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On site big data analysis system model to promote the competiveness of manufacturing enterprises

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Abstract. Small and medium-sized manufacturing enterprises are highly vulnerable to competition compared to conglomerates, as not many of them have adopted Manufacturing Execution Systems (MES) and do not have sufficient IT specialists and investment funds. In this research, therefore, a Big data analysis system model that can be used on site was developed that is practical and flexible enough to be adopted easily, thus enabling the use of Big data technology to consolidate the competitiveness of small and medium-sized manufacturing business. The on-site big data analysis system model saves the internet data into the proper Data Store according to their usage purpose after collection, including Excel data on the site of small and medium-sized manufacturing enterprises, typical and atypical files, sensor Data, and news/blogs/SNS data. The saved data supports decision making with strong visual effects, and intuitive data detectable network visualization technologies which are offered by various charts through the library of open source data visualization, D3.js. In addition, the model shows practical adaptation and flexibility through a customized plug-in method that can be adjusted to the IT environment of small and medium-sized manufacturing enterprises.

Keywords: manufacturing data on site, auto document identification, text analyzing, ODE (Office Data Excavation)

1 Introduction

Today, companies in the rapidly changing business environment are constantly working to optimize their external processes through collaboration, as well as helping their internal processes to effectively and quickly respond to market demand in order to secure competiveness [1].

However, it is difficult for small and medium-sized manufacturing businesses to follow this trend. Compared with larger conglomerates, most small and medium-sized manufacturers have not adopted Manufacturing Execution System (MES), and in many cases the field data is not being saved. As most of the existing field data is

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saved in handwriting or Excel format, data analysis and decision making need to be performed manually.

As a result, it is difficult to analyze the rate of operation of manufacturing process, production yield, and product quality, as well as to find the factors that cause product defects and abnormal phenomenon. It is also difficult to identify customer and market needs because there is no connection with external data, and there is not enough investment being made in IT and IT specialists. As can be seen, small and medium-sized manufacturing enterprises are inevitably vulnerable in competition compared with conglomerates. For this reason, it is planned in this research to develop a customized analysis solution for small and medium-sized manufacturing enterprises, which are vulnerable compared to conglomerates. Developing customized (plugin) solutions of companies' diverse environment and needs for having easy application and flexibility. And make it possible to connect internal and external data by developing field Excel data auto collection system and internet data collection/analyzing system. In addition, the solution can support decision-making by providing visual effects through the library of open source data visualization, D3.js.

The final aim of this research technology development is to contribute to enhancing the competitiveness of small and medium-sized manufacturing enterprises by developing a combined/related analysis and visualization system of all the data needed to strengthen a company's competitiveness, which is cost efficient and enables easier adoption and management.

2 Related Works

Major global SI and solution business-centered IT companies such as EMC, IBM, ORACLE, SAP, GOOGLE, and MICROSOFT are focusing on solution and core technology development to enable early dominance in the Big data market. M&A and technical cooperation of related business for technology development were ongoing until 2011, and related services and solutions were being launched in earnest starting in 2012. IT service companies run Big data businesses or develop the platform of Big data analysis, and social network analyzing companies work on various Big data businesses for ordinary people and companies [2][3].

Most Big data sales originate from huge IT companies like IBM and HP, and Big data solution companies such as Vertica and Cloudera. It is considered that the size of Big data market may increase at a 58% compound annual growth rate(CAGR) over 5 years, from 5 billion dollars in 2012 to 53 billion dollars in 2017 [4].

IDC, an IT market analysis and consulting institute, predicts that the scale of the Big data market may increase from 3.2 billion dollars in 2010 to 16.9 billion dollars in 2015. This is a CAGR of 40%, which is seven times higher than the growth rate of the overall ICT market. Significantly, it is expected that the technology and service market for Big data in the Asia-Pacific area (except Japan) may show a high growth rate, with annual average growth of 46.8% in the next 5 years [5].

In the rapidly changing era of smart digital, the direction is changing from how to predict and prepare for the era of Big data, to how to process and use it. The series of techniques of saving·collecting·managing·distributing·analyzing Big data are called

Big data processing technology. In reality, global companies have built new business models through Big data analysis and are using it successfully, and have also strengthened the capabilities of Big data processing technology [6].

Global competitors already have achieved a high level of effectiveness. In particular, it is necessary to develop a new business model that is able to create value through Big data analysis in diverse areas by benchmarking the success case of Hadoop, an open-source based Big data platform. [7]

3 Big data analysis system on site

In this research, a platform structure is developed that can be adopted to analyze data flexibly on a company site by automatically collecting, refining, and processing data of a manufacturing enterprise on site (typical, atypical). This system provides an effective decision making support system by offering a correlation between information and multi-dimensional analysis base, and maximizing system utilization through an intuitive and user-friendly User Interface. It also applies diverse visualized technology considering the executive group and site staff of small and medium-sized manufacturing enterprises

The big data analysis system on site, which is developed in this research, is processed through an ETL (Extract Transform Loading) process that extracts, refines and collects data using the DB function of each system which exists in ERP, MIS, and so on. Data that is recorded atypically on site (ex. Excel), is extracted, refined, and collected as typical data by the ODE (Office Data Excavation) module that automatically recognizes the pattern of the data. The digital information is saved in a NoSQL storage after an indexing process for various statistic analyses, the stored digital information can be analyzed in real-time series, visualized in Straight Table, Pivot Table or diverse Chart formations by each index, and calculated with various Aggregation functions. The information that has the same mutual Relation as the information stored in the existing R-DB is saved in Graph-based NoSQL storage after modeling and analyzing relations when it is collected. Ultimately, the information that is stored in Graph-based modeling provides an intuitive and user-friendly analysis tool visualized in Network format.

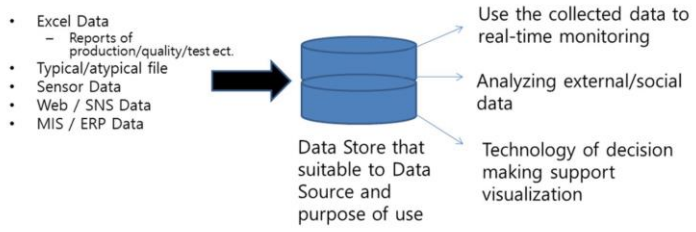

Fig. 1. Introduction of System

The first aim of the research is to modularize the Big data analysis system to enable the development of a system for data collection/saving/analysis only with technology support for early set-up about 1~2M/M. A second aim is to provide a visually intuitive interface so that workers on a manufacturing site who are not familiar with the computer system can use it easily. Finally, we aim to develop a S/W package to minimize adoption and maintenance costs by actively using open operating systems, web servers, open source, and so on.

The overall system composition diagram of the Big data analyzing system model on site is shown below.

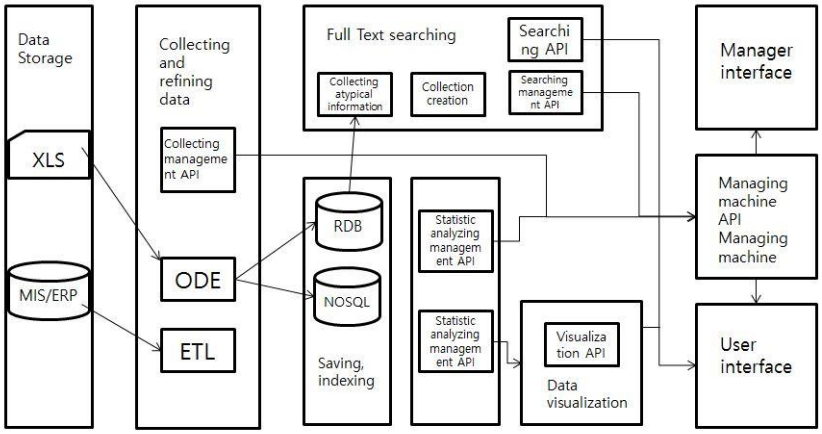

Fig. 2. System composition diagram

4 Conclusion

This research has developed a “Big data analysis system model on site” that collects and saves data from the structural data (typical, atypical, and semi-typical) and internal information systems of small and medium-sized manufacturing enterprises. Furthermore, it offers a base for decision making support, main index (quality, obstacle, sales and so on) monitoring that is refined and analyzed by using Big data technology. In my opinion, the newly developed system in research will aid effective decision making, enhance the management environment of a company, and accelerate the development of a production system that fits a company’s own manufacturing.

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