The Cross Platform Application Development Adapted Spring Framework to Support Front-End Services

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ABSTRACT

The world has gone mobile. As a result, it changes people's mindset and preferences. People tend to choose smaller and compact devices due to its mobility and started to leave the desktops and laptops behind. For that reason, many companies have engaged in taking a further step to update their services to be accessible from these kinds of device as well. However, to absolutely dispose and replace the legacy system in short time seems inappropriate, therefore having cross-platforms applications will be the best solution. With the aim to bring more convenience to the services offered by a construction industry, this paper proposes a cross-platform application development environment adapted Spring framework to secure a connection between two platforms; Android and Windows. The application is able to manage requests from the front-end; the android platform devices to the Web that runs on desktop. The system architecture, the framework implementation and the application design are then presented.

Categories and Subject Descriptors

D.2.7 [Software Engineering]: Distribution, Maintenance, and Enhancement --- Portability; H.2.3 [Database Management]: Languages --- query languages

General Terms

Client server, distributed, real-time system

Keywords

Cross-platform application, front-end, Spring framework, tendering application.

1. INTRODUCTION

Being one of the most dominated mobile platforms, android has gained users' interest due to its mobility, interactivity, and ease of use. While the demand for android applications progressively increases, the developers grabbed the opportunity to release their products ever more. On the other hand, many companies have seen this trend as a new requirement in business. Afraid of losing their customers and to keep parallel with the current technology advancement, many have started to invest in offering their business, products or services on multiple platforms that suits people's demands. Cross-platform applications may run on as many as all existing platforms or as few as two platforms. Having cross-platform applications will allow two or more platforms to communicate by sending requests and receive synchronize updates. Having a well-established application framework that comprises of multiple components will help reducing the time spent on the configuration. This project which aimed to ease the tender bidding process is specially designed for Construction Industry Development Board (CIDB) and the application is named as BQ Manager since its main focus is to allow the contractors to easily access and update the bill of quantities (BQ) on their android devices. Cross-platform suggests the ability of application to support multiple platforms or various operating systems [1]. In this case, we propose an application that not only is able to run on different platform, but to effectively integrate with the Web based application to perform tasks in order to support the CIDB business operation.

2. RELATED STUDIES

In Malaysia, all activities related to the construction industries are monitored by the CIDB, a statutory body under Ministry of Works. CIDB was established as a regulated body entrusted with many responsibilities such as managing and controlling the construction tender (that involves the construction of building, road, highway, etc), providing financial assistance to the construction industry, awarding certificates of proficiency, and planning and facilitating the current and future needs of the construction industries [2].

Tender bidding is a process where the registered contractors from different construction companies bid for a construction project offered by CIDB, under a contract. The sealed offers themselves, including company information, project outline, and a price quote using bill of quantities (BQ). In particular, BQ is a piece of paperwork that is used to list the items needed in a particular project (government agencies or private sectors). The document typically includes a mix of material and labor needs and is most often used to help a contractor to estimate the cost of a project in order to prepare an accurate bid for work. Sometimes a bill of quantities is also used by a project manager to determine project needs. BQ provides a good basis for cost planning and is primarily designed as tendering document. BQ compounds the costs of labour, materials and services in order to complete a specific project [3]. According to a survey conducted [4], the use of BQ in construction industry was reported to ease the users in terms of editing, getting faster and accurate measurement, increasing speed and reducing manpower. Another survey conducted by [5] found that BQ has benefited its users for its easiness, since it does not require double calculation.

3. PROBLEM DEFINITION

Despite its good usage, the current process applied for BQ is lack of mobility, where the users need to access it through the desktop. In the current practice, the CIDB website will be the main communication medium to all parties. It will be a place for registered contractor to access the BQ or for the administrator to announce new tender. After purchasing the tender, all contractors (regardless its class, level or categories) need to access the BQ in order to update the price quote and other information related to the project. All processes including the information update, and BQ access take place through CIDB Website. The list of all the released tenders will be displayed on the first page and are not accordingly sorted nor categorized. Therefore the page seems cluttered with excessive unwanted information to certain contractors in different class. In order for them to get their tender application status, they will have to wait for CIBD phone call. Eventually this has affected the business speed and client awareness.

4. THE DEVELOPMENT
4.1 Spring Framework

BQ Manager is developed based on Spring integrating framework to support the front-end services used by the client on mobile platform. Spring is a java application framework that allows user to bind different components together. It is an open source application framework that aims to make the java development easier by putting together several single-tier frameworks such as Struts or Hibernate and structure them into layers to create a coherent architecture [6]. Not only has it made the development easier but faster. Spring is good at handling client interactions by providing a more programmatic way to communicate. Therefore it will be a good choice for meddling two different platforms regardless the underlying technologies.
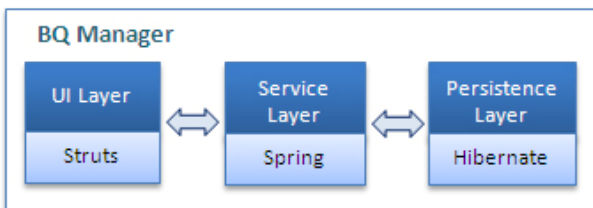

Figure 1. Spring integrating framework for the application

Even though every layer has distinct responsibilities but they are provided with an interface that allows communication between them. The UI or presentation layer is responsible to manage requests and response to user using `struts-config.xml`. While the service layer which also known as business layer provides interfaces for interaction with other layers and manage

transactions and business logic. Persistence or data access layer will query relational information into objects and update information stored in database.

4.2 System Architecture

Figure 2. The system architecture for BQ Manager

The tools used for the development of the cross platform application are Eclipse, with the supplementary of Spring, android SDK, android plug-in for eclipse, and Java. The use of Spring will enable the team to focus on application level business logic without having to think of the deployment environments and this has save a lot of our time. The main reason of applying Spring to this project is to allow cross platform interaction; from android to the Web application and vice versa. A MySQL database is used for data storage management and all the services are offered to the both back- and front-end users through an Apache server.

4.3 System Specifications

The aim of the project is to solve the BQ accessibility issues and to add easiness in BQ information update in the mean to ease the tender bidding process through client's mobile devices. The application is intended to meet the tender bidding standards and procedures, therefore the outcome of the project will work on the tender records, bidding, price update, and bidding status. In general, the goal is to establish connection between Web and mobile application to receive real time update and data synchronization. Besides these general specifications, the system specifications are categorized under two different platforms:

i.   Back-end operation (Web)
  - Main user is the administrator
  - Register client; the contractors
  - Manage all the client information, including renewal or termination of their services
  - Create, update or remove tender
  - Provide BQ document
  - Assign tender to specific contractor according to their class. To allow only the respective contractor to view the specified tender.
  - Post announcement or news
  - Tender approval
  - Provide geo-location services to each project to ease the contractor finding the venue of the project under his tender.

ii. Front-end operation (Android) :
  - Main user is the registered contractor

- View list of purchased tender
- Receive announcement or news
- View latest tender
- Access BQ document
- Update BQ requirements and resubmit to the administrator for bidding purpose, wait for approval
- View their tender application status
- Locate the project site.

The following is the use case diagram that represents the system specification for the cross platform application depicting the users' interaction.
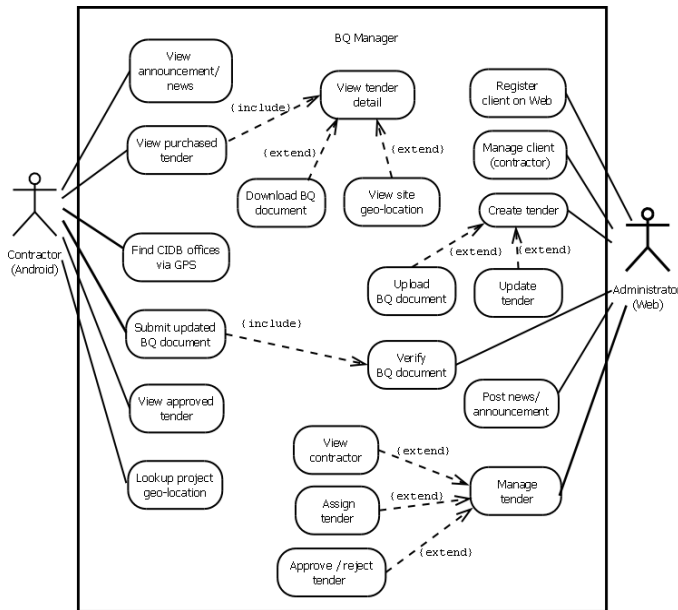

Figure 3. Use case diagram for the application

4.4 Prototype Design

Here are the user interface designs for some major features offered by the application. In all cases, the information of the tender uses Malay language as it is part of the CIDB requirements for the reason that it is developed for Malaysian contractors and their documents and statement of tenders are using Malay language.
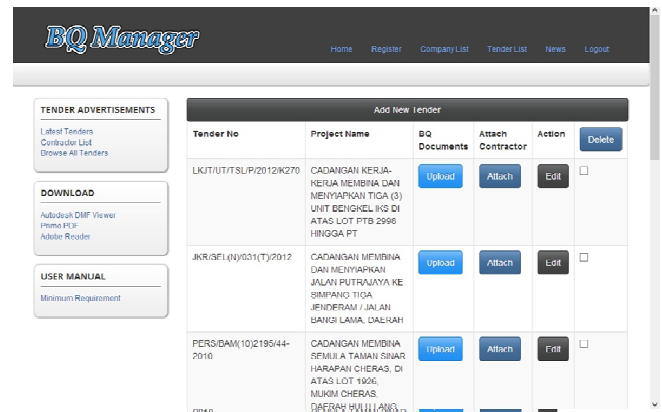
4.4.1 Back-end Processes

Figure 4. Administrator tender page on the Web

Basically figure 4 is the page where the administrator uses to manage tender information. Besides uploading BQ documents, admin also is able to attach or assign contractor(s) to each tender. If the administrator selects a particular company, the list of tenders purchased by that company will displayed.

Figure 5. Tenders purchased by specific contractor and the completed BQ

Figure 5 shows a page of specific contractor, under the administrator view. Once the contractor is done with the BQ pricing and details, they will upload the completed BQ through their android mobile devices and the uploaded BQ will be available in the Web, ready to be downloaded by the administrator. The administrator will then use the BQ for evaluation purposes. The evaluation process involves checking the BQ document of all bidders (company) and the winning or approved bidder will be listed under 'Approved Company' (Figure 6). Normally there will be many companies bid and attached to a project but only one will win. After the approval, all the 'attach' and approve' functions in the page will be disabled.

Attached Company

Company No	Company Name	Action
JH77651	beca interprise	Approve
778HJ88	nik and co	Approve

Approved Company

Company No	Company Name

eferenced herein shall be subject to our terms of usage

Figure 6. Approve company as winner for the tender bidding

4.4.2 Front-end Processes

Figure 7. Android login page

Figure 8. Nationwide office location

The front end application that is based on android platform is designed for the contractors and requires login (figure 7), using username and password provided by the administrator. The main page is also provided with 'GPS' button where the user can use to find the nearest or preferred CIDB office location throughout Malaysia (figure 8).

Figure 9. News

After a successful login, the page will direct the user to the news dashboard where all the latest news and notification from CIDB will be listed out (figure 9). User can check on the latest/new and their approved tender by tapping on the particular button. Details of each tender will be displayed accordingly. Also provided in the application is the icon to 'refresh', find the CIDB office 'location', or view the 'About' at the top right corner of every page to ease the navigation.

Figure 10. Approved tender

Users can also have a quick check for the tender(s) they have won as shown in figure 10. This data was fetched from the administrator's activity during the tender approval process as shown in previous figure 6.

Figure 11. List of tenders purchased by contractor

Figure 11 shows the list of tenders bought by a contractor. This information is relatively fetched from the attachment activity on the back-end. Once the user taps on each tender, its details will be displayed as shown in figure 12 below.

Figure 12. Tender details

In figure 12, the 'Download' button will allow user to download the original BQ document directly from web server and the 'Upload' button are for the user to submit their updated BQ document to CIDB for tender bidding purpose. The uploaded BQ document uploaded by contractor on the front-end (through android mobile devices) will be available on the administrator Website (refer Figure 5). The 'Show Map' button will be used to display the site location (figure 13), having Google map as a base. This is important to the contractor as it will aid them on the site visit.

Figure 13. Site location

With all these features provided to the contractors on the front-end platform, they can simply work on the mobile application without having to bother looking at the Web application.

5. CONCLUSION

In summary, we have developed a cross-platform application that runs on android to support the front-end activities performed by the contractor and the Web that support the work of administrator. As a result of conducting this project, we suggest the use of Spring framework in the development of cross-platform applications for Windows and android. The framework provides a pretty well solution in fetching the required data and response to requests made by the front-end devices. Apparently this will benefit both parties; the contractor and administrator to improve the services of CIDB by speeding up several tendering processes including document or file sharing. Our future work is to expand the use of application in some other platforms and will consider a mobile decision support system for the tender evaluation as well.

6. REFERENCES

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