Department of Computer Science and Engineering
19CSE101 – Computer Systems Essentials

Case Study: Fitness Management System

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TABLE OF CONTENTS

Brief Introduction of the Application

The fitness app is an application that can be downloaded on any mobile device and used anywhere to get fit. As of 2015, the number of health-related apps released on the two leading platforms, iPhone operating system (iOS) and Android, had reached more than 165,000. Apps can perform various functions such as allowing users to set fitness goals, tracking caloric intake, gathering workout ideas, and sharing progress on social media to facilitate healthy behavior change.

The app tracks how often you stand, how much you move, and how many minutes of exercise you do. Three rings in different colors summarize your progress. The goal is to sit less, move more, and get some exercise by completing each ring every day. The Fitness app keeps a record of your activity.

They can be used as a platform to promote healthy behavior change with personalized workouts, fitness advice and nutrition plans. Fitness apps can work in conjunction with wearable devices to synchronize their health data to third-party devices for easier accessibility.

The fitness app includes the following features:

1. Activity tracking.
2. Metrics tracking.
3. Diet and nutrition tracking.
4. Progress tracking.
5. Sleep tracking.
6. Social sharing.
7. Video tutorials.

The approximate cost of developing the application will be over $20,000.

The product will be a proficient competitor in the market as:

- Efficient User Interface.
- Fast loading time and high performance.
- Helpful customer support.

Operating System

An operating system is a software program required to manage and operate a computing device like smartphones, tablets, computers, supercomputers, web servers, cars, network towers, smartwatches, etc. ... It is a layer of graphical user interface (GUI), which acts as a platform between the user and the computer hardware.

a) Suitable OS at Server Side

Microsoft Windows, commonly referred to as Windows, is a group of several proprietary graphical operating system families, all of which are developed and marketed by Microsoft. Microsoft introduced the first version as 1.0. It was released for both home computing and professional functions of Windows on 10 November 1983. Later, it was released on many versions of Windows as well as the current version, Windows 11.

Advantages of Windows:

- Ease of use
- Availability of software
- Backwards Compatibility
- Support for New Hardware

b) Suitable OS at Client Side

Android is a mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets. Android is developed by a consortium of developers known as the Open Handset Alliance and commercially sponsored by Google. It was unveiled in November 2007, with the first commercial Android device, the HTC Dream, being launched in September 2008.

Advantages of Google Android:

- Android is an open-source platform allowing UI customization. ...
- Supports cloud storage enabling sync of devices with G-account. ...
- Continual improvement & removal of old features. ...
- Supports 3rd party widget & information display on screen. ...
- Supports running multiple apps simultaneously.

Database Schema Design: ER Model

An Entity Relationship Diagram (ERD) is a visual representation of different entities within a system and how they relate to each other.

ER diagrams represent the logical structure of databases. ER Diagram represent relationship between two database tables.

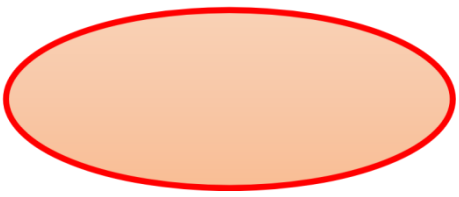
Conceptual design Use ER diagrams

Pictorial representation of DB schema is ER diagram.

We have constructed an ER diagram for a fitness app to manage the data of the users. They are supposed to fill all these details to enroll into our competition.

We have used 3 components in preparing the ER diagram they are, attributes, entity and relations.

*Entity: it is anything in the enterprise that is to be represented in our database. It is represented by a rectangle. Example: student, department, car etc. In my ER diagram Excercises,Tracking,Entity and User are the entities.



*Attributes: Property or characteristics of entity type. Example; age, DOB etc.

There are many types of attributes used while making this ER diagram.

Simple Attributes; These are the attributes which cannot be further divided. In our diagram: username, password etc.

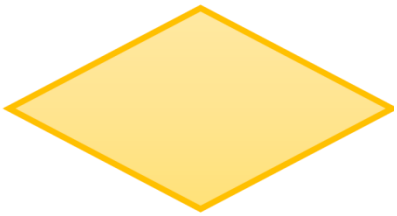
Composite attribute: Composite attributes are those attributes which are composed of many other simple attributes. Category name is the composite attribute here.

Single valued attribute: Single valued attributes are those attributes which can take only one value for a given entity from an entity set.

Multi valued attribute: Multi valued attributes are those attributes which can take more than one value for a given entity from an entity set. Gender, Training Type etc. are multivalued attributes I have used in this ER diagram. These are represented by double line.

Derived Attributes: Derived attributes are those attributes which can be derived from other attribute(s). Denoted by dotted line.

Key Attribute: Key attributes are those attributes which can identify an entity uniquely in an entity set. UserID, TrackingID are the key attributes.



*Relation: A verb phrase which associates between two or more entities. Represented by a rhombus. User's workout plan is the relation in our ER diagram.

Business Rules for the Application

In DBMS, business rules are statements that imposes some form of constraint on a specific aspect of the database, such as the elements within a field specification for a particular field or the characteristics of a given relationship. You base a business rule on the way the organization perceives and uses its data, which you determine from the manner in which the organization functions or conducts its business. Here are some business rules which are followed by the database we created:

1. Each user of the application can have multiple workout plans but it is individual for each user.
2. The age limit of the user is 13 and above. Users below the age of 13 must be check off the parental supervision box.
3. The UserID, PlanID, ExerciseID, and TrackingID will be unique to all the users.
4. The password of the user must consist of letters, uppercase, numbers and miscellaneous characters.
5. The monitoring of thigh, hips, biceps, weight etc. is done regularly.
6. Full use of the service is dependent on the upon your computer with adequate software or a supported mobile service with internet access.

SQL Queries for the Application

These are the queries that DBMS can answer for the application. These are 10 queries that are listed out.

We create a table 'User' using the CREATE TABLE command. Then we add the list of users with their Username, Password, Age, FirstName, LastName, Gender, TrainingType, Description, and UserID as attributes of the table. The UserID is set as a primary key using PRIMARY KEY when creating the table. The users are added once they have enrolled. These queries exhibit the specific information asked using the following commands.

1. A query to list all the details of the participants.
SELECT * from User

2. A query to list the Username of the user whose gender is Male.
SELECT Username from User WHERE Gender = 'Male'

3. A query to list the Username, UserID and TrainingType all the users.
SELECT Username, UserID, TrainingType from User

4. A query to list the UserID, gender and last name of the users whose UserID is between 10000 and 25000.
SELECT UserID, Gender, LastName from User WHERE UserID between 10000 AND 25000

5. A query to list the first name and last name of the users whose gender is female and TrainingType is basic.
SELECT FirstName, LastName from User WHERE Gender = 'Female' AND TrainingType = 'Basic'

6. A query to list the age, gender and UserID of the users whose TrainingType is pro and description is fat.
SELECT Age, Gender, UserID from User WHERE TrainingType = ‘Pro’ AND Description = ‘Fat’

7. A query to list the UserID of the users whose gender is male and TrainingType is medium and; gender is female and description is thin.
SELECT UserID from User WHERE Gender = ‘Male’ AND TrainingType = ‘Medium’ AND SELECT UserID from User WHERE Gender = ‘Female’ AND Description = ‘Thin’

8. A query to list the Description, Training Type and Username of the users whose gender is female, UserID is between 10000 and 30000 and age between 19 and 60.
SELECT Description, TrainingType, Username from User WHERE Gender = ‘Female’ AND Age between 19 AND 60 AND UserID between 10000 AND 30000

9. A query to list the firstname and lastname of the users who have signed at ages below 13.
SELECT FirstName, LastName FROM User WHERE Age<13

10. A query to list the Username, age and description of the users whose TrainingType is medium and Lastname is Sawant.
SELECT Username, Age, Description FROM User WHERE TrainingType = ‘Medium’ AND LastName = ‘Sawant’

Network Model for Deployment of Application

A network is a set of devices (often referred to as nodes) connected by communication links. A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network. A link can be a cable, air, optical fiber, or any medium which can transport a signal carrying information.

Uses of Computer Networks:

- It allows you to share resources such as printers, scanners, etc.
- You can share expensive software and databases among network users.
- It facilitates communication from one computer to another computer.
- It allows the exchange of data and information among users through a network.

Types of Computer Networks:

- Personal Area Network (PAN)
- Local Area Network (LAN)
- Wide Area Network (WAN)
- Wireless Local Area Network (WLAN)
- Campus Area Network (CAN)
- Metropolitan Area Network (MAN)
- Virtual Private Network (VPN)
- Home Area Network (HAN)

Topology defines the structure of the network of how all the components are interconnected to each other.

6 Types of Topologies:

1. Bus topology
2. Star topology
3. Mesh topology
4. Ring topology
5. Tree topology
6. Hybrid topology

a) Suitable Network Model at Server Side

Wide Area Network (WAN)

A wide area network (WAN) is a large computer network that connects groups of computers over large distances. WANs are often used by large businesses to connect their office networks. WANs allow organizations to create unified networks so that employees, customers, and other stakeholders can work together online, regardless of location.

Advantages of WAN:

- WAN covers larger geographical area. Hence business offices situated at longer distances can easily communicate.
- It allows sharing of resources and application softwares among distributed workstations or users.
- Wide area networks also provide you the facility of sharing the data to all of your connected devices in a network. For example, through WAN connection all office branches can share the data through the head office server. You can get back up, support, and other useful data from the head office and all data are synchronized with all other office branches.
- Organizations can form their global integrated network through WAN. Moreover, it supports global markets and global businesses.
- Software companies work over the live server to exchange updated files. So all the coders and office staff get updated version of files within seconds.

Hybrid Topology

Hybrid topology is an integration of two or more different topologies to form a resultant topology which has many advantages of all the constituent basic topologies rather than having characteristics of one specific topology.

For instance, if in an office in one of department ring topology is employed, and in another star topology is employed, connecting these topologies will end in Hybrid Topology (ring topology and star topology).

Advantages of Hybrid Topology:

- This type of topology combines the benefits of different types of topologies in one topology.
- Can be modified as per requirement.
- It is extremely flexible.
- It is very reliable.
- It is easily scalable as Hybrid networks are built in a fashion which enables for easy integration of new hardware components.
- Error detecting and troubleshooting is easy.
- Handles large volumes of traffic.
- It is very effective in large networks.

b) Suitable Network Model at Client Side

Local Area Network (LAN)

A LAN is a computer network that consists of access points, cables, routers, and switches that enable devices to connect to web servers and internal servers within a single building, campus, or home network, and to other LANs via Wide Area Networks (WAN) or Metropolitan Area Networks (MAN). Examples of LAN are networking in a home, school, library, laboratory, college, office, etc.

Advantages of LAN:

- LAN provides resource sharing; computer resources like printers, scanners, modems, DVD-ROM drives, and hard disks can be shared within the connected devices. This reduces cost and hardware purchases.
- In a Local Area Network, it is easy to use the same software in a number of computers connected to a network instead of purchasing the separately licensed software for each client a network.
- Data and messages can easily be shared with the other computer connected to the network.
- The data of all network users can be stored on a hard disk of the central/server computer. This helps users to use any computer in a network to access the required data.
- Since data is stored on the server computer, it will be easy to manage data at only one place and the data will be more secure as well.

Star Topology

Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer.

The central computer is known as a server, and the peripheral devices attached to the server are known as clients.

Advantages of Star Topology:

- Failure of one node does not show impact on other nodes and the other part of the network works perfectly. So, this topology shows high reliability
- Here, the addition and removal of nodes can be added to the network without influencing the rest of the network. So, replacing nodes seems to be simple and easily manageable
- The length of the star network topology can be extended by adding multiple stars to the server.
- As every device is connected to the server/hub using the cable, the probability of data collisions is very less. This also corresponds that performance is higher when compared with other network topologies.
- When there is any NIC failure or cut cable, the impact is shown only on one node.

Conclusion

- This application is for fitness daily tracking and monitoring.
- This application uses Android operating system as a server side OS.
- It uses its own device and mobile or computer, so customers can control the tracking and monitoring.
- This application stores the users name, age, body type, weight, height, etc. and is constantly monitored.
- This application uses a client - server model as a Networking model.
- We use a star topology in the client side and a hybrid topology in the server side of the OS.
- The application is meant to be user friendly, easy to use but also to be used with precaution as it the user's health that is on the line.

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