person responsible for the building. Each location has an ID, type of location, and coordinates of where within a building or the campus it is. An alert has an ID, the ID of the sensor transmission(s) that generated the alert, and a time stamp for when the alert occurred. Finally, an action has an ID, the ID of the alert that caused the action, the individual or several personnel taking the action, and the result of the action.

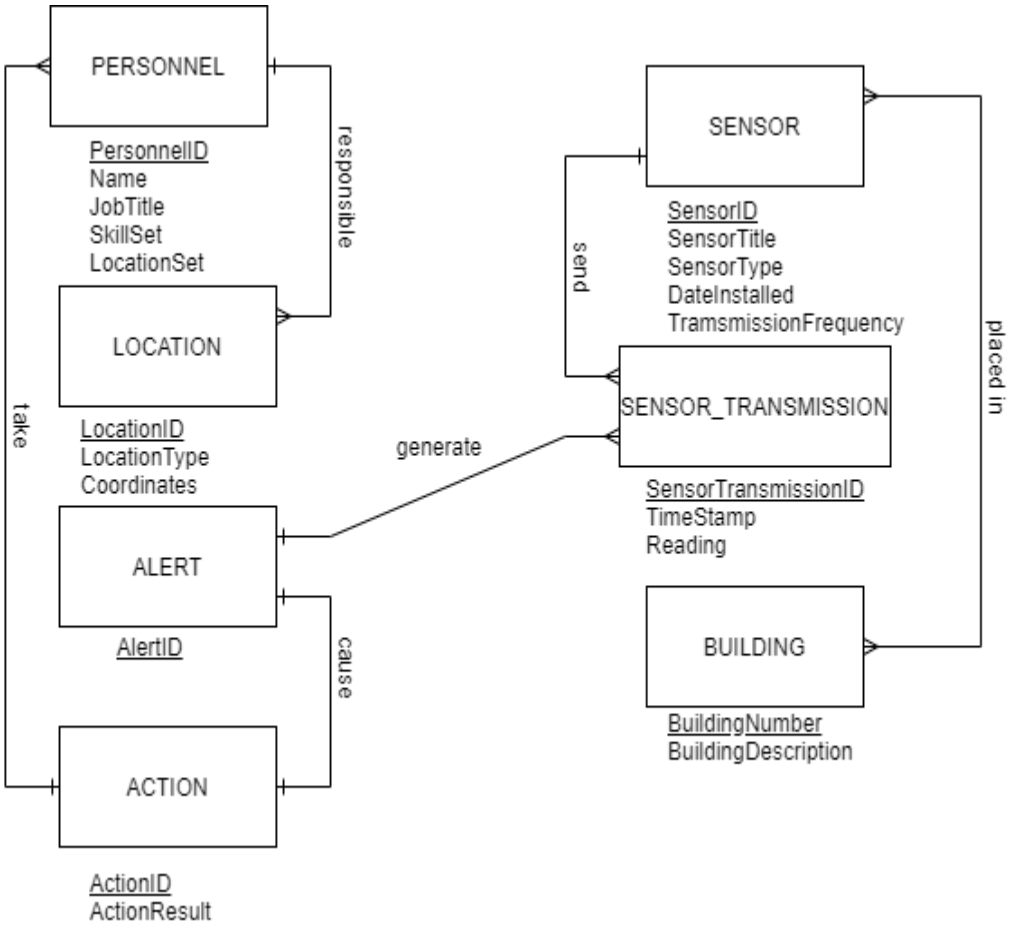

Fig. 12 Sensing Building Company ERD