Development of Mobile Enterprise Inventory Management System Application with CBD

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Abstract

In this paper a development of mobile enterprise inventory management system application is presented. Mobile enterprise is general term to describe a corporation or large organization that supports critical business functions and use of business applications via wireless mobile devices. Mobile enterprise applications are very helpful in gathering data for making business reports and assist employees in their daily transactions. Employees use mobile devices to do anything to make their work easier like for example, access email, manage projects, manage documents, provide customer relationship management, conduct enterprise resource planning, fill out invoices and receipts, accounting vouchers, work orders, purchase orders. In this paper the Component based Development (CBD) method is applied for mobile enterprise application development is proposed.

Keywords: Mobile Enterprise Application Development, CBD, Mobile Enterprise Management

1. Introduction

A mobile enterprise is referred as enterprise which uses mobile devices to make their work easier. Mobile enterprise applications are develop to assist the employees in their inventory or in their everyday transaction, like point of sale (POS), management information system (MIS), Enterprise Resource Planning (ERP) and other business related processes. A mobile enterprise is generally accepted to confer benefits in the areas of higher workforce productivity and employee satisfaction. Nowadays, many software components are available for free or by purchasing. In developing an enterprise mobile application, most of the time, the primary components that are being used are almost the same for every application they only vary on the uses and the design. It depends on the business requirements, but basically, the components are the same. Faster decision-making is another often cited benefit that results from employees having access to real-time data at the point of action, for example, during a meeting. Therefore, mobile knowledge workers are one of the groups among employees which are equipped with mobile devices by their organization. However, the strategic adoption of mobile devices in enterprises often also requires a change management process. Use of mobile applications in the workplace can increase worker productivity. While Component-based Development (CBD) is a software engineering development technique that emphasizes the separation of concerns in respect of the wide-ranging functionality available throughout a given software system. It is a reuse-based approach to defining, implementing and composing loosely coupled independent components into systems. This practice aims to bring about an equally wide-ranging degree of benefits in both the short-term and the long-term for the software itself and for organizations that sponsor such software. In this paper we designed a mobile application intended for enterprise used, run in mobile devices with the
CBD software engineering technique.

2. Background of the Study

2.1. Mobile Enterprise

Mobile enterprise is a term to describe a corporation or large organization that supports critical business functions and use of business applications via wireless mobile devices. In a mobile enterprise, employees use mobile devices to do any or all of the following: access email, manage projects, manage documents, provide customer relationship management, conduct enterprise resource planning, fill out invoices and receipts, accounting vouchers, work orders, purchase orders, etc. and manage a corporate calendar and address book. These are the most common applications though many other corporate mobile applications are being developed and used by organizations around the world [3, 4].

2.2. Component Based Development

Component-Based Development claims to offer a radically new approach to the design, construction, implementation and evolution of software applications. Software applications are assembled from components from a variety of sources; the components themselves may be written in several different programming languages and run on several different platforms. CBD architecture is being used nowadays and the research on how to make it more efficient is the focus of this study. A component re-used is one of the most convenient ways for the fast software production. There have been many methods on how to do this and it does involve more technical and detailed view. In this paper we tried to integrate the concept of CBD to develop a mobile enterprise application. We believed that enterprise application uses software components that are being re-used repeatedly; hence, component re-used for mass application developments is necessary [5][6]. Component Based Development (CBD) is popular methodology to develop a mobile component through component re-used. One of the interesting researches is the enterprise mobile application development with CBD.

If the components are available in repository, then it is easier to develop an application. Like for example, when we want to develop an inventory system. The inventory system has an user interface which accept data inputs. The data are then stored in the database for
calculations or analysis. The main use of inventory system is to produce a report at the end of processing. In Figure 1, as you can see, Interface for data inputs (GUI) component is in the first layer. GUI plays the important role in enterprise mobile computing, it is where the data is being inputted, and hence it must be user friendly and easy to understand. Next to that is the Database components, database also is very important as it will store the data that has been input by the user. Report Generator templates are also needed. This template is also a component. There are many available report template components which are ready to be connected to the applications to generate reports. Also, the printing option is very important.

Figure 2 shows the composition of the mobile enterprise application. These are the Enterprise connectors, Communication platform, mobile devices and storage or databases. Enterprise connectors are software, middleware and also components which are used to develop the applications. Communication platform, are the communication technology that support the mobility of the devices. Mobile devices are of course the devices; this can be smartphones, PDAs, tablets and etc. Also the most one of the most important is the databases. Data warehouse are essential and must be secures as it stores all the data from day-to-day business transactions.

2. 3. Management Requirements

2. 3. 1 Mobility Management

Enterprise mobility management (EMM) is the set of people, processes and technology focused on managing the increasing array of mobile devices, wireless networks, and related services to enable broad use of mobile computing in a business context. When we say mobility management it is refer to the management for mobility of the device. To perform a daily transaction, employees maybe move from one place to another, hence mobility is very important. This is an emerging discipline within the enterprise that has become increasingly important over the past few years as more workers have bought smartphone and tablet computing devices and have sought support for using these devices in the workplace [3, 4].
2.3.2. Application Management

Application Management is very important consideration. We can install application in to many mobile devices; however, it can be compromise by other users if not kept well. System administrators cannot expect to have the same access to mobile device clients as they would have to desktop devices that don't leave an office. Lack of access combines with operating system heterogeneity to make routine tasks such as deployments, configuration settings, and application installations and help desk tasks very difficult. Each device has unique management requirements and tasks often must be performed remotely, over the air. Enterprise mobility management systems generally provide middleware to automate management tasks and insulate administrators from the complexity of performing tasks on many different types of devices.

2.3.3. Financial Management

Since mobile enterprise can be used as general or typical device, billing should be taken into account. The cost of voice and data were once wholly contained within the walls of the enterprise. With mobile devices this is no longer the case. Often, each employee negotiates their own contract with a mobile carrier and then bills his employer for some or all of these costs as a reimbursement, creating budget unpredictability for the organization. Other tasks such as carrier contract negotiations, invoice processing and/or device requisition costs, when appropriate, can also be included. Enterprise mobility management often includes telecom expense management features that help organizations plan for and control the overall costs of mobile voice and data transmissions.

2.3.4. Security Management

The mobile devices are easily lost or stolen; the data on those devices is highly vulnerable. If corporate data is accessible via a personal mobile device, organizations suddenly lose a great deal of control over who can access that data. These can include password protection; encryption and/or remote wipe technology, which allows an administrator to delete all data from a misplaced device. Enterprise mobility management proposes systems to prevent unauthorized access to enterprise applications and/or corporate data on mobile devices. With many systems, security policies can be centrally managed and enforced. Such device management systems are programmed to support and cooperate with the application programming interfaces from various device makers to increase security compliance without increased labor. The used of mobile devices should follow the company’s policies to prevent misused of the devices.

3. Research Methodology

This chapter consists of project design, project development. In further study, research and understanding of the previous system must be consider in order to come up with the good and appropriate project plan and design.

3.1. Project Design

The succeeding methods include the development of the system. Information is provided to show the association of work and function of the proposed system. The following figures illustrate the flow of the system.

One of the most basic but important Enterprise System is the inventory system. Figure 3 shows the context diagram of the inventory system. It illustrates the first level of activities of each entity. Figure 5 is the functional decomposition diagram. In functional decomposition diagram, all the processes are shown. In inventory system, the enterprise components that can be used are Visual Studio 6, MySql Server, Active Reports and other
related components. It should be considered also that the components are flexible in mobile and PC application as possible. This is because when outside, for example is stock warehouse, the mobile device is being used to perform the inventory, however, when returning to the office, for final checking and other related processes, PC are being used. Figure 6 shows the scenario how to manage a stock-in record. Stock-in record means the listing of the stock arrived. Figure 7 shows the scenario for printing stock-in records. As what we have discussed in previous section, the application should be able to generate a report and print it as final output for document filing.

Figure 3. Inventory System Context Diagram

Figure 4. Use Case Diagram
Figure 5. Functional Decomposition Diagram

Figure 6. Scenario for Manage Stock-in Record

Figure 6 shows the scenario how to manage a stock-in record. Stock-in record means the listing of the stock arrived.

Figure 7. Scenario for Printing Stock-in Record
Figure 7 shows the scenario for printing stock-in records. As what we have discussed in previous section, the application should be able to generate a report and print it as final output for document filing.

3.2. Project Development

In developing the system, different activities must be performed. Activities that can identify precise analysis and design of the project based on the status of the existing system. One of the common methodology is called System Development Life Cycle (SDLC) is suited in completing the system development. The SDLC describes activities and functions that all systems developers perform regardless of which approach they use. This methodology feature several phases as shown in figure 8 that marks the progress of the system analysis and design. The specific steps and sequences are needed to adapt and as required for the project, appropriate with management approaches.

4. System Requirements

4.1. System Software Components

Stock Profiling. Stock Profiling is the process of registering and inventory information such as specifications, manufacturer and supplier details. Stocks are classified into intuitive categories for easy access to metadata.

Inventory movements. Stock movements are monitored, whether they are inflow, outflow, or even within the warehouse. Logs are maintained for accountability in case of loss or damage during transfer.

Usage and Maintenance histories. Proper mechanisms are in place to identify trends such as repeated replacement of certain stock or excess demand for certain equipment by a specific department to spot discrepancies and act accordingly. Stock usage and maintenance histories are monitored with respect to personnel, work orders and departments.
Stock Valuation. The system leverages advanced analytics tools generated graphs and reports to identify stocks that perform exceedingly well and hence increase their operational value.

Stock replenishment. Inventory levels and stock performance are evaluated on a regular basis to determine stock replenishment strategy. The system can also automatically trigger purchasing processes such as invoicing and purchase orders so that safety stock inventory levels are always maintained.

4.2. Mobile Programming and Database Tools

Here are some mobile programming and database tools that we used in developing the system.

Android software. Android software development is the process by which new applications are created for the Android operating system. Applications are usually developed in the Java programming language using the Android Software Development Kit, but other development tools are available.

AppGyver. AppGyver makes a number of tools for mobile app development, including a PhoneGap extension called Steroids. Prototyper may be the most eye-opening, though, because it lets you glue together a few pages into a flexible prototype for testing your ideas. It will deploy the result to your device through a QR code or let you test the prototype on the AppGyver website.

Intel HTML5 Development Environment. Intel’s HTML5 Development Environment is a cross-platform environment for developing, testing, and deploying applications on multiple device types. It is based on Web standards and was acquired by Intel when it purchased appMobi earlier this year. “It has a lot of really good strengths. It’s a very good tool,” says Stephen Campbell, lead developer at Second Fiction game studio. Second Fiction has used the tool to build HTML5 and JavaScript apps. HTML5 and JavaScript code are wrapped in a container to run as a native app. “The primary thing about using HTML5 is it isn’t as fast” as native code, he says. But work is being on this, he adds.

SQL Server. Database that can be connected to by a mobile computing device - such as smart phones or PDAs - over a mobile network, or a database which is actually carried by the mobile device. This could be a list of contacts, price information, distance travelled, or any other information. An example of this is a mobile workforce. In this scenario, a user would require access to update information from files in the home directories on a server or customer records from a database.

5. System Structure

The system consists of the following hardware and software components, the Barcode/QR Code enabled Smartphone and the inventory management system. This also includes other software and hardware requirements. Figure 9 shows the system components.
6. System Evaluation

In this study the proponents used the ISO 9126 as its core foundation. It is a software products evaluation standard form, the International Organization for Standardization. This International standard defines six characteristics that describe, with minimal overlap software quality.

**Figure 9. System Structure**

**Figure 10. ISO 9126 Standard**

*Functionality*- a set of attributes that bear on the existence of a set of the functions and their specified properties. The functions are those that satisfy stated or implied need.
Reliability - Attributes of software that bear on its ability to maintain a specified level of performance in case of software faults or of infringement of its specified interface.

Usability- Attributes of software that bear on the users’ effort for learning its application.

Efficiency- Attributes of software that bears on response and processing times and on throughput rates in performances its function.

Maintainability- Attributes of software that bear on the effort needed for modification, fault removal or for environmental change.

Portability- Attributes of software that bear on the effort needed to install the software in a specified environment.

7. Result and Discussion

The proposed software was presented to the end users to determine its acceptability, functionality, reliability, efficiency, maintainability and portability of the system.

<table>
<thead>
<tr>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Excellent</td>
</tr>
<tr>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Fair</td>
</tr>
<tr>
<td>1</td>
<td>Poor</td>
</tr>
</tbody>
</table>

In terms of functionality the level of satisfaction in suitability, accuracy, interoperability, compliance and security was rated between Very Good to Excellent.

Table 1. Functionality

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Accuracy</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Interoperability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Compliance</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Security</td>
<td>5</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

In terms of reliability, it includes the maturity and recoverability. As the user evaluated the system, the level of satisfaction is from Good to Very good.

Table 2. Reliability

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maturity</td>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>Recoverability</td>
<td>4</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

The usability of the system in terms of learnability, understandability, and operability the user find it easy to use but then requires much effort to the user to familiarize of newly form of system. It was evaluated as Very Good.
Table 3. Usability

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learnability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Operability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Understandability</td>
<td>4</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

In terms of efficiency of the system, the user rated the time and resource behavior of the system as very good.

Table 4. Efficiency

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time behavior</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Sources Behavior</td>
<td>4</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

The maintainability of the system, after undergo testing the user evaluated the stability, analyzability, changeability between Good to Very Good.

Table 5. Maintainability

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>Analyzability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Changeability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Testability</td>
<td>4</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

The portability of the system, determine by the user between Very Good to Excellent.

Table 6. Portability

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
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<td>Changeability</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Testability</td>
<td>4</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

8. Conclusion

In this paper a development of mobile enterprise inventory management system application is presented. Mobile Enterprise computing is necessary to day-to-day transactions of enterprise or company. It makes the transactions faster and easier because it supports mobility. In this paper we tried to integrate the concept of CBD to develop a mobile enterprise inventory management application. We believed that enterprise application uses software components that are being re-used repeatedly; hence, component re-used for mass application developments is necessary. We design a mobile inventory system as our sample application.
Acknowledgement

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References