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Mega.com

Project Report

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Database Systems
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1) Scope

In 21th century the role of the cell phones can not be underestimated. We saw an opportunity to sell cell phone product in a growing market. That’s why we created Mega.com. In Mega.com, we designed a website for selling all the things about the phone such as batteries, phone covers, charging and connection cables, headphones, car accessories, screen protectors, phone stands, portable speakers, armbands etc. Mega.com comes from the first letters of the group member’s name which are Mert, Efe, Gulce and Alper. Mega.com users can order all the things about a phone in our e-store in a large scale. Users can see the products without logging in and they can sign up to the Mega.com for free. For giving an order to the site, users must have an account. Mega.com will send the products via their account information safely.

Mega.com’s database is used to store category information, city information, color information, manufacturer information, order information, product information, user information, type of telephone information and special information & stock about every product. For Web Design & Management part we use NetBeans IDE. Also for the database part we use Java DB. In our database we use integer, varchar, blob, double and date data types.

1.1) Major Inputs

– Product Issues
  *Information about every product is defined by Mega.com employees
– Financial Issues
  *Credit Card Number
  *Credit Card Security Number
  *Credit Card Expiration Date
– Security Issues
  *Usernames
  *Passwords (should be kept with cryptic version)
– Processing Functionalities:
  * Interface for ordering product
  *Showing the stock for every product and buy now option for if stock is valid

1.2) Major Output

-Mega.com order request

1.3) Processing Functionalities

Function	**Priority**
User Login	Optional
User Checkout	Optional
User Information on Checkout	Essential
Credit Card Number	Essential
Credit Card CVC	Essential
Credit Card Expiration Date	Essential

Table 1: Processing Functionalities

1.4) User Requirements

Req. No	**Priority**	**Reference**	**Description**
R1	Low	Costumer	Login the Mega.com
R2	High	Costumer	User should login for ordering products
R3	High	Costumer	User should give his/her credit card number
R4	High	Costumer	User should give his/her credit card CVC
R5	High	System	System take the order and send it
R6	High	System	System automatically update the stock

Table 2: User Requirements

1.5) Milestones

Key Milestones	**Start Date**	**End Date**
Project requirements planning	15 March 2015	1 April 2015
Planning and creating tables for database	1 April 2015	15 April 2015
Designing and coding website	15 April 2015	20 April 2015

Database and website connected	20 April 2015	1 May 2015
Test case & Bug fix	1 May 2015	7 May 2015

Table 3: Milestones

1.6) CRUD Operations

SQL Insert Operations

- Adding user information to User Table while signing up of a user to website
- Adding purchasing product to Order Table in database

SQL Update Operations

- Editing Information of user
- Updating stock number after a successful purchase

SQL Delete Operations

- Deleting a user

SQL Read Operations

- Reading all product information (photos, price, name, size etc.) from database
- Reading all user information from database

2) Functional Dependencies

Functional dependency is a relationship that exists when one attribute uniquely determines another attribute. If R is a relation with attributes A and B, a functional dependency between the attributes is represented as A→B, which specifies B is functionally dependent on A.

Functional dependency in a database serves as a constraint between two sets of attributes. Defining functional dependency is a significant part of relational database design and contributes to aspect normalization.

- ProductID → ProductName
- ProductID → ProductPrice
- ProductID → ProductPhoto
- ProductID → ProductSize
- ProductID → ProductSpec
- ProductID → ProductStock
- ProductID → ColorName
- ProductID → ManufName
- ProductID → TypeName
- UserID → UserMail
- UserID → UserPassword
- UserID → UserName
- UserID → UserSurname
- UserID → UserAddress
- UserID → CityName
- {ProductID, UserID} → OrderID

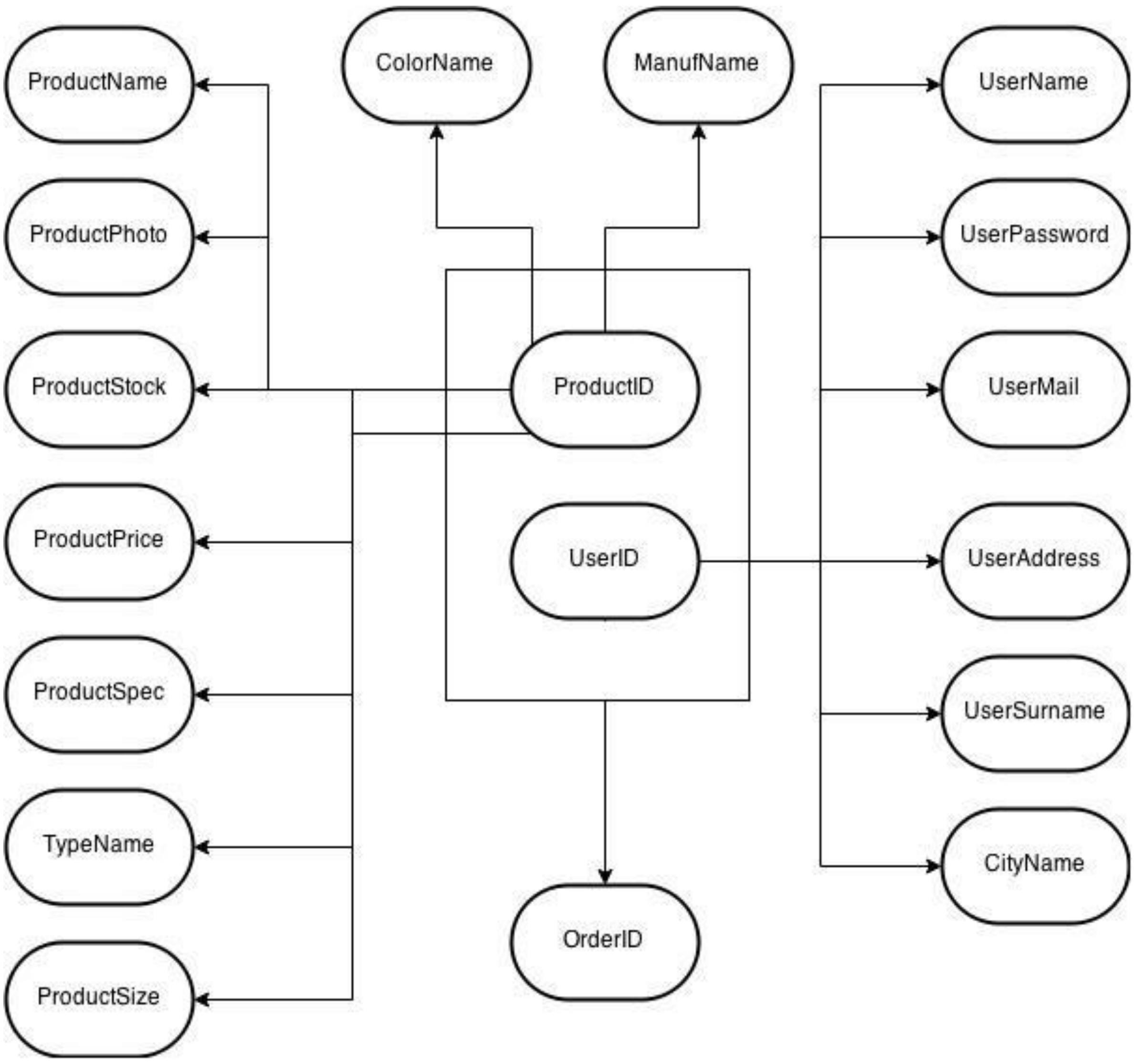


Table 4: Functional Dependencies

3) Normalization Steps

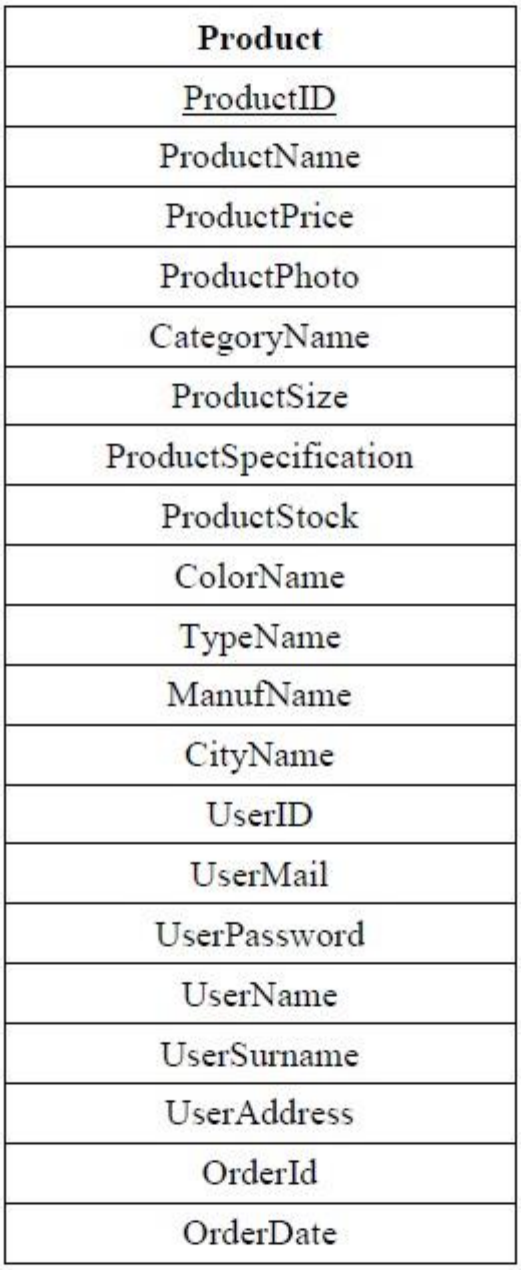
Normalization is the process of efficiently organizing data in a database. The purpose of normalization is to reduce data storage and to reduce data redundancy by making sure any given piece of data is stored only once.

For instance, if there are a lot of same city values in a table, programmers do not want to write them all. They create another table for cities and connect two tables with keys. This process makes effective database and programmer can save a lot of space after normalization.

3.1) 1NF

The main purpose of the first normalization form is eliminate repeating groups. The first rule dictates that we must not duplicate data within the same row of a table.

- There is no duplicate rows in the table.
- There is no duplicate columns in the table.
- No multi-valued attributes, like storing multiple phone number in a single column.
- All entries within a single column must be of the same data type.



Product
<u>ProductID</u>
ProductName
ProductPrice
ProductPhoto
CategoryName
ProductSize
ProductSpecification
ProductStock
ColorName
TypeName
ManufName
CityName
UserID
UserMail
UserPassword
UserName
UserSurname
UserAddress
OrderId
OrderDate

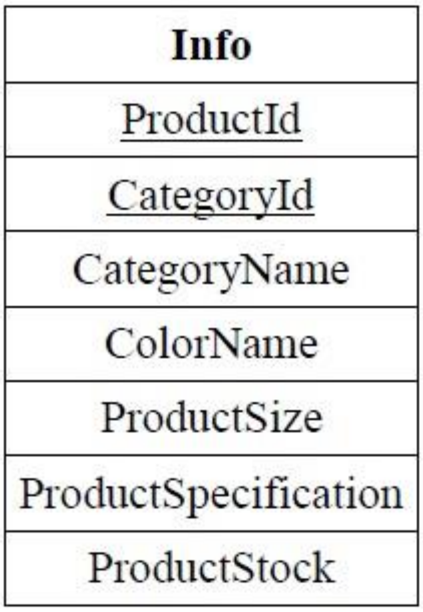
Table 5: 1NF

In the project, we use normalization to define and organize entities and attributes. In first normal form, we define all rows and collect attributes in a single table without any repetition.

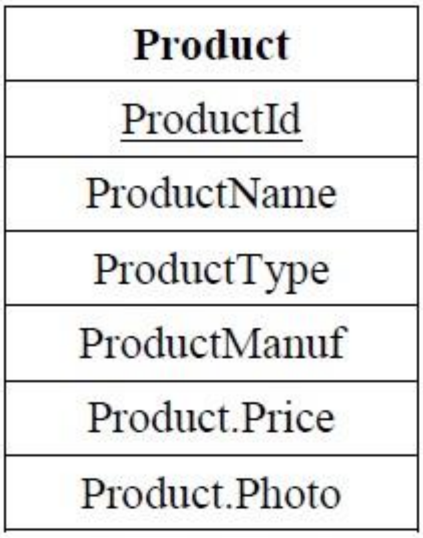
3.2) 2NF

The main purpose of the second normalization form is eliminate redundant data. 2NF attempts to reduce the amount of redundant data in a table by extracting it, placing it in new table or tables and creating relationships between those tables.

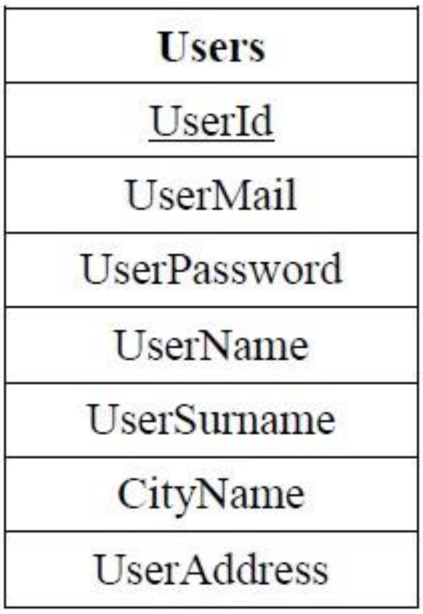
- Remove subsets of data that apply to multiple rows of a table and place them in separate tables.
- Create relationships between these new tables and their predecessors through the use of foreign keys.



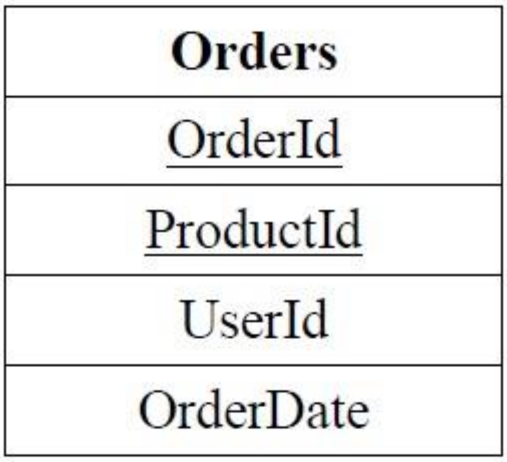
Info
ProductId
CategoryId
CategoryName
ColorName
ProductSize
ProductSpecification
ProductStock



Product
ProductId
ProductName
ProductType
ProductManuf
Product.Price
Product.Photo



Users
UserId
UserMail
UserPassword
UserName
UserSurname
CityName
UserAddress



Orders
OrderId
ProductId
UserId
OrderDate

Table 6: 2NF

In second normal form, we split one table to four main tables and define a primary key /keys for each table. In Info table, there are two primary keys because any product can be in different categories at the same time. Also Order table has 2 primary keys because users can buy a lot of products in the same order number. This situation gives the chance of creating shopping carts in this project. The rest of them have only one primary key.

3.3) 3NF

The main purpose of the third normalization form is eliminate non-dependent columns. Third normal form (3NF) is a database principle that allows you to cleanly organize your tables by building upon the database normalization principles provided by 1NF and 2NF.

- Eliminate transient dependencies.
- Remove columns that are not fully dependent upon the primary key.

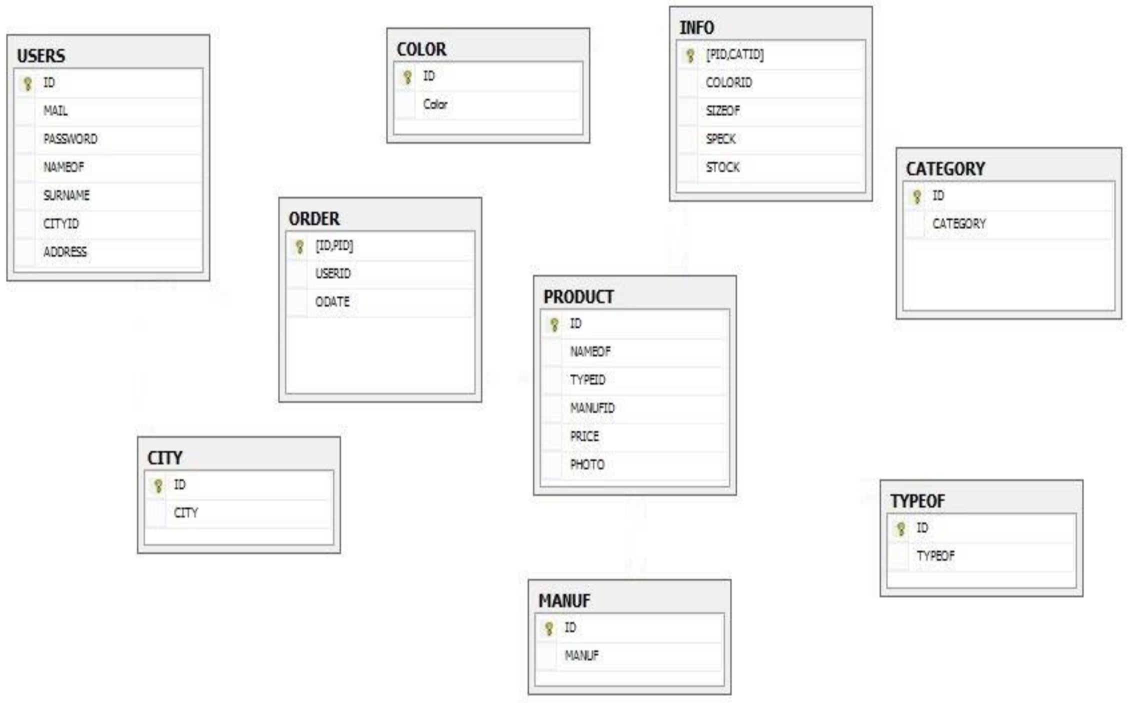


Table 7: 3NF

In third normal form, we separate 4 tables into 9 different tables. We define that color, city, manuf, typeof, and category tables should be in different table. We determine like that because of efficient memory management and organizing information easily in database.

Every color name has a unique integer id number because integer is 4 byte, using id in color table provide us more efficient memory. In addition, because color, city, manuf, typeof, and category have unique id, nobody can add meaningless color, manufacture name to database and organizing them will be easy.

4) Entity Relationship Diagram

ER models are represented by ER diagram. In project, we have 9 different entities (USERS, ORDER, CATEGORY, INFO, CITY, PRODUCT, COLOR, MANUF, and TYPEOF). Each entities have different attributes and all of these are in some relationship each other. In ER diagram, there are no many to many (M2M) because controlling and defining entities are not easy in entities and relationships diagram. There are 5 'one to many' relationships and 3 'one to one' relationships in ER diagram.

One to One

- Category → Info
- Info → Product
- Order → Product

One to Many

- Order → Users
- Product → Typeof
- Product → Manuf
- Info → Color
- Users → City

In User, category, city, product, orders, manuf, typeof, and color tables, ID is a primary key. In Info table, there are two different primary keys (PID and CATID) because any product can be in different categories at the same time. Also in Order table, there are two different primary keys (ID and PID) because in shopping cart, all products which is purchased need to be the same order number.

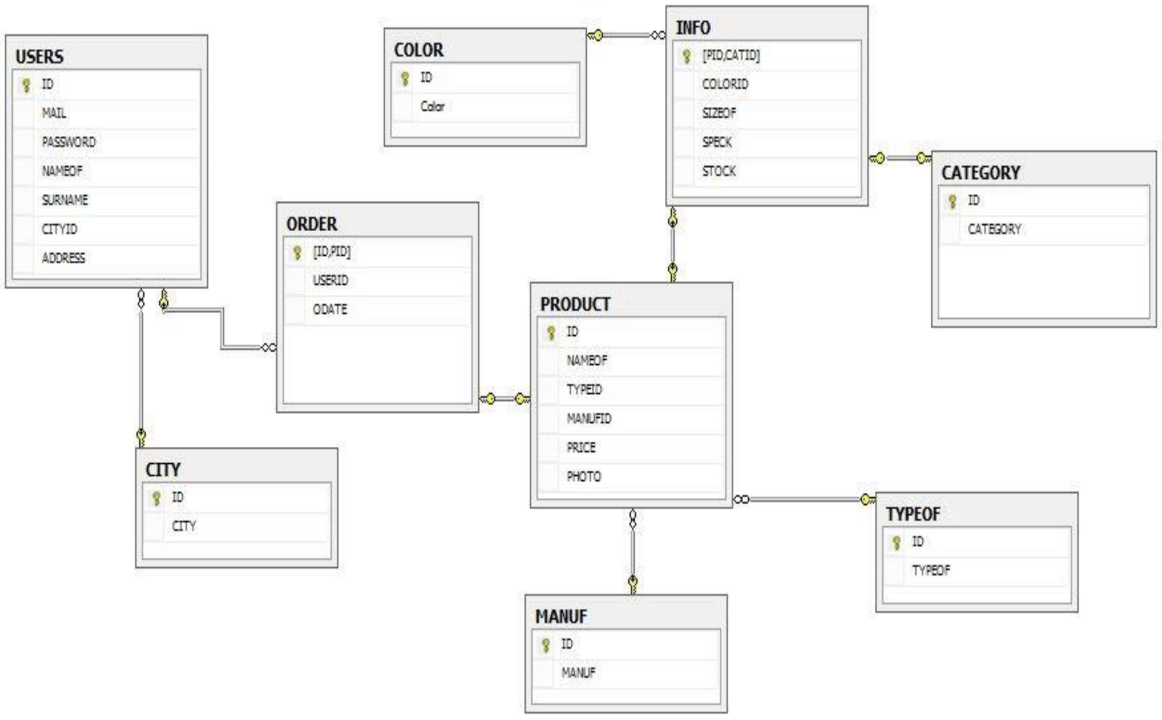


Table 8: ER Diagram

5) Application Information

5.1) Platform

- Java : Our programming language and computing platform for Mega.com project
- Glassfish: Open-source application server
- Html: HTML stands for Hypertext Markup Language and it is used for creating websites. HTML is not a programming language but it is a markup language. It needs to be interpreted by web browser.
- CSS: CSS stands for Cascading Style Sheet. It is used for editing the look and format of a page written by a markup language.
- JDBC: It is Java database connectivity technology by Oracle. This is an API for Java to set connection between database and program.
- Derby: It is a relational database management system and it is open source. We choose Derby because it has small footprint and it has embedded JDBC driver that we can use in Java.
- NetBeans IDE: It is a software development platform developed by Oracle. In Mega.com we preferred to use NetBeans because it is free, open source and it has support for Java platforms.

5.2) Architecture

Mega.com has 3 layer application architecture. First layer is user interface in this layer we have a website for users to buy their products from our website. Second layer is business logic layer. Business logic essential to be shared through channels. Also we have a database layer in our Mega.com project. The whole thing need to be stored in our database.

First of all we designed our database for Mega.com project. While we are designing our database, we aim to store the clean data. Also, we aim to use low memory while we are designing Mega.com database. We create our tables for our future needs in this project. After designing and coding our database, we created our website. We used database first approach in this project.

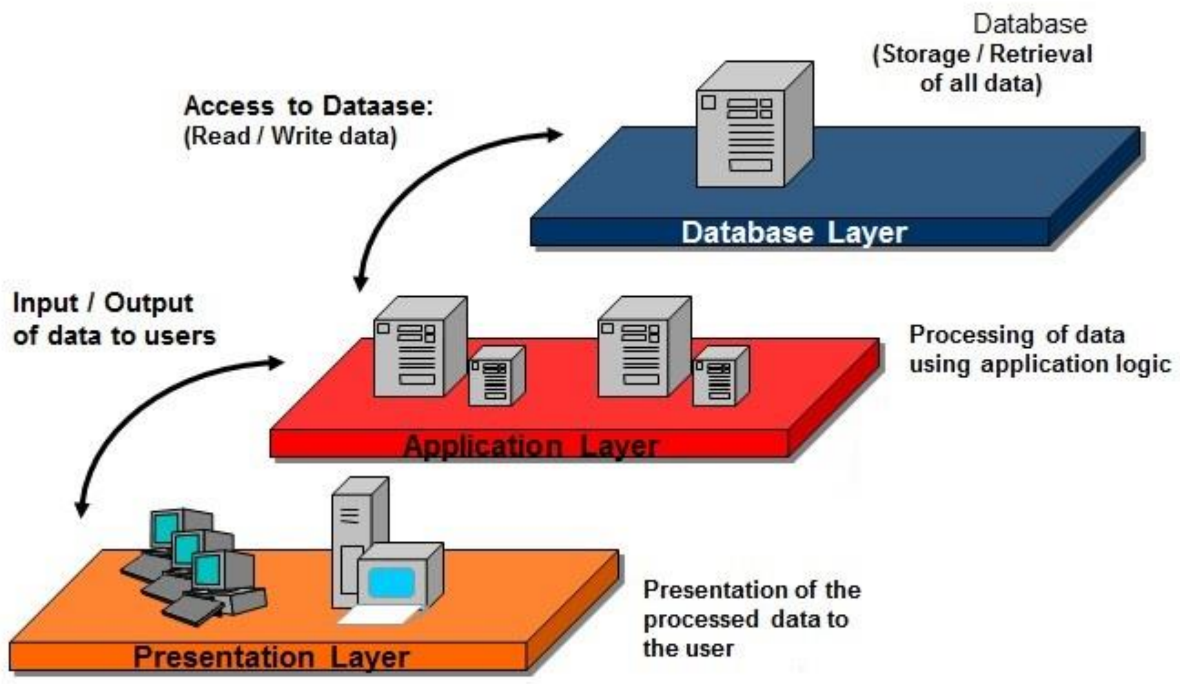

Database
(Storage / Retrieval of all data)
Access to Dataase:
(Read / Write data)
Database Layer
Input / Output of data to users
Processing of data using application logic
Application Layer
Presentation of the processed data to the user
Presentation Layer

Table 9: Tier Client/Server Environment