Creative Construction Conference 2019, CCC 2019, 29 June - 2 July 2019, Budapest, Hungary

Application Development to Reduce Generation Time for Punch List

Jae Yup Kim[a,*], Bong Uk Nam[b], Hunhee Cho[c]

[a]Department of Achitectural Engineering, Korea National University of Transportation,Chungju and 27469, South Korea
[b]A bachelor's degree at Department of Achitertural Engineering, Korea National University of Transportation,Chungju and 27469, South Korea
[c]Department of Civil, Architecrure and Environmental Enginerring, Korea University, Seoul and 02841, South Korea

Abstract

With the recent improvement in the quality of life, more and more people are now demanding higher quality in terms of construction projects. Accordingly, construction techniques and construction control techniques have advanced. Recently, various construction project quality control techniques have been introduced. However, due to the non-optimized processes, it is difficult to commercialize these techniques. The biggest problem of the existing task process is 'the duplicated input'. The 'input at the site', the first phase of the 'duplicated input', is entered by typing within the application. However, due to the characteristics of the tasks on a construction site, it takes a long time and thus is inappropriate. Second, 'the input at the office' is problematic as it requires manual input for each sentence. The first problem was improved by changing the on-site typing method to 'input by item selection'. The second problem was improved by using 'automatic sorting' for the on-site input within the application. When the improved task process was implemented in the application, the working hours were reduced by about 18.4%.

1. Introduction

In South Korea, several information technologies (ITs) are being introduced to building construction projects to enhance such projects' efficiency. Various studies have been conducted to promote building construction tasks using mobile applications. One example of such approaches is to generate a punch list of construction defects during a project based on an application. This notwithstanding, there is still much room for improvement. As such, this study aimed to propose a plan to improve the efficiency of punch list generation

2. Generation of a Punch List for the Quality Management of a Building Construction Project

In South Korea, a punch list is generally generated to manage the quality of a building construction project at the construction site. A punch list is a document that lists the construction defects found through construction quality inspection following the project's completion. These construction defects are documented for repair and maintenance work. To generate a punch list, an application is usually employed at the site. Most of the currently used applications allow the entering of the construction defect contents and images (Fig. 1). The manager in charge of generating a punch

*Corresponding author: Author email: kimjy67@ut.ac.kr

list enters the construction defect contents to the site using a smartphone, and then completes the list at the site office on a desktop PC.
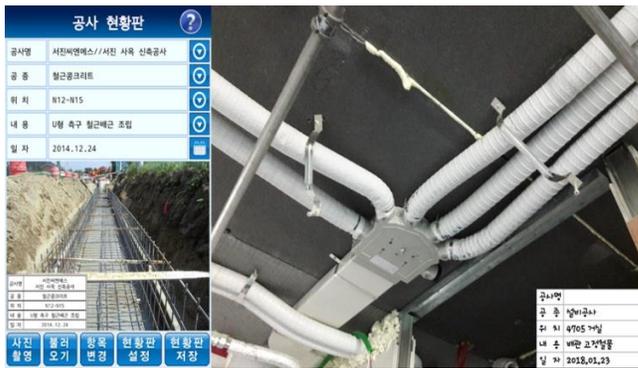

Fig. 1. examples of punch list generation

Fig. 2. improved input method

3. Punch List Generation Problems and Improvement Plan

3.1. Problems of the currently used applications for punch list generation

There are three types of applications that are currently being used at construction sites in South Korea for punch list generation. Of these, this study focused on D-App, the most widely used and most downloaded application. The analysis that was conducted in this study showed that the generation of punch lists using these existing applications encounters the following problems:

- Entering the defect contents was inconvenient as the user needed to type them into the application. The generation of a punch list on D-App requires the user to enter the defect contents by typing. Such a method requires a large number of key touches, thus lengthening the time required for completing the tasks.

- The generation of a punch list using the existing applications for such are not very efficient. The punch list is generated both at the site and in the office, which degrades the efficiency of the task completion. The survey conducted in this study showed that the users enter the construction defect contents using an application, and generate the punch list again on a desktop PC in the office, thus performing the task twice.

3.2. Improvement of punch list generation

This study aimed to improve the existing method of generating a punch list, as cited below.

- The input method was improved by changing from typing to selecting items (Fig. 2). Accordingly, the time that it takes the user to enter the contents was reduced, and the whole task of punch list generation was made more convenient.

- The punch list generated at the site can now be used as is. The information on the construction defects entered at the site is transmitted via e-mail, and in the office the user can then simply produce a punch list using the data obtained from the sent e-mail. Shown in Fig. 4 are the changes in the flowchart with the improvement of the punch list generation.

3.3. Development of an application based on the punch list generation improvements

In this study, a new application (P-App), which improved the problems of the existing punch list generation method, was developed. Shown in Fig. 3 is a part of the user interface of P-App. The basic functions of P-App are as follows. As shown in Fig. 3a, the main screen consists of three parts: "Generating a List," "Punch List," and "Preferences." Fig.

3b shows the method of entering the construction defect contents using the application. If necessary, images can be taken and added to the list. Fig. 3c shows how to enter the construction defect contents by simply selecting items. New contents can be added using the + button, as shown in Fig. 3b. With the use of the button on the upper right corner and after the accomplishment of the confirmation procedure shown in Fig. 3d, the list can be added as shown in Fig. 3e. Once the list is completed, it can be sent as a Microsoft Excel file in an e-mail, as shown in Fig. 3f.
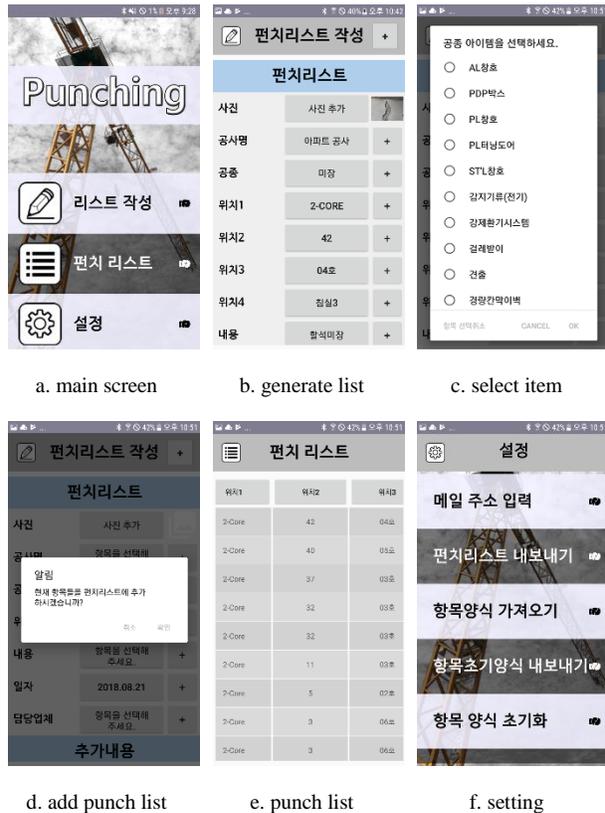

a. main screen   b. generate list   c. select item

d. add punch list   e. punch list   f. setting

Fig. 3. user interface of P-App

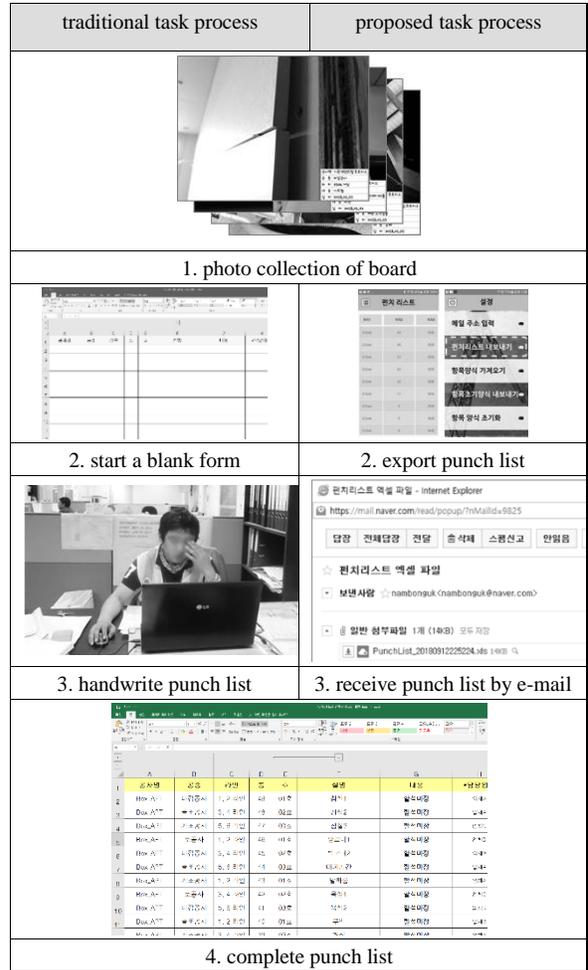| traditional task process	proposed task process
1. photo collection of board	
2. start a blank form	2. export punch list
3. handwrite punch list	3. receive punch list by e-mail
4. complete punch list	

Fig. 4. proposed punch list procedure

4. Analysis of the Changes in the Punch List Generation Tasks

4.1. Improvement of the punch list generation procedure

Using the P-App developed in this study, the punch list generation procedure was improved. As shown in Fig. 4, the existing method only allowed for the entering of images taken on the site and the construction defect contents, but the subsequent task, the generation of a punch list, cannot be performed onsite using such a method. Using the application developed in this study however, the entering of the construction defects and images as well as the generation of a punch list can be performed at the same time. This will result in removing duplicated tasks and improving the overall task procedure.

4.2. Analysis of the time it takes to generate a punch list

In this study, the change in the task efficiency based on the new application was analyzed by applying the application to an actual building construction case. The case used for the analysis was an apartment construction project (A Project), the most usual construction type in South Korea. A Project developed buildings for 1,498 households in Suwon, Gyeonggi-do. For quality management, A Project generated 22,744 punch lists using the D-App.

To analyze the difference in task efficiency by application type, the time that it took to generate a punch list in A Project was determined. Shown in Table 1 are the punch list generation procedures by application type. Based on Table 1, the time that it took to generate punch lists in A Project was determined, as shown in Fig. 5. Using the P-App developed in this study, the time that it took to generate a punch list was reduced by 18.4% compared to the time that it took to do the same with the D-App

Table 1. Punch list procedure

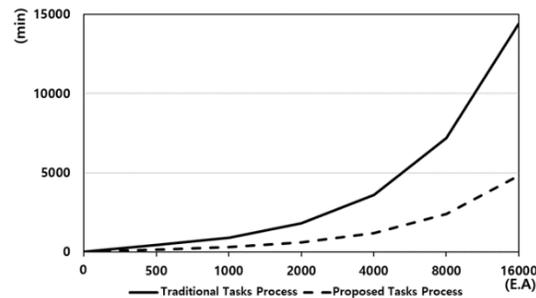| Task information	D-App	P-App
Preparing app	1min.	20min.
Move	5min/1e.a.	5min/1e.a.
App utilization	0.9mun/1e.a.	0.3min/1e.a.
Office movement	5min.	5min.
Generation punch list	0.6min/1e.a.	1min

Fig. 5. analysis of punch list generation time

5. Conclusion

A wide range of information technologies (ITs) have been introduced to the management of building construction projects. Applications have also been introduced for the quality management of various tasks, including punch list generation. It has been shown, however, that app-based quality management has not been sufficiently optimized. As such, this study aimed to develop an application with which to improve the efficiency of punch list generation. Furthermore, it was determined that the developed application could reduce the time that it takes to generate a punch list. Below are the key results of this study.

- The problems of the existing applications for punch list generation were analyzed. The problems were the inconvenience in entering construction defect contents and the inefficiency of punch list generation.

- An application with which to improve the efficiency of punch list generation was developed.

- The new application was used to improve the punch list generation tasks. The input method was changed from typing to item selection, and the time that it takes to generate a punch list was reduced.

- The time that it takes to generate a punch list based on the introduction of the new application was analyzed. Compared to the existing applications, the new application reduced the time by 18.4%.

Acknowledgements

References

[1] Seong Jin Kim, Tae Hak Kim, Hyun Ok, A Study on Developing the System for Supporting Mobile-based Work Process in Construction Site, Smart Media Journal. 6 (4) 50–57.

[2] Jae Yong Lee, Dae Jun Ji, Soo Yong Lee, A Method for the Quality Improvement by the Punch List Analysis of Apartment Construction, The Korean Society of Safety. 22(2) 53-58.

[3] DongSanApp Board[Internet], Korea: Traditional Punch List Application in Korea; c2013-2019[updated Feb.23 2019]. Available from : https://play.google.com/store/apps/details?id=kr.drct.dsanapps