RESEARCH ON THE DESIGN OF AN ALGORITHM AND THE DEVELOPMENT OF AN ONLINE COMPUTER APPLICATION FOR ASSISTED TRACKING OF MANUFACTURING BATCHES

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ABSTRACT: The paper involves the creation of an online computer application built using the C # programming language. This application facilitates the online tracking of production batches, offering the possibility to report daily the status of the various departments where the parts are distributed. The head of reporting provides information at the end of the day, and the batch tracker views the aggregated data from all departments in a concise manner, being able to make real-time decisions if the batches do not meet the requirements.

KEY WORDS: C #, batch tracking, SQL Server

1. Introduction

Tracking production batches requires an increased degree of complexity due to the multitude of batches that can be performed simultaneously in different production lines (departments). Thus, the application facilitates the distribution of landmarks to the corresponding production lines and the centralization of all reports in one place. It is important that the batch tracker has real-time information to determine landmark compliance.

The application was developed in the C # programming language, and the open-source Blazor framework, which allows developers to create web applications. Blazor is developed by Microsoft. The database was designed in SQL Server, a database server that is also provided by Microsoft.

The application allows 2 types of users:

- The user responsible for tracking batches
- The user responsible for batch reporting

From the user's point of view, who is responsible for batch tracking, the flow is as follows: It enters a command into the system that contains several landmarks. At this point, all parts are assigned lots and start and end dates of the manufacturing batches and the department in which they will be made. Subsequently, orders can be tracked throughout them, graphically viewing the status of manufacturing batches and their progress. Notifications of a specific order sent by the reporting user may also be read, and notifications may be sent to the departments responsible for certain batches.

The user responsible for reporting could send at the end of the day the number of points made, if he encountered problems that day, any suggestions to avoid problems and can read the communications sent by the user responsible for tracking batches.

2. The current stage

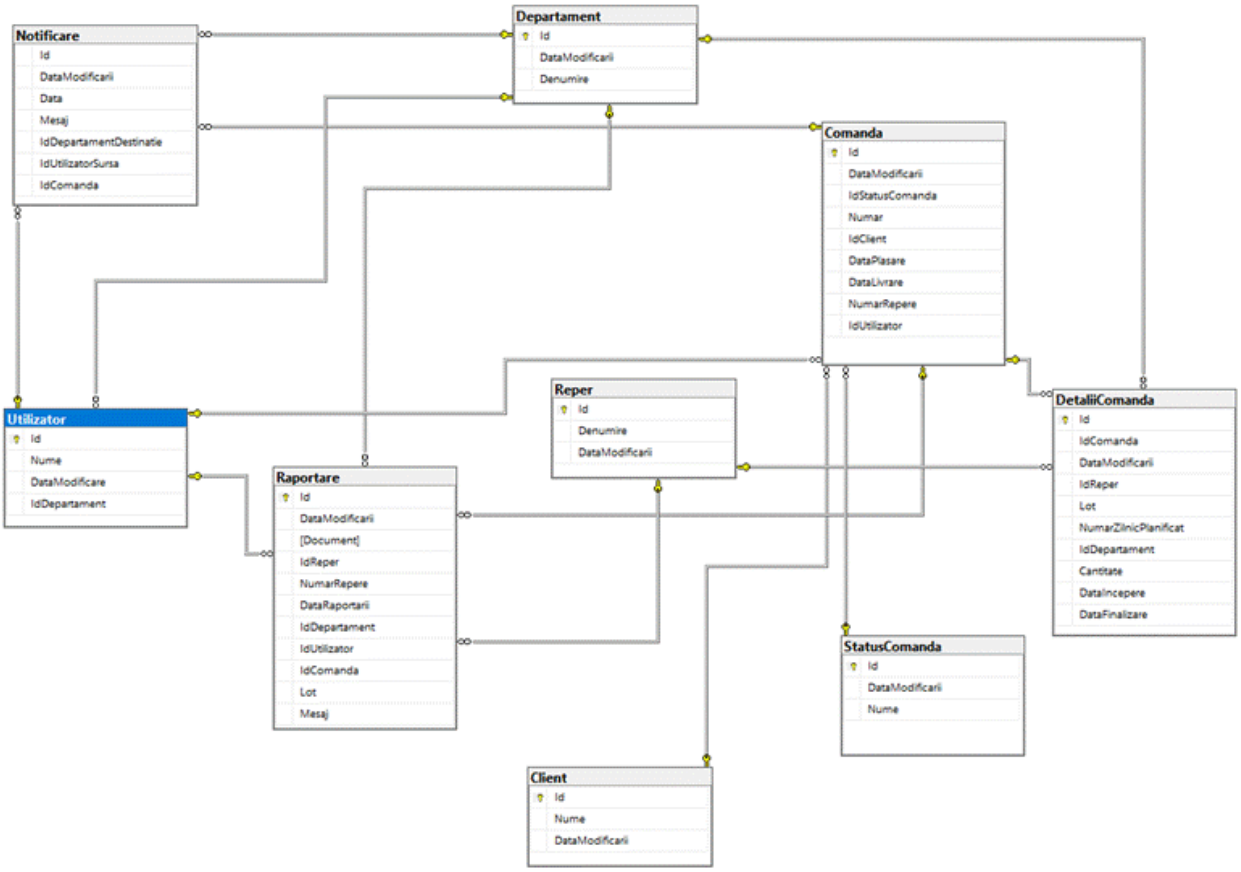

Figure. 2.1. Databasis diagram

The image above shows the databases diagram. All tables contain the Id and Date of Change columns. Id is the primary key to all tables. The primary key is a field that uniquely identifies the records in a table. The Date Modification column is automatically filled in with the current date and time insert operation at the time of insertion and has been entered to make it easier to track the order of databasis operations.

The tables were linked together using foreign keys. A foreign key is a column or group of columns in a relational database table that provides a link between data in two tables. It acts as a cross-reference between tables, as it refers to the primary key of another table, thus establishing a link between them. For example, the link between the User and Department tables is a one-to-many link, and is made using a foreign key. The Department Id column of the User table contains a foreign key to the primary key of the Department table (Id column). Thus, a department can have multiple users.

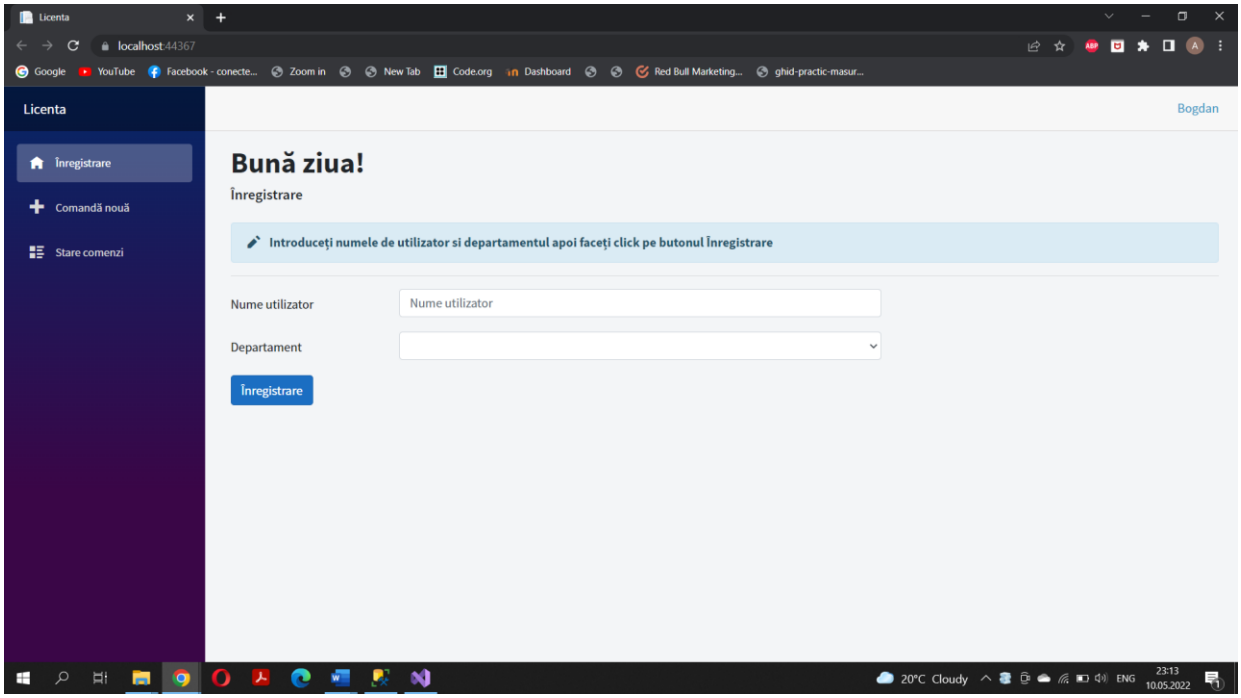

Figure. 2.2. Application login page

The login page of the application, where you enter the username and choose the department to which it belongs. The list of departments is loaded when you start the application, selecting them from the databasis.

```
<h1>Bună ziua!</h1>

<EditForm Model="@Utilizator" OnSubmit="@HandleSubmit">
    <DataAnnotationsValidator />
    <h4>Înregistrare</h4>
    <Prompt Title="Introduceți numele de utilizator si departamentul apoi faceți click pe butonul Înregistrare" />
    <hr />
    <div class="form-group row">
        <label for="firstName" class="col-sm-2 col-form-label">
            Nume utilizator
        </label>
        <div class="col-sm-6">
            <InputText id="firstName" class="form-control" placeholder="Nume utilizator" @bind-Value="Utilizator.Nume" />
            <ValidationMessage For="@(() => Utilizator.Nume)" />
        </div>
    </div>
    <div class="form-group row">
        <label for="department" class="col-sm-2 col-form-label">
            Departament
        </label>
        <div class="col-sm-6">
            <InputSelect id="department" @bind-Value="SelectedDepartmentId" class="form-control">
                @foreach (var dept in Departments)
                {
                    <option value="@dept.Id">@dept.Denumire</option>
                }
            </InputSelect>
        </div>
    </div>
    <button class="btn btn-primary" type="submit">Înregistrare</button>
</EditForm>
```

Figure. 2.3. Application algorithm

```
3 references
public Task<List<Departament>> GetDepartments()
{
    var connectionString = @"Server=localhost\SQLEXPRESS;Database=licenta;Trusted_Connection=True;";
    var queryString = "SELECT * from departament";
    using (var connection = new SqlConnection(connectionString))
    {
        var command = new SqlCommand(queryString, connection);
        var departamente = new List<Departament>();
        try
        {
            connection.Open();
            var reader = command.ExecuteReader();
            while (reader.Read())
            {
                var dept = new Departament
                {
                    Id = (long)reader["Id"],
                    Denumire = reader["Denumire"].ToString()?.Trim()
                };
                departamente.Add(dept);
            }
            reader.Close();
        }
        catch (Exception ex)
        {
            throw ex;
        }
        return Task.FromResult(departamente);
    }
}
```

Figure. 2.4. Application algorithm

3. Languages used

Blazor is a new framework from Microsoft designed to compete with industry-leading platforms such as React. Except that instead of using JavaScript, it runs on the .NET runtime and allows developers to create interactive web applications with C # and HTML. [1]

HTML (Hypertext Markup Language) is a text-based approach to describing how content in an HTML file is structured. This bookmark tells a web browser how to display text, images, and other forms of multimedia on a webpage. [3]

C# is an object-oriented programming language developed by Microsoft in the late 1990's. It was designed as a competitor to the Java language. Like this, C# is a derivative of the C++ programming language.

C# greatly simplifies writing programs for Windows, iOS, Android, etc. It is a cross-platform programming language. [2]

4. Defining the pursuit

Manufacturing monitoring involves the activity of supervising the way in which the production is carried out, more precisely the reverse cycle through which the execution of those provided in the planning and programming phases is verified.

The follow-up of the production is a continuous management activity consisting of the daily uninterrupted supervision of the production. [5]

Tracking process:

- It is performed daily by supervising all operations
made by workers and machines;
- Supervise the production activity;

- It has a more passive character, of analysis of the way of accomplishment of operations and finding of deviations;
- It is made by a section of the production department. [5]

Production tracking can be made in three ways:

- Program-based tracking. As I mentioned before, in the programming activity certain graphics and worksheets are made that have the role to specify the time and place where each operation will be performed. Based on these graphs the people responsible for tracking production can ascertain whether these operations have been carried out;
- Documentation tracking. This method is based on documentation performed during the launching activity in manufacturing;
- Inventory tracking. After analyzing material stocks and finished products stocks, we can deduce how to carry out the production process. [5]

Batch production is a method of manufacturing in which products are made in specified groups or quantities over a period of time. A batch can go through a series of steps in an extensive manufacturing process to achieve the desired final product. Batch production is used for many types of production that may require smaller quantities of production at a time to ensure specific quality standards or process changes. [4]

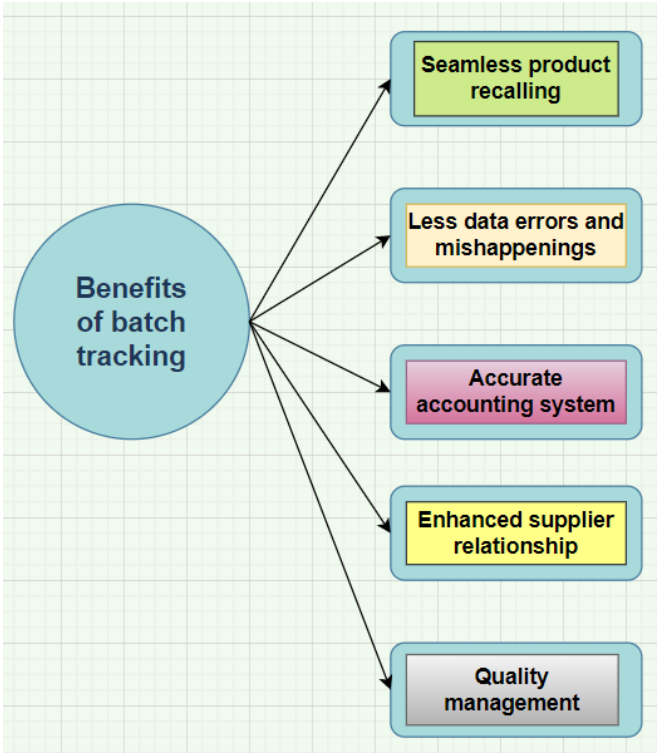

Figure. 4.1. Benefits of batch tracking

- In the final version, the application will work according to the flow in the diagram below.

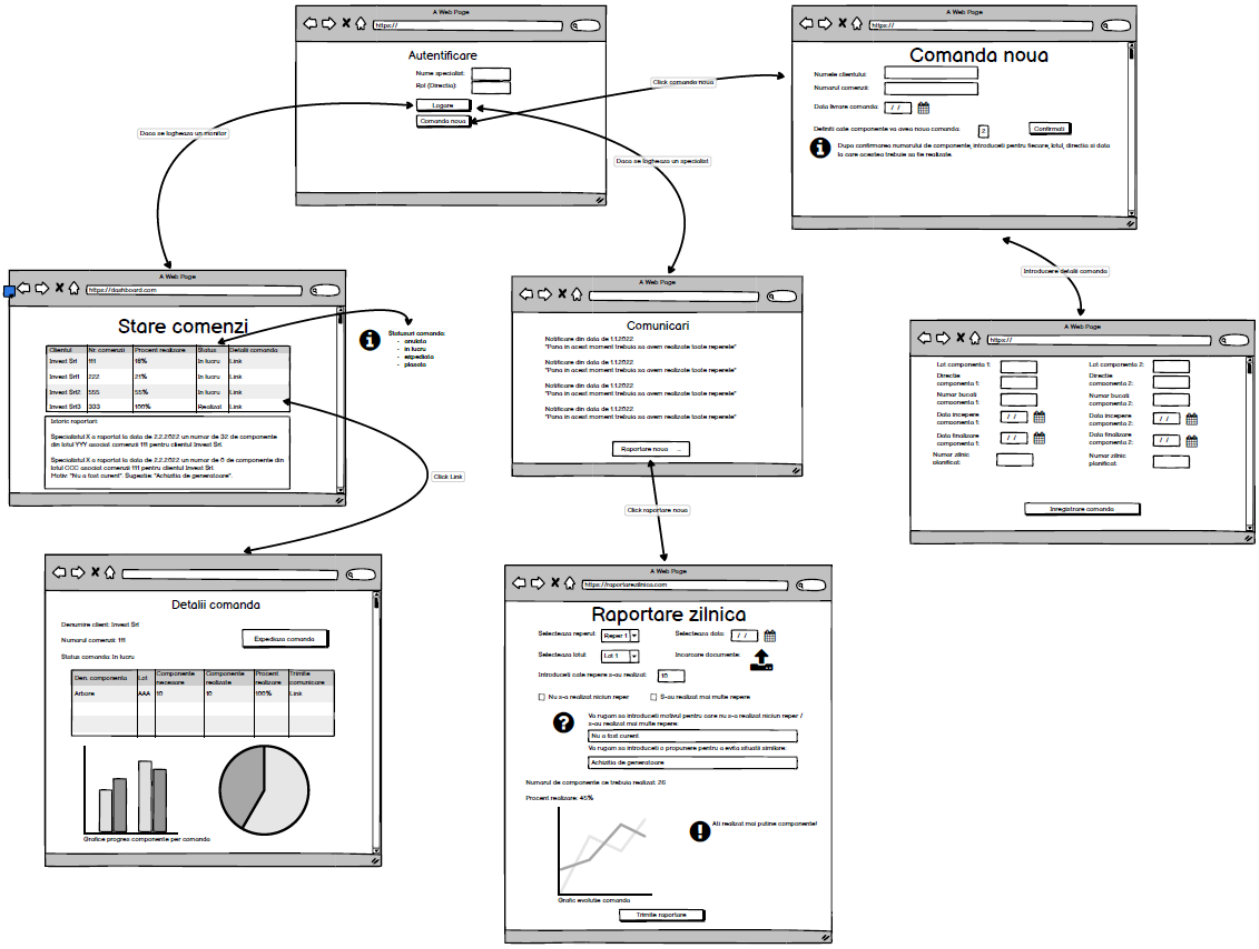

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Figure.4.2. Sketch screens

5. Conclusions

In conclusion, a computer system for tracking manufacturing batches contributes to the realization of batches in an optimal time, offers the possibility of placing an order in a detailed way, thus ensuring the quantity of each batch and whose department corresponds to the realization of the product. It also provides an overview of the processes performed in all departments and provides useful cumulative statistics to determine work capacity.

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