

A Survey on Human-computer Interaction Technology for Financial Terminals

Mengxing Zhang, Feng Wang*, Hui Deng, Jibin Yin
Computer Technology Application Key Lab
Kunming University of Science and Technology
Kunming, China
zhangmengxing@cmlab.net, wangfeng@acm.org

Abstract- Human computer interaction technology has been applied too many in Financial terminal (with Automated Teller Machine as an example) design, such as interface design. In this paper¹, we have done a survey on human computer technology for financial terminals and present an investigation of the ATM's design on the precious literatures. The user experience test and evaluation of the prototype are reviewed and discussed in details, and we find the defects and the improvement of the ATM's design. In the end, we propose some suggestions and discussion in future works.

Keywords- Human Computer Interaction; ATM; Financial Terminal; Interface design.

I. INTRODUCTION

In our life, there are so many financial terminals and the most in common is Auto Teller machine (ATM). Now in the fast-paces society and the information age, the rhythm of our life is highly nervous, I think no one want to spend a lot of time in lining at the bank just to waiting for the crowded business. Constructing a 24 hour system, no specific time limit, is very necessary. We can handle business when we have time, we need not go to row the boundless line any longer, and this is undoubtedly the best choice. In order to solve the problem, the financial terminal appeared-the Auto Teller machine (ATM). ATM's birth provided a lot of convenience for human life.

ATM also referred to as a cash machine, a cash dispenser among other names, which is an electronic computerized telecommunications device that allows financial institutions (e.g. bank) customers to directly use it in a secure communication method to accessing their bank accounts. ATM is a self-service banking terminal that accepts deposits and dispenses cash. Most ATM's also let users carry out other banking transactions (e.g. check balance). ATM is activated by inserting a bank card (cash or credit card) into the card reader slot. On the cards magnetic stripe, there are including the customer's account number and PIN (Personal Identification Number). For example, when a customer is trying to withdraw cash, ATM first connects the banks computers to verify the balance, then dispenses the cash and transmits a completed transaction notice at last.

ATM's lot is also a content of the survey. Who created the first ATM, when and where first used the ATM is a debate topic. Basically what answer you get is depends on when the question is been asked and who you ask for. The answer have many versions, each version is describing in different side.

ATM's have security keys programmed. Between the ATM, the bank and the network processor, the code changing can guarantee the credit of access and the safety of ATM card numbers by scrambled.

¹ Feng Wang, Corresponding Author, Wangfeng@acm.org

In the below content, we will analysis the progress of ATM's design through the investigation and study of the existing ATM, to find the efficiency improvement of the ATM.

II. HCI TECHNOLOGY APPLICATION IN ATM

Human computer interface (HCI) is a term used to describe the interaction between users and computers; in other words, the method by which a user tells the computer what to do, and the responses which the computer makes. Even more, HCI is about designing computer systems to support people's using, so that they can carry out their activities productively and safely. All of this can be summarized as "to develop or improve the safety, utility, effectiveness, efficiency and usability of systems that include computers" [1]. If ATM were more usable then they would become more effective and efficient machines, then users would find them easier to using. It would help the users to spend less time to use the machines and to carry out more efficient transactions.

In order to produce an good ATM systems with good usability HCI specialists strive to understand the factors which determine how people operate and make good use of the ATM effectively; develop tools and techniques to help designers ensure that ATM are suitable for the activities for which people will use them and achieve efficient, effective and safe interaction both in terms of individual and group interactions [2].

III. THE GENERAL ATM

A. The ATM user interface

In the design of the ATM, the most important is the man-machine interface, namely the user interface. The ATM's user interface remains consistent for each ATM, which is the main screen, the selection keys, the keypad and several slots. This is illustrated in Figure 1.

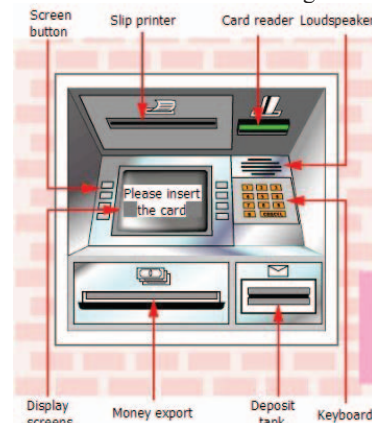


Figure 1, The general ATM's operation panel.

Figure 1 is a real ATM machine. However, we often use the simulator ATM interface in the research. Figure 2 is a picture of simulate ATM.

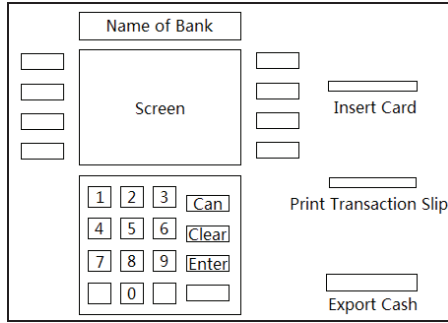


Figure 2, ATM Simulator Interface Design.

B. The ATM interface fuction

As shown in the figure 2, either side of the ATM screen has four selection keys, which will be used to make users to select the factions from the menu. There are also some other keys: the "Insert Card" will be used to inserting the ATM card into the machine; the "Print Transaction Slip" is used to printing the receipt of this operation; in addition, users can use the "Export Cash" export to get the cash. Beyond that, there is a keypad in the interface. The keypad containing the digits 0-9 and the keys "Cancel", "Clear" and "Enter" is standard for all the various types of ATMs investigated in this research.

In the General ATM, the click event is triggered when the "Enter" key is clicked in the ATM. To select an option from the menu, the user simply clicks on the select key adjacent to the menu option displayed on screen. This is the same as using an ATM in real-life; only the user presses the selection key with their finger. The user can only move onto another menu screen after an input i.e. choosing an option.

C. ATM's general using steps

- Insert card
- Enter PIN (General 6 digits)
- Choose transaction option (Withdraw cash)
- Select/Enter amount of cash to be withdrawn
- Receipt? (Yes/No)
- Card ejected from ATM
- Take cash
- Back to Main Menu
- Enter PIN
- Choose transaction option (Balance Enquiry)
- Return card

IV. THE RESEARCH HISTORY OF ATM

A number of studies have already been putted forward about ATM's design. Most of these studies have focused on ATM's use in relation to the age of users and user disabilities (such as blindness). Adams and Thieben (1991), Mead et al. (1996), Rogers et al. (1997) and Rogers and Fisk (1997) concentrate on ATM use in relation to the age group of the users. Mankze et al. (1998) focuses on ATM usability by the blind while Hone et al. (1998) focuses on modes of control for ATM's including

voice control. Rogers et al. (1994) say that they have been informed by banking staff that training is not necessary for ATM's because they are inherently user friendly [12][13][14][15][16][17].

Despite the large amount of works related to the usability of web sites and web applications, there is a lack of empirical studies addressing usability of ATMs. In 2005 Wells Fargo (one of the most important Bank in the U.S.A.) re-designed user interfaces of their ATMs in order to improve customer satisfaction and user experience. This result has been achieved by both improving the aesthetic appeal of the interface and using touch screens as input/output devices; a set of profile-based functions was implemented in the system. This latter is able to recognize the most frequent operation made by the user offering him/her shortcuts.

In order to solve these problems, the scholars have also done a lot of experiments and researches, made a series of studies to improve ATM's design.

Marco Camilli and his team have done a lot of study about the user-centered design approach for interactive kiosks. In the present study of Marco Camilli, they investigated the relation among user experience, usability and the introduction of customized functions (based on users' profiles) in a bank's ATM system interface [6]. Then a redesign process has been carried out based on results obtained from the usability tests and on the introduction of profile-based functions to solve usability problems and to improve the overall user experience. A prototype has been developed and tested to compare the user experience and the usability between the old and the new interface and to check the effectiveness of design strategy.

The study by Kevin Curran and David King examines a variety of UK Bank ATM navigation menus and proposes a best of breed ATM menu. This research paper focuses on the user interface design problems [4]. ATM navigation menus could be improved considerably to make ATM's more usable [5].

Getting through with these important researches, we can summarize a lot of experience for which can improve the design of ATM.

V. THE IMPROVEMENT OF ATM

ATM is among the most commonly used public kiosk. During these years, bank institutions have been challenging a service innovation opening new channels for providing their services. They have also enhanced their terminals by adding a wide range of services. However, despite their importance and the increasing number of functions, ATM interface often show usability defects and the user experience could be frustrating [2]. To the user the interface is the product, a frustrating experience and usability problem will have consequences on ability of users to achieve their goals. We will through several important cases to introduce the improvement of ATM's design.

A. The approach of User-centered design for ATM

In Marco Camilli and his team's experiment, they have adopted the Heuristic Evaluation; first of all they

evaluated the original model, after that, they improved the design according to the evaluation results.

Heuristic Evaluation is pointed to using a content analysis, Jun and Cai (2001) identified six dimensions of online systems quality. These include content, accuracy, ease of use, timeliness, aesthetics and security.

These studies indicated that using internet in this case has many aspects, include compatibility, user friendly, easy login, speed of responses, accessibility of the web site, functions that customers need and easy navigation. Most of these aspects are also applicable to the ATMs usage. A camera recorded the interaction of the user with the ATM interface and the keypad.

In the current study, the usability and the user experience of ATM of Banca Carige was assessed by using both a heuristic evaluation and test with users. The heuristic analysis of the original ATM system showed a basic and plain design strongly focused on few main functions. Moreover, results pointed out several usability issues affecting labeling, navigation and controls. The ATM was not always self explicative and when users were required to digit many inputs, the system was not able to predict errors (e.g., providing feedbacks) and did not offer quick way to recover: when the user made a mistake which was forced to quit the operation and insert the card again. These criticisms may be caused by a function-oriented design that neglected users' needs and expectations. Figure 3 is the test with users. A camera recorded the interaction of the user with the ATM interface and the keypad.



Figure 3, A picture from a user test session.

Through the above analysis, they redesign their system. The evaluation of the original version of the ATM showed some usability criticism and a design strongly oriented to the functional system's features. A partial redesign of the system was carried out with the aim of:

- Solving the usability problems.
- Centering the system design on specific users' needs.

With that in mind, the system redesign implemented two new user profile based functions. This type of redesign was based on a hypothetical integration between the ATM and the Customers Relation Management system (CRM). Currently, CRM systems are able to store both customer-profile information and the frequency of transactions performed at the ATMs. The current redesign proposes a sort of adaptive interface with functionalities based on user-profile information; in real world systems, "profile-based functions" might be activated by data provided by the CRM system. More generally, this redesign was based on the hypothesis that the integration

between CRM and ATM will be a new and innovative channel of communication between bank institutions and their customers.

Differently from the original version, the entire new interface was designed for a touch screen system. As that area was meant to speed up the interaction with the ATM, it was added in the left part of the screen, to be the first thing read by the user. Therefore, users can make their decision easily. In other words, the users' operation can be more efficient.

B. The approach of optimal menu design for ATM

The modern ATM is much more than a simple cash dispenser. In Kevin Curran and David King's research, they have introduced the standard UK ATM's offers relatively basic services including cash withdrawals, balance checks and the ability to top-up pay-as-you-go mobile phones. ATM in different countries (such as USA and Japan) tend to offer advanced services which include cash deposits, cheque deposits, paying bills, purchasing tickets and purchasing stamps. So the design of an ATM should not only include its inherent usability but also its perceived usability.

A good interface design can help to ensure that users carry out task when the using the system, it need have these characteristics as follows [4]:

- Safely-this is important for safety-critical software systems; such as software for a jumbo jet for example.
 - Effectively-the user get what they want from the system e.g. if an ATM user requests £100 cash, the user should get this and not £50.
 - Efficiently-this is the main point concerned with this research paper. If the ATM menu's were improved this would make ATM use more efficient.
 - Enjoyably-systems should be attractive and inviting.
- The main objective of Kevin Curran and David King's study was to design a "best-of-breed" ATM menu system. This was achieved in the form of the OptiATM (means optimal ATM menu). However, it still provides an insight into the problems of ATM HCI issues.

As demonstrated by their experiments, the OptiATM menu design is a more usable and efficient system than other existing ATMs. The OptiATM system has designed an extra faction, which can resolve the problem of users having to reinsert their ATM cards to carry out another transaction and to speed up transaction times. The system could help improve user's basic everyday ATM transactions.

The fact that the OptiATM design has the added facility of eliminating the need to reinsert ATM cards, while at the same time improving overall performance, reinforces that the OptiATM menu design is an improved "best-of-breed" ATM menu system [4].

ATM manufacturers have also demonstrated several different technologies which as of yet have not gained worldwide acceptance.

- Biometrics for security purposes i.e. the authorization of transactions is based on the scanning of fingerprints, the eye, face etc.

- Ability to print "items of value" such as traveler's cheques.

- Customers' specific advertising on the ATM.

C. The approach no card operation design for ATM

Many advanced ATM machines offer an abundance of additional services including cash and cheque deposits, ability to pay bills at terminal, top-up pay as you go mobile phone and purchasing tickets such as train or concert tickets[5]. For these process of using ATM, many users will appear forget take their card, it will cause some loss; also bring a lot of inconvenience for the user. In some of the study now, the researchers also found the problem, thus designed a no card operation ATM system.

Portable ATM's or Independent Convenience Cash Dispensers work in a different manner is that:

- User inserts card.
- Card is read and user is instructed to remove card.
- User enters PIN and carries out transaction required.

Getting through with this method, by which enables customers to be offered another transaction after withdrawing cash. Customers could withdraw cash and then will appear a prompt which said if users want to do another transaction. Once the customer takes their cash, it is not possible to forget their card-as they already took it before they began their transaction. However, this creates a security problem on its own. If the user just takes their cash and walks off without responding to the prompt, could the next user simply use the previous users account and withdraw cash? To solve this problem, a fail-safe would be in place to ensure the safety of the transaction. If the user does not respond within a given time period e.g. 5 seconds, the session ends. In fact this fail-safe would be in place whenever a user is using the ATM at any given time.

No card operation is a breakthrough of the ATM's design, it makes ATM more security.

CONCLUSION

The main purpose for this paper is to research the application of Human-computer Interaction Technology for financial terminal. Through the study of traditional ATM, we can find that ATM still has many defects which make users had some troubles in using ATM. For this reason, we have done a lot of surveys on present ATM's design on the precious literatures to sum up the shortcomings of ATM. These problems have been noticed by many scholars, we have made a survey of Marco and Kevin and other scholar's research. Marco think while engineers are required to develop reliable and highly performing systems, interaction designers and usability practitioners should solve usability problems and find solutions to improve the user experience. In the current study, the usability and the user experience of ATM of Banca was assessed by using both a heuristic evaluation and test with users. The main objective of Kevin and David's research was to design a "best-of-breed" ATM menu system. This was achieved in the form of the OptiATM. As demonstrated, the OptiATM menu design is a more usable and efficient system than the existed ATM's. The no card operation system was designed to resolve the problem of users having to reinsert their ATM cards to carry out another transaction and to speed up transaction times.

ATMs have become part of the modern world's infrastructure. We expect ATMs as a good transport service as much convenience as we expect. However, as

the services offered growing, the ATM menu designs will become more complicated. This may lead the systems becoming even more confusing for users and harder to choose. Therefore, ATM designers can consult extensively with ATM users to help them design and create ATM systems which are more easy to use and efficient.

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