International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

A Study on Comparison of UML and ER Diagram

Ravi[1],Shikha Yadav[2],Rishabh Jindal[3], Santwana Anand[4]

Dept. of I.T., IPEC

Abstract:

A data model is used to represent all the relations between data elements. Entity relation diagrams are commonly used for conceptual data modeling in database design. The Unified Modeling Language (UML) and Enhanced Entity Relationship (EER) are diagrammatic notations for designing large systems and applications. There is a comparison between UML and EER class diagram and an experiment is done to determine the best of it. An experiment is done to compare both of the data models and determine their strengths and weaknesses. UML class diagram provides better representation for cardinality representation. Entity relation diagram is cognitively complex. The purpose of this research paper is not only reduced cognitively load, error and also provide some basic function of ER modeling and do comparison between the EER and UML. The learning system is based on a framework it provides systematic guideline and support during entity relationship. This framework used visualization graphical, animation, technique to reduce complexity and support ER model.

1. Introduction

The entity relationship process is first developed by chen (1976).it is based on ER conceptual data model which represent in a graphical format. ER and Unified Modeling Language (UML) Both are data models used by many database designers.

Relational Database System (RDBMS) is used to manage the huge database system. ER modeling is used to represent the relational databases diagrammatically.

Specialization

Specialization process of broken higher-level entity into lower level entity. It is a top-down approach. Superclass entities are divided into further subclass entities.

Generalization

Generalization process is opposite of specialization process. In this lower level entity are combined to form higher level entities. It is a bottom –up approach. Normalization is another important part to design a relational database. It has various phases of normalization example, 1NF, 2NF and 3NF. It is very important to have no insertion, deletion and update anomalies.

In today's scenario, Database systems require diagrammatic notations that accurately identify their requirements.

Database Systems: The EER is used in the conceptual database system and the UML is used in OOP. They identify business rules and also determines schema relational database for each model.

UML (Unified Modeling Language)

UML stand for Unified Modeling Language. As per the standard language its specifying, visualizing, constructing, and documenting. It is different from the other common programming languages such as C++, Java, COBOL etc.

EER and UML Background

The Entity Relationship is used for designing relational database and Unified Modeling Language (UML) for describing design of the system.

The Notations:

The notations used in ER and UML are different from each other

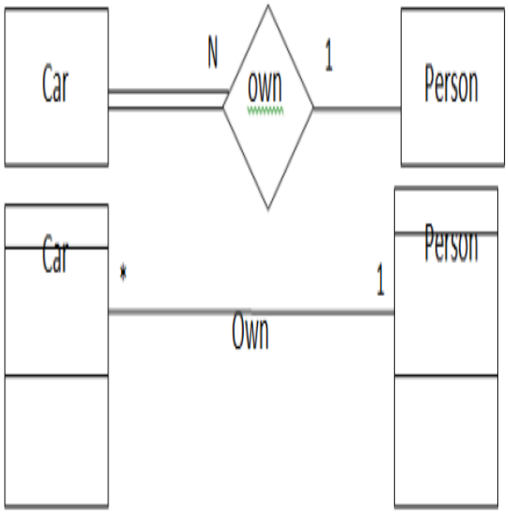

Figure 1. The EER and UML Class Notations

There are many differences between UML and ER including the notations. Computer based learning environment support cognitive behavior during ER modeling. It provides more effective learning process of ER model as compared to traditional method. It improves effectiveness of ER Model. Computer support for conceptual ER model to increase productivity to impressive looking. some knowledge-based tools to support ER and object-oriented modeling was proposed by Reiner 1992.In 1993 modeling and design knowledge are represented and implemented as rule-based knowledge in 1998 they are implemented as case-based. The study shows various diagrammatic notations for Information Technology students and determines the best of it. The study involves a group of students from Department of Information Technology at Indraprastha Engineering College.

II. DESIGN

Class vs Entity: The class diagram has a rectangular box with 3 sections that contains class, attribute and the operation name. The ER diagram has a rectangular box that contains the name of entity. The diagrams are shown in figure:

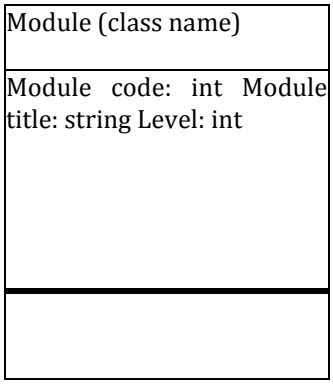

Figure 2.1 The UML Class Notation

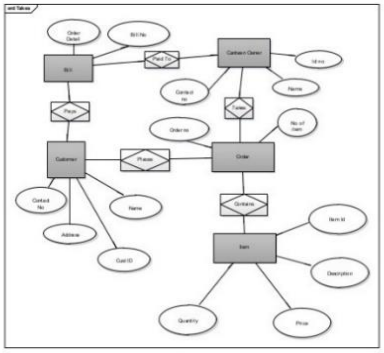

Figure 2.2 The Entity Notation

Attributes: The attributes in UML are plain text as shown in figure 1. The attributes in ERD are linked through lines and circular forms as shown in figure 2.

Operations: Operation states the specific work done by class in UML. There is no definition in ER model.

Cardinalities and Participation: Both show the same level for techniques between two entity/classes. But there are some differences. These are shown in the figure.

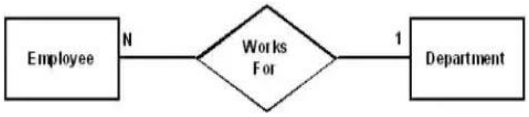

Figure 2.3 Cardinality and Participation Notation in UML Class Diagram

4. Association vs. Relationship: Association in UML determines the affect between two classes.In EER model, this relation is represented using diamond shape.

III. PREVIOUS IMPLEMENTATIONS

It created to design more precisely database schemas to reflects the constraints. EER is a semantic data model, describing the data needs for the information in an easy to understand graphical notation.

Attributes

These describe the unique value which cannot divide further. An attribute associates with each instance of an entity (or relationship). The domain contains the allowable values for the attribute. Examples of attribute are Surname, Salary and Age.

Composite Attributes

It describes to group of attributes of single attribute or more than a single attribute. Such groups are called Composite Attributes.

Cardinalities

Cardinalities defined as the minimum or maximum number of participating of entity relationship between two tables.

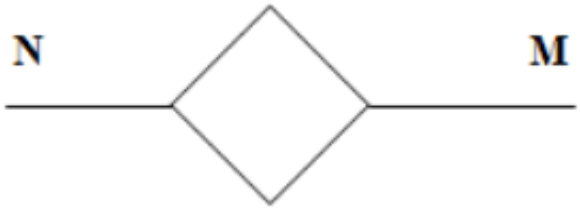

Figure 3.1 Cardinality

SYSTEM IMPLEMETATION

UML stands for Unified Modelling Language its used in object oriented software engineering. There are several models that are used in UML in which we are categories in

two categories i.e structure diagrams and behavioural diagrams.

Class Diagram

Class diagram are used in UML diagram. It necessary includes systems, attributes and operations of each class and their relationship with each other classes. It is a data modelling diagram.

Figure 3.2 Class Diagram

Component Diagram

A software system displays the structural relationship of components of Component Diagram. It does not show the functionality of the system but components of functionalities shows.

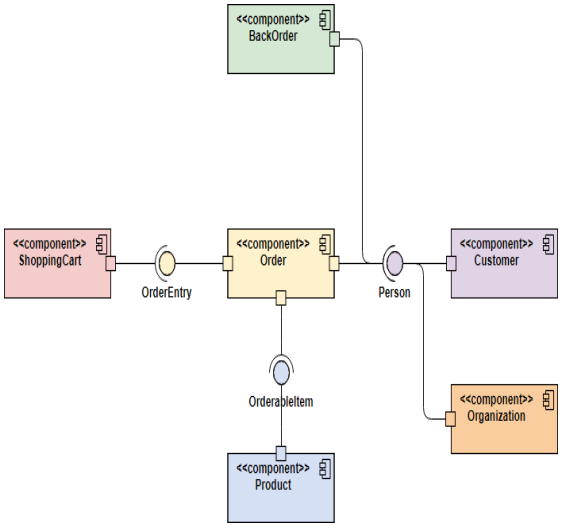

Figure 3.3 Component Diagram

Use Case Diagram

It involved actors in a system which gives a graphic overview where different functions are perform different operations in system of different actors.

Activity Diagram

In a graphical way it represents workflows the Activity of diagrams. It describes workflow in the system. It rarely used as an alternative to State machine diagrams.

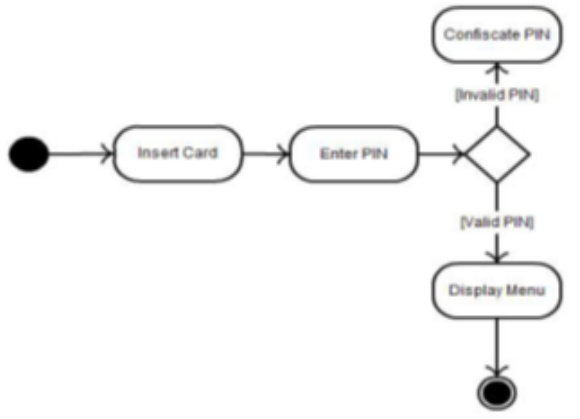

Figure 3.4 Activity Diagram

IV. Experiment Procedure

Experimental Method

The experimental method is used to indicating weather each diagram correctly matches its signification it consists correct and incorrect diagram.

Application Domains

In this we consist an example of small college. A college have many student, department and offer any courses and different relationship with each other.it consists different relationship and entities.

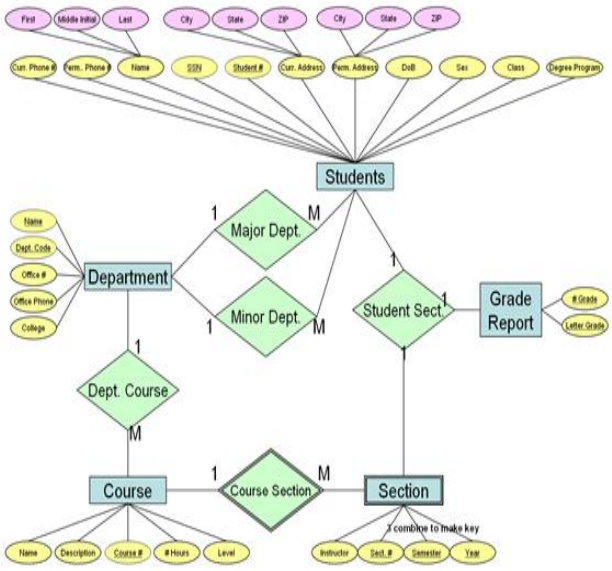

Figure 4.1 The experimental domain of ER Domain

Worked Example

It is a general description of college it consists entity, relationship and have attributes show the signification of college system. A college have many departments. Each department offer courses. A student enrolls many courses.

Student :-

Student enroll at least one courses in college.

Department:-

Offer at least one course. One department have many students.

Courses: -

Must have number of students.

Experimental Diagram

This experiment consists of different correct and incorrect diagram there are some error applied on correct diagrams this error effect on the cardinality and relationship of the diagram.

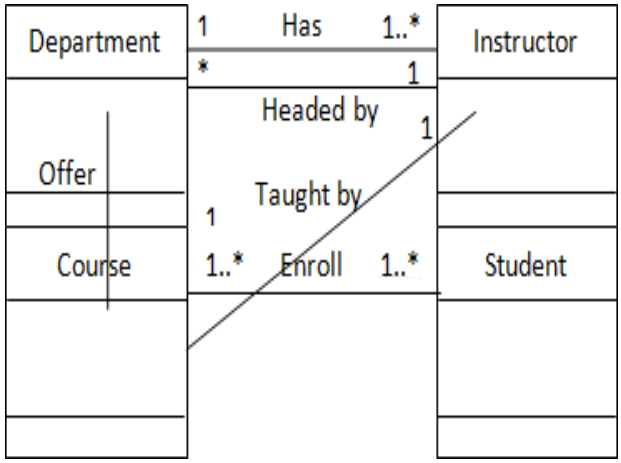

Figure 4.2 Application domain of UML Notation.

Now there is error applied on this UML diagram that effect the cardinality of the relationship. The relationship between the courses and instructor entity are changed from one-many to many-many relationship and the courses and department entity also change from one - many to many to many relationships.

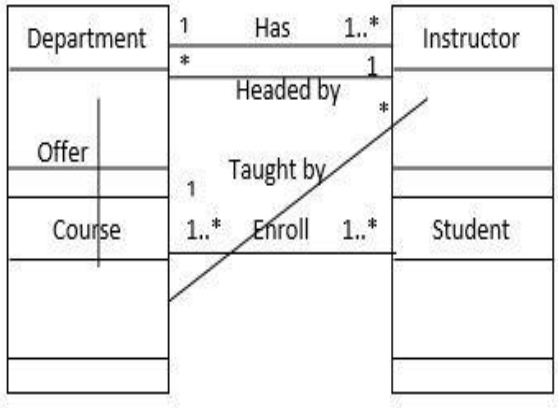

Figure 4.3 Application domain of UML notation with error.

Methodology

For proving the level of ER model there are group of students to do experiment and evaluate this there are two groups control and experimental to do experiment on ER Model to test it.

There are two methods to evaluate: -

First is the verification of ER model to enhancing learner performance in ER model.

Second is used to measure the satisfaction level of the learner.

The required ER diagram model in the test have three activates:

a.) Identification entities.

b.) Relationship.

c.) Resolution of any M-M relationship.

The control group is used to manually develop the ER model based on their knowledge and skills. The experimental group used learning system for ER modeling to develop ER diagram. The independent T-test show the mean of the experimental group and the mean of control group this indicate that ER modeling proposed by the student was enhanced using the learning system.

Problems in Current Approaches and Need of AER Diagrams

The ER diagram is used to represent the relational databases. For automation of normalization described above, we need description as well as FD information. The tools in ER diagram are taken as input and provide relations. This input provides FD information and they normalize. This makes it automated.

Current ER diagram cannot normalize the existing top-down design of existing relational databases. The ER diagram can normalize entities for 1NF. But it cannot do the same for 2NF, 3NF and BCNF which requires functional dependency information. Due to this drawback, there will be unconditional automation. Also, for any insertion, deletion and update, there will be inconsistent FD.

So, it is clear that the current ER diagram was not made by keeping in mind the normalization anomalies and FD information. To make it an integral part and to make normalization an element of conceptual design, AER is proposed

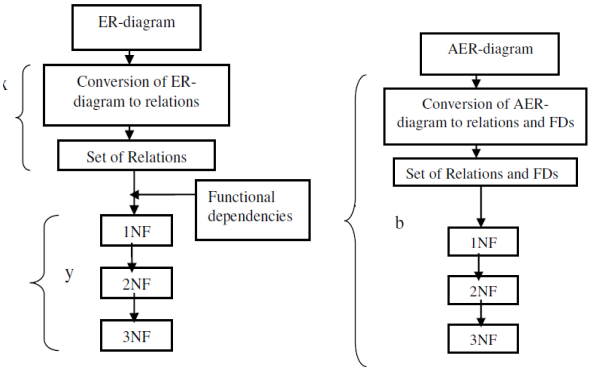

Figure 4.4 a) Partial and Conditional Automation of Normalization in current approaches.
b) Total and unconditional Automation of Normalization Using AER Diagram.

V. Conclusion

The result of a controlled by break down the abide given by EER and UML diagrams during the study of data models. It is commonly used conceptual and logical modelling, but is not deliberate for physical design. On the analysis, it suggested that EER diagrams are generally more graspable than UML diagrams. The contrast shows that both are same but their notations are different, it results that how EER diagram fields used in the UML diagram. The comparison between the two diagrams are not easy task each diagram has different characteristics. In this research paper there is comparison between the ER diagram and UML class diagram and the UML class diagram provide a better representation for cardinality and relationship than the ER diagram. UML depicts the behavior and represents logical level. EERD represents conceptual level of database and is designed for OOP that has public as well has private class. So it works accordingly. Therefore, it is observed that EERD is more helpful for students than UML. In the logical phase, it may be taught to them. But EERD is important in all phases, especially when it is many-to-many relationship.

This research review that computer-based learning system support conceptual ER modeling. The framework and prototype were designed to reduce complexity. The independent T-test were proposed to increase effectiveness and usability. T-test is performed by group of university student which are divided into two group as control group and experimental group. The idea of using graphical organizer, animation, visualization and generalization to support cognitive process we can applied to other conceptual tools like UML, Class diagram, activity diagram.

Sr N.	Author's Name	Year	Reference No.	Short Description
1	Mrs. Kavitha	2015	**[1]**	Comparative study on extended entity relationship and unified modeling language.
2	AhmadAl-Shamailh	2015	**[2]**	An Experimental comparison of ER and UML diagrams.
3	W chu.	2008	**[3]**	Extracting ER diagrams from a table-based legacy database.
4	Manal Mahmoud Alkoshman	2015	**[4]**	Unified Modeling Language and Enhanced Entity Relationship: An Empirical Study.
5	P. S. Dhabe	2010	**[5]**	Articulated entity relationship(AER) diagram for complete automation of relational database normalization.
6	Mustafa I. Eid	2012	**[6]**	A Learning System For Entity Relationship Modeling.

References

[1] Mrs. Kavitha S., A.,,"Comparative study on extended entity relationship and unified modeling language" Vellore, Tamil Nadu, India, e-ISSN: 2395 -0056 Volume:02 p-ISSN: 2395-0072(2015).

[2] Helen C, Ray Welland, Matthew McGill and Linda Colpoys, "Comprehension of diagram syntax: an empirical study of Entity Relationship notations", International Journal of Human-Computer Studies,2004

[3] Shivaji Arjun Kakad, Prof. Y. N. Patil, "EER To UML Model Transformation Using Atlas Transformation Language (ATL)", International Journal for Technological Research, ISSN (Online): 2347 – 4718, 2014.

[4] Yeh, Dowming, Yuwen Li, and William Chu. "Extracting entity-relationship diagram from a table-based legacy database." Journal of Systems and Software 81.5 ,pp.764-771(2008).

[5] Cruz-Lemus, José A., Marcela Genero, M. Esperanza Manso, and Mario Piattini. "Evaluating the effect of composite states on the understandability of UML statechart diagrams." In Model Driven Engineering Languages and Systems, pp. 113-125. Springer Berlin Heidelberg, (2005).

[6] Mfourga, N. "Extracting entity-relationship schemas from relational databases: a form-driven approach." In Reverse Engineering, 1997. Proceedings of the Fourth Working Conference on, pp. 184-193,IEEE(1997).

[7] Ahmad Al- Shamailh., "An Experimental Comparison of ER and UML Class Diagrams"
Mutah University, Jordan, Vol.8, No.2, pp.279-288(2015).

[8] Manal Mahmoud Alkoshman, "Unified Modeling Language and Enhanced Entity Relationship: An Empirical Study" Al Shoubak - Ma'an, Jordan, International Journal of Database Theory and Application, Vol.8, No.3, pp.215-227(2015).

[9] P. S. Dhabe, Dr. M. S. Patwardhan, Asavari A. Deshpande, M. L. Dhore,B.V. Barbadekar and H. K. Abhyankar, "Articulated entity relationship(AER) diagram for complete automation of relational database normalization", Pune-411037,Maharashtra State, India, vol.2, No.2(2010).

[10] H.W. BUFF,(1992) "The relational model contra entity relationship?" , *ACM SIGMOD* RECORD, Vol. 21, No. 3