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Smart Stock Tracking System

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Abstract – The project is a system for tracking and managing stock tracking processes with innovative technologies. The problem addressed in the project is that the current tracking and management of stock tracking and management processes have problems. For companies and warehouses that have stock tracking and management processes, it is aimed to provide simultaneous stock tracking and management processes and to benefit from innovative artificial intelligence technologies and forecasting models in stock management processes. Factories and warehouses will be able to simultaneously update and view stock information and improve processes with artificial intelligence technology. Benefiting from innovative technologies and the impact of artificial intelligence technologies on processes are revealed in this project.

Keywords – Stock, Tracking, Management, Factories, Artificial Intelligence

I. Introduction

Smart Stock Tracking system was designed considering the processes between producer factories, consumer factories and warehouses. Smart stock tracking project is a web application project. The web application will be a platform where producer factories can simultaneously view the current stock information in their warehouses, and the data will be updated simultaneously if consumer factories request products from the warehouses.

The application has a report page where all transactions can be listed with various parameters and filtering options. In the application, stock forecasts are made with artificial intelligence technology and warning messages are sent to factories with these forecasts. The application improves processes by sending warning messages to factories about stock status when the stock quantity falls below the determined critical level, in cases of stock out-of-stock, and in necessary situations detected by data analysis resulting from artificial intelligence prediction algorithms.

II. Materials and Method

Smart stock tracking project work was developed through various stages after problem identification. Many related studies in a similar field were evaluated, a literature review was conducted, and the requirements of the project were studied. By evaluating the project requirements, technologies that would be suitable for the project and would highlight the project with its high performance were determined.

A. *Related Works*

In the field of stock tracking and management, many various studies have been examined regarding the problem detection area of the smart stock management project. Many studies have contributed to the field of inventory management, and related projects will be examined in this section.

A similar approach was used in the field of inventory management in the study [1] published at the 2017 IEEE Third International Conference on Big Data Computing Service and Applications

(BigDataService). In this project, studies were carried out on artificial intelligence technologies and data analysis in the field of stock management.

This project focuses on forecasting product demands, processing large volumes of inventory data, and using distributed computing resources. It uses Linear Regression, Neural Network (NN) and Gradient Boosting Regression Tree algorithms for prediction models in stock transactions. In the Smart stock tracking project, it is envisaged to develop prediction models with higher accuracy than existing studies and to perform data analysis operations with data mining technology.

In the study [2] published in the 2016 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), similar to the smart stock management project, a study was conducted on the demand issue in stock management.

In the project, it was determined that the main purpose of inventory models is to know when and how much to order, and the study was carried out by drawing conclusions through statistical analysis. On the other hand, the smart stock tracking project aims to obtain high-performance results by analyzing data with data mining, which is a data analysis technology.

The study [3], published in the International Research Journal of Modernization in Engineering Technology and Science, is similar to the smart inventory management project in that it aims to investigate and discover how artificial intelligence technology can improve inventory management. The project focuses on various artificial intelligence applications that will benefit the company in terms of cost effectiveness, higher turnover, increased customer satisfaction and customer loyalty.

Similar to the smart stock management project, the study focuses on data mining technology to increase efficiency with artificial intelligence applications in stock management. While the study focuses on the logistic regression algorithm for the artificial intelligence prediction model, it is envisaged to work on high-accuracy predictions with various algorithms in the smart stock management project.

B. Smart Stock Tracking System

The aim of the project is to improve stock management processes. Smart stock tracking management is an efficient technology to have a high-performance operation in logistics processes. When factories keep stock information manually rather than through software, data inconsistency situations arise. With smart stock tracking, demands of consumer factories are updated simultaneously, and producer factories can make preparations by being informed about the status of their warehouses early enough.

The fact that the system sends warning messages to manufacturing factories when necessary provides the benefits of adapting to technological developments by not resisting them. It is envisaged that the stock transaction processes developed with the benefits of the smart stock tracking system will increase efficiency and reduce time and cost losses resulting from data inconsistencies.

The project basically consists of 4 parts. The parts are given below.

Artificial Intelligence Forecast System: It is a system in which stock situations are analyzed depending on various parameters such as time and season and forecast models are created. Manufacturer factories can learn how the product stock in the warehouse changes depending on which parameters, and can be prepared for sudden situations in advance.

Web Application: In the web application, producer and consumer factories can simultaneously view the amount of stock in warehouses and see transaction details. Consumer factories can process product requests and information is updated. On the other hand, manufacturing factories can prepare for various situations in the warehouse in time, with up-to-date data access and warning systems.

Warning Message System: With the warning message system, a warning message is sent by the system when the stock amount falls to the determined critical levels, when it runs out, and when necessary as determined by data analysis. Thanks to this system, efficiency in stock supply planning increases, and plans can be made when necessary.

Database of the System: The database part is the part where factories, warehouses, product information and transaction details in the warehouses are stored. Factories can access product information and transaction details in warehouses with the information in the database,

within the authority they have depending on their user role.

C. System Architecture

In this section, information about the architecture of the system will be given. It will include information about the operation of the system, project requirements and the technological architectural background of the project.

The use-case diagram where the requirements and project scenario of the smart stock tracking system can be examined is shown in Figure 1. This diagram clearly shows the requirements of the producing factories, consumer factories, warehouses and the system.

The features of simultaneously viewing the stock amount, viewing the information of factories and warehouses, logging in and out of the system, and viewing the report page with transaction details are common features for producer and consumer factories. On the other hand, while adding products to the warehouse and stock alert notifications are features only for producing factories, the feature of requesting products is a feature that only consumer factories have. In the web application, authorizations vary depending on the factory type. Screens are presented to existing users within the scope of the authorizations they have. Data analysis processes of the system, stock status alert messages, and entry-exit transactions to the web application system requirements are seen under the system header.

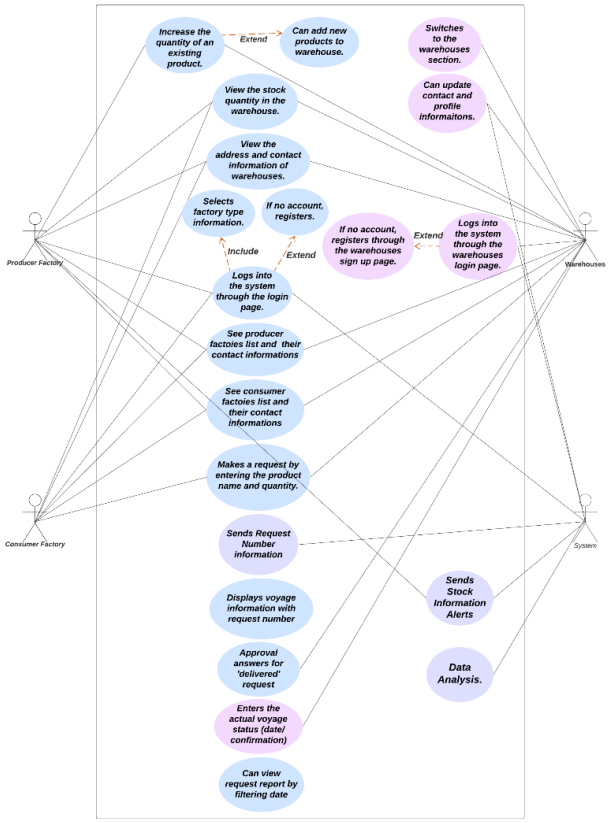

Fig. 1 Use-Case Diagram of the Project

Figure 2 represents the high-level design of the project. This diagram clearly reveals the system architecture and provides information about the technologies used. In the high-level design of the Smart stock tracking project, the two structures on which the project is based are represented. On one side of the project, there is a web application that the user uses with a browser, and on the other side, there is a smart stock tracking system.

The user layer of the project is the stock management officers of the producer and consumer factories who will use the smart stock tracking system. The interface that the user encounters in a Web application is represented as the Web application interface (Web GUI). HTML, CSS, JavaScript, Typescript and Angular framework technologies will be used in the front-end layer of the project. The chosen framework was chosen based on its efficiency in the field of web technologies, its request response speed and the benefits of being supported by developers.

The transfer between the user interface layer (Web GUI) and the backend layer will be provided via REST API (http protocols). Rest architecture, which has the advantages of fast data transfer, understandability and error catching performance, is very efficient in web projects. In the smart stock

tracking project, .NET technologies were preferred because it is a highly developed technology in the field of web technologies, currently supported by Microsoft and developers, and has features that enable working with an efficient structure.

In the high level-design of the project, the backend layer is represented by being divided into two parts. The business logic part and the NET Core parts where data connection operations are performed are the backend infrastructure parts. In .NET backend development in the project, Entity Framework Core (EF Core) ORM (Object-Relational Mapping) tool is used to manage database operations.

The data layer of the project is represented in high-level design. Microsoft SQL Server (MSSQL) technology will be used in the data layer of the project. A database technology that meets the project requirements and will provide high performance and security was selected. Stock information of products, information of factories and all transaction information will be kept in the database. It is anticipated that the Smart stock management project will surpass related projects in similar fields with its database design. The focus is on the design of a database that consists of encrypting sensitive data, high-performance tables, and systematically keeping deleted data, which is a detailed subject.

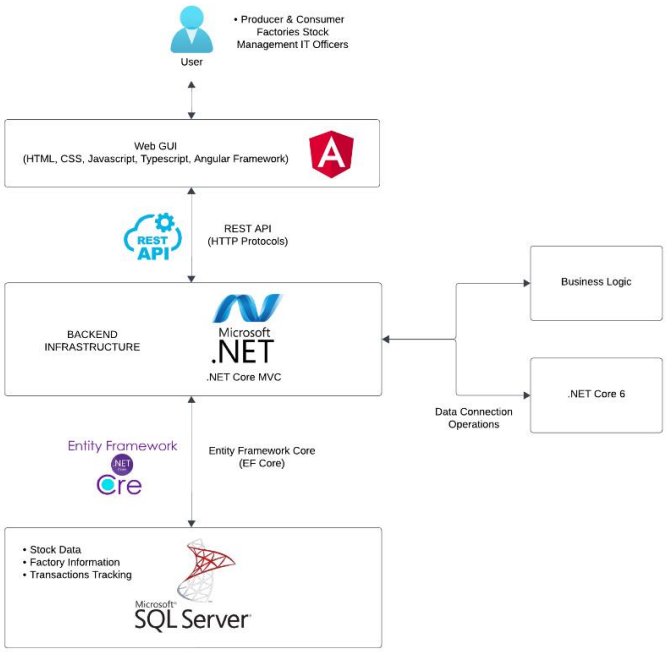

Fig. 2 High Level Design of the Project

III. RESULTS

One of the findings obtained in this study is that in logistics processes, manual systems have fallen behind technology, on the other hand, innovative technologies are coming to the fore, and studies in this field are developing. While software technologies stand out in the field of stock management, developing artificial technologies have also been included in this field.

One of the results obtained is that various algorithms stand out in artificial intelligence prediction models, based on the accuracy rates obtained in studies conducted with artificial intelligence technologies. In stock management, an efficient architectural system, selection of high-accuracy algorithms in artificial intelligence forecasting models, stock warning messages, and a system that provides simultaneous tracking are required for efficiency.

IV. DISCUSSION

The study [4], published in the International Journal of Logistics: Research and Applications, found that artificial intelligence, with its ability to intelligently analyze data, holds great promise in improving decision-making processes and subsequent productivity. However, it is noted that its application in supply chain management (SCM) remains limited.

However, in the study, as in the study results of the smart stock tracking project, it was mentioned that artificial intelligence forecasting applications are increasingly used to solve problems, have proven to be useful in improving decisions, and the contributions of artificial intelligence to the decision-making process.

The study mentions the potential of artificial intelligence in pioneering efforts to solve complex problems. By using artificial intelligence technologies in the field of stock management, algorithms in this field are actually worked with and the benefits of improving them are observed. These studies reveal their contribution to both stock processes and forecast models, and thus to science.

Analysis and study Artificial Intelligence to improve Inventory management study [5] mentions that the application of new technologies in logistics processes includes artificial intelligence technologies, and that this technology transforms

process execution processes and offers competitive developments.

In the study, various applications were examined and the importance of artificial intelligence in improving inventory management activities was included, and the important role of artificial intelligence applications in improving inventory management activities in logistics processes was revealed.

The findings of the study have similar results with smart stock management, on the other hand, the application results in different fields in the field of artificial intelligence in the study are different from the smart stock tracking project specialized in the field of data mining. The approach of using artificial intelligence processes in inventory management is the common aspect of the findings of the study and the smart stock tracking project.

Inventory management processes developed with artificial intelligence technologies enable the development rate of forecasting algorithms in this field to increase as a result of the integration of these technologies into different sectors.

V. CONCLUSION

As a result of this study, it is observed that four different components, namely the web application, artificial intelligence prediction system, message alert system and database system, are seamlessly connected to each other and data communication is successful. It is envisaged that the project, which was planned by conducting a literature review in the field of stock management, examining relevant studies, and performing the necessary model tests, will stand out in its field.

It is planned to examine the security details between the elements of the project in the future versions of this study. It is also planned to develop system updates within the evolving technological requirements.

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