DEVELOPMENT PLAN OF INDIVIDUAL UNIT PMIS USING SMARTPHONE

Jae-sang. Ahn [1], Chan-ho. Park [1], , Dong-min Lee, Yu-na. Cha [1] and *Sang-yoon. Chin [2]

[1]*Department of u-City Design and Engineering Sungkyunkwan University,*
2066, Seobu-ro, Jangan-gu, Suwon, Korea
speedcome@skku.edu

Professor, Department of u-City Design and Engineering Sungkyunkwan University,
2066, Seobu-ro, Jangan-gu, Suwon, Korea
schin@skku.edu

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ABSTRACT

As the amount of construction information used in the growing construction field increases, the importance of efficient construction field management has been growing. Therefore, construction industry have been tried to introduce and conjugate various software and IT technology such as PMIS, Web Camera, RFID, GPS, PDA. However, existing IT technology especially PMIS have not been performed systematically because of difficulty of real time information collection and decision-making from the insufficient handy equipment. These problems make construction manager cannot efficiently respond to diverse condition occur in construction sites. In addition, after the completion, individual who use PMIS have to move another site and use another system so than cannot use information from previous sites. On the other hand, development of IT technology transmute PDA phone for text-based work like schedule management, internet research to smart phone for network based multimedia service. In other words, smart phone is not just IT equipment but new way for overall industry and it can satisfy the demand IT technology on construction sites. Therefore, the purpose of this study is introduce mobile based individual unit PMIS system using cloud computing and SNS which is in development progress. It is expected to be possible to collect and record the real-time information that occur at the site and make rapid decisions based on the recorded information, by converting the office works that are managed based on the site PC or Web, if the site management system that is based on the smart phones and Cloud computing that will be constructed through this research are utilized. After this study, it is necessary to research about interwork with project unit PMIS system and test on real construction site.

KEYWORDS

Smartphone, Application, Cloud computing, SNS

1. INTRODUCTION

In order to successfully carry out the construction project, it is necessary to efficiently manage various sorts of information and also to make the decisions by quick communications among the participation subjects. Accordingly, although the construction companies have made efforts to efficiently carry out the construction projects by adopting various IT technologies, the conventional technologies have been limited in terms of writing and conserving the records, sharing real-time data between the site and the office, and making the decisions..

Meanwhile, the process of adopting the technologies have recently been realized in various industrial fields based on the usability of the smart phones, and specifically, the smart phones have been utilized in order to resolve such problems as real-time payment, decision-making, and sharing of data. [2] However, although the smart phones along with the development of supporting applications have managed to carry out various kinds of tasks, difficulties still remain for the site managers to actually manage the sites by using these applications. Although many large construction companies do posses their own PMIS, only few of them provide mobile functions and even the PMIS that support the mobile functions have failed to sufficiently reflect the usability of the mobile device. For this reason, it is still hard work to collect and record the real-time information that occur at the site and make rapid decisions based on the recorded information.

Accordingly, this research aims to suggest development direction of application based on SNS which can make possible to collect and record the real-time information that occur at the site and make rapid decisions based on the recorded information, by converting the office works that are managed based on the site PC or Web.

Also, the method of connecting the cloud computing technologies was suggested for saving and utilizing the acquired information. It is possible to cooperatively work by downloading or sharing the information anytime by connecting various information acquired through the smart phone through utilization of cloud computing technologies to the web through wireless network. Also, it is expected to serve as a solution for accumulation of personal-knowledge or company information by supplementing the fact that the individually-collected information cannot easily be recycled after the termination of the project. The flow and methodology of this study can be drawn as Figure.1.

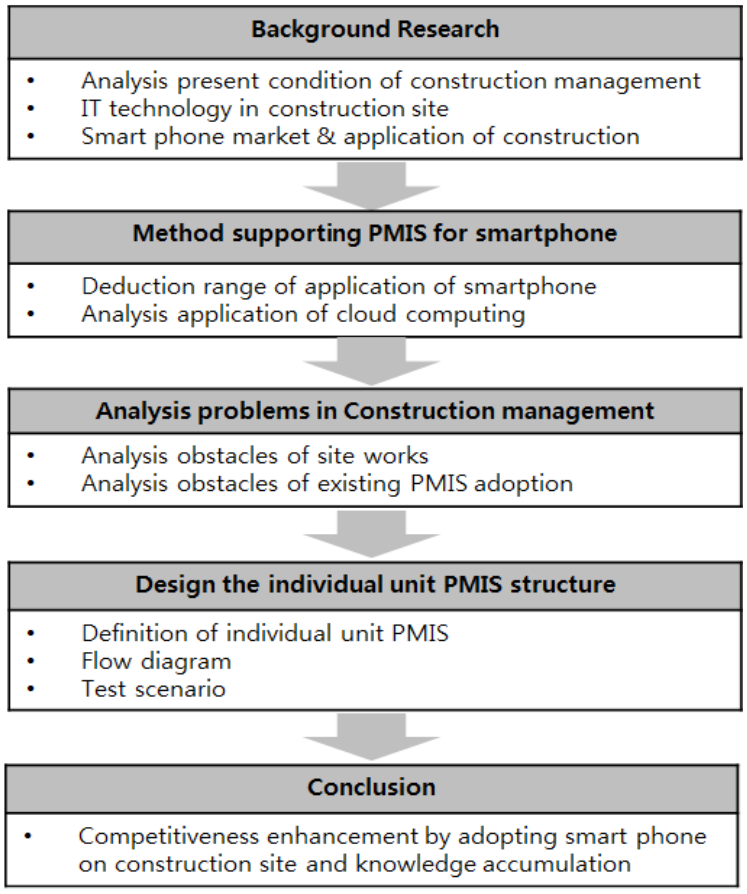


Fig. 1 Flow and methodology of research

2. SMART PHONE IN CONSTRUCTION

2.1. Effort for information management in construction and limitation

The demands for each of the projects are complicated and different and various corporations, labor force, equipment, and materials are needed as inputs. The exchange of information caused by the diversification of types and contents of the information occurred has faced difficulties, and efficient methods of management for infinite information have been demanded. Accordingly, various systems and IT technologies such as PMIS (Project Management Information System), Web Camera, RFID(Radio Frequency IDentification), GPS(Global Positioning System) have been attempted for more effective site management in the past construction industry. However, the IT technologies that had been adopted are limited in terms of i) real-time collection and decision-making due to the problem of the record of the site

manager and the limit of equipment, and also ii) rapidly and efficiently coping with various situations that occur real-time at the construction site. Actually, although various applications have been developed, the functions of supporting, managing, monitoring and continuously enhancing the work process have failed to be coincided since the focus was made on the function-oriented IT system construction and work and data flow [5]. Especially, the PMIS that is utilized as a tool for supporting the site management in the construction industry faces the problem of wasting the budget since the number of managers managing the entire data lacks, dual-management tasks with the in-house intranet exist, the work can only be done where the PC and the network can be accessed, and the system is constructed solely based on the projects [6]. Accordingly, new introduction measures and the suggestion of the work process that can make up for the problems of conventional PMIS are needed.

2.2 Smartphone in construction

As for the smart phones that have been rapidly diffused recently, after the release of iPhone in 2007, as the smart phones that had been utilized in the mobile business for corporation-use were diffused to individual users, various products such as the Android of Google have been released. The smart phone market has been increasing the its rate in the entire cell phone market, and specifically in Korea, it was found that 44.3% of the mobile communication subscribers were smart phone users by the end of 2011, and 93.2% of the economic activity population were using the smart phones (ROA Consulting). The environment in which the products can be utilized in various works without using the separate equipment that had been considered for carrying out business works in the past industry is expected to arrive.
Also in the construction industry, various attempts have been made to use the smart phones in various fields such as settlement, mail, and communication starting with the large construction companies [2]. Also in the academic field, the researches on the mobile-based cooperation [3], labor management, logistics management, and quality management using the smart devices[4][11] have been conducted in or to enhance the productivity by using the smart phones and mobile devices in the construction industry. Recently, researches have been conducted on the methods of work management through the derivation of the smart phone factor technologies that can be applied to construction site and application utilization.[1][9] This research is distinguished as it suggests the method of how the site manager collect information and support decision making through the communication using smart phone and SNS.

2.3 Cloud Computing

Cloud computing refers to the computational center which operates the data sensor or large computer and all technologies saved in the Cloud regardless of the location through various terminals such as the PC in which the network can be accessed, cell phone, and tablet PC. Currently, the construction of the cloud-computing based infrastructure is actively underway and the cloud service is changing with various functions, not simply being a competition of the virtual storage space any longer. The work environment is also rapidly changing due to development of mobile technology and the emergence of cloud computing. The data that was written in paper form in conventional construction site may easily be damaged by poor work environment of the site and the mistake of the writer. In addition, there are some problems such as the inconvenience caused by narrow storage space since enormous data are stored in the office and also problems about the utilization of the data. Although the data can be stored and printed in the conventional PMIS server, it is necessary for the manager to re-classify and write various kinds of information acquired at the site using various smart devices.

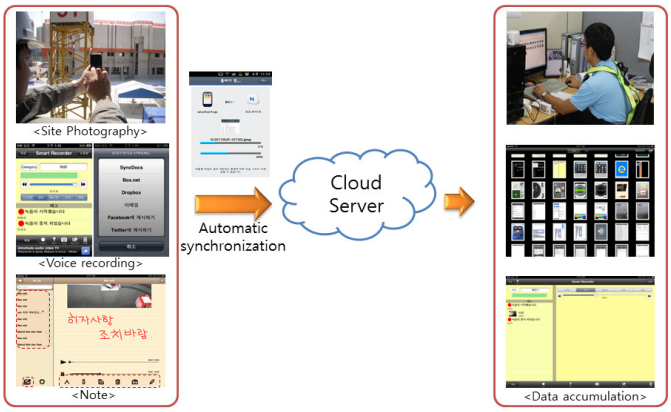


Fig. 2 Utilization of site information with smartphone and cloud computing

However, it would be possible to help SNS utilization and supporting decision making in construction site by either uploading the information on the cloud or arranging the information on the web that can be obtained by an individual on construction site. In addition, the accumulated knowledge will exist as the asset of an individual and corporation that can be utilized to other projects for defect management, and quality management and etc.

3. INDIVIDUAL UNIT PMIS USING CLOUD COMPUTING

3.1 Definition of individual unit PMIS

The PMIS (Project Management Information System) that has been widely used in various fields such as construction, civil engineering, and plant is "to process various kinds of management works and communications in all phases of the life-cycle of the construction project as an assembly of individual information system that carries out its function of collection-processing-saving-distribution of the information that is frequently used in the sites of constructor and HQ organization[7]", and it has been adopted in various forms according to the lifecycle stage of the project that applies PMIS, management task of the project, and the participation subjects of the project.

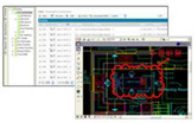
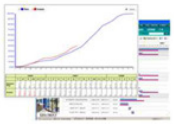
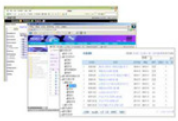
Function	Characteristic	Image	Function	Characteristic	Image
Project Management	- As a part of Managing basic data of project, provides functions to check and manage data - Offer Briefing room for owner and head office to explain project summary		Collaboration Management (Correspondence)	- Efficient information sharing and communication function for project participant such as official document transmission, Change order, MOM(Minute of Meeting)	
Design Management	- Index and various drawings produced on project process. Then apply to final as-built drawing - Offer drawing viewer and checking function		Cost Management	- Manage total cost of the project, Detailed statement, Completed amount	
Process Management	- Manage standard of process management, present condition - Register and manage submission to handle following process		Construction Management	- Automation of checking quantity takeoff, labor attendant, material subtotal - Data gathering by work classification/business - Functions for managing sites	
Quality/Safety Management	- Register education and inspection about quality and safety - Manage budget compilation and execution for safety equipments		Document Management	- Manage incoming and outgoing documents during project process	

Fig. 3 Major function of PMIS

As reflected in Picture 3, it can be understood that the PMIS that is utilized in the construction site handles business management associated with the site work, design management, process management, quality/safety management, labor/materials management, collaborative management, construction cost management, construction management and document management and etc. However, though this kind of system operated based on web which make it possible to improve system usability and information accuracy in substandard construction site, existing PMIS in internal and external have a limitation to meet various requirement in terms of accessibility and usability of site manager.

Site Management Works	Major Specific Task
Project	Design document drawing Design change review Design change history management Document, SR management Civil complaint management Subcontractor management
Quality	Quality record management Equipment management Quality test management Education planning and implementation Quality guarantee management
Safety	Safety organization management Education planning and implementation Safety check Safety equipment management

Time	Process planning Labor supply and deposition management Making detailed progress schedule Material/equipment management Process management report Completion management
Cost	Actual cost analysis Construction implementation plan Expense document management Working budget management Progress payment management Completion management

Fig. 4 Major function of PMIS

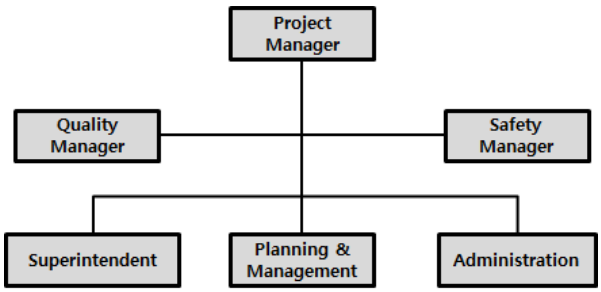


Fig. 5 Organization for site management

Picture 4 shows major specific task for site management work classification performed by site manager and it is general work conducted on construction site. It can be classified as Project, Quality, Safety, Time, Cost and it conducted by construction site organization. Through the comparison of site works and works supported by PMIS, various problems(such as unnecessary movement to field office for checking and action of completion progress, impossibility of check and data entry task for inspection/examination on site, impossibility of data sharing with other participants) are encountered and it can be understood that PMIS actually can not support site works effectively. Accordingly, individual PMIS suggested in this research is the system that can support data sharing and communication of each participant by using SNS for Project, Quality, Safety, Time, Cost which are major works on construction site.

3.2 Analysis data flow of individual unit PMIS

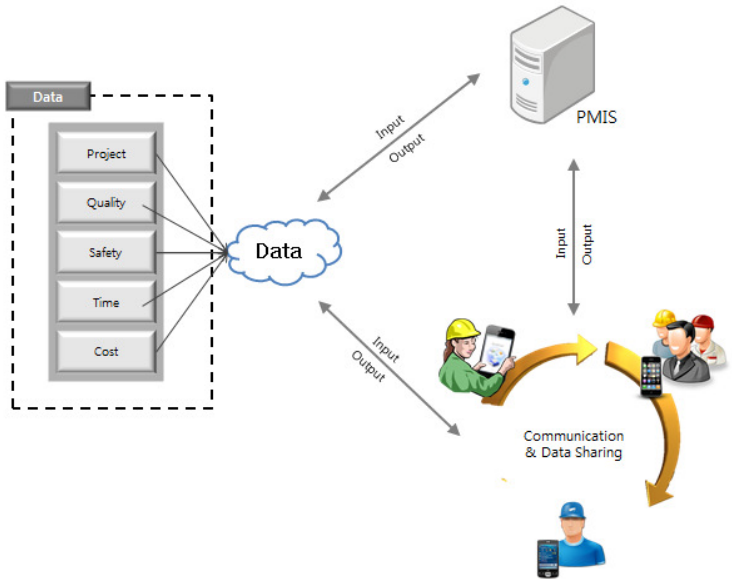


Fig. 2 Data flow of individual unit PMIS

Some situation that need data input and output can be occurred when site manager perform major task: Project, Quality, Safety, Time, Cost. In case of data input, site manager collect various information from the construction site and upload to PMIS and handle problems by share and utilize data with participants. Existing process should be in unproductive process of upload to PMIS or delivered on offline after data collection and record, movement to field office. However, if site manager can deliver data collected on construction site to PMIS or other participants directly, PMIS can support site works more efficiently and existing input, task checking, action process will be shorter. Case of data output is when site manager need to shared data which necessary to perform site task from PMIS or other participants. Also, it is possible to shorten unnecessary movement between site and field office and manage construction effectively. Site manager can data sharing, communication and get essential information from PMIS by using smartphone and SNS in order to more active site management.

4. CONCLUSION

This research suggested the measures for efficient site management by using smart phones and Cloud computing technologies in order to cope with i) the difficulties of efficient management of various information that occur in the project despite IT technologies and ii) inefficient communication problem among the participation subjects. Works supported PMIS and task should be done on construction site are analyzed and development plan of smart phone application which can solve data sharing and communication by using SNS are suggested.

It is expected to be possible to collect and record the real-time information that occur at the site and make rapid decisions based on the recorded information, by converting the office works that are managed based on the site PC or Web, if the site management system that is based on the smart phones and Cloud computing that will be constructed through this research are utilized. In addition, even if the corresponding site is terminated by saving the information classified through the smart phones, it will become an asset of an individual or corporation in the form of defect information management and quality information management.

The development of high-end smart-phones that are equipped with various sensors and functions will not only enable processing the individual-unit tasks but also project-unit information. Also the diffusion of the tablet PC such as iPad and Galaxy, will make up for the limit of the size of the

conventional smart phones to completely integrate the works such as plan managements and documents management that are done separately at office/worksite.

Lastly, this research is be in progress in SBA R&D project and derived function and system development plan, description of partially developed system will be refer in conference.

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