A Proposed e-Payment Service for Visually Disabled

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Abstract
In the last decade, there has been international interest in providing special e-services for our social partnership that are visually disabled. In particular, they face hard and numerous problems in their daily activities such as paying for products or service's fee or bills electronic-payment. In this paper, a proposed e-service is introduced to visually impair in order to facilitate the process of e-payment. This e-service is used to allow them to pay their bills without external help from humans with easy and simple steps. The proposed e-service depends on two technical features for reading and listening to their bills electronically such as (Optical Character Recognition) OCR and (Text-to-Speech) TTS thus, after converting the snapshot image into (digital numbers) or money value from. Furthermore, it is directly connected to their bank accounts by using Near Field Communication (NFC) technology that is available on their smartphones. Therefore, the payment is done with high privacy and short-range communication. Therefore, TTS technique will be used to allow visually impaired to listen. Moreover, a "PAY" voice command is used to give the payment process in order to confirm and approve the current payment transaction. A large sector of blind disabilities will get more benefits after applying this integrated e-service. It allows them to secure pay their purchases at any time, as well as quickly as possible and will be a convenience payment method.

Key-words:
Visually Disable, Bills, E-Service, NFC, OCR, TTS

1. Introduction

In general, there are more than 285 million visually impaired around the world. It is predicted that duplicated by 2020 it may reach 550 million around the world [1]. The visually impaired are needed to do their daily activities without any challenges. One of these activities may be paying bills such as (Internet usage bill, gas bill, electricity bill and land telephone bill). There are many electronic services for paying these bills, but without fully handling of visual impaired requirements/needs. These e-services based on the latest and new trend technologies and approaches such as the integration of mobile commerce application and mobile payment methods. Mobile commerce means the process of buying or selling of products or services through wireless devices those connected to the Internet. For example; Wireless technology such as Infrared, Bluetooth, Wi-Fi, WiMax and the last technology; NFC that will be focused on this paper. M-commerce applications have become the most popular application for mobile devices users who want to do business and engaged in financial transaction easily and securely, anytime and anywhere. Furthermore, e-money is becoming the language of the business world transaction. Therefore, m-payment is an important topic in the current technological era because it allows the exchange of financial value between two entities to pay for a product or service. [2]

The content of this paper is organized as follows: section 2 reviews the related work on payment application system with an introduction to NFC technology. Section 3 presents the proposed e-payment service. Its major components are presented basically in block diagram. Discussion of the benefits and advantages of the proposed e-service are presented in section 4. Finally, the conclusions are drawn in section 5.

2. Related Work

In the last few years, several research studies were introduced to discuss the subject of discourse. For example; Sanjana.B et al 2016 [3] talking about proposing a text reading system that is used for visually impaired people by using Text-To-Speech (TTS) methods such as (label reading, Pen aiding system, Brick pi reader and sentences based approach) in order to make the printed text read and understand in an easier way. Moreover, a figure mounted camera method with a vibrator sensor is used. Furthermore, a predefined dataset is loaded in order to match the observed text with the captured image. Once it is matched the text is synthesized for producing speech output. The summary of that module is to make user feels easier to read the text in the form of speech using speech synthesizing. Moreover, Akshay Sh. et al 2014 [4] presented an assistive reading system for visually disabled by using OCR and TTS modules but without a link with NFC. Its operation based on reading real textual information on papers and producing corresponding voice. It uses histogram analysis on binarized image and concatenative synthesis technique of TTS system. Figure (1) shows the architecture of the two modules (OCR and TTS) in details. But, Huda U. 2012 [2] presented a scientific article that focused on providing payment

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processing application integrated with NFC technology but it is presented for the normal/healthy people. Her system is based on the new trend of the Google mobile operating system (Android). Moreover, it was designed to pay for the normal user side (nBelanja) as a consumer and the merchant side (nBayar) as a trader/seller by using the handset of Google Samsung Nexus S. that already has NFC technology. Furthermore, his application was based on tag-to-tag protocol with Advanced Encryption System (ASE) security algorithm with 128-bit key length.

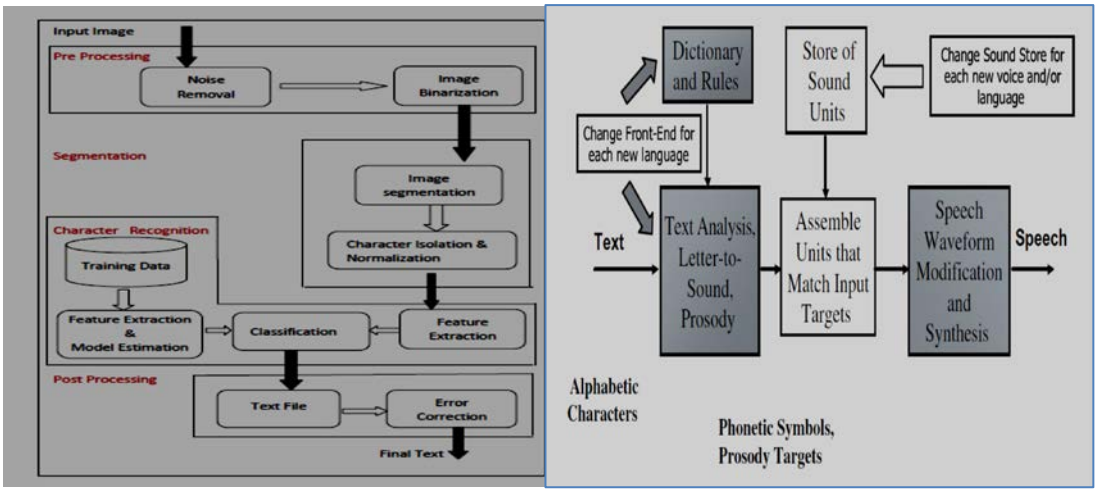

Fig. 1 The architecture of OCR and TTS modules [4]

2.1 NFC Technology

NFC is a wireless connectivity which evolved from the combination of contactless identification and interconnection technologies Radio-frequency identification (RFID) that uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored important information about the (product or service). NFC has transfer rate up to 424 kbps. Its operation occurs when doing simple movements such as twist or swing in the distance between two NFC-enable devices which they are a closer connection between Zero and 10 CM. It does not need pairing code to link up. NFC communication technique is based on Tag-to-Tag protocols [4].

Fig. 2 The Three Modes of NFC communication [5]

Figure (2) shows the three operation modes of NFC: i) Card emulation mode ii) peer-to-peer mode iii) Reader/writer mode. Now, NFC has become an essential part of any smartphone. NFC provides a new way for people to use their mobile devices to interact with the external and physical world around them such as making payments for everyday activities all by tapping or waving the smartphones near a merchant terminal. Furthermore, NFC chip stocked inside the bank credit card for contactless payment and also support micro-payment. There are many application fields of NFC usage such as e-ticketing, e-identification key, downloading commercial offer, social networking, set-up services, and e-wallet. NFC can be used as a reader of a contactless transaction at (Point of Sale) POS location. It is actively engaged in leading companies such as Nokia, Microsoft, Visa and MasterCard worldwide. Discussion on the advantages of NFC compared with the existing communication technologies such as Bluetooth, and RFID is introduced in Table (1). It appears the technical reasons to select the NFC technology as a core component of our proposed e-payment service. NFC proves to be more successful [5].

Table 1: a comparison between NFC and Other Communication technologies

Item	NFC	RFID	Bluetooth
Set-up time	< 0.1 ms	< 0.1 ms	6 sec
Range	Up to 10 CM	Up to 3 m	Up to 30 m
Usability	Human Centric Easy, Intuitive, Fast	Item centric Easy	Data Centric Medium
Selectivity	High, given, security	Partly given	Who are you?

Use Cases	Pay, get access, share, imitate service, easy setup	Item tracking	Network for data exchange, headset
Consumer Experience	Touch, wave simply connect	Get Information	Pairing needed
Discovery	Respond to field	Broadcasting	Broadcasting
Power	Tag: Zero Reader: Very low	Mid.	Mid.
Privacy	Very high	Mid.	Mid.

3. The proposed E-service Components

The concept of our proposed e-service is constructed with the idea of developing an integrated service that merge OCR, TTS modules with NFC technology as a third component. Fig. 3 illustrates the conceptual overview proposed e-service for visually disabled

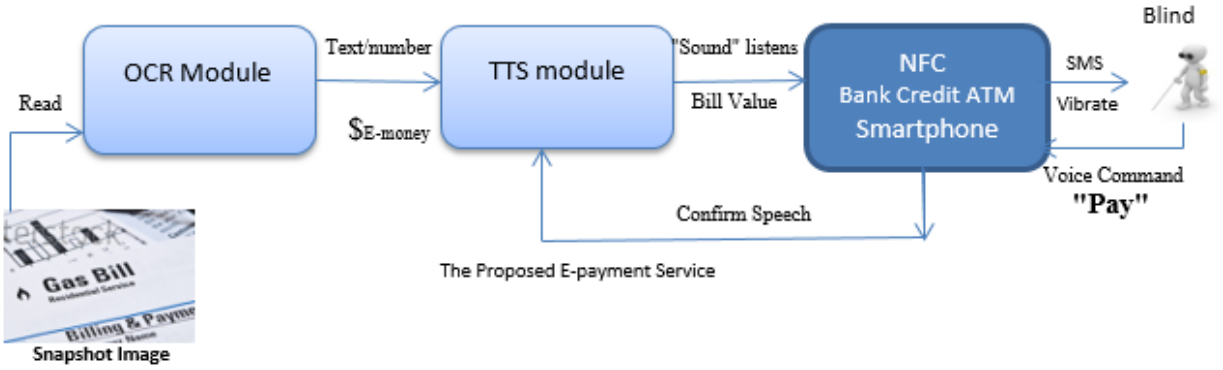

Fig 3. A conceptual overview of the proposed e-payment service

To achieve the desired target of this proposed e-service, it must combine the three modules namely (OCR, NFC, and TTS) in order to work together for serving blinds' requests.

Figure (4) shows the block diagram of the proposed e-service which consists of three parts OCR Module, TTS Module and linked with NFC technology as the third part.

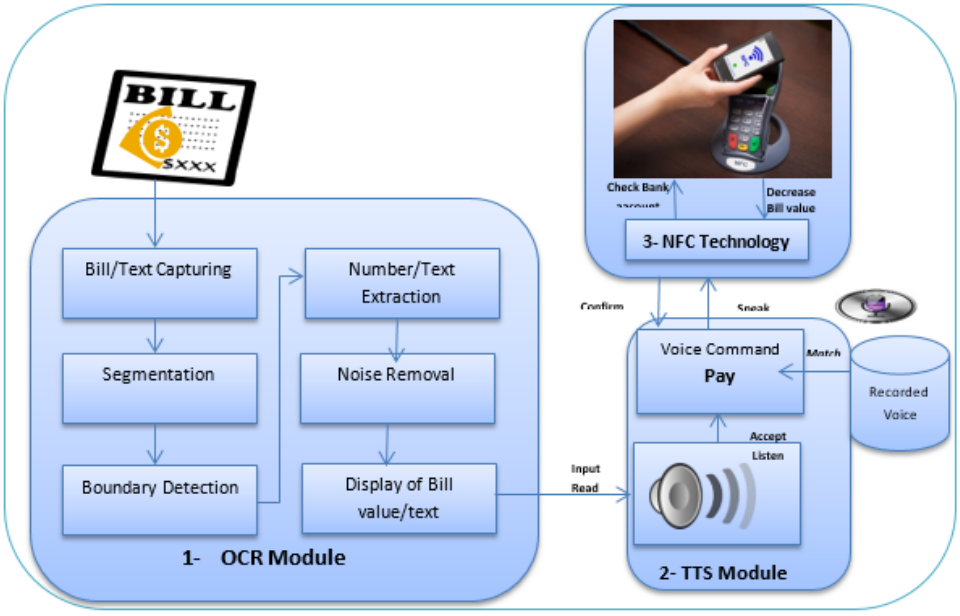

Fig 4. The Block Diagram of the proposed e-service

Therefore, the workflow of the proposed e-payment services is presented in figure (5). Furthermore, UML Diagrams are introduced for its specific purposes such as use case diagram; class diagram and activity diagram which are depicted in figure (6, 7, and 8) respectively in order to help the Android's developers easy coding.

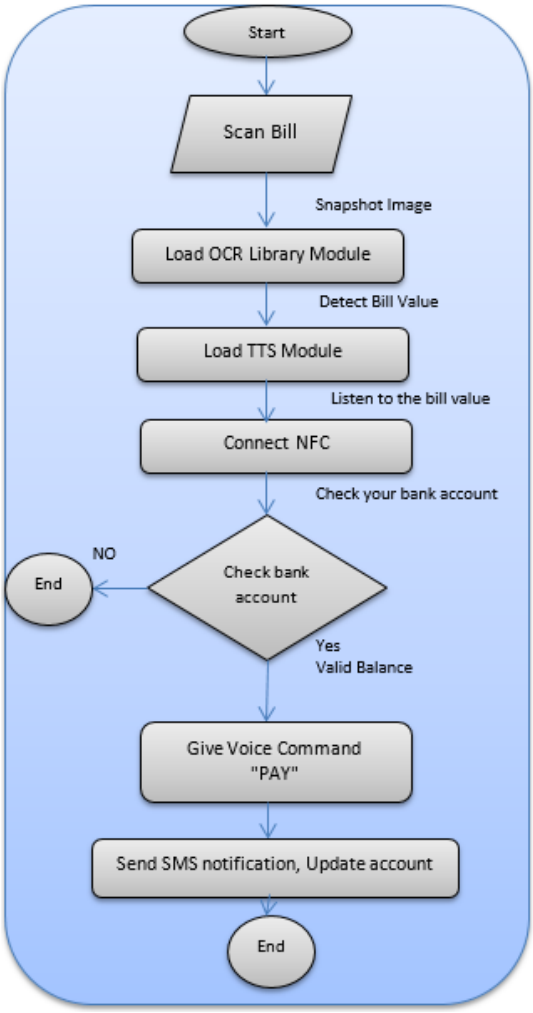

Fig. 5 A proposed e-payment service's Flowchart

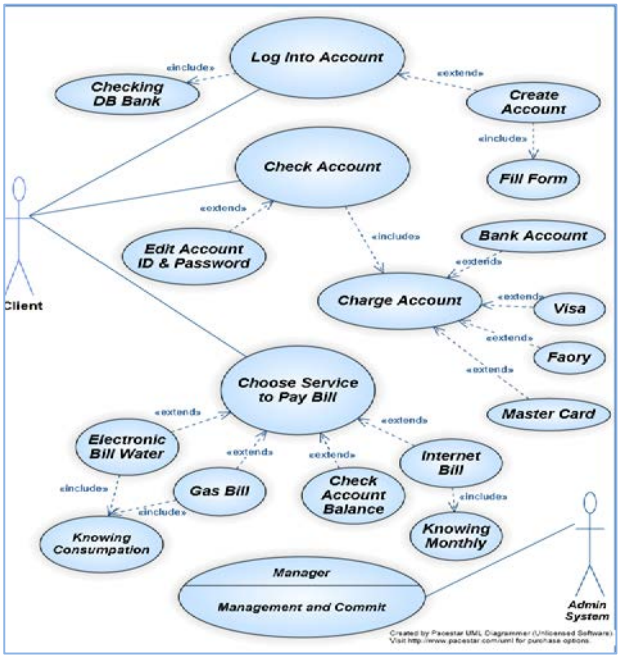

Fig.6 The Use Case Diagram of the proposed E-payment service

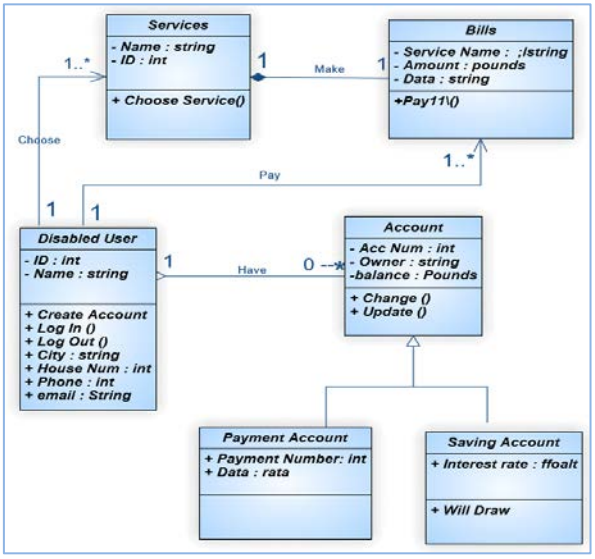

Fig.7 Class diagram of the proposed E-payment service

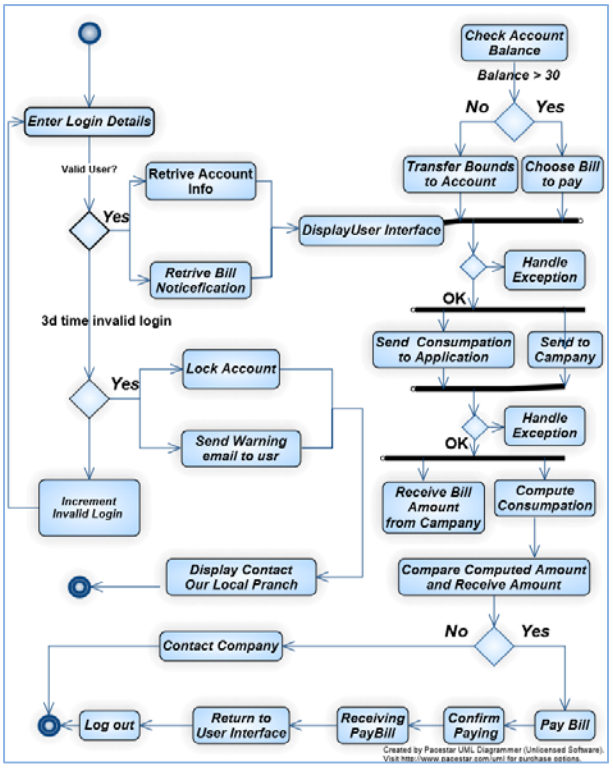

Fig. 8 The Activity Diagram of the proposed e-payment service.

4. Discussion

After applying the proposed e-service, it will be one of the most important payment methods for all blind and visually disabled in order to purchase their products simply or easily pay their bills. Nowadays, mobile operating systems such as Android and (iPhone Operation System) iOS has become widespread infrastructures to build this e-payment service and it will be based on the support of banks leadership's teams to produce NFC credit ATM. The privacy of this e-payment service is considered as an important technical issue and need concerted effort of all parties. Our target of this proposed e-payment service is making visually impaired sense more satisfactory and reaches to fully payment trust. It needs more technical effort to ensure the integrity of the proposed e-payment service before releasing it for general use. The future implementation of this e-service will be based on an interoperability framework such as Service Oriented Architecture (SOA) in order to achieve the concept of services integration. The bit of advice now is to build this e-service with easily and smoothly graphical user interface such as adding different interaction tools, touch sound and vibration features. Table 2 summarizes a comparison between the proposed e-payment service and the current e-payment service such as PayPal and Quick Payment services.

Table 2: a comparison between the proposed e-service and the current e-payment service

Items	Current payment service	Proposed e-payment service
Category	Specific For Normal People	Specific For Blind disabled people
TTS, OCR Tools Dependency	Independent	Dependent
NFC Technology	Semi-applicable and sometimes dependent	Fully- Applicable and dependent
Benefits	Online application 24/7 availability Mobile-Based application Normal people convenience	Online and Offline Mode 24/7 availability, quickly Integrated Service, Blind disabled people convenience

5. Conclusion

Mobile payments have increased usage because of its advantages of providing economical solution in that it saves time and money. E-payment service offers new competitive services to the market. Facilitation of electronic payment for a blind disabled person is an important issue and need more efforts. Scientific researchers and IT companies should work together as to present new ideas to serve our partnerships who are disabled people. ORC and TTS are introduced to facilitate easy reading system. But, in this paper integration with NFC technology is used to offer a novel e-payment service for visually disabled. It will allow a large sector of blind disabilities to quickly and easily pay their bill/purchases.

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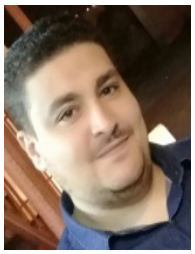

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