

DEVELOPMENT OF THE MANAGEMENT SYSTEM OF ORDERS OF THE COMPANIES AND ORGANIZATION OF THE STAFF WORK

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Abstract

In the course of the study, the activity of Ukrainian enterprises was analyzed. It was revealed that the main aspects that require increased attention, regardless of the industry, are staff management and order management.

The activity of any enterprise consists of fulfilling orders and, as a consequence, satisfying customers.

It is proposed to develop an automated system that will enable to keep records of orders, namely: the time of order receipt, the number of products, the urgency, the necessary material and time resources, the priority of the order, the executor, the predicted and actual time of the order. This system will help to organize the work of staff, namely: to optimize the working hours of employees due to the dynamic scheduling of the task list; to introduce responsibility for an order that is tied to a specific employee, to keep records of shifts and working hours, automatically form a payroll with due account of worked shifts/hours. The work designed an automated system for managing orders and staff at middle-class enterprises. The requirements for this system are defined and two types of architecture are proposed. For a better understanding of the design phase of the automated system, a class diagram, activity diagram and interaction diagrams are presented.

In the process of research, the end product was created with a user-friendly and intuitive user interface that maximally satisfies all the requirements that have been defined for this system. For today the system works in a test mode at the enterprise of Ukraine. The introduction of the system to the filter element manufacturing company allowed to improve the interaction with customers by 40 % due to faster fulfillment of orders; 80 % facilitate the work of managers to track and control the execution of orders; and also, by 20 % increase the efficiency of the staff department. What on the whole positively affected the work of the enterprise as a whole.

Keywords: automated system, order management, staff work organization, system architecture, UML diagrams.

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1. Introduction

The success of the production and economic activities of any enterprise or organization is necessarily connected and directly depends on the leader's leadership qualities and its ability to organize the production process and all staff. It should be managed in such way that everything that needs to be done to achieve corporate goals has been carried out in a timely, qualitative and rational manner in terms of resources spent on it.

In modern conditions, the need to use the latest technologies in staff management and organization of work at the enterprise is becoming increasingly urgent. They are designed to optimize order management, improve the quality of the final product, improve methods and production technology and optimize the use of temporary resources. The use of the latest information technologies in this field makes it possible:

- significantly improve the distribution of time in the company;
- increase the number of tasks on which the team works simultaneously;
- clearly define the main and secondary tasks;
- accelerate the exchange of information and data in the company;

- quickly obtain statistical data;
- significantly reduce the time and financial costs associated with the organization of staff time.

The success of any business depends, first of all, on the qualification of the staff of the enterprise, its ability and desire to work productively. An important role in optimizing the management of enterprise employees belongs to automated human resources management systems (the so-called Human Resource Systems) [1]. Staff is the long-term factor of competitiveness and survival of the enterprise.

It is also difficult to ignore one of the most important components of a successful operation of an enterprise ensuring effective order management and as a result a satisfied customer.

Order management is an area of activity during which clear goals are defined and achieved when balancing the amount of work, resources, time, quality, aimed at achieving a certain result under the specified constraints. Order management application of knowledge, skills, tools and methods for planning and implementing actions aimed at achieving the goal in the framework of specified requirements. When managing orders, the following steps can be distinguished:

- work planning;
- risk assessment;
- assessment of the necessary resources;
- work organization;
- attracting human and material resources;
- assigning tasks;
- leadership;
- control over the progress of implementation (to control the effectiveness of the execution of orders, the method of utilized volume is used);
- progress report;
- analysis of the results based on the findings.

In this paper, the aim was set, in detail, to investigate the process of developing such an automated system that would help the enterprise's employees organize their work and the work of subordinates in such way that the short-term and long-term aims set for the company were achieved in the shortest possible time and with the minimum spent on it resources. In other words, to help the company's staff in practice follow the principles of time management of technology for rational planning and distribution of working time, taking into account the fulfillment of orders in a given timeframe and priorities, with the aim of releasing opportunities [2, 3].

2. Literature review

The issue of automation of staff management is widely studied both in Ukraine and around the world [4–17]. So, in works [4–6] the main attention is paid to the necessity of automation of the enterprise by introducing the accounting of employees' working hours. Issues of visualization of risks, taking into account the multilevel management at the enterprise, are devoted to works [7, 8]. The main systems that require automation are customer service systems for working with customers in various industries, some aspects of which are discussed in [9]. In works [10, 11] attention is paid to the issues of architecture and the design of automated enterprise management systems.

Most of the work on staff management is devoted to the differences between executives and executors and the use of this understanding for effective work [12], as well as a lot of literature on staff motivation [13, 14]. Today's management of an enterprise requires a number of capabilities, which include finding quick solutions for the shortage of employees with a field of certain qualities. In work [15] it is proposed to apply the selected schedules to facilitate mobile staff management.

An important matter is the relationship between the involvement of staff and the joint creation of the product. In [16], various types of products and categories of staff, as well as the relationships between them, are considered. And in [17] a hierarchical control system with several agents is proposed.

However, the task of managing orders, with reference to a particular employee, and organizing their work is not adequately described in the literature and requires additional research.

Automation of order management processes and staff should help to organize the enterprise correctly with a minimum amount of initial investment and maximum benefit from the implementation of this system.

The expected benefits from the introduction of an automated order management system and staff can be the following:

- increase of the enterprise efficiency;
- timeliness of making managerial decisions;
- rational allocation of time between orders and tasks;
- effective staff management;
- increase the efficiency of staff work;
- effective control over the performance of tasks;
- effective management of enterprise funds;
- control over the performance of the enterprise and the like.

For many enterprises, it is essential to gradually introduce an information system with the possibility of first-priority automation of the most problematic areas. It is possible to implement modules that will allow for the phased introduction of the information system. For example, it is possible first automate the activities of individual units, then connect to the accounting system, which will create conditions for monitoring the movement of resources. After that, it is possible to put in operation the budgeting system, automate the formation and control of the order list, as well as other elements of the information system.

Usually, order management automation systems contain the following structural elements:

- funds for calendar-and-network planning (CNP-systems);
- means for solving individual problems (the formation of the list of orders, the prioritization of orders, the appointment of the responsible executor, the deadline for the completion of the order, risk analysis, contract management, time, budget);
- means for organizing communications between contractors;
- means for automatic payroll, depending on the number of shifts hours worked and/or the amount of work.

As a result of work to achieve the aforementioned goal, the software product “OrderBook” was created, which provides ample opportunities for users to effectively manage orders, staff and their time. This system is focused mainly on small and medium-sized businesses (the number of workers is up to 200 people), which can be used by staff of enterprises of any industry, whole companies or individual departments.

Let’s consider the requirements that were put before the system:

1. Allow the user to log in to the system under his account.
2. Ability to work with the system on PCs, tablets and telephones.
3. Create and manage orders, determine the order manager/executor, the start date for the work on it, and the end date.
4. Create tasks related to orders.
5. Create and manage tasks, define their performers, status and priority, start and end dates for the task.
6. Manage your own calendar, create entries for important meetings and events.
7. View the list of staff contacts of the company.
8. Place ads on the corporate virtual bulletin board.
9. View and publish important documents, templates and other company files to your computer.

3. Materials and Methods

To implement the functionality stated in the previous section, the automated system was divided into several divisions, each of which would perform a specific set of tasks for the user’s needs.

The system has the following sections:

- 1) Personal calendar;
- 2) Order book;

- 3) Task log;
- 4) Ad Log;
- 5) Contact log;
- 6) Company files.

When implementing the order management system and staff work, it is important to ensure the financial feasibility of its use. It is important that the cost of development does not exceed the amount of possible damage that will be incurred in the case of the development and operation of this system without an information security system.

3. 1. Physical structure of the system

Let's consider two possible options for deploying the OrderBook system in the company:

- 1) Closed system for internal use in the local network (**Fig. 1**).

Each company will have its own local server. All data on this company is stored on it. Users of the system will connect to the server through the local network. Connection is possible both with the help of cable connection, and Wi-Fi. The system will work stably locally, without requiring connections over the Internet.

In this structure it is very easy to update the system. Since all data is on the server, the user automatically receives all the innovations with minimal interruptions in the work.

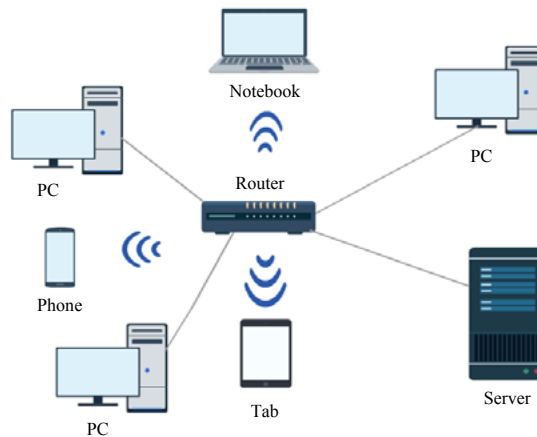


Fig. 1. The structure of a closed system for internal use in the local network

This approach is very convenient for software engineers who support the system and saves their time.

- 2) Open system with the ability to access it from the Internet (**Fig. 2**).

In this structure, the server is hosted on a virtual hosting. Users of the system will connect to the server over a wide area network. Connection is possible, both with the help of cable connection, and Wi-Fi.

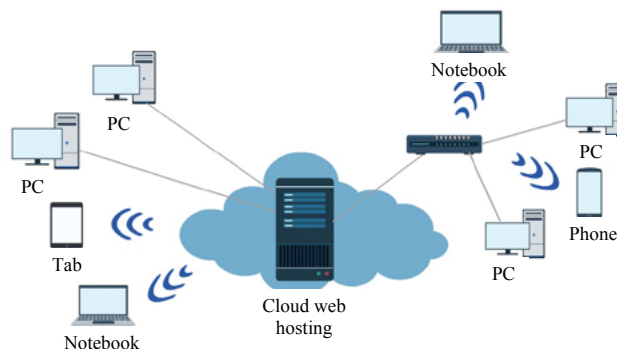


Fig. 2. The structure of an open system with the possibility of access to it from the Internet

The advantage of this structure is that it can be used in case the organization of the local network is problematic or in some way restricts the use of the system. The update is also very convenient for both users and technical staff, supports the company's software.

3. 2. System architecture

The system architecture is a structural diagram of the components of the system interacting with each other through interfaces. Components can consist of a sequence of smaller components and interfaces. The system architecture is constructed by defining the system's objectives, its input and output data, decomposing the system into subsystems, components or modules and developing its general structure.

When building the architecture of the order management system and staff work, the Model-View-Controller (MVC) architectural template was used (Fig. 3).

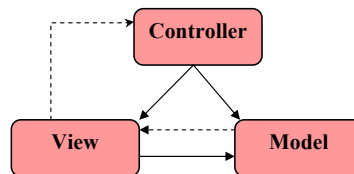


Fig. 3. Diagram of interaction between the components of the MVC template

4. Experimental procedures

4. 1. Development of the activity diagram

So, the activity diagram (in UML) is a visual representation of the graph of activities. The graph of activities is a kind of graph of states of a finite automaton which vertices are certain actions, and transitions occur after completion of actions.

Action is the fundamental unit of behavior definition in the specification. The activity specification (at higher compatibility levels) can allow the execution of several (logical) flows, and the existence of synchronization mechanisms to ensure that the actions are performed in the correct order.

For the OrderBook system, an activity diagram is created that depicts the process of working with orders in the system (Fig. 4).

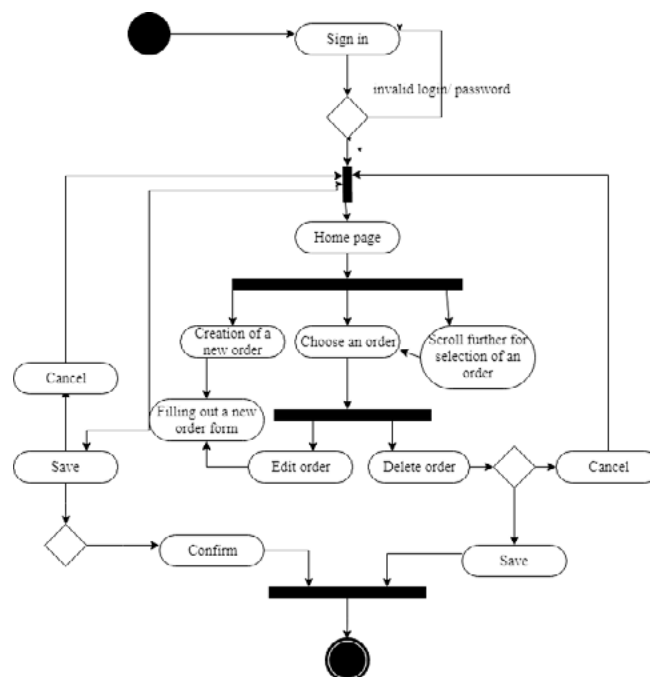


Fig. 4. Diagram of activity according to the precedent "Process of work with orders in the system"

The user must log in by entering a username and password. Further from the main page, which has a bookmark “orders” it has the ability to view existing ones, create new ones, edit and delete orders.

4. 2. Development of the interaction diagram

Most often at the specification stage of requirements it is necessary to show not only the algorithm of actions or change of the state of the object, but also the exchange of messages between individual objects of the system. This problem is solved by the interaction diagram.

The interaction diagram is one of the models describing the behavior of interacting groups of objects in the UML, describing the behavior only within one use case.

The interaction diagram is intended for modeling relationships between objects (roles, classes, components) of the system within a single use case.

This type of diagram reflects the following aspects of the projected system:

- exchange of messages between objects (including in the framework of messaging with third-party systems);
- constraints imposed on the interaction of objects;
- events that initiate the interaction of objects.

Unlike the activity diagram, it shows only the sequence (algorithm) of the system operation, the interaction diagrams emphasize the developers’ attention to messages initiating the call of certain operations of the object (class) or is the result of the operation.

Two main types of interaction diagrams are divided:

- sequence diagram;
- collaboration diagram.

Extending the notation of interaction diagrams in UML allows analysts at a more detailed level to work out the requirements as much as possible to replace activity diagrams with interaction diagrams.

Thus, the main target audience for the interaction diagram will be the development team. For the customer, this kind of diagrams will be of interest only in the framework of modeling the interaction between the projected IS and extraneous Systems operating on the Customer’s side.

4. 2. 1. Development of a sequence diagram

The sequence diagram illustrates the order in which objects interact with time operations and reflects the objects and classes involved in the scenario, next to the message chains exchanged between objects in the execution of the functions specified in the scenario.

According to the OrderBook project, a sequence diagram was created with the precedent “Creation of a new order” (Fig. 5).

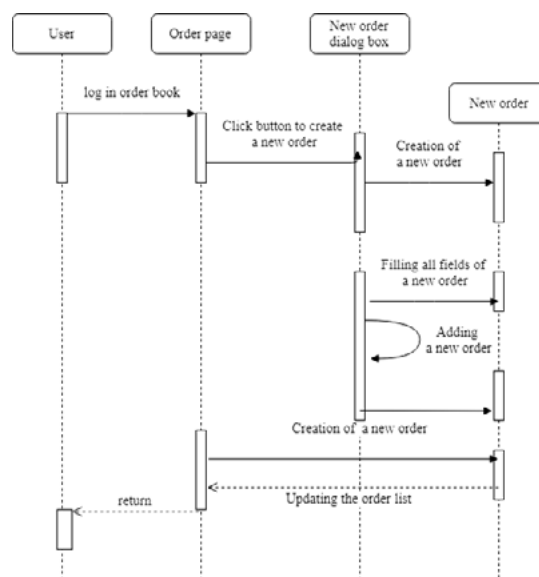


Fig. 5. Sequence diagram behind the use case “Creation of a new order”

Each object in the sequence diagram is associated with a timestamp, denoted by a dashed line segment, and the messages exchanged between the two objects are represented by an arrow connecting the source object to the receiver object.

4. 2. 2. Development of a collaboration diagram

The collaboration diagram represents an alternative way of describing the scenario. The collaboration concept is used to denote the set of objects interacting with a specific purpose in the general context of the modeled system. The goal of the collaboration itself is specification of the specific features of the implementation of the individual most significant operations in the system. Collaboration determines the structure of the system's behavior in terms of the interaction of participants in this collaboration.

According to the OrderBook project, a cooperative diagram was created according to the precedent "Creation of a new job" (Fig. 6).

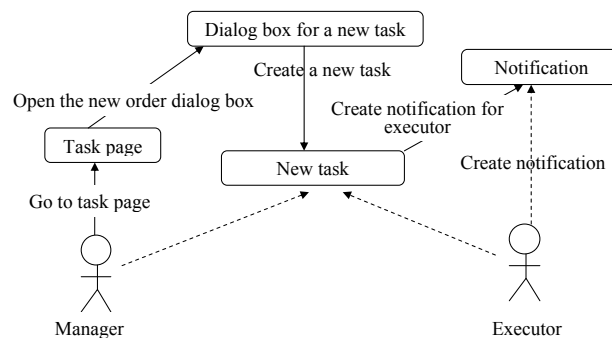


Fig. 6. The collaboration diagram after the precedent "Creation of a new job"

When constructing a sequence diagram, the emphasis is on the temporal aspect, while in constructing the collaboration diagram, the static interaction of the objects of the system is considered.

5. Results

As a result of the work, a system for managing orders and organizing the staff work is created.

Working with the OrderBook system starts with the main page, which welcomes the user and plays the role of the business card of the system, providing an accurate description of the main functionality of the system.

The OrderBook system allows to manage users of the system, for which the Colleagues page was created. For the administrator, it allows to add a new user, edit it and delete it from the system, for a regular user, it allows to view the list of your colleagues in a convenient format.

In order for a new user to start working with the system, it is necessary that his account be created by the administrator. To do this, the administrator must go to the main page and log in by entering a username and password.

It is important to note that the new user's page addition page has validation of the data entered by the administrator, which was implemented using the jQuery Validation plug-in. For example, if not all required fields are entered, or data that has been entered does not meet certain requirements, the system does not accept such information and issues an error message. If all fields are entered correctly, a new user is created on the system and displayed in the general list, which all other users see.

6. Discussion

For today the system works in a test mode at the enterprise of Ukraine. The introduction of the system into the enterprise for the manufacture of filter elements allowed:

- improve interaction with customers by 40 % due to faster execution of orders;
- 80 % facilitate the work of managers to track and control the execution of orders;
- increase the efficiency of the HR department by 20 %.

The implementation of the OrderBook system at Unifilter, which specializes in the development and production of filter elements, has had a positive impact on the work of the enterprise as a whole. The peculiarity of the work of this enterprise is in servicing a large number of customers. Orders consist of the main parameters, including: the scope of the filter element, the filter diameter (internal and external), the length, the number of filter layers, the filter requirements for the due date. These are the main parameters that are necessary for determining the manufacturing process of filter elements [18–20]. In the process of work, each order is assigned the code, priority, time for execution, estimated time of order execution and the responsible executor. These data make it possible to trace the status of the order, the number of produced filter elements, to form a provisional value and, in the case of rejection, to analyze on which shift and by whom of the employees the order was executed.

For the correct operation of this automated system requires the correct introduction of information by managers and timely filling out a report on the manufactured filter elements by employees. Employees must include the order code and the number of manufactured items. To do this, it is necessary to provide workers with access to a portable device, such as a tablet, in which they will see the task that must be performed and note what is done for the shift and/or hour.

The introduction of this system requires additional technical resources, as a rule, these are computers for managers and a tablet in the working area for production workers. One of the constraints faced by this company is the human factor: reluctance to perform additional actions by shop workers who produce filter elements and time for their training on the use of this system.

In general, the system is quite universal and does not depend on the field of application. It can be widely used in enterprises that work with customers, fulfill orders and have the need to bind the order to the date of implementation and to the responsible executor.

7. Conclusions

In recent decades, changes in the external environment of the functioning of enterprises, institutions and organizations have been taking place at an extremely high pace. Today, effective management of orders and staff is impossible without the use of modern software, as the size of companies, employees, orders, volumes of information grow.

In the course of the work the following is accomplished.

First, the automation of order management and staff work at enterprises in Ukraine and in the world is analyzed, and the benefits and advantages of information systems for order management and staff work are found.

Secondly, an automated system for order management and staff work at middle-class enterprises is designed. The requirements for this system are determined and the architecture is built.

Thirdly, the system for managing orders and organization of staff work is designed in detail: class diagram, activity diagram and interaction diagrams are developed.

Fourthly, a user's instruction is developed and some screen displays for demonstrating work with the system are provided.

In the process of work, the end product is created with a user-friendly and intuitive user interface that maximally satisfies all the requirements that have been defined for this system.

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