Development of the Mobile application of drawing editor based on android

Jung-Sook Kim, Junho Jung

Abstract: A field measurement is that measures the sizes and spaces in advance for the remodeling and interior construction. In this paper, we design the smart automated mobile drawing editor which can show the plane objects that composed of a space for remodeling and interior construction and can show the position and the number of sensors to recognize the fire and natural disasters as soon as possible efficiently. Also, that is a mobile application on Android. The smart automated mobile drawing editor could reduce the cost, time, and inconvenience of the user which occur a field measurement on paper in field. And it could input and edit on measurement data in field directly. Especially, If the fire and natural disasters occur then it will present effective escape route according to doors, stairs and near environments. The sketch method that was previously employed on the tablet device was a point-drawing sketch using NOD, but this method is inaccurate because it uses a finger touch, and there is a limit to expressing a detailed shape like a column quickly. To make an improvement on this, we devised a method called 'Drawing Editor' that enables us to draw a sketch faster than sketching a space on paper.

***Index Terms*: Drawing Editor, Mobile Application, Field Measurement, 2D, 3D, Sensors**

I. INTRODUCTION

Field measurement refers to measuring the space that should be constructed in advance before working on the interior and remodeling work site. In the case of other countries, there are a number of applications that are being used for field measurement, and the most famous of them has recorded more than 11 million downloads [1]. However, most of them are interest-oriented programs in the sense that they are being tried for planar configuration to satisfy their personal curiosity [2]. As such, although there is a high interest in the programs by common people and experts alike, they are being ignored by the industry. Nowadays, due to rising labor costs, there are many interior work places that are being operated by one person. Consequently, there is a difficulty for one person to do both field measurement and digitalization. Accordingly, in this paper, it was thought that if a program is developed that helps to reduce cost and improve quality when applied to interior architectural practice, this domestic technology can be popular in domestic as well as overseas market. The sketch method that was previously employed on the tablet device was a point-drawing sketch using NOD, but this method is inaccurate because it uses a finger touch, and there is a limit to expressing a detailed shape like a column quickly. To make an improvement on this, we devised a. method called 'Drawing Editor' that enables us to draw a sketch faster than sketching a space on paper. Especially, in consideration of natural and other disasters that occur frequently, in this design, attempts were made to install various sensors in indoor space and buildings. The type and number of sensors will vary depending on the type of sensors, such as fire sensor, seismic sensor, human body detector, and smart home sensor. Also, when these sensors are installed, they should be installed according to the arrangement of the space or the size of the space. Hence, this is a Drawing Editor that enables smart designs that can suggest the place where the sensors will be most effective in field measurement for designs and to suggest the direction and method of optimal evacuation in case of actual disaster. For example, the main fire area is a kitchen with a gas range, so if you install a fire detector sensor, you will be able to recognize the fire as quickly as possible when the sensor is installed near the gas range in the kitchen. That will help suppress the fire in the early stage and can prevent a potentially big fire accident. If this Drawing Editor is used when making a field measurement, it will provide the function automatically so that the designer can automatically select what are required. Furthermore, it will also provide functions that can arrange design and spatial arrangement optimally. It will be more desirable if fast and effective evacuation functions are provided for natural disasters or fire. Accordingly, in designing this Drawing Editor, the function that can guide the optimal evacuation route was also incorporated, taking the entrance, stairs, and the surrounding environment into consideration [3,4].

The composition of this paper is as follows: First, in Chapter 2, preceding studies on the subject have been reviewed. In Chapter 3, a description was provided on the design of the automatic smart Drawing Editor for field measurement. In Chapter 4, we described the implementation results and lastly, in Chapter 5, we presented our conclusion as well as a suggestion for future studies.

II. RELATED WORKS

In the case of other countries, there are a number of applications that are being used for field measurement, and the most famous of them has recorded more than 11 million downloads. However, most of these are interest-oriented programs that mainly reflect the curiosity of the general public. Although there is a high interest in the programs by common people and experts

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alike, they are being ignored by the industry as their function and configuration are not closely related to practice. So, it was thought that if a program is developed that will reduce cost and improve quality when applied to the interior architecture practice, this domestically developed product could attract popular attention both in domestic and overseas markets.

Table 1 shown below presents the results of comparative analysis of the characteristics of cases developed overseas. As can be seen, most of them use NOD method.

Table 1 Overseas Examples

	Magic Plan	Grapholite Floor plan	Inard Floor Plan
Interface	Photo, NOD	NOD	NOD
Bluetooth	O	X	X
Transformation	2D, 3D	2D	2D
Memo	X	O	X
Download	11,000,000	500,000	500,000

Attempts to input the space in 3D have continued in the past as well as at present. As can be seen in the examples shown below, Apple is working on 3D space data on an on-going basis using camera sensors. However, it requires expensive equipment using a high-priced camera, and there is a concern about the cumbersome field measurement as well as exposure of privacy. In the main, they develop technologies related to augmented reality. One Korean company has a technology that automatically reads 2D drawings and converts them to 3D, but this technology is useless in spaces where there are no drawings. Conventional measurement methods using tape measure or laser ranger are the most common methods thus far in measurement sites and practices, and are the most reliable method. Since spatial data is obtained through the most common measurements, it is the most accessible and popular platform format in architecture and interior fields.

III. SMART DRAWING EDITOR

A. Field measurement flow

The system designed in this paper is an application program that runs in a mobile environment. The mobile environment can be implemented on Android-based devices, and the language used for development is Kotlin [5]. The field measurement process has an order by experts in site and the mobile application process the field measurement step by step similar experts. The process has 5 steps. The first step is drawing and secondly step is that the structures are laid out in items. After that, the numbers are input using keypad and memo function is provided in mobile drawing editor. Finally, the field measurement data are saved.

B. Generation of 2D & 3D drawings and navigation configuration

1. As (Z) axis information such as ceiling height and door height are inputted along with (X, Y) coordinates of plane information, we plan to develop this so that it can be exported as a 3D file together with the elevation.

2. As for drawing materials necessary in meetings with the clients which accompany field measurement, the floor plan, the ceiling, and the main elevation of each room are required. Therefore, the above drawings are cataloged and supported in the form of navigation, so that they can facilitate exact communication in meetings with the customers.

3. Fire and natural disasters are occurring frequently, and many re searches are being implemented on the installation of sensors and installation methods that can detect them quickly in a new building or remodelling stage. Therefore, in this paper, an attempt was made to provide a smart function to automatically present the position and the number of sensors at the place where they are to be installed in the field measurement, so that the user can proceed with the design quickly.

C. System functions

The table 2 shows the menus and detailed components which are provided by mobile drawing editor.

Table 2 Functions

Menus	Components
Navigation	- close - cancel - restore - save - download
Tools	- plane drawing - delete plane - point/line editing - round edge - angular edge - divide line - drawing memo - file attachment - etc
Structural units	- group - delete group - delete drawing - move drawing - copy drawing
Edit	- windows - stairs - wall - pillar - symbols - technical icon(sensors) - an opening

Project management	- recycling - drawing rotation - drawing scale - drawing reverse

Concept definition of 'portal': The door and the window are the device to link present space and different space. If you need to draw newly to measure another space at the present measuring space, space production is impossible if there is no portal (door, window).

- Option category is constructed of door/window/pillar/built-in furniture
- specific option: arrange each type of door, window and pillar and display it by icon.

- If each item is inserted in the drawing, detail function setting step is needed to fill in or select the necessary information.

1. Item arrangement activation
- Tap item button in the process to transit the working screen and use refresh at the right panel

2. Select the item category
- If you select the option category at the right panel, detail option at each classification is exposed at two-step panel
- Call in work screen from the selected item at two-step panel

3. Modification of item location
- Provide the standard point and guideline of item

4. item modification tool
- copy/Up-Down conversion/Left-Right Conversion/rotate/delete

C. Enter figure

You can enter arbitrary numerical value and modify it tapping the part that the user wants. Enter the name of ceiling and space and select the position that the value line will be shown. Enter the ceiling height first by the process deduced from expert interview. Reference value will be entered by measuring the longest width/vertical length and entering them as reference value. And when you enter detail value in standard of the longest width, you can avoid the break of the figure form. When it is difficult to correct the error by the standard of the longest width, you can provide value line division function and enter the reference value in division.

1. Enter detail figure
- Calculate and summon the arbitrary value in the base of entered reference value
- Modify detail value in the counter-clock way in standard of upper left corner
- Divide arbitrary value and the value that user entered directly by color

2. Error revision
- Revise error by calculating reference value and entered detail value
- Concentrated distribution: when there is error in the sum of the longest width and the longest width including the segment, combine error in one segment
- Equal distribution: when there is error in the sum of the longest width and the longest width including the segment, divide the average of error on each segment equally
- When the error revision is done, no other factor is influenced expect the selected segment

3. Figure Entry sequence
- Measure the circumference of space by counterclock way in the standard of left upper side.
- When the item is subject to the wall, luanch pop-up to enter the detail value of the item
- When the item is not subject to the wall and exist in solid form in space (pillar/built-in furniture), measure and enter the distance between item and the space.

4. Entering measured value using lazer distance measuring instrument
- Select bluetooth button to synchronize with lazer distance measuring instrument
- Provide second measurement and average value to select the value that the user decides more appropriate to the field situation

IV. Result And Discussions

The system designed in this paper is an application program that runs in a mobile environment. The mobile environment can be implemented on Android-based devices, and the language used for development is Kotlin [5]. The functions provided by smart drawing editor are a navigation, tools, project management, structural unit and editing function.

Figure 1 shows the mobile application programs and the technology to be developed in this paper.

Fig 1 Loading display

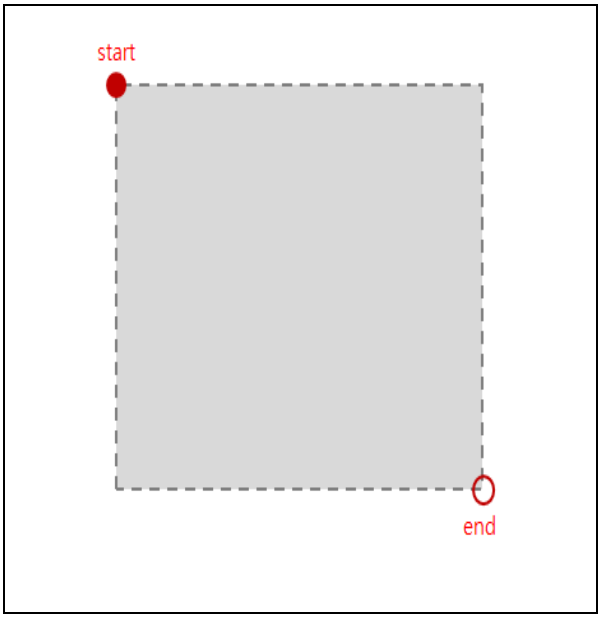


Figure 2 Plane sketch

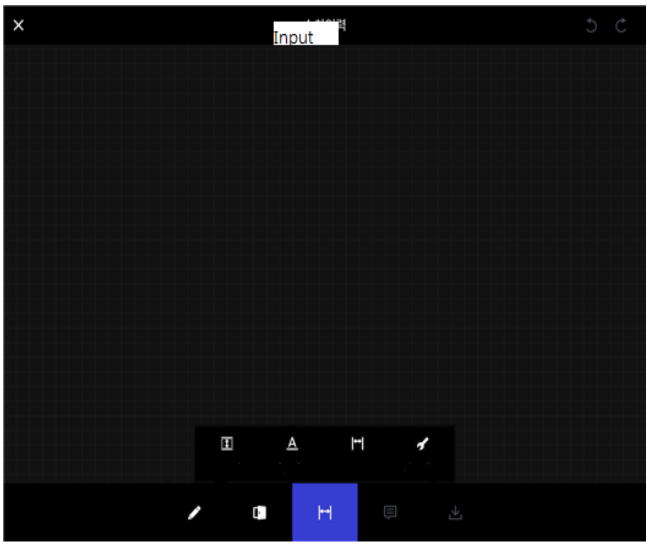


Figure 3 below shows the result of the first drawing created using the Drawing Editor during field measurement.

Figure 4 below shows the result of measured values inputted through the input device with memo input and Bluetooth function while operating the Drawing Editor in field measurement. When pressing the switch button below after capturing the shape, the shape is confirmed, automatically changed to the size input window, and the ceiling height input window is automatically created.

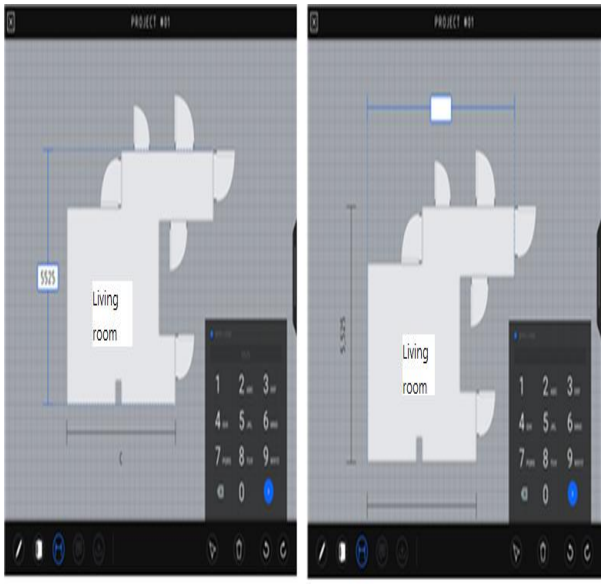
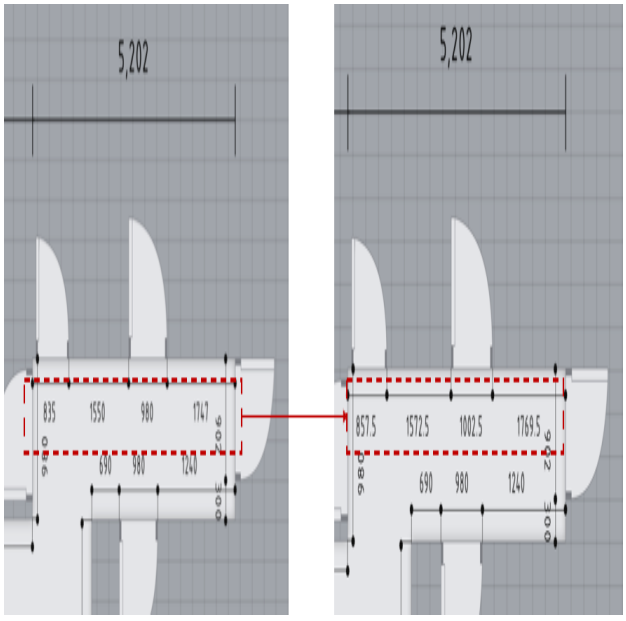


Figure 4 Input the size

The following figure 5 shows an example of field measurement. If you determine the approximate location and direction of the door, exact positional dimensions are inputted. For location of the door, the length between the door hinge and



the wall will be inputted. When inputting is completed for doors and windows, information for each space is completed. Other accessories can also be inputted. For the purpose, information on the type of sensors and position information should be presented. This can continue even after all plane information is inputted. When space inputting is completed, there remain guide lines on doors and windows.

V. CONCLUSIONS AND FUTURE RESEARCH DIRECTION

In this paper, an automatic Drawing Editor for field measurement was designed that can inform on the position and number of disaster detection sensors and optimal methods to evacuate from the site of a disaster in a smart way. The

smart automatic Drawing Editor for field measurement is an automated system for field measurement that can be run on a mobile device. This mobile application allows a user to draw field measurement data and design drawings while moving on a site for field measurement directly, which was designed to reduce the inconvenience, cost, and loss of time involved in drawing on a piece of paper manually. Regarding the direction of future research, a system is being developed that can apply the design method that was developed in this article. When development is completed, we will work on how to utilize it on actual sites.

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