SaaS(Software as a Service) 기반 지방유적도시 구조물 유지관리계측 통합모니터링시스템 구현

Implementation of an Integrated Monitoring System for Constructional Structures Based on SaaS in Traditional Towns with Local Heritage

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요약

Measuring sensor, equipment, ICT facilities and their software have relatively short life time comparing to constructional structure so that we should exchange or fix them continuously in the process of maintenance and management. In this paper, we propose a novel design of integrated maintenance, management, and measuring monitoring system applying the concept of mobile cloud. For the sake of disaster prevention for constructional structures such as bridge, tunnel, and other traditional buildings in the village of local heritage, we analyze status of these structures in the long term or short term period as well as disaster situations. Collecting data based on mobile cloud and analyzing future expectations based on probabilistic and statistical techniques, we implement our integrated monitoring system for constructional structures to solve these existing problems. Final results of this design and implementation are basically applied to the monitoring system for more than 10,000 structures spread over national land in Korea. In addition, we can specifically apply the monitoring system presented here to a bridge of timber structure in Asan Oeam Village and a traditional house in Andong Hahoe Village to watch them from possible disasters. Total procedure of system design and implementation as well as development of the platform LinkSaaS and application services of monitoring functions implemented on the platform. We prove a good performance of our system by fulfilling TTA authentication test, web accommodation test, and operation test using real measuring data..

I. INTRODUCTION

Comparing lifetime of constructional structure with its attached ICT HW and/or SW including measuring tools, sensors, and other peripheral facilities, we can easily recognize much shorter lifetime in measuring ICT facilities so that we should periodically exchange or modify these attached facilities during the lifetime of structure itself. In addition, periodical upgrade in the monitoring system should be essential because we need to apply advanced software or analyzing technology to these maintenance or management processes. On the other hand, conventional monitoring systems for constructional structure generally have their blind characteristics in software so that any maintenance personnel should depend upon the original developer when they need to modify or upgrade software and analyzing algorithm because it is difficult to understand the inner contents of that programs. This problem has been one of the most serious ones in the world of monitoring system of constructional structure[1].

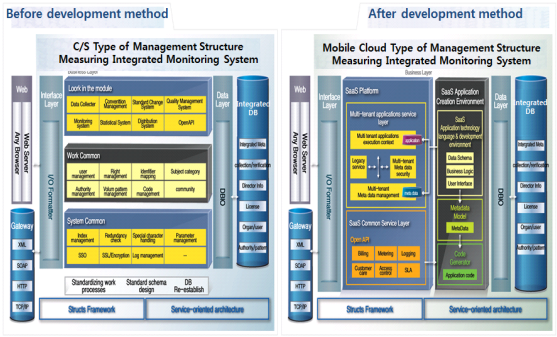
Currently, almost all monitoring systems for constructional structure in Korea are using Client/Server or ASP environment for their software supply. However, such systems are difficult to manage and require high operating costs because of the problem related to high costs of HW, SW, and their installation, distribution, customization, upgrade, fault & tolerance management, and expensive license royalties [2].

Ⅱ. SYSTEM ARCHITECTURE

Fig.1 shows two different architectures of monitoring system for constructional structure. Left one indicates conventional Client/Server type architecture and right one is our Mobile Cloud type architecture of monitoring system. Considering upgrading easiness, user-friendly interface, and other cost benefits indicated above, we convert all the design of C/S type integrated monitoring system into mobile cloud type.

Management structure measuring integrated monitoring system designed in this paper to support a SaaS-based multi-tenant environment is composed of a multi-tenant application service layer, a SaaS(software as a service) common service layer, and a SaaS

application generating environment layer as shown at the right hand side in Fig.1.

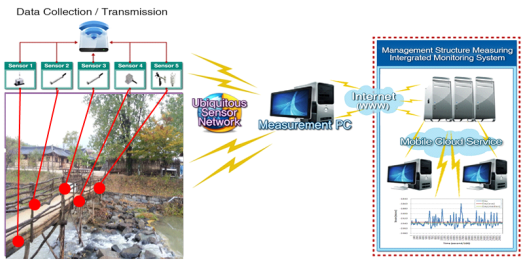


▶▶ Fig.1 Comparison of System Architectures between C/S Type and Mobile Cloud Type for Structure Monitoring System

Ⅲ. Possible Monitoring Application and its Folk Village Considerations

3.1 Asan 'Oeam' Village

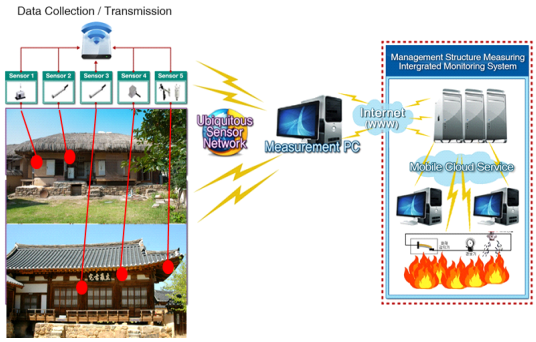
We propose the monitoring system designed throughout this paper applying to these traditional constructional facilities as a good counterplan against the disaster. Measuring, maintenance, and management of any constructional structures include cleaning, safety diagnosis, repairing, reinforcement, and restructuring etc. that we can obtain by applying the integrated monitoring system. Fig.2 shows an example of application that the monitoring system is established at the critical spots of a timber bridge located in Asan 'Oeam' Village.



▶▶ Fig.2 An Application of the Monitoring System to a Structure in Asan 'Oeam' Village

3.2 Andong 'Hahoe' Village

It is apparently possible to apply our integrated monitoring system for traditional houses in Andong 'Hahoe' Village against fire disasters using the formation and process depicted in Fig.3. Heat, smoke, gas, flame, and/or temperature sensors can be established and connected throughout the USN so that we can collect fire alarm sensing data and transmit them to automatic measuring equipment. Using these accumulated sensing data to be processed by component extraction algorithm, we can automatically detect beforehand variations of safety, progress of damage, and/or symptoms of fire occurrence.



▶▶ Fig.3 An Application of the Monitoring System to Detect Fire Symptoms for Traditional Houses in Andong 'Hahoe' Village

Ⅳ. CONCLUDING REMARKS

System offers a lot of useful features for the sake of disaster prevention for constructions such as bridge, tunnel, and other traditional structures in folk villages of local heritage. We can obtain rate of variations, cracks, and/or vibrations of target structures and analyze the physical status of them in the long term or short term period as well as disaster situations. Bridge of timber structure in Asan Oeam Village and traditional houses in Andong Hahoe Village are proved to be good applications of the monitoring system presented in this paper. Folk villages, in general, have traditional houses and other structures of timber and they are very close with each other so that there can be a lot of weak points against fire disasters. Our monitoring system can provide with a good solution of automatic detector or watching equipment for possible disasters in that area.

▮ References ▮

[1] Yong-Sun Oh, "Maintenance, Management, and Measuring Structure Integrated Monitoring System Based on Mobile Cloud", the Proposal of cooperation between company and university technology development business, Small and Medium Business Administration, 2014

[2] Byung-Won Min, and Yong-Sun Oh, "Design of Management Structure Measuring Integrated Monitoring System Based on Mobile Cloud", Proceedings of Korea Contents Association 2014 Fall Conference, pp.9-10, 2014.