Short Communication

Proposing a Model for Patient Admission and NFC Mobile Payment by Biometric Identification and Smart Health Card

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Abstract

Following the advances in mobile communication and information technology, smart phones have been used in a wide variety of commercial, social, entertainment, file sharing and health transactions and applications. The current procedures in healthcare environment for patient registration, appointment scheduling and payment are time consuming and somehow tiresome. Traditionally, patients were supposed to fill out registration forms, wait for being called, and finally stand in long lines for payment procedures. In some places, appointment could be done online via web but still the patient has to walk in with appointment card and in our case, provide the insurance booklet to the front desk personnel to pay for services and receive discounts for insurance. Therefore, the present study intended to propose a model using Near Field Communication-enabled mobile application for a medical clinic which currently offers online and call services for making an appointment, though patient waiting time is still too much in the current process of payment for services.

Keywords: Healthcare; Mobile payment; Near-field communication; Smart health card

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Introduction

Managing patients' health records, appointment and medical service payments are inevitably effective and crucial to maintain the overall level of health standards in a country. However, to reach a certain degree of satisfaction as well as efficiency and effectiveness, management systems should be implemented with a certain degree of quality, which leads to the overall satisfaction of patients and the medical system, including patient waiting time and management of staffs, such as patient registration, scheduling appointment, handling patient's medical prescriptions and payment of health services [1]. Therefore, inefficient flow of information and paper appointment systems eventually leads to delays in management of report updates as well as lengthy stays and lines of patients in the medical centers. The current procedures followed in healthcare centers mostly fall into one of the following categories [1]:

- Appointments that the patients walk in and are required to fill out a registration form or present their identification card and insurance booklet to the registration staff and wait to be called upon.
- Scheduling an appointment beforehand, that the patient has to call in, ask for available dates or be informed through an Interactive Voice Response (IVR) system and then walk in to the medical center, and again wait in long lines for getting admitted to doctors.
- Schedule and online appointment beforehand, that the patient has to register online, get informed of available dates and schedules and then after visiting the hospital, hand in the insurance information, and wait for subsequent responses from the hospital staff.

The mean waiting time for walk-in patients in a hospital studied by Jabbari and colleagues is approximately 48.72±42.53 min from the time the patient enters to the hospital till admission and visiting the doctor [2]. On the other hand, a great deal of patients' files and records of their health history, doctor prescriptions, appointment records, laboratory and radiology results, doctor visits and other related patient records need to be handled. Recently Information and Communication Technologies (ICT) have become a widely anticipated approach in healthcare sectors, to ensure the quality and standards of medical services [3-25]. Identifying patients and the procedures in which the patient is admitted for being visited and checked up in the hospital is very essential for an automatic system with an appropriate work flow in hospitals which provide an efficient healthcare environment and enable quick access to accurate medical data [10]. These data were previously stored in a paper-based manner which were low in cost but had limitations such as difficult access, time consuming updates and no major security [9]. These problems can be easily solved by the introduction of intelligent storage and retrieval mechanisms in healthcare sectors, namely smart health cards. Smart cards can play a key role in sharing patient's specific information.

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Smart cards tend to be cheap, easy to use and updated, which are normally not easily damaged [9]. Today, regarding the advancement of technologies such as Radio Frequency Identifier (RFID) and Near Field Communication (NFC), these technologies have been applied in various areas of application including healthcare [17]. A brief review of various literatures on ICT applications in healthcare including general Benefits and advantages of using technologies, in particular NFC technology can be divided into four main categories shown in Fig 1 (right).



Figure 1: Typical RFID system parts (Left) & benefits and advantages of using NFC technology (right)

Radio Frequency Identification (RFID) and Near Field Communication (NFC)

RFID is a technology using radio waves, which was developed as an identification technology. It has gone through many changes, entering new fields of application including monitoring and information management systems [17]. This applied technology is comparable to the bar code system, where a bar code (tags in RFID) is scanned using a barcode reader, whereas in RFID systems, the tags not only can be read but also can be rewritten and they can read several tags simultaneously. Typical parts of a RFID system have also been demonstrated in Fig 1 (left). On the other hand, NFC is an enhanced RFID system which is already integrated into many smart devices including current mobile phones [12].

Designing an efficient patient appointment system can reduce the patient waiting time, e.g. NFC based mobile payment which itself is a good reason for conducting a research in this field to enhance patient flow in such medical clinics considering criteria such as the appointment request time and patient waiting time

Case Review and Problem Statement

Fig 2 describes the general delays from the time the patient requests an appointment to the time the patient actually visits the doctor. Accordingly, the patient normally makes a reservation using the two options mentioned above. Once the appointment has been scheduled, patients must report their arrival to the clinic using a kiosk as mentioned above and then wait possibly due to being early until being called, since the reservation made using the Online or IVR system does not announce the exact time of visit to the patient. Finally the patient gets to be visited by the doctor possibly waiting long minutes

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before getting visited. Hence, the current process for patients' admission in the majority of clinics and health care centers has been illustrated in Fig 2.

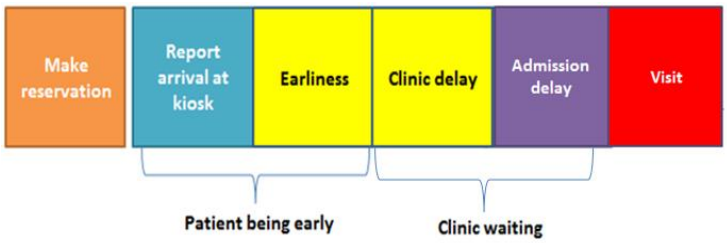
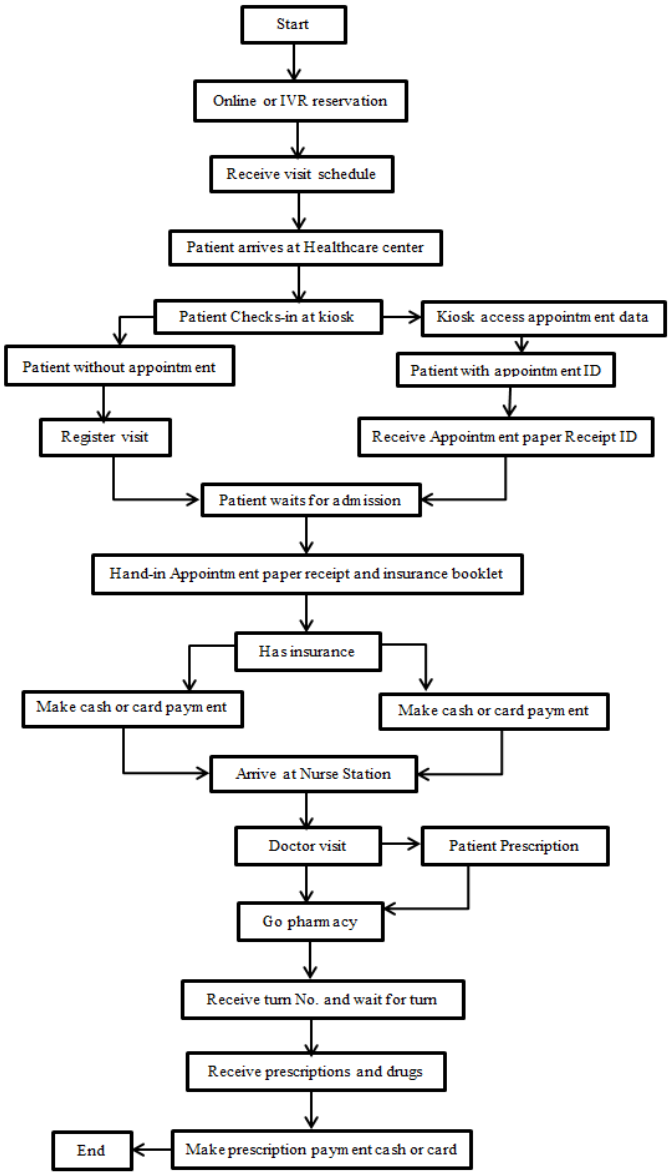


Figure 2: General delays in patient admission

Results and Discussion

In general, the procedures of getting admitted for the visit in this clinic can be categorized into four main sections: insurance and identity check, appointment reservation, prescriptions and doctor visit, and medical services payment. After introducing the proposed model for using NFC, biometric and smart health card technology in this clinic, and the enhanced system flow in Figure 4 can be demonstrated. The number of steps and processes eliminated from the system flow can be observed comparing the flow of patients in Figure 4 with Figure 5 which has significantly decreased. Therefore, by implementing the proposed system in a test clinical environment, not only the process flow of the system will be enhanced, but also a better clinical and medical environment will be provided for patients following the reduction in the total waiting time of patients.



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Figure 2: Current patient flow

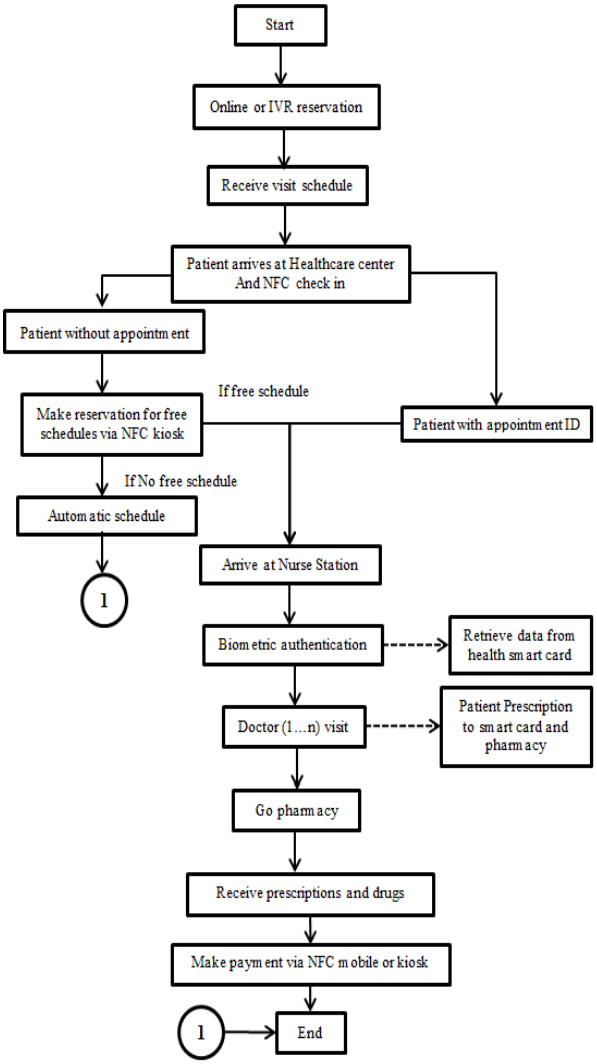


Figure 5: Patient flow after applying proposed model

Conclusion

Considering the advances in ICT, the proposed model for mobile payment, and medical services can be regarded influential in appointment and scheduling systems to reduce patient waiting time as well as increase efficiency of systems. The proposed model can be used as a basis for further research in this field.

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