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For original research paper, the manuscript should be arranged in the following order: Title page, Abstract, Keywords, Introduction, Materials and Methods, Results, Discussion, Acknowledgment, References, Tables with legends, figures with legends and supplementary materials

The title page should contain the title, the name(s) of the author(s), the name(s) and address(es) of the institution(s) where the work was carried out, including a valid e-mail address from the corresponding author along with telephone numbers. The title of the manuscript should be specific and concise but sufficiently informative.

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The keywords should have a minimum of five and maximum of seven words.

The introduction should provide a clear statement of the problem and indicates aim of the study citing relevant literature to support background statements.

The Materials and Methods should include the methods and methodology of the research.

The Results should be presented in the form of tables or figures. It should be presented with clarity and precision. Statements used to present results should be written in the past tense. Detailed interpretation of data should not be included in the results but should be put into the Discussion section.

The Discussion should interpret the results clearly and concisely, and should integrate the research findings of this and past studies on this topic. Highlight the significant/unique findings of the research under conclusion.

The acknowledgments of people, grants or funds should be brief.

Contents

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Database Design and Implementation: A Requirement for Organizational Growth and Productivity in Information Management

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Abstract

The database design is imperative in the imputing and retrieval of information from a database management system (DBMS). This is hinged on conceptual modelling upon which cardinality constraint is a major factor to consider. If the evaluation of the model is positive, then comes the implementation of the physical design and the database becomes operational. Thereafter maintenance which ensures optimum performance and life cycle of the DBMS is ensued. Thus this study showcases how the relevance of a good database design and implantation is utilised in information management to achieve organizational productivity and growth.

Key Words: Database Management System (DBMS), Database Design and Implementation.

Introduction

For a proper management of information in an organisation, there is a need for ease of information input and retrieval. A well designed and implemented database thus helps an aspiring organisation to achieve this objective to earn the expected growth and productivity as noted by Dwivedi et al. (2020).To achieve this fit therefore, a database designed to be an ordered collection of data according to Oracle 2018 is meant to access and retrieve data in a particular order. An example of such an order can be achieved through a spreadsheet typically organised into fields and records.

In affirmation to what is generally believed, Martinez-Mosquera et al. (2020) noted that database design is a part of a larger picture called an information system more like a relational database management system. Within the system, we not only collect, store, and retrieve data but also transform that raw data into useful information. The system does not just happen, they are a product of a carefully staged development process (Amaechi et al., 2018). To determine the need for an information system and to establish its limit, we use a process known as system analysis to develop the system. This continuous process of creation, maintenance, enhancement, and replacement constitutes the Systems Development Life Cycle (Kyeremeh, 2019). The information contained in this study to a large extent, is the product of interviews with the end-users who manage their organisations' information system. Prior to the era of using organised database management system, information retrieval used to be very difficult task such that it could take days to perform a task of one hour. So, with the negative multiplying effect on data management and retrieval, database design together with its implementation and maintenance were considered. This study is aimed at creating design principle required in achieving standard database and information management system. A properly designed database determines how good the implementation

would be. This study covers database conceptual modelling, design and developmental process.

Review of Related Work

In planning and designing a database, Sciore (2020) noted that despite the wide range of uses, all database share the same features. The database should be persistent, can be shared, kept accurate, and usable. He went further to assert that a database system that hopes to be commercially viable must have a planning algorithm that finds efficient plan.

In relating to the usefulness of web applications, Marcoset al. (2016) noted that for applications that are very common (such as Web applications, DB applications, etc.),it would be desirable to provide a standard extension that could be used by every developer.

In looking at the reality of issues facing software application, Sokappaduet al (2016)agreed that maintaining a software is actually a process that is hectic and challenging to both software engineers and IT consultancy firms. Hence it is considered as the longest phase in the lifecycle of the software as soon as such software is deployed at the client's side (Pławińska-Czarnak et al., 2018).

In the software design and implementation of management and control system of a particular device, Gunawardhana (2019)strongly affirmed the importance of requirement analysis in the development part of software design.

Data can be said to be anything that has a name which may be living or non-living, facts and statistics collected together for reference or analysis. A database (DB) can be said to be a container of data used to collect and hold data in an organised form and the main purpose of database is so that data can be retrieved in an orderly manner. Database Management System (DBMS)is therefore a software designed to enable the ordered collection of data which is meant to access data in a particular order(Azhar-Susanto, 2019).

In the new generation's use of electronic software, it has become imperative to ensure that every part of information we deal with is collected in an organised manner, stored and easily retrieved. Furthermore, a database can therefore be said to be container of data used to collect and hold data in an organised form. Database management helps us manage our ordered collection of data (Alabdulaly, 2016).

Database Design

Database design is the act of building up data structure according to a prescribed model of a database. In this process, the data that would be stored is determined by the designer altogether with how the elements of the data would interact and interrelate (Raghuvanshi, 2018).The database management system manages the stored data and their corresponding interrelationship accordingly.

Database Implementation

According to Alzahrani (2016), it is imperative to note that the logical schema specification is followed when constructing a database. Now to implement a database involves the construction of a database according to the specification of a logical schema. Accordingly, this will include the specification of an appropriate storage schema, security enforcement, external schema, and so on.

Importance of Design And Implementation of Database in Information Management

Database and information management form an integral part of growth and productivity in an organization. Consequently therefore, the need to have a well developed database design and its implementation in managing an information is of paramount importance to organizational development. Thus the relevance of database design with its implementation cannot be overemphasized such that it is strongly noted by Gupta (2015) that the collection of processes that facilitate the design, development, implementation, and maintenance of enterprise and data management systems is leveraged on database design. Consequently, it is easy to maintain a database that is properly designed, data consistency is maintained and ultimately, cost-effectiveness in terms of disk storage space is also achieved as noted by Chudinovet al. (2017). Some of the importance include:

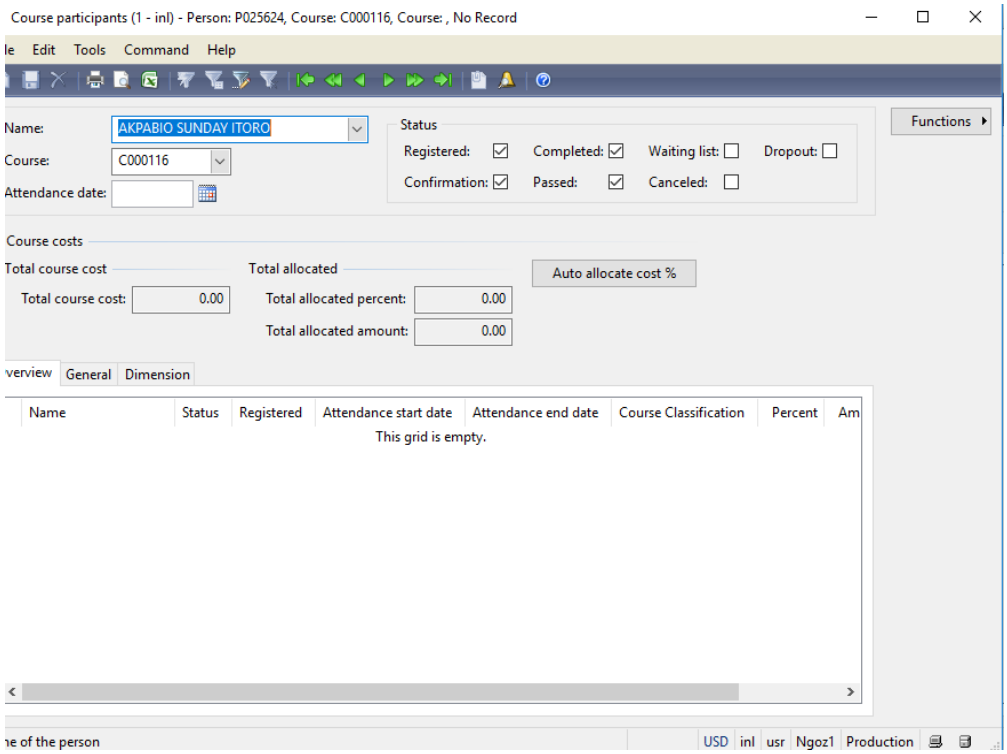
- Scalability for new features: Usually, when a database system is running, making changes in the system may be difficult. So if we follow the proper design principle of the database, the scalability for future enhancement of the system is ensured.
- Other benefits according to Kantor (2018)include high performance of the system, enforcing the integrity of data, using surrogate keys instead of a single, auto-generated key for all entities, ensuring no redundancy and discover ability which ensures that the structure of the data speaks for itself.

Application in Database

Having understood what a database is, we can see a form through which information are collected for storing in the data container known as database. The figures below are examples of Microsoft Dynamic AX and Access applications used in storing and retrieving data.

Figure 1

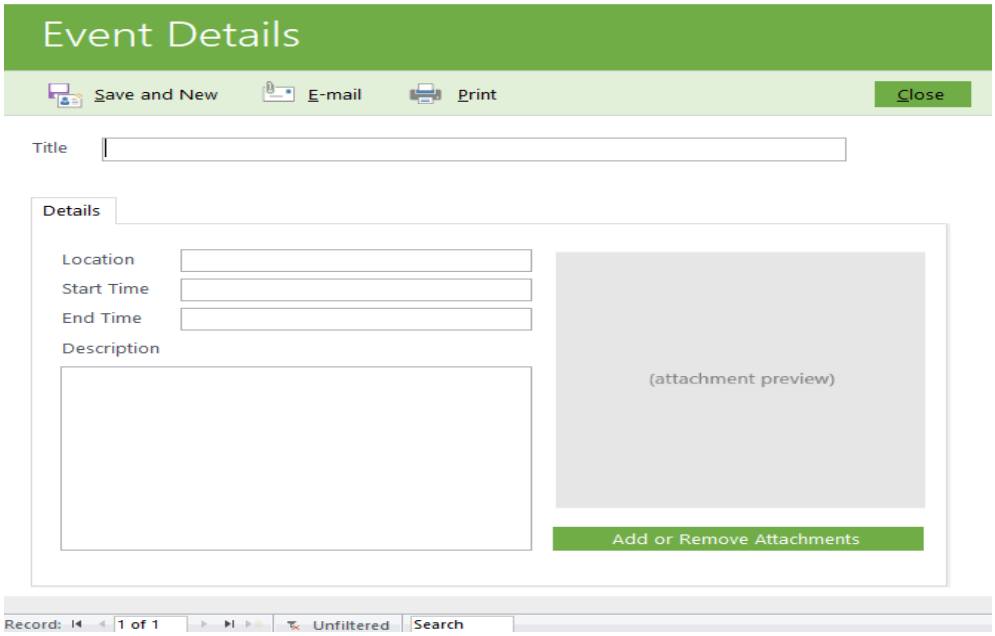
MS AX Application Graphical Interface



*Note.*A graphical user interface of a Microsoft Dynamic AX application depicting user-end environment.

Figure 2

MS Access Application Graphical Interface



Note. A graphical user interface of a Microsoft Access 365 application depicting user end environment.

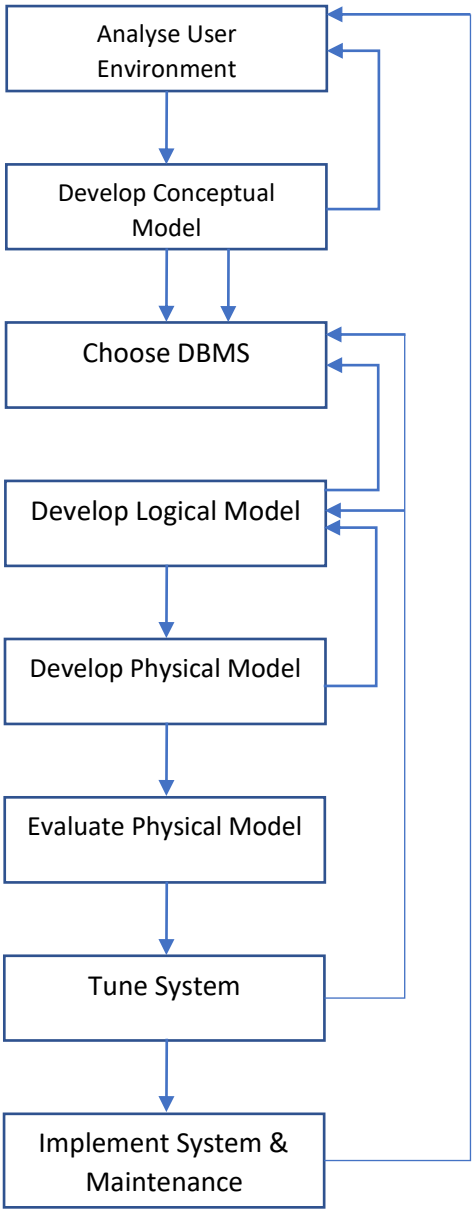
Design and Database Development Process

When a conceptual database model is well designed, it gives protection to the resource by allowing it to resolve so as to serve the present and future information needs. In some cases though, the database management system chosen for implementation may be replaced and consequently, as noted by Marcos et al. (2016), the logical model may be affected but the conceptual model nonetheless can survive.

The diagram below depicts the different stages in the design and development process of a database.

Figure 3

Database Design Model



Note. Steps in staged database design. From Database Designing and Architecture, (2020). Adapted from http://samples.jbpub.com/9781449606008/06008_CH02_RicardoSec.pdf

a. Requirement Analysis/Analyse User Environment Phase

This is the beginning of the stage of the development analysis. In this stage of the design cycle, every necessary information requirements concerning the data the client needs to store in the database are gathered. The database designer then studies the available application to determine their input and output. After all these the examination of the reports obtained by the available and current systems is conducted.

b. Design Phase

After the requirement analysis phase is the design phase which includes developing a conceptual model of the data, choosing database management, developing logical and physical models, and then evaluating the physical model.

i. Develop a Conceptual Data Model

Here the model of the user environment is considered which ensures that the detailed conceptual model of the database that will identify the attributes and entities are developed. How the database should be used is considered by the designer which includes transaction and application types, access type, transaction, and data volume coupled with data frequency(Duarte et al., 2016).

ii. Choose a Database Management System (DBMS)

From the knowledge of the available software and hardware resources, the designer uses the specification derived from such to evaluate what alternative database management system that would best meet the specification should be.

iii. Develop the Logical Model

After choosing and selecting the alternative database management system, the logical model is developed. In this model according to Martinez-Mosquera et al. (2020), the business information and rules are represented and defined, and the data are described in detail upon which entities and relationships among them are included.

iv. Develop the Physical Model

What happens here is that the physical layout of the data that considers the structures (which include the chosen and selected DBMS, hardware, and software support) is planned by the designer.

v. Evaluate the Physical Model

To evaluate the physical model, there is an estimation of application and transaction performance, the quantitative data identified is considered together with the performance characteristics of the hardware and software information to be used.

vi. Tuning Performed if Indicated by Evaluation

The tuning phase is situational such that if from the evaluation stage, there is a need for tuning, then it will uphold. Accordingly, physical structure modification adjustment or software optimization can be done to improve performance.

c. Implementation Phase

If the evaluation is positive, the designer then implements the physical model and the database becomes operational. Therefore, the implementation phase is where you install the DBMS on the required hardware, optimize the database to run best on that hardware and software platform, and create the database and load the data.

Conceptual Modelling and Relationship in Database Design

Conceptual modelling helps us to understand the flow of information in a database and the following factors are involved:

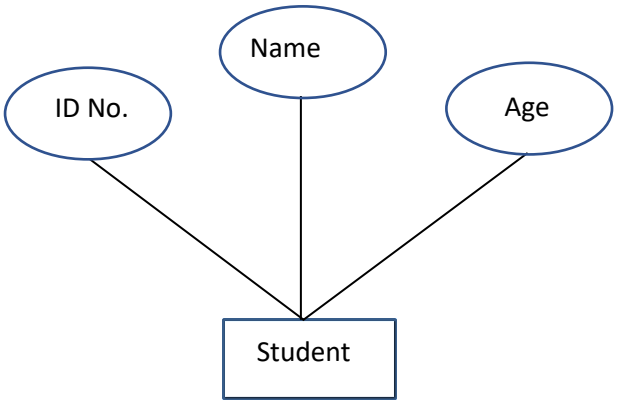
ER Model (Entity-Relationship Model): An ER Model is based on Entities, Attributes, and Relationships among Entities.

a. Entities: An Entities refers to things in the real world which can be physical or abstract, it is anything that has properties e.g. person, student, employee, etc. For example, a student can have a name, date of birth, place of birth, age, and other properties. It is represented with a rectangular shape with the name of the entity inside the box.

b. Attributes: Attributes here refer to properties of entities e.g. name of a person, social security number, date of birth, age, etc. and they are represented with oval shapes.

Figure 4

Entity-Relationship Diagram



Note. This figure shows the entity relationship

In figure 4, the ID No. serves as an identifier. An identifier is an attribute or set of attributes for which no two entities of a given type will have the same value (these attributes are underlined) e.g.

- Student → Student_id
- Employee →Employee_id

Types of Attributes:

i. Simple Verses Composite
- Composite attributes can be broken into meaningful parts.
- Each part has a name and could be of different types.

ii. Single Verses Multivalued
- For some attributes, we may have more than one value for the same entity.
- All values are of the same types and they are not identified by names, similar to array or a set.
- Represented by double lines double oval shape for a multivalued entity .e.g. somebody can have multiple emails.

iii. Stored Verses Derived

- Sometimes, we can calculate an attribute from some other attributes stored in a database
- We call such, derived attributes.
- Dotted lines are used to indicate derived attribute.

c. **Relationships**: This is an association between two or more entities and represented with a diamond shape.

Implementation and Maintenance

Implementation

After the design of any project structure, implementation succeeds the design process. For the project manager and strategic planning process, implementation is needful. This is important because usually at this stage, some challenges that the project designers may not have anticipated are revealed, and as a result, more refined processes, strategies, and products are achieved (Azhar-Susanto, 2019). Consequently, if what is evaluated is in the affirmative, the physical design will be implemented by the designer and the database becomes operational as earlier stated.

The database management system (DBMS) on the required hardware is installed during the implementation phase. In this implementation phase, the database is optimized to run best on the hardware and software platform, creating of database and loading of data are performed as well. The security of the database is established together with the initiation of a data backup plan.

Maintenance

In maintaining a database, the concept is to ensure that sets of tasks run smoothly in order to improve the performance and smooth functioning of the database. Some of the routine tasks are meant to help performance, free up disk space, check for data errors, check for hardware faults, update internal statistics, and many other obscure (but important) things (Azhar-Susanto, 2019). Furthermore, there are some other tips used in maintaining a database which include keeping data in one central file or program, providing insight into the data by using clear descriptive names, tabs and definitions of data, keeping the database complete by adding new information directly, keeping your database up-to-date, and allowing the profiles access to their own data with an edit form or a URL.

Benefits of Database Design Implantation and Maintenance

The benefits and importance of database design and its implementation are the real driving force in embarking on the design and implementation project. So, when a database is properly designed, there would be ease of maintaining the database, the data consistency is improved and in terms of disk storage, there is cost-effectiveness. Other benefits include: scalability for new features, high performance, enforce the integrity of data, surrogate keys, no redundancy, discoverability as noted by Square Code (2018).

Looking at why database maintenance is important, it can be seen that in a poorly maintained or not maintained database, the application performance can be affected adversely which usually leads to downtime and loss of data. Therefore effective maintenance of a database is required to mitigate this risk otherwise the application dependent on them will be slow in

performance and the users will have difficulty in task completion. Ultimately according to Azhar-Susanto 2019 who is particular about proper design and maintenance, if a system is properly designed, implemented, and maintained, one would be able to achieve better flexibility, easy disaster recovery, more storage space, meeting up with technology trends, better company communication, frequent, and real-time availability of information.

Conclusion

For the integrity of data to be achieved, there must be a good database design, coupled with relevant implementation and quality maintenance that follow thereafter. Good maintenance culture improves the performance and life cycle of a database. The only way to mitigate the risk of a prevailing problem is the effective maintenance of the database. Owing to changes that are bound to take place in the system, it is important to periodically monitor the database and keep it up to date. Ultimately a properly designed and implemented database affects the information management and retrieval system which in turn supports the growth

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