

Modeling and Development of a Database for the Analysis of Financial Indicators of the Company

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Abstract—The article considered the issues of modeling and development of a database for storing and processing information. Furthermore, an analysis was carried out between the systems for database development. After a detailed analysis, there was selected one popular database management system. It should be taken into account that all systems have been studied for the optimal choice of the platform. The basic concepts of databases, methods of their classification, principles of organization of data structures were considered and described. A model is presented that allows describing conceptual schemes of data storage and processing. Moreover, after compiling the infological data model, the data structure was developed and tables with data types were created. The next stage was the implementation of the user interaction interface with the database management system. The final stage of the implementation of the article was the analysis of the financial indicators of the organization. To analyze the financial indicators of the organization, materials on calculating profits, deductions, and preliminary expenses of the store were studied. Thus, the organization's indicators were developed.

Keywords—Database Management System (DBMS), Database (DB), SQL, Postgresql, automated information systems (AIS), information systems (IS), Django

I. INTRODUCTION

In the 21st century, the rapid growth of the computer industry allowed almost all organizations to have their own electronic databases. Thus, electronic databases have become a powerful tool in the work of absolutely all spheres of activity of any organization. Complexes of tools called information systems (IS) are designed for storing, organizing and analyzing large amounts of information. One of the types of such automated information systems (AIS) today are databases (DB) managed using database management systems (DBMS)[1].

It should be taken into account that the modeling and implementation of the correct database structure will provide access to up-to-date and accurate information, which will make it possible to analyze the financial performance of the organization in the market.

Materials and methods of research. In this paper, to develop a database, the basic concepts of a database were first studied. A database is an organized structure designed to store information. The concept of a database management system is closely related to the concept of a database.[11] A database system consists of software, a database management system (DBMS) and one or more databases. A DBMS is a set of programs that allows users to store, manage and access data[2]. All databases are created for one purpose - data storage. However, when searching, for example, the performance and reliability of different DBMS, they differ from each other. To solve the tasks, a comparison of the most popular DBMS of domestic and foreign production was carried out. Among them, imported DBMS include: Oracle, MS SQL Server, PostgreSQL[15].

II. DATA STORAGE

MS SQL Server DBMS has a wide range of functionality and is in no way inferior to Oracle DBMS in its performance. It should be taken into account that MySQL is designed to solve a narrow range of tasks[9]. The advantage of PostgreSQL over MySQL is an attempt to comply with the SQL standard as much as possible with the implementation of the newest standards, which significantly expands the functionality of this DBMS[10,11]. Also, PostgreSQL has no limitations in application, starting from a simple database serving a website or a small company, and ending with huge powerful data stores [3].

III. ANALYSIS OF THE ORACLE DBMS

Oracle DBMS is a relational database management system. It is also called OracleDB or simply Oracle. It is run and sold by Oracle. It was created in 1977 by founder Lawrence Ellison and other engineers. It is one of the most popular relational database engines on the IT market for storing, organizing and retrieving data.

The current version of Oracle is 21c, it is used for cloud environments and can be published on several servers or in one, this will help regulate the database, which contains a lot of records. He always focused on the needs of enterprises and did not lag behind the latest technological developments. As a result, its products are constantly updated with new features. Oracle allows users to choose from different database releases according to their specific requirements with a cost-effective solution.

In addition, the security in this version is brought up to a high degree, due to the fact that any transaction is isolated from others. The main advantages and disadvantages of this DBMS are presented in Table 1.

TABLE 1- ADVANTAGES AND DISADVANTAGES OF THE ORACLE DBMS

Advantages	Disadvantages
+Reliable	-Price: paid
+There is a backup server	-Hardware upgrade
+The newest innovations and the best functionality have been introduced	-Dear support

MySQL is one of the most recognizable technologies in the modern big data ecosystem. Often called the most popular database and currently enjoying wide and effective use regardless of the industry, it is clear that anyone involved with corporate data or general IT should strive for at least a basic familiarity with MySQL. With MySQL, even those who are not familiar with relational systems can immediately create fast, powerful and secure data storage systems. MySQL programming syntax and interfaces are also the ideal gateway to the wide world of other popular query languages and structured data stores[8]. Database structures are formed in physical files that are needed to optimize speed. The database applies these rules, so with a well-designed database, the application will in no way notice contradictory, duplicated, unattended, outdated or missing data. After the above analysis, a table was developed where you can easily analyze the disadvantages and advantages of this DBMS in Table 2.

TABLE 2 - ADVANTAGES AND DISADVANTAGES OF MYSQL DBMS

Advantages	Disadvantages
+ One of the most common DBMS with non-closed source code.	-MySQL does not effectively support a very large database size.
+ The product is very easy to use.	-The price for legal entities is unacceptable for most organizations.
+MySQL is available for free download	-An earlier version of MySQL (5.0 or less) does not support ROLE, COMMIT and stored procedure.

PostgreSQL is a strong concept of object-relational databases together with an open source code, which applies and extends the SQL programming language in combination with numerous functions that allow you to reliably keep and scale the most difficult labor overload of information. PostgreSQL appeared by 1986 as part of the POSTGRES project at the University of California at Berkeley and has been actively developing on the base platform for more than 35 years.

It should not be ignored that PostgreSQL has several databases that together form a database cluster. During initialization, template0, template1 and Postgres databases are created. The creation of a new user database is carried out through template databases, which consist of system catalog tables.

PostgreSQL is used as the primary data warehouse or data warehouse for many web, mobile, geospatial, and analytics applications. The latest major version is PostgreSQL 12.

This DBMS has many features, and helps developers develop applications, administrators protect the unity of data and implement environments, in addition, manage data, regardless of how large or small the data set is.

The main advantages and disadvantages of PostgreSQL are presented in Table 3.

TABLE 3- ADVANTAGES AND DISADVANTAGES OF POSTGRESQL DBMS

Advantages	Disadvantages
<ul style="list-style-type: none"> + A database that is known for supporting multiple data types, an intuitive data warehouse. + Price: Open source + PostgreSQL has no restrictions in use, starting from a simple database serving a website or a small company, and ending with huge powerful data warehouses + Less complex SQL syntax as PostgreSQL follows standard SQL + Supports JSON format. 	<ul style="list-style-type: none"> -The instructions for use are not entirely clear, therefore, because of this, answers to some problematic questions will need to be searched on the Internet -There is no emergency phone number

As a result, there was a comparison of the speed of sampling from one table, updating one table, the speed of sorting (ORDER BY) and grouping (GROUP BY) when sampling data from one table, as well as the speed of insertion into the table and internal merging of two tables. And we got this result. And as a result, we saw that PostgreSQL works faster than MySQL, as the tests showed (Figure 1), by about 2 times. And it was decided to use PostgreSQL.

Summing up, taking into account the analysis done, I would like to note that the most suitable DBMS for this dissertation project are: MySQL and PostgreSQL. But, it is necessary to choose one COURT. And for this, another analysis was made. It became clear to everyone that MySQL is specialized in order to solve limited problem solving.

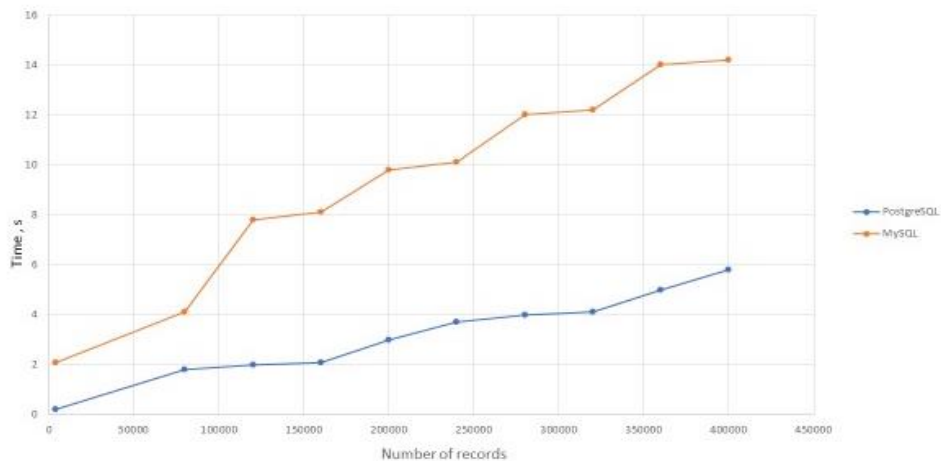


Figure 1 Adding data with an index to a table

After sampling the DBMS, an infological data model was formed.[4,12] This model is compiled by the author and is shown in Figure 2.

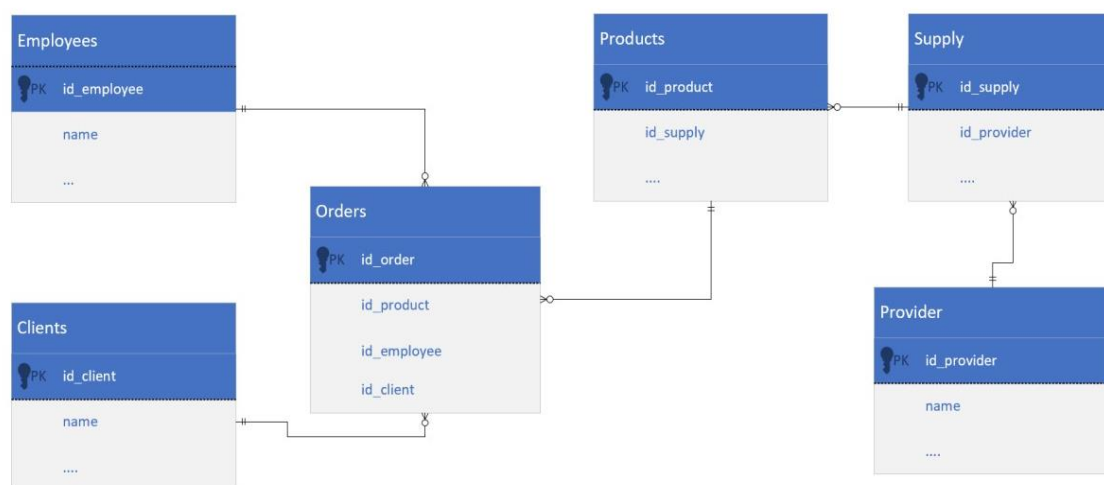


Figure 2 Infological model of a computer store database

The first stage and the most important stage in the process of designing and creating a database is the development of an infological model.

The purpose of infological modeling is to provide the most natural ways for a person to collect and present the information that is supposed to be stored in the database being created. The main structural elements of infological models are entities, the relationships between them and their properties (attributes).

PostgreSQL was used to create the database. After the analysis, the structure was developed and tables were created.[8]

In tables, data is distributed into columns (which are called fields) and rows (which are called records). All data contained in the table field must have the same type. Each field of the table is characterized by the name, type and width of the field. When setting the field data type, you can also specify the size, format, and other parameters that affect the display of the field value and the accuracy of numeric data.

Basic data types:

- Text. Text or numbers that do not require calculations.
- MEMO. A field of this type is intended for storing small text data (up to 64,000 characters). A field of this type cannot be keyed or indexed.
- Numeric. This data type contains many subtypes. The accuracy of calculations depends on the choice of subtype (size).
- Counter. Unique, sequentially increasing numbers that are automatically entered when a new record is added to the table.
- Logical. Boolean values, as well as fields that can contain one of two possible values.
- Money. Monetary values and numerical data used in mathematical calculations.
- Date/Time. The date and time are stored in a special fixed format. To create a database, it was necessary to determine what types of data would be present in our tables.[5] These data types are developed by the author and shown in Figure 3.

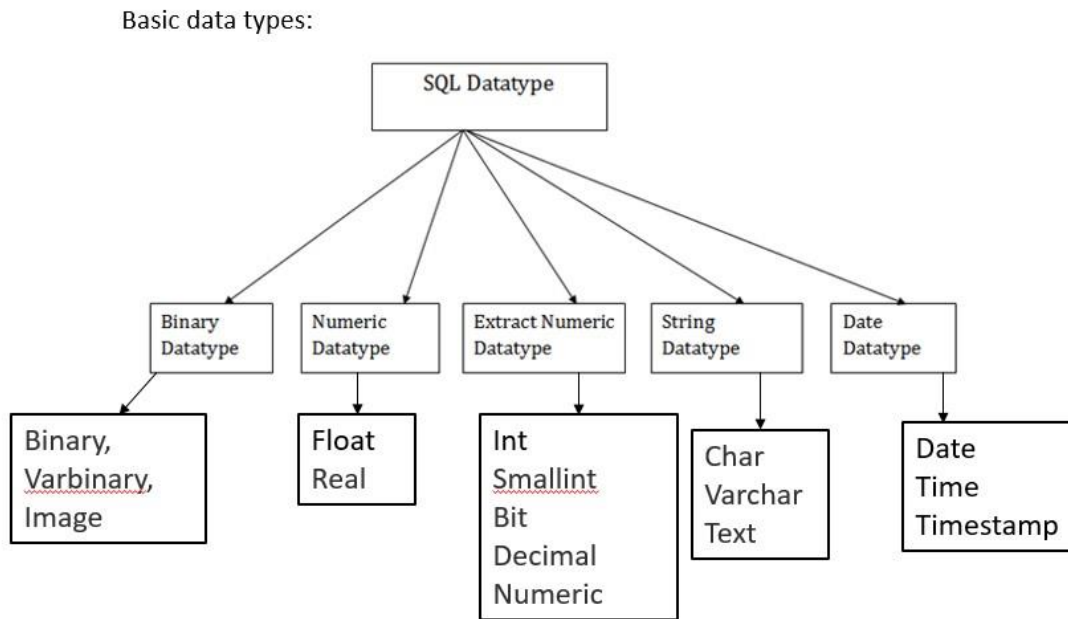


Figure 3 Data Types

Entities are the basic types of information that are stored in a database (in a relational database, each entity is assigned a table). Figure 3 shows entities as: employees, products, customers, delivery[6]. Each entity has its own attributes[7] and data types. Also, tables were created in the PostgreSQL database.

TABLE 4- CREATING A PRODUCT TABLE

```

create table PRODUCT
(
    product_id          NUMBER(19) not null,
    delivery_id         NUMBER(19),
    producttype        VARCHAR2(255 CHAR)
not null,
    status              VARCHAR2(255 CHAR),
    contract            NUMBER(19),
    productname         NUMBER(19),
    sumofcomission     NUMBER(19),
    sum                 NUMBER(19),
    producticon        NUMBER(19),
    amount              NUMBER(19)
)
    
```

TABLE 5- CREATING A EMPLOYEES TABLE

```

create table EMPLOYEEES
(
    employee_id         NUMBER(19) not
null,
    phone               VARCHAR2(255 CHAR),
    companyname        VARCHAR2(255 CHAR),
    address             VARCHAR2(255 CHAR)
)
    
```

TABLE 6- CREATING A CLIENT TABLE

```

create table CLIENT
(
  client_id          NUMBER(19) not null,
  first_name        VAR HAR2 (255 CHAR),
  surname           VAR HAR2 (255 CHAR),
  address           VAR HAR2 (256 CHAR),
  phone_number      NUMBER(19)
)

```

TABLE 7- CREATING A DELIVERY TABLE

```

create table DELIVERY
(
  delivery_id       VARCHAR2(255) not null,
  provider_id       VARCHAR2(255) not null,
  date_of_delivery  DATE,
  parent_id         VARCHAR2(255)
)

```

TABLE 8- CREATING A PROVIDER TABLE

```

create table Provider
(
  provider_id       NUMBER(19) not
null,
  name_provider    VARCHAR2(255 CHAR),
  representative    VARCHAR2(255 CHAR),
  Telephone         NUMBER(19)
  Address          VARCHAR2(255 CHAR)
)

```

TABLE 9- CREATING A ORDER TABLE

```

create table ORDER
(
  order_id          NUMBER(19) not null,
  product_id        NUMBER(19) not null,
  employee_id       NUMBER(19) not null,
  client_id         NUMBER(19) not null,
  Placement_date    VARCHAR2(255 CHAR),
  execution_date    VARCHAR2(255 CHAR)
)

```

System models are a model that consists of all models, such as usage scenarios, action diagram, sequence diagram, er diagram. Here we will try to analyze the overall activity of the proposed system using usage scenarios, sequence diagrams, activity diagrams and scenarios.

System models can explain the system from different points of view:

The external perspective in which you model the context or environment of the system. An interaction perspective in which you model the interaction between a system and its environment or between system components.

A structural perspective in which you model the organization of the system or the structure of the data processed by the system.

A behavioral perspective in which you model the dynamic behavior of a system and how it reacts to events.

When developing requirements, models of both new and existing systems are used. Models of existing systems help clarify what the existing system does and can be used as a basis for discussing its strengths and weaknesses. Then they lead to requirements for the new system. Models of the new system are used during requirements development to help explain the proposed requirements to other system stakeholders. Engineers use these models to discuss design proposals and document the system for implementation.

Each website has three main sections of code: input logic, business logic, and user interface logic.

The code has to perform certain functions, the input data is a set of data and how it is stored in the database. It's just a matter of delivering the input data to the database in the desired format.

Business logic is what controls the output of the server in HTML or another format. HTML and CSS are the pages for which it is written. Nowadays, a different approach is used. Content is collected from multiple sources and stored in separate files. This is known as page streaming, and it is a widely used approach to website content. The code of a web page is stored in a single file, and HTML, CSS and JS are stored in separate files. The content is transmitted from the server and displayed in the browser. Nowadays, the vast majority of software development is done using web technologies such as JavaScript, HTML, CSS and JAVA, which are familiar to developers. It may seem surprising that most of the software development is done using these technologies.

The web browser requests the page. When the page is received, the data is displayed in placeholders on the page. The response is then sent back to the client, terminating the session and blocking further requests for a few seconds. The next time the client navigates to the same URL, the application will be ready, and a new session will start. This is how traditional web applications work. Traditional web applications are difficult to change. If business requirements change, the application is usually too large to be changed. If the marketing requirements change, the application is usually too large to be changed.

Separate files are used to process each of these steps in the Django web application. URLs: The browsing functions can be used to process HTTP requests more efficiently by processing each resource separately. URLs, on the other hand, can be processed together using a single function. The view functions can handle each resource separately by handling URLs separately. The viewer functions can also receive data from the URL converter, which matches certain literal strings or characters in the URL and passes them as data.

Performance. The view can be based on a database, application, or any other source of information, and it is usually separated from the code that receives HTTP requests and responds to them. When you send an HTTP request to an application, the code processing that request may be on the same physical computer as the application code. This may not be the case for a large number of requests. For example, a web application running in a cloud infrastructure may have one virtual host running on one physical computer. In this case, the code processing the requests may not be on the same physical computer as the code receiving the requests. Models: The data structure and methodologies of database applications are determined by the model.

Template: A txt HTML template file defines a structure or layout file with placeholder text representing the actual content. The model can be used to dynamically populate an HTML page

with data from a view, creating a view. The template is used by defining the structure of any type of file, not just HTML.

How models and templates are interconnected with view can be seen in (Figure 4).

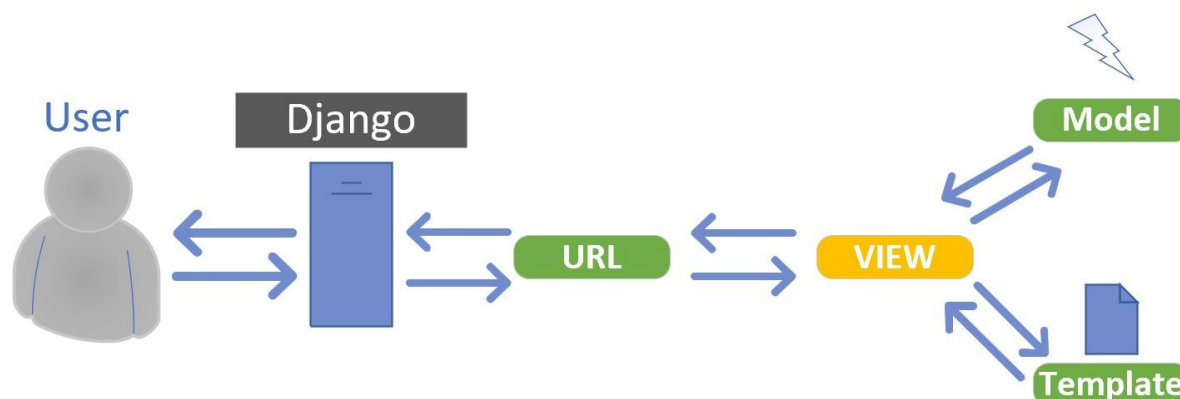


Figure 4. Django Architecture

I would like to show some advantages of using this architecture in Django:

A. Fast development:

One of the advantages of Django is that multiple developers can simultaneously work on different aspects of the same application. In fact, Django's architecture, which separates components, allows multiple developers to work on different aspects of the same application at the same time.

B. Loosely coupled:

Every part of the Django architecture must be present to maintain a high level of website security. Because the model file will now be stored only on our server, and not on the web page.

C. Ease of modification.

The value of this element of the Django architecture is that we don't need to change other components if there are changes in them. The advantage of using Django is that it gives us much more flexibility when developing our website than other frameworks.

The tools that were used to create the application are: Python. Python is a high-level interpreted object-oriented programming language with dynamic semantics. Its high-level embedded data structures combined with dynamic typing and dynamic binding make it very attractive for rapid application development, as well as for use as a scripting language or a binding language for connecting existing components. Lightweight and simple for the purpose of research, Python syntax focuses on readability and, thus, reduces the cost of product service. Python retains modules and packages, which contributes to program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form for free for all major platforms and can be freely distributed.

Web services are published to facilitate the use and integration of operationalized models and codes in the system and applications. Every time web services are deployed or updated, a Swagger-based JSON file defining the service is created automatically. Application developers can invoke and integrate web services into their applications by using a Swagger-based JSON file for a specific service and providing any necessary input data for that service. A Swaggerbased JSON file is used to create client libraries for integration.

It was with the advent of web services that the idea of SOAP-service-oriented architecture of web applications appeared[17].

Swagger is a framework for the RESTful API specification. Its purpose is that it makes it possible not only to interactively view the specification, but also to send requests – the so-called Swagger UI.

It is also possible to generate a client or server directly according to the Swagger API specification, for this you will need Swagger Codegen.

Swagger has two approaches to writing documentation:

Documentation is written based on your code.

This approach is positioned as "very simple". It is enough for us to add a few dependencies to the project, add a configuration and we will already have the necessary documentation, although not as described as we wanted.

The project code becomes not very readable from the abundance of annotations and descriptions in them.

All documentation will be written in our code (all controllers and models turn into a Java Swagger Code)

The approach is not advised to use if there are opportunities, but it is very easy to integrate.

The documentation is written separately from the code.

This approach requires knowledge of the Swagger Specification syntax.

Documentation is written either in a YAML/JSON file or in the Swagger Editor.

This base is needed to create the right financial model for the development and competitiveness of the organization in the market[13]. To do this, you need to calculate the net profit, revenue, and operating expenses of the store. And they used different formulas, such as for deducting revenue:

Net profit = revenue – operating expenses – interest on loans – depreciation – taxes.

And graphs were built to model the organization's indicators [14].

IV. CONCLUSIONS.

A database is a collection of structured and interconnected data and methods that ensure the addition, selection and display of data. The database developed in this article will optimize and automate the company's workflow, which will relieve the reporting workload, as well as increase profitability by analyzing and forecasting the sales model.

The result of this article is a developed database application that allows optimal management of commodity flows to ensure the delivery of goods at the right time, in the right place, on time and with minimal costs. Also, the developed application is responsible for modeling store indicators for large profits. In the process of writing the article, theoretical and practical knowledge in the field of database design were systematized and consolidated, skills of independent educational and research work with special literature on the theory and practice of solving economic problems were acquired.

Designing a database for financial modeling of the organization's indicators is a tool that helps in making decisions for the correct modeling of the company's income and expenses. The task of this process is to ensure innovations and changes in the enterprise, to sufficiently reduce costs.

At the same time, a methodology was developed for the conceptual design of database systems and the overall database structure for the organization. All stages of database design were taken into account. In the process of creating a data model, information objects that meet the requirements of data standardization were identified and the relationship between them was determined. The last stage of the internalization of the article was the creation of calculations for deducting income and expenses for the organization. The generated reports show the results of the executed commands.

ACKNOWLEDGMENT

The presented research was supported by the the project ERASMUS+ ACeSYRI: Advanced Center for PhD Students and Young Researchers in Informatics reg.no. 610166-EPP-1-20191-SK-EPPKA2-CBHE-JP.



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