

BASIC DESIGN OF A SCHEDULING TOOL FOR SMART DEVICES

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ABSTRACT: Schedule management of construction work is important in order to complete construction projects within a given period of time. Many efforts have been made and many tools have been developed in order to manage construction projects by a smart device such as smart phones and smart pads. This research proposed a basic design to manage construction schedules via a smart device using Flash. The interactive and graphic property of Flash enables a field manager to manage schedules easily and efficiently. A basic structure was designed for a user to be able to make and change a schedule by touching the smart device's screen. And a prototype was implemented by Adobe Flash/Flex Builder, it is applied to a sample network in a smart phone.

Keywords: Schedule management; Smart device; Flash; Web-based

1. INTRODUCTION

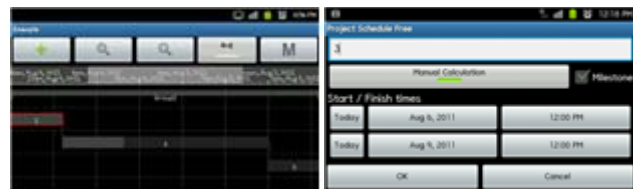
Smart devices such as smart phones and smart pads are extensively used to create or search date and to make decisions. These smart devices make it possible that mobile office[1] enables a working place everywhere and everytime. Furthermore, some companies¹ provide a smart work system² so that people can work regardless of time and space, e.g. a home office, mobile working, and a smart work center.

The information managed in the main office of an enterprise can be transferred to a field office and it is used to make a decision for construction management like schedule management by a field manager on a construction site using smart devices[2]. The schedule on the site is usually managed by a PC (personal computer) to confirm and edit the network schedule. Some tools provide a method to control web-based schedules[3].

There are various schedule management applications for smart devices, but very few to control construction schedules. Project Schedule³, MPM⁴, Power List⁵, and Ganttroid⁶ are the scheduling tools for smart devices based on Android OS(Operating System) shown in Figure 1. MPM just shows tasks entered by a user in a bar chart in HTML(HyperText Markup Language). The user is unable to edit directly the tasks. Power List uses a bar chart showing activities in one window whose start time and finish time are stored in another. It is inconvenient to zoom in and out the bar chart. Ganttroid shows schedules in the calendar in a smart device, it is also impossible to

update the schedule directly. These applications are suitable for simple contents such as works to do and personal tasks and are hard to display the priorities of tasks, percent(%) complete, and resources.

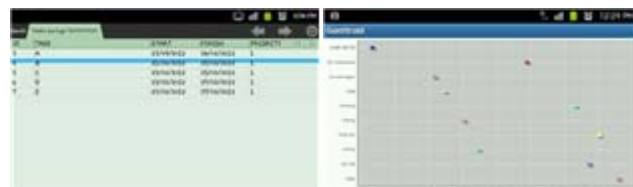
This research proposes a method to manage a schedule network in a smart device in order to use positively the smart device including check and update the information about construction schedules. The scope of the research does not include resource or cost.



(a) Project Schedule



(b) MPM



(c) Power List

(d) Ganttroid

Figure 1. Scheduling apps for Android phones

¹ Ministry of Public Administration and Security, Smart work best practices. 2012.4.

² Smart Work Center. www.smartwork.go.kr

³ Thorstens App. www.thorstensapps.com.

⁴ Hawkmoon Software, LLC. www.hawkmoonsoftware.com.

⁵ XXT Studio. www.xiaoxiaotu.com.

⁶ Ganttproject. www.ganttproject.biz.

2. RESEARCHES USING SMART DEVICES

Methods and tools are increasing to manage a construction project using smart devices because they are widely used not only by persons but also by industries. Several researches have been proposed in construction management such as safety management, material management, and progress management, but their implementations shows only external shapes and frames so that they are not insufficient to be used in the construction fields.

The development direction of a construction site-focused application[4][5] has been proposed after investigating softwares used in construction sites. It has included schedule management, communication, document management, photo/voice management, and decision process. A smart phone-based construction field management system[6] showed the link of the smart phone and PMIS(project management information system). These researches noticed that the smart phone application has optimal and a few functions to manage construction projects because of a small display and limited functions. An application for safety management[7] based on PMIS has showed the concept and UI(user interface) to manage real-time construction site safety. It had a screen design and menu for photos, pictures, and safety guidelines. Some researches[8,9] proposed the camera of a smart phone to gather information about materials and workers by Bar code, QR code, and RFID.

Augmented reality and location-based service(LBS) are the techniques in a smart phone. A method[10] to manage construction progress showed a virtual reality model to overlay the building under construction in the camera screen. The road monitoring system[11] has used LBS to repair roads, and reported time and cost reduced. G construction company showed mobile office and smart work[12,13] used on construction sites. It used a mobile project management system to manage workers and materials on sites, increase productivity, and reduce cost.

Most of the previous researches have just showed concept or frames but no concrete system. It is an earlier stage to use smart devices for construction management. This paper proposes a design and implementation of schedule management application to actively use the smart devices to control a schedule network.

3. DESIGN OF A SCHEDULE MANAGEMENT TOOL FOR SMART DEVICES

3.1 Tool Design

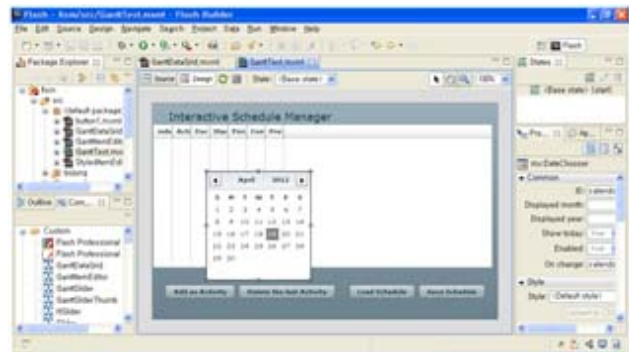
A schedule network must be able to be added, reviewed and updated in a smart device to manage construction schedules in consideration of the quantity of schedule information. It is difficult to manage overall construction works because of the screen size and function of a smart device. The smart device needs to zoom in and out the task to view the detailed information of a task. And a method to move the start and finish time of a task is necessary.

In general, smart device applications are built by Eclipse⁷ based on Java. This study developed a prototype. using Flash that has a user-friendly graphic interface. The Flash is used on various platforms such as Microsoft Windows, web pages, and Android OS. Adobe Flex⁸ was used to build a Flash application. It is able to make and distribute expressive applications in most of web browsers, desktops, and operating systems. Controls in the Adobe Flex provide input/output components and the DataGrid that is a tabular control to show an activity name, duration, start date, and finish date.

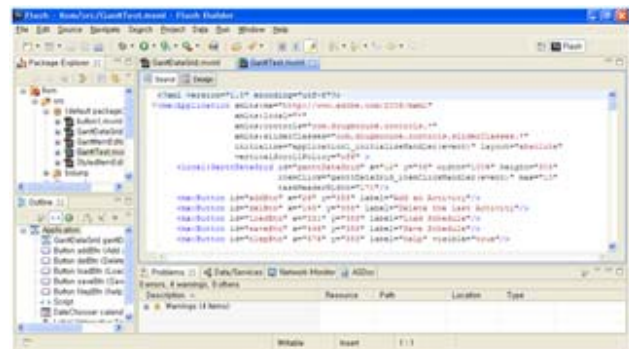
3.2 Prototype

Adobe Flash/Flex Builder is a tool to make Flash and Flex applications. Figure 2 shows a screen to edit source codes in the Adobe Flash Builder. A programmer puts a DataGrid and several buttons on the screen and writes source codes in Java-based language. The source codes are stored in the form of MXML(XML-based user interface markup language)⁹. MXML lays out the screen by arranging controls for the user interface.

A prototype to manage a schedule network consists of several buttons and a DataGrid shown in Figure 2(a). There are buttons to add and delete activities, and a button to save and load the schedule network. The DataGrid displays the detail information of an activity on the left screen and its bar chart on the right. Figure 2(b) is the source codes written in MXML to change the start



(a) Screen layout



(b) Coding

Figure 2. Adobe Flash/Flex Builder (version 4.6)

⁷ Eclipse (software). en.wikipedia.org/wiki/Eclipse_(software)

⁸ Adobe homepage. www.adobe.com/kr/products/flex/

⁹ MXML. en.wikipedia.org/wiki/MXML

and finish date of an activity in the DataGrid. A calendar to set the start and finish date of an activity is embedded in the DataGrid.

The source codes were written to assign a function to each control used to implement the prototype. Figure 3 shows the relations of internal functions. Fism.xml is an execution function to compose the screen and user input/output, and transfers the activity information to other functions. FismDataGrid.xml designs the types of activity name, duration, start date and finish date for the DataGrid. FismItemEditor.xml processes the internal data that a user inputs or updates in the DataGrid. Important variables and values of the prototype are stored GlobalVars.as in the form of ActionScripts. Figure 4 shows an application named SWF Player¹⁰ executed in an Android smart phone. The application loads the prototype built in Flash. It is possible to execute the same application in a smart pad that has a larger screen than a smart phone, thus the smart pad is easy to touch and handle the prototype. The prototype provides the same user interface and functions in a smart phone and a smart pad. A user can add an activity on the screen of the prototype by touching the 'Add an activity' button. The added activity has 1-day duration and can be changed by moving the bar chart back and forth. The start and finish date of the activity are selected in a calendar embedded in the DataGrid. The user can remove activities and export

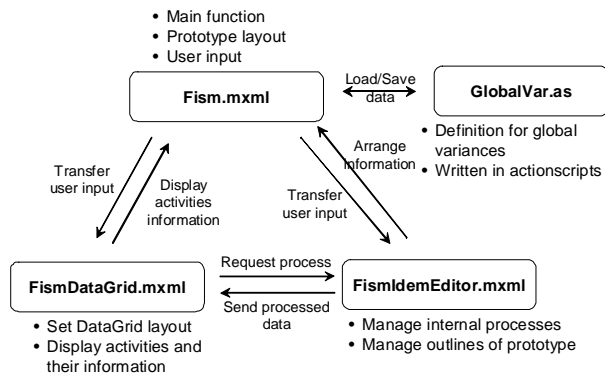


Figure 3. Internal functions of the prototype

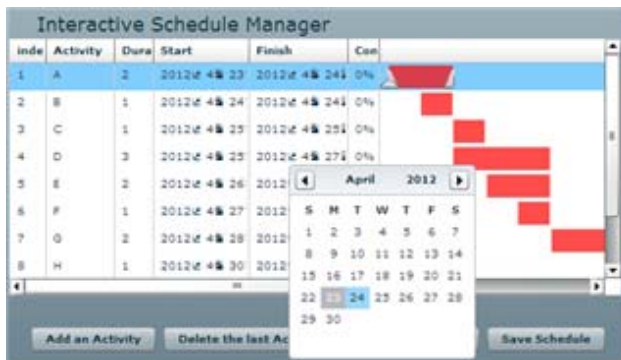


Figure 3. Internal functions of the prototype

the schedule network in XML(eXtensible Markup Language) form.

4. CONCLUSIONS

As smart devices are popular and widespread, the effort is increasing to use them to manage building construction. This paper proposed a basic design to develop a method to control a construction schedule network using Flash in a smart device. A prototype was implemented to manipulate an activity on the smart phone screen. It verified the possibility as a schedule control tool. There are several problems in the prototype such as insufficient detail information of the activity and inconvenient selection and update of activities because of small screen.

The proposed tool is possible to be adapted to various platforms, but an exclusive developing tool for each platform must be considered to implement the optimal application. Furthermore, as the hardwares of smart devices are improving, not only schedule management but also resource management and cost management should be included in the smart device application.

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¹⁰ SWF Player. www.bitlabs.com

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