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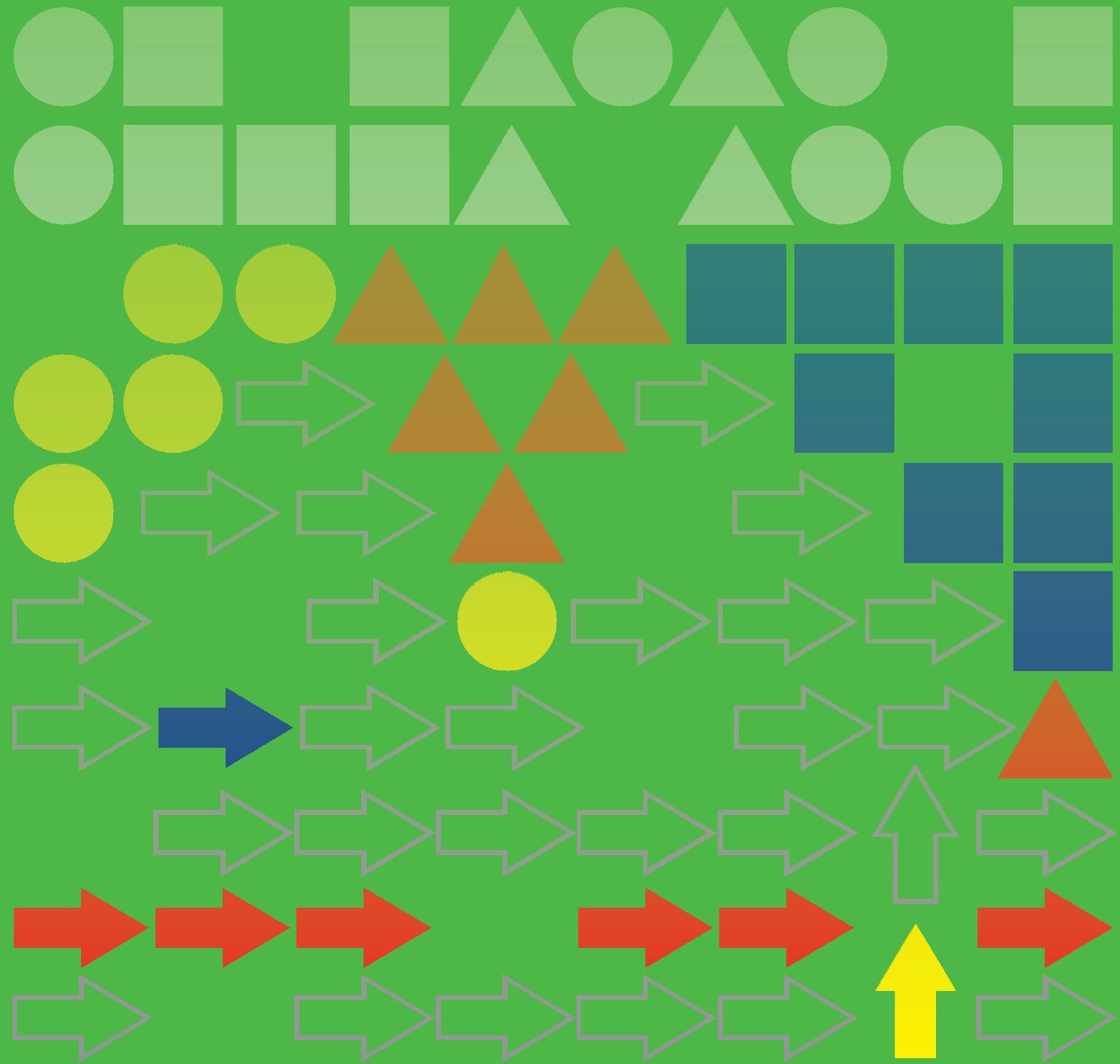

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Innovation of warehouse management in the company

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Abstract: The aim of the presented article is to evaluate warehouse management in a specific company in order to reveal deficiencies and then propose measures to eliminate these deficiencies and propose a new warehouse management system. The investigated enterprise focuses on the sale of spare car parts. Currently, the current premises are no longer enough to cover all orders, so it will be moving to new premises. Therefore, our sub-goals are also the design of the distribution of warehouse stocks in new premises, the design of handling routes and the implementation of an internal company information system.

1 Introduction

The current era is characterized by high competition in the market economy. Every company tries not to succumb to the competition, but on the contrary to succeed. She should carefully consider the tactics she chooses to do this. Quality management in the field of supply is also the basis of success. Inventories affect the economic result of the company, for many companies they represent a large investment that ties up financial resources. No less important is access to supplies in terms of their availability in time. In connection with this, it is necessary to think about the size of stocks and the method of their replenishment, because here too many potential difficulties arise for the company.

Warehouse management is a very comprehensive area that includes a large number of different business processes. We can meet warehouse management in all kinds of businesses. If a business operates warehousing and inventory management effectively, these areas can become its competitive advantage. Efficient warehouse management leads to inventory optimization. Deciding on the amount of inventory can affect the company's further operation on the market. If the company keeps a disproportionately high stock level, it ties up a large amount of funds in these stocks. However, if a business keeps little inventory, it loses profit because it cannot meet market demand [1-3].

2 Analysis of the current state of warehouse management

The current store building, with an area of less than 110 m², proved to be insufficient for the needs of a dynamically growing business. Its internal arrangement does not meet the modern standards of the business environment and has limited capacity for efficient storage and presentation of the assortment.

Customers often face limited space when browsing goods and limited comfort when shopping. Employees, on the other hand, face limited opportunities in administrative tasks and unsuitable working conditions.

In the company, we are facing a serious problem regarding the lack of transparency and efficiency in the processes of storing and selling goods from our warehouses (Figure 1). This problem also manifests itself disadvantageously inside the warehouse, where there is unnecessary chaotic movement and difficult communication. The lack of proper use of storage space is evident and can lead to unnecessary losses and waste of resources. Furthermore, we encounter outdated procedures for receiving and issuing goods, which are no longer adequately adapted to current needs. Also, the computer

systems that process data about the goods and their location in the warehouse are outdated and need modernization. It is essential to address these deficiencies and implement more efficient and transparent processes in order to achieve better control over our inventory and increase the overall efficiency of the company's operations [4-6].

Figure 1 Distribution of goods in the company GARANT K&K s.r.o.

3 Storage space innovation proposal

Due to the lack of space and the inefficient arrangement of warehouse spaces, it was necessary to consider investing in a larger and more modern building. Therefore, the company GARANT K&K s.r.o. decided to change its headquarters and premises in 2024 through the construction of new premises, which will not only be larger, but also more optimal for better clarity and improved handling of goods. Complete project documentation is currently being prepared and is awaiting assessment by the building authority, therefore our task in this proposal is to process a project plan for warehouse spaces, which will be an innovation for this company. The new space should be designed to better meet the needs of both customers and employees. With the proposal, we should ensure enough space for the comfortable movement of customers, as well as their relaxation while handling the requested order and ensure efficient storage of goods.

The front part of the sales area should be optimized for the display of products with smaller dimensions. Our proposal is therefore also to create attractive exhibition spaces and improve the visual presentation of the goods in order to increase the attractiveness of the store and to improve the visual presentation of the goods in order to increase the attractiveness of the store which could attract more customers. Part of this proposal is a detailed project plan of the storage areas.

We propose to implement modern inventory tracking and order planning systems to ensure sufficient availability of goods to meet customer demand. It is also important to monitor demand trends and adapt supply strategies according to market needs. And therefore, at the same time, the goal of this innovation proposal is also to include the use of an information system, the task of which is the continuous control of warehouse stocks and the transparency of the location of goods. In this information system, there is a comprehensive database of the operation's goods. Each of these products is defined under a QR code, on the basis of which the location of the given product will be searched. The information system works with the stock of goods and the available assortment and is therefore developed to streamline and speed up the work with the given goods in the warehouse during distribution. This information system also ensures the automatic navigation of the autonomous robot, whose task is to weigh the goods to the employee or customer. The autonomous robot works based on information about where the goods are stored and moves along a predetermined path of movement.

When creating visualizations of the company's warehouse space, we worked with the Solid Works and Siemens Process Simulate programs. With the help of these programs, a detailed layout of warehouse spaces as well as spaces for customers was developed. These visualizations in the practical part, as we mentioned above, are developed

based on the drawings of the project documentation provided by the company GARANT K&K s.r.o.

When creating the operation model, we were based on the complete dimensions of the project documentation provided by the company. The total operation thus extends to 293.29 m2. In the model created by us, the areas intended for the storage of goods, areas for sales purposes and areas for customers or complete technical equipment, including an office, a dressing room, toilets and showers, are depicted. We drew and modeled these spaces in the Solid Works program, which we can see in Figure 2.

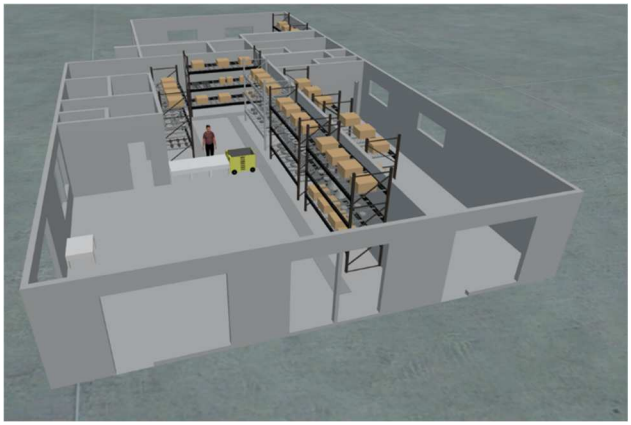

Figure 2 New operation model

For the company GARANT K&K s.r.o. we proposed the application of the use of a computer information system, intended for inventory management, with the help of which the exact location of specific goods will be defined. We included this proposal, as the current distribution of goods in the company is difficult to understand, which also affects the very speed of the processes of distribution of goods to the customer.

The marking of the goods, which is currently used in the operation, is a handwritten registration number on the labels kept on each type of offered goods, with the help of which the goods are then searched for in the economic program Pohoda. The current labeling of the goods and its search proved to be insufficient due to the growing number of available assortments for the customer.

Our proposal is therefore an information system in which the search for goods is managed using QR codes that will indicate the specific location of each stored product (Fig.3). In this way, we will increase efficiency and reduce time when searching for a specific product according to the customer's needs. It is important to note that this information system will also record the availability of specific requested goods. The advantage of this label is the defined specific location where the employee can find the stored goods and deliver them to the customer.

Figure 3 Detailed view of the shelf with QR codes

As an aid to the employee, we proposed, as already mentioned above, the use of an autonomous mobile robot whose task will be to weigh goods from the warehouse directly to the sales counter (Fig.4). Weighing of goods from the warehouse will be carried out based on the employee's request through the information system.

Figure 4 Robot in warehouses

The robot is moving independently in a defined space and will be oriented using a defined path when transporting cargo. Thanks to its sensors and navigation system, it can safely maneuver around obstacles and precisely control its movement, all the way to the destination along the designated path. The role of the robot is to increase efficiency in customer service and automation of warehouse processes. The robot will cooperate with the information system and, based on the employee's request, will be able to search for the given goods thanks to the markings and QR codes on the shelves. Subsequently, the robot will be able to deliver the goods safely to the designated place. The robot will be integrated with the information system of the operation, through which the

robot is able to respond quickly to the requests of the employee.

4 Comparison of the current state and the design

Compared to the current state, the innovation proposal is aimed at maximizing the efficiency of handling goods and distribution. With the help of our innovation proposal that we submitted, we managed to streamline the process of finding goods and fulfilling the customer's request. Stocks of goods will be more systematically and clearly placed in shelves marked with the help of QR codes. Also, handling will be easier, enriched with an autonomous robot, which the employee can use for searching by entering commands into the computer, which simplifies and modernizes the distribution process. Through the implementation of the proposed innovations, we believe that we will achieve an overall improvement in the operation compared to the previous conditions. All these measures, in addition to everything else, also modernize the operation and can thus increase customer satisfaction through faster and more accurate service.

Our proposed innovations at GARANT K&K s.r.o. they also bring a significant improvement in the time management of processes. The table expresses the expected changes in the time average of the duration of the processes after the implementation of our proposals. A significant reduction in the time needed to process orders, fulfill customer requests, monitor stock levels and manage warehouse space shows the efficiency and effectiveness of the proposed innovations.

Before the implementation of our proposals, the average time duration of processes would range from 600 to 864 seconds. Once implemented, these times are expected to drop significantly, with the new values ranging from 237 to 422 seconds. These data clearly show that our proposals contribute to a significant acceleration of processes and improve the overall efficiency of the company's operation.

Table 1 Time management of processes

Process	Before the proposal (seconds)	After the proposal (seconds)
Order processing	72 – 120	24 – 48
Verification of the availability of goods	120 – 168	48 – 96
Search for a part in stock	168 – 240	45 – 110
Issue of the part to the customer	240 – 336	120 – 168
Overall time frame	**600 – 864**	**237 – 422**

With improved processes, the time required to process a customer's order has been reduced from the original 600-864 seconds to just 237-422 seconds, an average of more than half the time saved. A faster order fulfillment process means that customers can expect significantly shorter waiting times and faster access to the parts they require. This contributes to overall customer satisfaction, which is a key factor in increasing the company's success on the market.

5 Conclusion

In this post, we analyzed the current state of GARANT K&K s.r.o., we proposed innovations for more efficient use of spaces and processes. The goal was to plan more space for storage as efficiently as possible and to improve the handling of the goods itself. At the same time, the goal was to increase the competitiveness on the market by more efficiently used warehouse space thanks to the possibility of a greater supply of requested goods to customers and at the same time to reduce the time duration of order delivery. We compared the current state with proposed innovations that emphasized clarity and efficiency in the warehouse space.

The benefit of the work is identifying problems and offering solutions that could lead to improved company performance [7-9]. The work provides concrete proposals and innovations that can improve the company's more efficient use and management of space. Which can lead to improved customer experience with the company, increased operational efficiency, increased competitiveness, improved working conditions, better control over stocks, but also improved cooperation with suppliers.

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