

FORM WORK MANAGEMENT BASED ON UBIQUITOUS COMPUTING FOR HIGH-RISE BUILDING CONSTRUCTION

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ABSTRACT: The recent development of ubiquitous computing has resulted in an improvement of management performance through real-time monitoring and control. Especially, in high-rise building construction with reinforced concrete structures, form work requires effective management systems to reduce the duration and cost of structural frame work and subsequent activities. Recently, a concrete curing management system by adapting a ubiquitous computing environment has been developed as a method for effective quality management. However, the system has difficulties in its application to form work management. Therefore, this study intends to develop a form work management system in high-rise building construction based on ubiquitous computing. This study presents the results of the first phase of the present research.

Keywords: *Form Work Management, Ubiquitous Computing, High-rise Building Construction*

1. INTRODUCTION

Form work significantly influences successful project completion in high-rise building construction with reinforced concrete structures. One of the effective ways for reducing the form work duration is to strip the forms without delay when concrete placed in the form is sufficiently cured to stand by itself. In order to strip the forms at the appropriate time, it is important to estimate the concrete strength development at the early stage of the curing process. The concrete maturity method can determine the concrete strength more accurately and consistently than other conventional methods such as using test cylinders or a Schmidt hammer [1]. A ubiquitous computing environment can facilitate the application of the concrete maturity method on the construction site, and a wireless temperature monitoring system has been recently developed in Korea [2]. However, the system has some difficulties in its application to form work management in high-rise building construction. Therefore, the objective of this study is to propose an approach for effective form work management in high-rise building construction through the concrete maturity method based on ubiquitous computing.

2. EXISTING WIRELESS TEMPERATURE MONITORING SYSTEM

Fig. 1 [2] shows the constitution of the existing wireless temperature monitoring system in Korea. The system transmits the temperature data measured from the sensors wirelessly in real-time into the personal computer in the site office, and estimates the maturity and concrete strength. The data are also stored in the computer server, and information is shared with related experts for technical support.

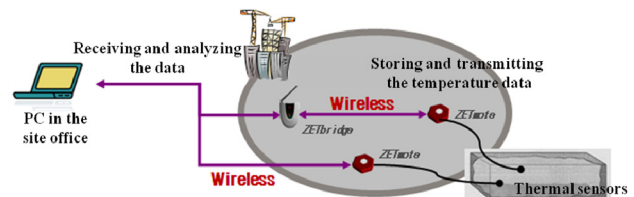


Fig. 1 Wireless temperature monitoring system

However, there are some limitations on the application for form work management in a structural frame work in high-rise building projects as follows: 1) time for installing the sensors and connecting wires with recording devices, 2) identification of the data into the PC in the site office, and 3) gap between the time when the estimated strength of

concrete reaches the required standard and form stripping time due to a planned schedule in structural frame work.

3. THE PROPOSED APPROACH

In this study, an approach was developed for effective form work management by improving the limitations mentioned above. Fig. 2 presents the procedure of form work management using the proposed approach.

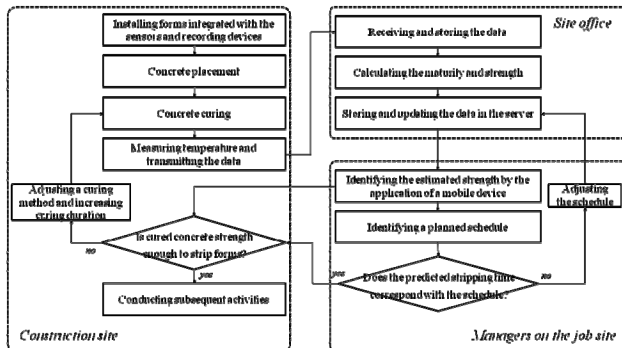


Fig. 2 Procedure of form work management using the proposed approach

In the case where the existing system is applied to a structural frame work in high-rise building construction, installing the thermal sensors and connecting wires of all sensors with the recording devices will take a considerable time. Thus, the research proposes a method which integrates a sensor and recording device with a form, and the sensor and recording device can be separated from the form in the case of a problem such as failure in the sensor or discharge in the recording device. The installing time may then be reduced considerably. Next, the construction manager can identify acquired data and estimated strength on the PC in the site office. However, this could cause proper and timely actions to be delayed according to the changes in the site condition, even though the system has the function of sending the warning message to the managers. Mobile devices, such as smart phones and web pads, can be offered as useful tools for timely management. In the proposed approach, the data stored on the PC in the site office are transmitted to mobile devices, and the related construction managers and engineers can identify the data through the application program in their mobile devices. The managers can also then update data which is required to be inputted on the job site immediately, and the data can

be stored in the server through the Internet. Finally, form stripping work could be delayed at the time when the required concrete strength is gained. This is because the time of resources input needs to be adjusted if the time taken to reach the required strength for form stripping is inconsistent with the time planned in advance. Thus, daily work management needs to be managed effectively through predicting the concrete strength development and form stripping time. The research proposes the work management tool based on mobile devices, which can intercommunicate efficiently between general contractors and specialty contractors.

4. CONCLUSIONS

The present study showed an improved approach based on ubiquitous computing for form work management in structural frame work of high-rise building construction. In a further study, it is envisioned that a management system will be developed and the system's performance will be tested through a mock-up test. The test will focus on the examination of the following: 1) method for establishing stable sensor network, and 2) effectiveness and drawbacks of the system for duration reduction and work management. Based on the results, the research team will construct a cost-efficient and effective management system.

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