THE APPLICATION OF RFID AS CASHLESS TRANSACTION IN BUSINESS ORIENTED ACTIVITIES

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ABSTRACT

Radio Frequency Identification (RFID) is the most advanced technological method for automatic data collection. It can be integrated with any enterprise applications to help reduce human errors and improve the speed and accuracy of business processes. As we know, insufficient small change is a small matter but it can lead to a big problem to the shopkeeper as well as to the customer. Therefore, a smart payment system is developed by applying the RFID technology. This project is basically an electronic cash system that is referred as one of the categories in electronic payment system. Customer can register and top up their card at the administration centre while the payment of meal can be done at participating shop. Microsoft Visual Basic 6.0 program is used to develop the interface and software of the system. Besides RFID tag and reader, Microsoft Office Access 2003 is also used to design the system database while the networking system is carried out by using Ethernet. The result shows that the RFID can be applied to the smart payment system. The system can be applied in the transaction activities such as school cooperatives, book shops, stationery shops, or canteens. Entrepreneurship can play an important role in providing the service to the participating shops.

Introduction

Radio Frequency Identification (RFID) is the last and the most advanced technological method for automatic data collection. It is a mechanism for data transfer by electromagnetic waves. It works by detection and unique identification of a transponder tag by a reader. The tag responds to the reader's radio signal with its own identity and other stored data [1].

This technology does not require line of sight and it goes far beyond what bar code scans can do. The optical nature of barcode requires labels to be seen by lasers. That line-of-sight between label and reader is often difficult, impractical, or even impossible to achieve in industrial environments. In order to function properly, a barcode reader must have clean, clear optics, the label must be clean and free of abrasion, and the reader and label must be properly oriented with respect to each other. Contrast with barcode, RFID technology enables tag reading from a greater distance, even in harsh environments [1].

Furthermore, the information imprinted on a barcode is fixed and cannot be changed. RFID tags, on the other hand, have electronic memory similar to what is in the computer or digital camera to store information about the inventory or equipment. This information can be dynamically updated [1].

RFID systems can be differentiated based on the frequency range it uses. Low-frequency (30 kHz to 500 kHz) systems have short reading ranges and lower system costs. They are most commonly used in security access, asset tracking, and animal identification applications. High-frequency (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) systems, offering long read ranges (greater than 90 feet) and high reading speeds, are used for such applications as railroad car tracking and automated toll collection [1].

Background

In today's modern world, the fast growing technology has helped human in solving their daily problems. As we know, insufficient small change is a small matter but it can lead to a big problem to the shopkeeper as well as to the customer. Therefore, the RFID technology should inspire to the invention of a useful and practical system that can be used in our daily life. The main objective of this project is to develop a smart payment

system by applying the RFID technology. With this system, the shopkeeper will not need to be worried of the small change. This project involves hardware and software. The hardware is RFID equipment that consists of tag and reader while the software is Microsoft Office Access 2003 program that is used to build the database of the system. In addition, Microsoft Visual Basic 6.0 software program is also used to develop the system interface. This smart payment system is developed for the use in daily transaction such as in the food court premises, stationary shops and any entrepreneurship activities/

Methodology

This system is developed by using Waterfall Life-Cycle Model (shown in Figure 1). This software process model is characterized by feedback loops and documentation-driven. This model has six main phases consist of requirements, analysis, system and software design, implementation and unit testing, integration and system testing, and operation and maintenance.
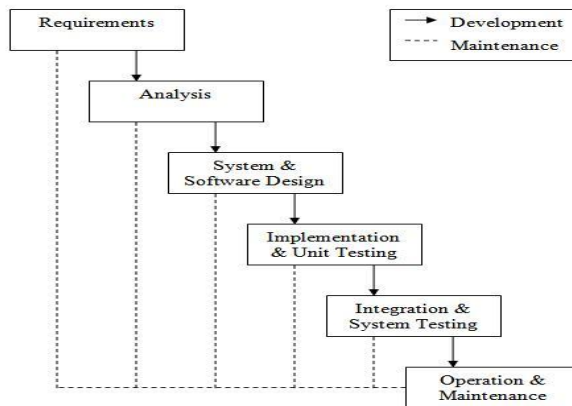
Figure 1: Waterfall Life-Cycle Model

Requirements

This is the first phase of Waterfall Life-Cycle Model. Among the activities during this phase are exploring the concept and elicit the project's requirement (extract). During this phase, the title, objective and scope of the project are identified. Then, all the literature is reviewed and information from various sources is gathered.

Analysis

In analysis (also called specification) phase, the system's requirement is analyzed. Then, the specification document and the software project management plan are drawn up. In other word, this phase should answer the question of "What the system is supposed to do?" For this project, the decision on which types of hardware and software that is used is based on the advantages and availability of both elements.

System and Software Design

Before starting the actual coding, it is highly important to understand what we are going to create and what it should look like. The requirement specifications from previous phases are studied in this phase and system design is prepared. System design helps in specifying hardware and system requirements and also helps in defining overall system architecture.

System Block Diagram

Figure 2 shows the overview of the system. Every workgroup in which includes the client (shop) and server (administration) must be attached with RFID reader. Besides that, this system also applies the concept of client-server application where only one database located at server and it will be accessed by both client and

server. At administration, the process of new registration and top up can be done while the process of payment can be only executed at client.
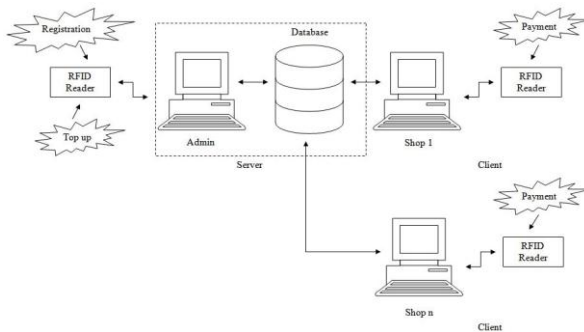

Figure 2: Block diagram of the system

Implementation and Unit Testing

This phase is done after system and software design phase. Both of these phases are related in each other. Theoretically, the activities which included in this phase are coding, unit testing, and acceptance testing. In this phase, the designs are translated into code. With respect to the type of application, the right programming language is chosen. On receiving system design documents, the work is divided in modules/units and actual coding is started. The system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality; this is referred to as Unit Testing. Unit testing mainly verifies if the modules/units meet their specifications.

Integration and System Testing

As specified in previous phase, the system is first divided in units which are developed and tested for their functionalities. These units are integrated into a complete system during Integration phase and tested to check if all modules/units coordinate between each other and the system as a whole behaves as per the specifications. In other word, the separate modules are brought together and tested as a complete system. The system is tested to ensure that interfaces between modules work (integration testing), the system works on the intended platform and with the expected volume of data (volume testing) and that the system does what the user requires (acceptance/beta testing). After successfully testing the system, it is then ready to be used.

Operation and Maintenance

This last phase is virtually never ending phase. Generally, problems with the system developed come up after its practical use starts, so the issues related to the system are solved after deployment of the system. Not all the problems come in picture directly but they arise time to time and needs to be solved; hence this process is referred as Maintenance. Inevitably the system will need maintenance. Software will definitely undergo change once it is used. There are many reasons for the change. Changes could happen because of some unexpected input values into the system. In addition, the changes in the system could directly affect the software operations. The software should be developed to accommodate changes that could happen during the post implementation period.

Result and Analysis

Administration Login Page Security Test

The security of the login page is important for the protection of the administration system. If the correct password is inserted, it will let user to enter the administration system. But, if the user enters a wrong password, a message box will pop up to acknowledge the user to re-login again (shown in Figure 3).

Figure 3: Testing with a wrong password

Registration Process

The process of registration is only applied to customer as the RFID tag is only used by the customer. However, the shop registration is also important so that the record of shop id can be saved in the system database. At first, the customer required to pay to admin a registration fees plus the minimum top up amount. Then, admin will read a new, blank RFID tag. After that, admin will key in the personal information of the customer and the amount of top up as the initial balance. The registration will be successful after the "Register" button is clicked. This command button will save all the data to the RFID tag as well as to the database. Figure 4 shows the successful registration process. To update customer information, the new information is filled in the specified fields and the "Update" button is pressed.

Figure 4: Successful registration process

Top up Process

As been stated before, the top up process can be only done at administration. Figure 5 shows a top up process being executed by administrator. At first, admin requests the card from customer. Then, he clicks the "Read Tag" command button to read the card. After he receives money and gets confirmation of top up amount from the customer, then he clicks the "Select Amount" combo box to select the top up amount. A list of pre-defined amount which are RM5, RM10, RM15, RM20, RM50 and RM100 will be shown. One of them is selected. If the amount is other than that, click "Others". From this, admin can key in the amount as shown in Figure 6. Then, the new balance of the card will be updated automatically. However, admin need to click

the "Top Up" button as the confirmation of the top up process. After that, the latest balance will be saved in the card and updated in database.
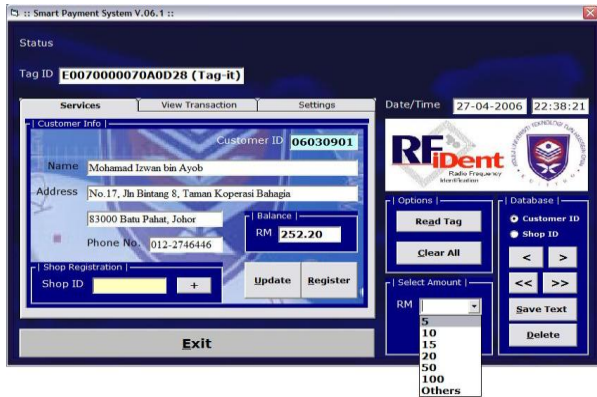

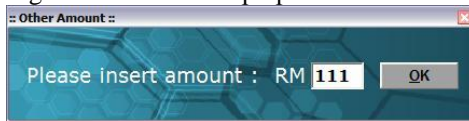Figure 5: Select the top up amount from "cboTopup" combo box list

Figure 6: "Other Amount" pop up form

Payment Process

At first, shopkeeper requests the card from customer. After that, the "Read Tag" command button is clicked to read the card. After the calculation of meal's price is done, then the shopkeeper clicks the "Select Amount" combo box to deduct the balance in the customer card. A list of pre-defined amount which are RM1, RM2, RM3, RM4, RM5 and RM10 will be shown. One of them is selected. If the amount is other than that, click "Others". From this, the shopkeeper can insert the payment amount as shown in Figure 7. Then, the card's balance will be updated automatically. However, the payment process will not be successful if the "Pay Now" button is not clicked. Figure 8 shows the successful payment process.
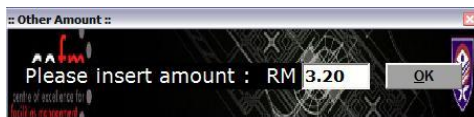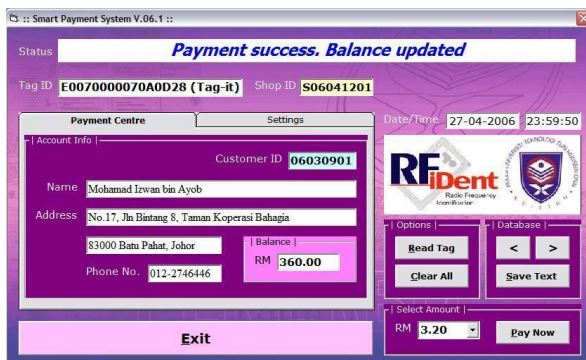

Figure 7: "Other Amount" pop up form

Figure 8: Successful payment process

Transaction History

At administration, there is a menu that enables admin to view transaction of client and customer. From this, shopkeeper can claim money from admin and admin can view the shop's transaction to verify it. Figure 9

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shows the selection of "Shop ID" and date to view the shop's transaction. Meanwhile, Figure 10 shows the selection of "Customer ID" and date to view the customer's transaction. Selection must be done either to view shop's transaction or customer's transaction at one time.

After selecting the "Shop ID" from the list at data combo, admin must also insert a valid format of date at the specified text box. Then, the "View" button is clicked to enables the system to find any transaction done on selected date that involves the shop that has the same selected "Shop ID". Figure 11 shows the transaction done by a shop on 27-04-2006.

Figure 9: Select "ShopID" and insert date to view the transaction

Figure 10: Select "CustomerID" and insert date to view the transaction
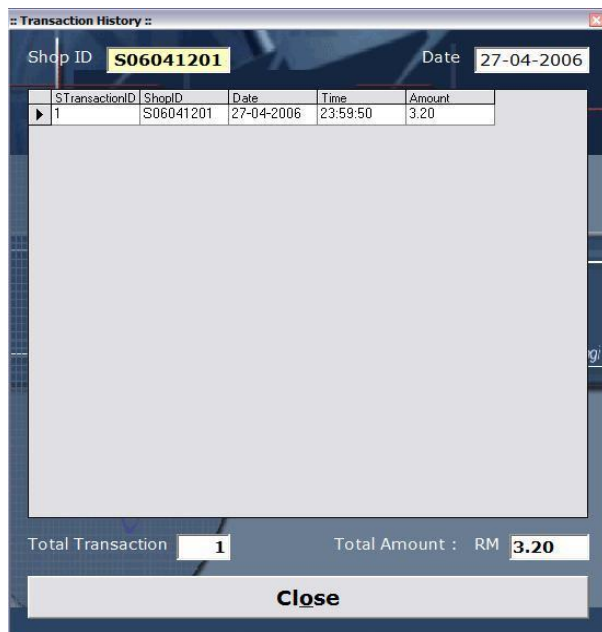
Figure 11: Transaction history base on selected "ShopID" and date

Meanwhile, there are two sections on "frmView2" that are used to display the total top up and total expense done by a customer. Both transactions are separated for easy and fast viewing. Figure 12 shows the transaction done by a customer on 27-04-2006 that has one top up process of RM111 and a payment of RM3.20 was done at "S06041201" shop.

Figure 12: Transaction history base on selected "CustomerID" and date

Conclusion

The four main aspects in this project are Visual Basic programming language, Microsoft Access database design, RFID literature studies, and network connection between client and server. This project has described the basic design approach for Radio Frequency Identification (RFID) Application in Smart Payment System by adapting the Waterfall Life-Cycle Model. Currently, radio frequency identification (RFID) may be something new in this country since there are not so many applications can be seen using this technology. But in recent years, the use has been increased rapidly in various applications whether in government sectors or private sectors. For instance, it is successfully used by PLUS Expressways Bhd. (PEB) in the country's automated toll system for the past several years. The use of this system also can be extended as cashless transaction in various types of businesses such as food court premises, selected shops and sundries. The whole system needs hardware, software and support service to run smoothly without flaws. This is how it can create business or entrepreneurship to provide the hardware and support service. This prototype can be upgraded in future to overcome the current weakness in the system so that it will become a reality and beneficial for the usage in food court in university campuses.

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