Agent Based Cinder Monitoring System supporting PDA

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ABSTRACT

This paper embodies the agent based cinder monitoring system which supports PDA(Personal Digital Assistant). Monitoring system automatically manages data by using data managing agents such as a state managing agent, a location managing agent, a badness managing agent, a circumstances managing agent, etc, and uses a massive data processing agent to manage massive data. The development of agent based data monitoring system for the stable cinder reuse will be an epoch-making method to develop the process mechanized or manual-labored that widely spreads into the real-time automated process.

Keywords*: Cinder Reuse, Monitoring System, Brick Manufacturing Process, Mobile, RFID.*

1. INTRODUCTION

Recently one of the hot issues from the information communication field is the ubiquitous computing. Due to the development of network, information exchanges on-line and automated processing system embodiment has been increasing by using these data. RFID(Radio Frequency IDentification) uses information of wireless connection tag through reader's antenna[1]. USN(Ubiquitous Sensor Network) is what is added sensing function by using RFID to network[2]. This work tries to construct the agent based cinder reuse monitoring system, which supports by using RFID tag. In order to develop the agent based monitoring system, it chooses a frequency range and designs an agent that manages a tag and a reader, which are effective for the frequency range. Analyzed data through this system reuses the cinder, so it can effectively manage the production process of the factory which produces bricks through processing automation, faulty-ratio minimization, real-time monitoring and loading managing. Data monitoring system with agent technique will be seen through PDA interface by users. However, PDA has a small capacity of RAM and wireless-communicates. Therefore, it is not easy to manage massive data. So, we have developed a massive data processing agent to solve this problem. The interface by the data processing agent can effectively inspect the whole process from materials warehousing to the production process of the brick production factory. Also, it computes the minimal faulty ratio of the brick production by using data analysis collected through the monitoring and therefore, it can achieve more effective and stable brick producing process.

Section 2 describes related works. Section 3 explains cinder reuse monitoring system structure. Section 4 discusses agent based monitoring system. Section 5 evaluates performance of our system. Finally section 6 concludes the paper.

2. RESEARCH BACKGROUNDS

The amount of rubbish in Korea today is not only the increase of the quantity, but it also has very complex types in quality due to highly development of industry and population increase in the cities. So, it has been paid a lot of attentions to how to disposal it. There are a few methods to disposal rubbish apart from reclamation and incineration. These days, people pay lots of attention to incineration. The amount of incineration was 577 tons per day in 2001 and 460 tons in 2004 after spreading separated collecting [3]. But, cinder which is generated while incinerating includes a lot of heavy metals. In the cinder management system according to the current waste management law, fly ash is sorted as a specific waste with no concern of elution standard and managed, but in the case of bottom ash, experiment should be done intermittently. If it is over the standard, the total amount should be disposed. Some other countries generally reuse bottom ash of sorted waste like this as road support supplement, however reuse of bottom ash in this country has not revved up yet because of heavy metals like Pb etc, which are contained in bottom ash.

Therefore, this research has a purpose of constructing the data monitoring system that makes two-tier work state in the brick production factory to unification by reusing cinder. Interface will help inspect the process from the materials warehousing to producing of the factory. It also achieves the effective brick producing process by using data collected through agents.

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3. CINDER REUSE MONITORING SYSTEM STRUCTURE

3.1 Brick Manufacturing Process Structure

Figure 1 shows the structure of the brick manufacturing process-monitoring system. Here the brick manufacturing

process monitoring system receives information from the tags of 6 processes. Tags have long recognition distance by using 433.92MHz band and they are used as sensors such as real-time tracking, inner humidity, impact, and so on. Information recognized from tags can be input in 2 ways. First, data from a tag will be automatically read to fixed RFID reader and transmitted to monitoring system. The distance between fixed RFID and tag is within 50m~100m. Second, it is a method that the user recognizes the tag from PDA and is input data through wireless communication, then transmits the data to the monitoring system[4]. The reason why it does this, it makes it possible for the user to check real-time data in the process or in the office. The monitoring system forms suitable data as DB for the each process from information collected and stores them. From the stored data like this, the user can extract data by using search engine through interface. For the data extract method, it uses data search extract by using thesaurus [5].

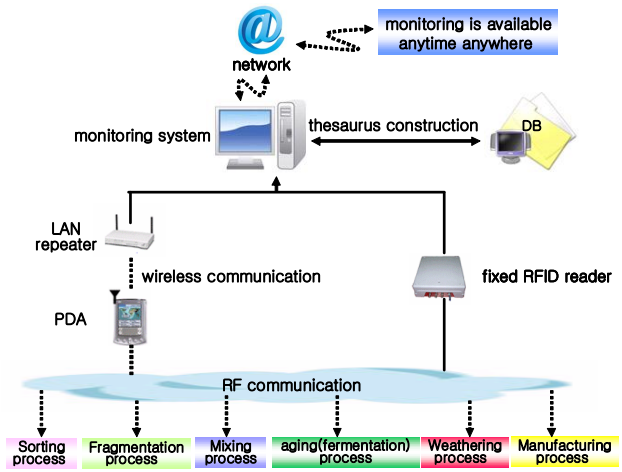

Fig. 1 The Structure of Brick Manufacturing Process

There are a few kinds of data such as state data of the state, line balance data that are input to the machine, progress data of the process, faulty management data which extract faulty products and so on. In order to manage these data, agents were designed. These agents are applied to the monitoring system and there are a state management agent, a location management agent, a faulty management agent, circumstance management agents, and so on. Data can be not only managed on the desk top, but also offered on the PDA for users to manage anytime anywhere. PDAs access to the monitoring system and send/receive these data. The data monitoring system offers monitoring anytime anywhere through Internet. The monitoring system monitors through simple user authentication by using JAVA and XML if the computer is connected to network monitoring data includes information for the each process and users can control the producing process circumstance of the field in the office or at home with these data. Monitoring system is connected to database what effectively manages monitoring data, so it is able to manage and search data. It uses thesaurus search to offer this structure design and offers similar data search by using object-oriented method when it embodies [6].

3.2 RFID Model of Monitoring System

The brick producing using cinder is divided up into 6 of processes like sorting process, fragmentation process, mixing process, aging (fermentation) process, weathering process, and manufacturing process. However, almost every workplace has a two-tier work structure of office and the field, so there is a possibility to be produced a lot of faulty goods and unqualified goods, which harm human bodies if errors are ignored. Therefore, the data monitoring system that uses internet (with wire/wireless) and lets the office know the process and the result in real-time should be constructed and installed at the establishment. It collects signals from all measuring instruments and sensors in real-time by using IDMC-Net8842, which is a data collector, and it tries to construct the system what confirms and controls the circumstance of the field in real-time by connecting TCP/IP with wire/wireless communication modules.

Figure 2 shows how to construct the data monitoring system by using RFID. It sticks tags to 6 of processes and makes their own IDs transmission and circumstances information transmission possible. It also has a function that transmits modified information when there is an information change. The data management monitoring system manufactures data received from RFID and applies them to materials and process management system. The manager offers management information to watch and inspect data anytime anywhere.

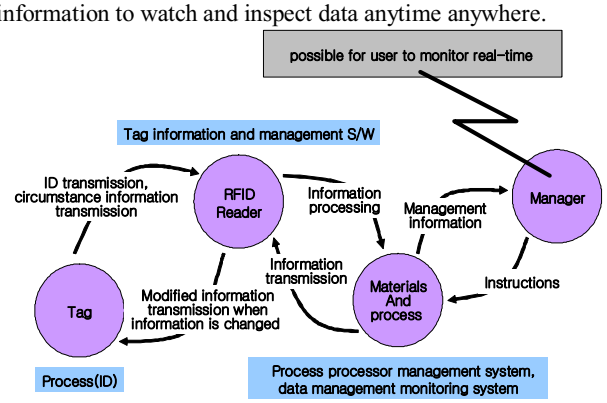

Fig. 2 System Structure

4. AGENT BASED MONITORING SYSTEM

4.1 Data Management Agent

Figure 3 means data management agents of each process. 4 of agents like a state management agent, a location management agent, a faulty management agent and a circumstance management agent take care of the data management [7]. The state management agent transmits data by RFID sensors stuck to the processes of sorting and fragmentation to the monitoring system in real-time. Sensors offer information of what material should be reused or not. In the sorting process, magnets are used to operate sorting. The

sorting with magnets is the process that separates pieces of iron from the materials and removes them. In this process, RFID sensor is used to sense foreign elements and figures out how much they are. If the sensor transmits data to the monitoring system, the monitoring system tries to re-sort with magnets according to how much foreign elements are or orders to step on to the next process. Then, data will be managed with thesaurus to the database of the monitoring system. RFID sensor measures fragmentation information in the fragmentation process. After finding out how much fragmentation has done, it sends data to the monitoring system. Then the monitoring system computes fragmentation ratio up to the kind of the material. According to the fragmentation ratio, it orders whether it should re-fragment or step to the next process. In the mixing process that mixes the materials sent from the sorting and fragmentation processes, to decide mixing ratio among materials is a very hard and important task. Mixing ratio is different in materials and it shows the differences up to how much the fragmentation has done. So, only the specialist out of managers can find out the materials and decide mixing ratio. Even if there is a small error in the mixing ratio, it could have a big impact to the final products. That is, according to the error of mixing ratio, there will be an error ratio difference. In order to this problem, a faulty management agent finds out the kind of the materials and automatically controls the mixing ratio. The faulty management agent finds out the kinds of the materials and sends data to the monitoring system and then the monitoring system monitors these and computes the mixing ratio. After that, it inputs these data into the process. That's how it offers the accurate and stable mixing ratio.

The circumstance agent is an agent that controls the speed of the process with load data. The process speed control with load ratio makes it possible to supply materials well and deliver products. If there is a high load ratio and it keeps the process speed high, it will affect things like the lack of loading place, smooth financial affairs and materials distribution. Therefore, if the load ratio is high, then the process should be speeded lower. And if the load ratio is low, then the process should be speeded higher. That's how it offers the effective model for the load management. To do this, the load ratio sensing RFID sensor watches the load ratio and transmits this data to the monitoring system, and then the monitoring system manufactures data transmitted and sends the speed control data to the process system in order to control speed.

The location management agent manages all these processes and the data monitoring system automatically manages the all processes by the agents. The manager only watches and inspects the data that can be seen on the monitoring system simply.

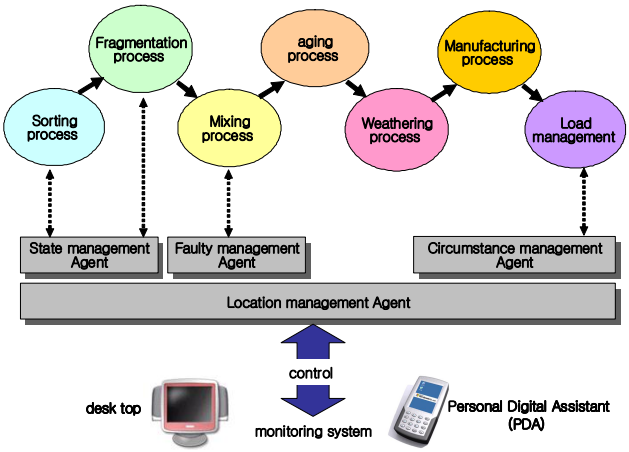

Fig. 3 The Area of Data Management Agent

4.2 Data Processing Agent

The system of this research has been developed for the purpose of cinder reuse and designed to fit requirements of the system. A data processing agent consists of components and it is a module able to execute with an unseen inner logic to the users. So, this work suggests the execution of component, which does a function of the agent through any user interface. The data processing agent is the interface to process easily when users do not know information of materials [8]. PDA has a small volume of RAM and uses wireless communication. So it is hard for PDA to manage a lot of data. In the case of reference service, if a user asks more than 100 materials, it is ineffective when it considers the PDA system circumstance [9]. If the user happens to know information about the materials exactly and puts the conditions when he/she refers, there would be no problem. However, if the user does not know information of the materials, there will be problems. In order to solve that, it embodies interface which makes batch processing possible for users and distributed processing is used for data processing. Figure 4 is the data processing interface for PDA. If you look at the first interface, it looks like that it receives 114 of data at the same time. However the fact is that it receives 7 events and displays on the PDA screen. As the user moves the scroll bar, he/she receives information of the next 7 events. If the PDA received 114 of data from the beginning, it would take about 15 seconds. But if it takes 7 by 7, the user feels the waiting time much less. Second screen is the goods-investigation batch-input screen about chosen materials of 114 events. Because the server received 114 events of data, it has remembered these and it does batch processing data by receiving only the headers of chosen items from PDA.

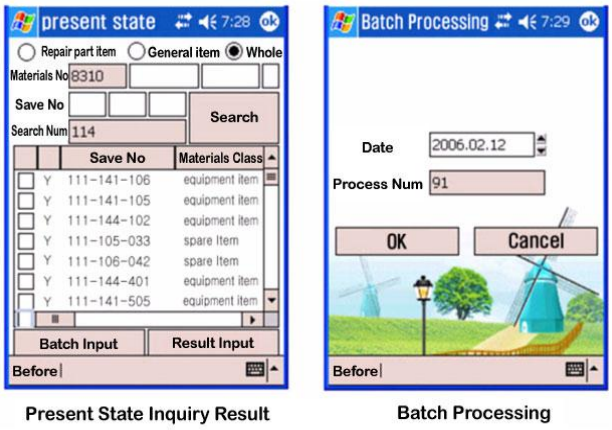

Fig. 4 Distributed Interface(PDA) System

5. PERFORMANCE EVALUATION

For the evaluation of this research, we put a weight value in each item. The weight value which has influence on the major impact in system is 1. The weight value where becomes the help in system improvement is 0.75. And the weight value which becomes service in system is 0.5. Also the user satisfaction is as follows: very satisfaction 1, satisfaction 0.75, average 0.5, and poor satisfaction 0.25. We calculate the average of weight value and user satisfaction of each item. As the results, if the average is above 0.75, the system is evaluated in propriety.

Table 1 is the result of evaluation of the system presented in this paper according to the evaluating standard. I put weight 1 for system quality, reliability, potential risk; 0.75 for use convenience, use effect; 0.5 for service quality. When the mark from the user was analyzed, most of them were well satisfied. However, the evaluation of satisfaction got from system processing speed, always available due to no interference, appropriateness of screen display, practical use possibility of various terminals, trust on data on the communication, and trust on tag recognition. This is caused by rather hardware problem than by software problem when the system was embodied. That is, system-processing speed has influence over database system [9]. Database includes information about 10,000 parts. If the user searches part information, it happens through PDA or desktop PC. In the case of PDA, it has small capacity of RAM and does wireless communication, there will be a remarkable speed difference from desktop PC. However, the user would not know this environment, so she/he would think there would be a problem in the application of PDA. The appropriateness of screen display was evaluated low because the user who got used to existing system did not adapt to new system [10]. About trust, it happens not to respond quickly to user's request if the reader that should recognize the tag is influenced by surrounding environment or due to communication difficulty between PDA and wireless repeater. Despite of these problems, the users evaluated "well satisfied."

Table 1. Result of Evaluation

Item	Detail	Weight	User	AVE
System quality	System processing speed	1	0.75	0.875
	System stability	1	0.75	0.875
	Always available due to no interference	1	0.75	0.875
Information quality	Accuracy of output information	1	1	1
	Appropriateness of screen display	0.75	0.75	0.75
	Appropriateness of information as business	1	1	1
	Timeliness of information	1	1	1
Service quality	Error automated correction	0.5	0.75	0.625
	Rapid problem solve	0.5	1	0.75
Use convenience	Easy to learn how to use	0.75	1	0.875
	Possible to practical use of various terminal	0.75	0.75	0.75
	Easy to use due to simple operation	0.75	1	0.875
Satisfaction	Meet the expectation	0.5	1	0.75
	Positive use of output information	0.5	0.75	0.625
	Overall satisfaction	0.75	1	0.875
Trust	Trust on data on the communication	1	0.75	0.875
	Trust on data management of server	1	1	1
	Trust on tag recognition	1	0.75	0.875
	Trust on management information	1	0.75	0.875
Potential risk	Risk of leaking enterprise information	1	1	1
	Risk of leaking business information	1	1	1
	Risk of leaking personal information	1	1	1
Use effectiveness	Improvement of business processing speed	0.75	1	0.875
	Improvement of processing accuracy	0.75	1	0.875
	Deduction of repeating business	0.75	1	0.875
Average				0.87

6. CONCLUSION

This paper has designed the agent based cinder reuse monitoring system that supports PDAs with RFID. It has developed a state management agent, a location management agent, a faulty management agent and a circumstance agent for data monitoring of one enterprise. Manufactured data processing by agent rather than simple data input can automate the process, which was operated by manual in the sorting and fragmentation processes. It in the mixing process collects materials information to get mixing ratio and gets the result that minimizes faulty ratio by computing ratio automatically. For the load management, it eliminates the ineffective processing that produces products unplanned and controls the processing speed with accurate computing. Therefore, it remarkably helps reduce the burden of enterprise by overloaded.

The development of the agent based data monitoring system for

the stable cinder reuse will be an epochal approach that develops the mechanized and manual process spread widely on the industry in general into the real-time automation process. It is possible for the manager to confirm data offered from the data monitoring in anytime and in anywhere. So, it is good to reduce the manager's effort and to help trust the result of the products.

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