APPLYING USER-CENTERED DESIGN METHODOLOGY IN DESIGNING BOOKING MEDICAL APPOINTMENT APPLICATION
تطبيق منهجية المستخدم مركز التصميم في تصميم تطبيق حجز المواعيد الطبية

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ABSTRACT

In recent years, Egypt has witnessed a significant surge in digitalization, with a notable increase in awareness and prioritization across the nation. This article delves into a case study highlighting digital transformation within the medical sector, focusing on citizen involvement in identifying and proposing solutions. User-centered design (UCD) has emerged as a prominent approach in software development, emphasizing the centrality of user needs and goals to ensure the creation of highly usable products.

The primary aim of this research was to integrate UCD principles into the development of an Android-based medical appointment booking application, focusing on understanding user requirements for functionality and interface design. This paper introduces a new design for medical booking appointments application that reduces the costs, and interaction time between patients and administrative. The findings reveal that such an approach not only fosters citizen engagement and active participation in the digital transformation journey but also enhances public awareness, enhances the management of public policies, and streamlines decision-making processes. Actually, user- centered design improves system efficiency and user engagement by ensuring that technological investments will meet user requirements and usability standards.

KEYWORDS

User-Centred Design; Medical Application; Product Design.

الملخص

في السنوات الأخيرة، شهدت مصر زيادة كبيرة في الترقية الرقمية، مع زيادة ملحوظة في الوعي والتفضيل في جميع أنحاء البلاد. يستكشف هذا المقال دراسة حالة تسلط الضوء على التحول الرقمي داخل القطاع الطبي، مع التركيز على مشاركة المواطنين في تحديد واقتراح الحلول. ظهر مفهوم المستخدم مركز التصميم كنهج بارز في تطوير البرمجيات، مؤكداً على أهمية احتياجات المستخدمين وأهدافهم لضمان إنشاء منتجات قابلة للاستخدام بشكل كبير. الهدف الرئيسي لهذا البحث هو دمج مبادئ المستخدم مركز التصميم في تطوير تطبيق حجز المواعيد الطبية على أندرويد، مع التركيز على فهم متطلبات المستخدم للوظائف وتصميم التواجه. هذا البحث يقدم تصميما جديدا لتطبيق حجز المواعيد الطبية الذي يقلل التكاليف ووقت التفاعل بين المرضى والإداريين , تشير النتائج إلى أن مثل هذا النهج لا يشجع فقط على مشاركة المواطنين ومشاركتهم الفعالة في رحلة التحول الرقمي، بل يعزز أيضًا الوعي العام، ويعزز إدارة السياسات العامة، ويبسط عمليات اتخاذ القرارات . في الواقع، المستخدم مركز التصميم يعمل على تحسين كفاءة النظام وإشراك المستخدم من خلال ضمان أن الاستثمارات التكنولوجية ستلبي متطلبات المستخدم ومعايير سهولة الاستخدام.

الكلمات المفتاحية

المستخدم مركز التصميم؛ تطبيق طبي؛ تصميم المنتج.

1. INTRODUCTION

In today's rapidly evolving healthcare landscape, the need for streamlined and efficient healthcare systems is paramount for both patients and healthcare providers alike. Doctor appointment booking applications have emerged as indispensable tools for simplifying the appointment process and ensuring timely access to vital healthcare services.

The philosophy of User-Centred Design (UCD) represents a paradigm shift towards creating more effective products. UCD challenges designers in tailoring interfaces based on the abilities and requirements of end-users (Riley, Strater, Chappell, Connors, & Endsley, 2016). Instead of focusing solely on the technical aspects of information presentation, a user-centered approach integrates this information in a manner that aligns with users' tasks, goals, and preferences.

The adoption of UCD is gaining momentum across various systems, primarily due to its emphasis on understanding the profiles and needs of prospective users (Moquillaza et al., 2017). Research has demonstrated that the success of UCD interface design hinges on three key factors: user, usability, and utility (Roth, Ross, & MacEachren, 2015).

UCD principles have been applied in diverse domains, including mobile health applications (Schnall et al., 2016), emergency call systems for the deaf community (Santoso, 2018), language learning (Rohandi, Husain, & Bay, 2018) through mobile technology, tourist attraction (Palilingan, Santoso, & Rahayu, 2015), search applications, and even in the development of academic information systems (Efendi, Purwaningsih, & Sriyanto, 2016).

The Ministry of Communications and Information Technology in Egypt is undergoing a notable transformation towards digitization, with a focused effort to improve citizen services. This transformation involves a multifaceted approach, including initiatives such as data integration and the introduction of the "Digital Egypt" platform. Substantial investments, totaling EGP 25 billion, underscore the government's commitment to this endeavor (Elgohary, 2022).

The overarching goal of the "Digital Egypt" Initiative is to streamline the accessibility of government services, bolster digital infrastructure to facilitate widespread internet access and stimulate employment opportunities within the digital economy. Additionally, the initiative aims to nurture a culture of entrepreneurship and digital innovation among Egyptian citizens, fostering an environment conducive to growth and progress in the digital realm (Elgohary, 2022).

User-centered design is a methodology grounded in evidence that places a strong emphasis on engaging with and prioritizing the needs of end-users throughout the development process of a service or product (McCurdie et al., 2012). This approach is endorsed by the World Health Organization (WHO), which highlights its importance in the lifecycle of mHealth interventions to ensure optimal outcomes (WHO, 2011). It emphasizes addressing not only the functional aspects but also the usability of the intervention (Linares-Vásquez et al., 2013).

Incorporating user-centered design means considering both technical functionalities and how the intervention integrates into the daily lives of end-users, encompassing both technical and social elements. However, in developing contexts, there is a scarcity of frameworks that support this comprehensive approach to mHealth app design. While various frameworks exist for designing mHealth apps, few are specifically tailored to the unique challenges and needs present in developing contexts (Moqeem, Baig, Hosseini, & Mirza, 2018; Wilhide III, Peeples, & Kouyaté, 2016).

Recently, there has been a surge of interest in utilizing smartphones and web technology for appointment booking at medical facilities and hospitals (Qabajeh, Mousa, Saleh, & Hasan, 2023). These innovative applications offer valuable services that contribute to enhanced medical care for patients while assisting healthcare professionals in improving treatment delivery (Garavand, Aslani, Ayyoubzadeh, & Abhari, 2021).

In a study conducted by Khalid and Singh et al., a real-time appointment scheduling system was introduced, allowing patients to schedule appointments at specific times and dates and match them with available doctors. This system efficiently manages patient bookings and facilitates live consultations with healthcare providers (Khalid, Singh, Singh, Jeevitha, & Anand, 2018).

Similarly, Habibi and Abadi et al. developed an Android-based mobile application designed to address the challenges encountered with traditional booking systems. This system empowers patients to easily book appointments with their preferred doctors through both patient and doctor panels. Patients can register their information independently, while doctors can access appointment schedules and confirm bookings based on their availability (Habibi et al., 2019).

The objective of this study is to support Egypt's digital transformation efforts. To achieve this goal, product design students from October 6 University have developed an application aimed at facilitating appointment bookings at the university hospital for a diverse range of patients. Leveraging their creative thinking, the students utilized the User-Centred Design (UCD) process to conceptualize and design the application interface.

2. LITERATURE REVIEW

2.1. UCD In Healthcare

User-centered design (UCD) is a methodical approach for design and development that emphasizes the need of users to ensure the creation of effective and user-friendly products (Ferreira, Noble, & Biddle, 2007). In the realm of healthcare, electronic health systems are experiencing a surge in utilization by hospitals, patients, and various stakeholders. These systems play a crucial role in gathering, storing, and transmitting the administrative and clinical data of patients.

In recent years, a growing body of research on UCD methods within the healthcare sector has been conducted. The subsequent section provides a succinct overview of some of these prior reviews, shedding light on the evolving landscape of UCD applications in healthcare.

One study highlighted the predominant usability evaluation methods utilized for healthcare applications, including heuristic testing, questionnaires, think-aloud protocols, task completion assessments, interviews, and focus groups. Their study revealed that 67% of the examined papers employed multiple methods for assessing usability (Maramba, Chatterjee, & Newman, 2019).

Another study employed a user-centered design (UCD) approach to revamp the official health section website for Surabaya, employing heuristic evaluation as a key method. By measuring heuristic indicators on both the existing and redesigned websites, they identified and addressed areas for improvement in the updated system (Puspitasari & Cahyani, 2018).

Smaradottir (2016) implemented a UCD methodology involving field studies, interviews, and observations to grasp the contextual usage of the system. User workshops were then conducted to extract end-user requirements, with paper prototyping and graphical sketches proving effective in capturing these requirements (Smaradottir, 2016).

Wijesinghe, Prasad, Alsadoon, and Elchouemi (2016) proposed a novel model termed the User-Integrated HE Walkthrough Method for assessing the usability of electronic health records (EHR). This model integrates heuristic evaluation and cognitive walkthrough techniques, with open-ended questionnaires providing a platform for healthcare professionals to candidly express their perspectives and insights regarding user tasks (Wijesinghe, Prasad, Alsadoon, & Elchouemi, 2016).

3. METHODOLOGY

3.1. Data Collection Method

The data collection techniques included in-depth interviews with potential users of the application, direct observations of comparable systems in action, and an extensive review of relevant literature to examine existing theories and prior research findings.

3.2. Designing Applications with Ucd Approach

The process of designing applications follows a structured approach consisting of four stages within the User-Centred Design (UCD) framework. These stages include initiating the human-centered process, defining the use context, identifying users' requirements, and crafting solutions for product design (Purnama, 2017).

4. RESULTS AND DISCUSSION

To design an Android-based medical application using the UCD method, the following steps are undertaken:

4.1. Initiating The User-Focused Approach

During this phase, interviews are conducted with potential users to understand their preferences and requirements. This information guides the design process to ensure that the medical application developed using UCD aligns with users' needs and desires.

4.2. Specify The Context Of Use

The applications being designed will serve patients seeking information about clinics and doctors, enabling them to access relevant details and services provided by hospitals. *Figure 1* illustrates the patients' workflow in searching for clinics, outlining the context in which the application will be utilized.

Figure 1. The business process through which doctors search by patients.

4.2.1. Persona and User Profile

This medical application caters to a diverse user base, including university students and patients seeking clinics and doctors who are tailored to their specific needs. Insights gleaned from interviews have provided valuable information about user preferences and requirements. The subsequent phase involves crafting persona designs, which serve to vividly depict individuals and

their relevant needs within the context of the application's usage (Pichot & Bonnardel, 2019). For instance, patients seek an efficient appointment reservation tool to minimize missed appointments, preferring applications that streamline scheduling processes and safeguard their sensitive medical records. Similarly, university students and patients alike desire an application that offers swift appointment management capabilities while ensuring the confidentiality of their personal health information.

4.2.2. Task Analysis and Scenario

Following user persona development, the focus shifts towards constructing a task analysis model elucidating the steps that users undertake when searching for suitable clinics and doctors (Setyoningrum, Santosa, & Setiawan, 2017). This task analysis model, depicted in *Figure 2*, delineates the sequence of actions and decision points inherent in the user's journey.

Figure 2. Patient task analysis model.

4.3. Specify User and Organizational Requirements

The essential requirements for the development of medical applications include the following:

4.3.1. Data Management Requirements

This involves organizing various types of data essential for the application, including clinic profiles, doctor profiles, available medical tests, appointment schedules, doctor categories, and types of medical imaging tests.

4.3.2. Non-Functional and Functional Requirements

These requirements delineate the functionalities and performance characteristics that the application must possess. **Table 1** provides an overview of both the non-functional and functional requirements pertinent to the application.

Table 1. Non-functional and functional requirements of the application.

Non-Functional	Functional
• The applications are developed using Java, HTML5, and a framework tailored for mobile applications compatible with the Android operating system. • They function seamlessly when connected to the internet, even with standard bandwidth. • The user interface is designed to be intuitive and easily understandable for users. • Additionally, stringent measures are implemented to safeguard data from unauthorized access.	• The applications have the capability to handle profile data for both students and patients. • They can also manage information regarding different categories of doctors. • Moreover, the applications facilitate clinic searches and support interactive conversations. • Additionally, users have the option to bookmark or favourite specific doctors for future reference.

4.4. Design Solutions for Product Development

During this phase, we outline the structure of the application, conduct functional analysis to understand its operations, develop database models, and design the user interface.

4.4.1. Medical Application Architecture

The application's architectural model encompasses interconnected components aimed at achieving optimal system performance. This model is a blueprint detailing the technological framework employed within medical applications, ensuring its efficient utilization (Finandhita & Afrianto, 2018). *Figure 3* shows a visual representation of the medical application architecture model.
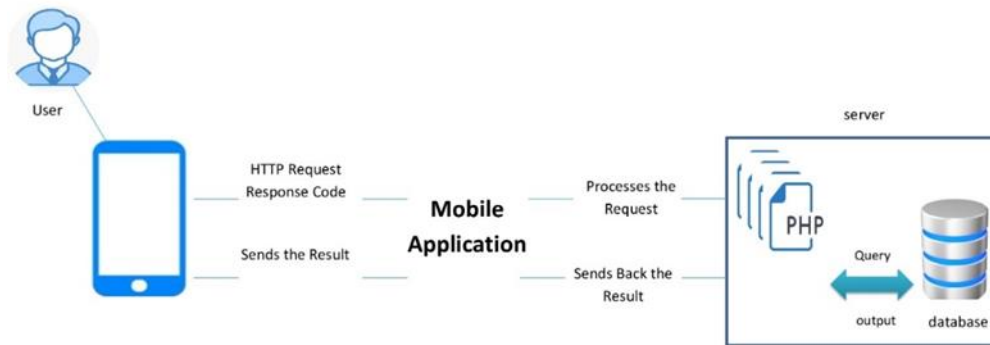
Figure 3. Medical application architecture (Qabajeh et al., 2023).

4.4.2. Functional analysis of the application

A valuable technique for depicting the functional specifications of software is through the use of UML (Unified Modelling Language). This modelling approach typically involves creating use case diagrams. These diagrams serve as graphical representations illustrating the interactions between actors and the various activities within the system. *Figure 4* displays the use case diagram specifically tailored for medical applications.
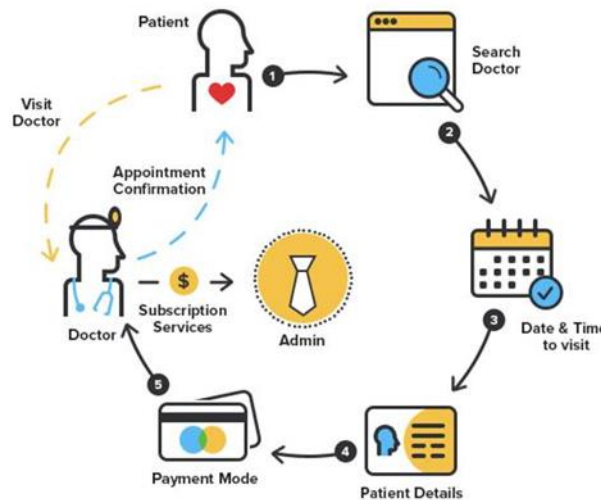
Figure 4. Use case diagram of medical application
("Features Worth Considering to Launch Online Medical Appointment Booking Platform," n.d.).

4.5. Medical Application Interface

In crafting the interface for the medical application, the focus is on utilizing layout principles to effectively showcase each functional page to the user. Initially, attention was directed towards designing a user-friendly login interface that enables seamless access to medical applications using registered accounts. Subsequently, the final design phase revolves around creating profiles for healthcare providers, allowing patients to access clinic-related information and favourite doctors who align with their specific requirements and preferences.

5. APPLICATION FEATURES AND RECOMMENDATIONS

The application boasts vibrant colors, an appealing welcome page, and a straightforward login process utilizing the student ID. Refer to *Figure 5* for a visual depiction.
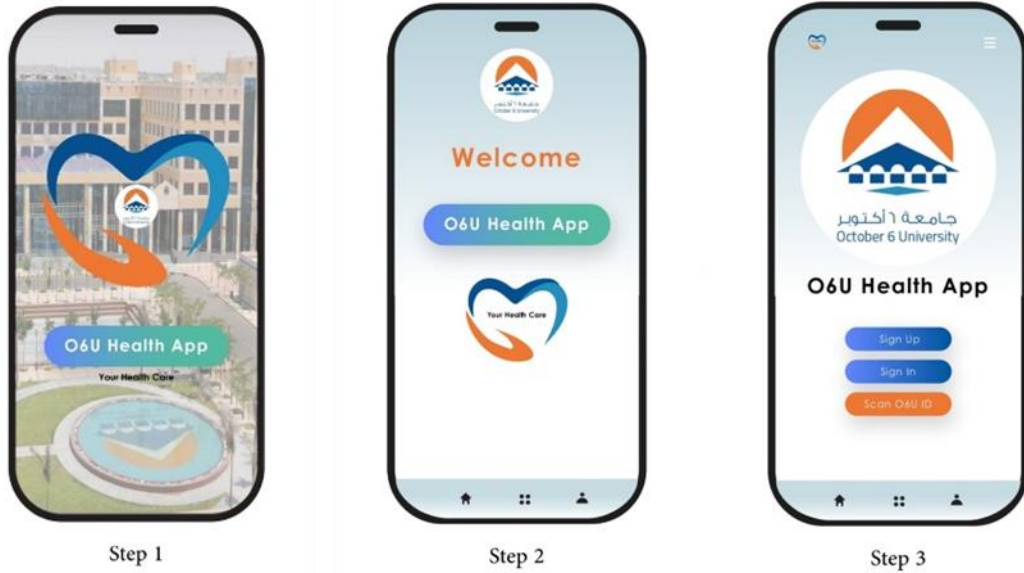

Figure 5. Application main page interface.

Patients or students can either create their accounts or log in by scanning a QR code. Refer to *Figure 6* for visual guidance.
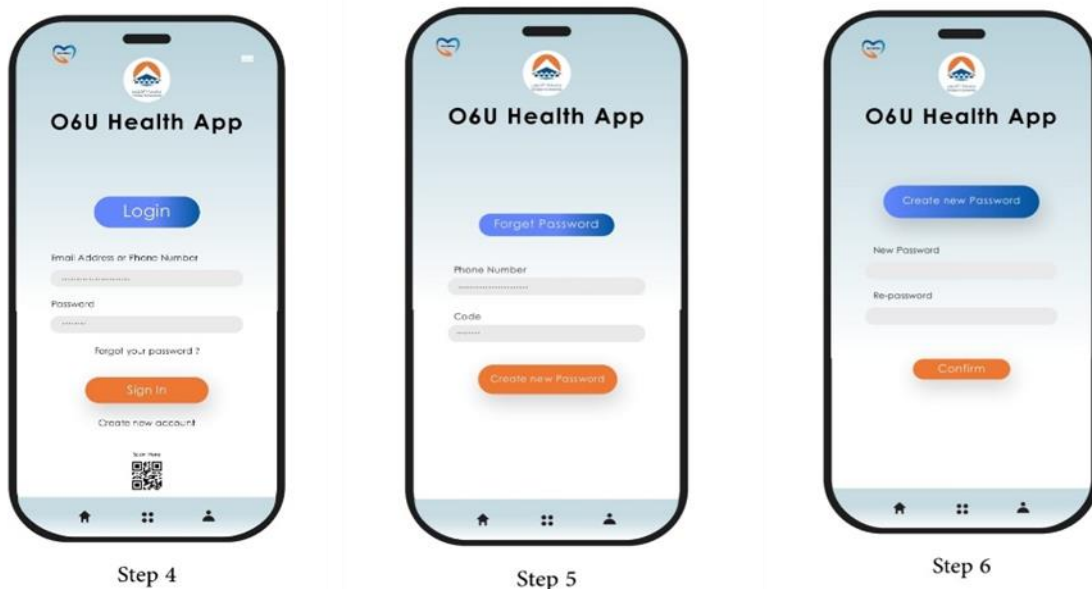

Figure 6. Log-in to the application.

Patients or students can conveniently select from a range of available services, choose their preferred doctor, and subsequently schedule an appointment. *Figure 7* provides a visual reference.
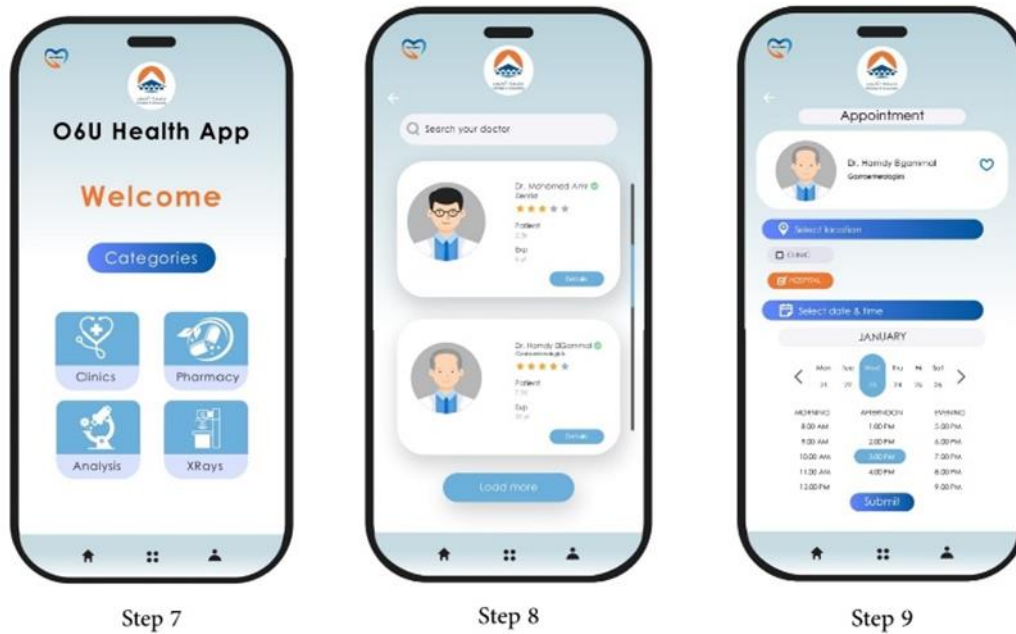
Figure 7. Choosing services and doctors.

The application offers diverse payment options, ensuring flexibility for patients or students. Additionally, users receive a confirmation message before finalizing the payment process. *Figure 8* provides a visual representation.
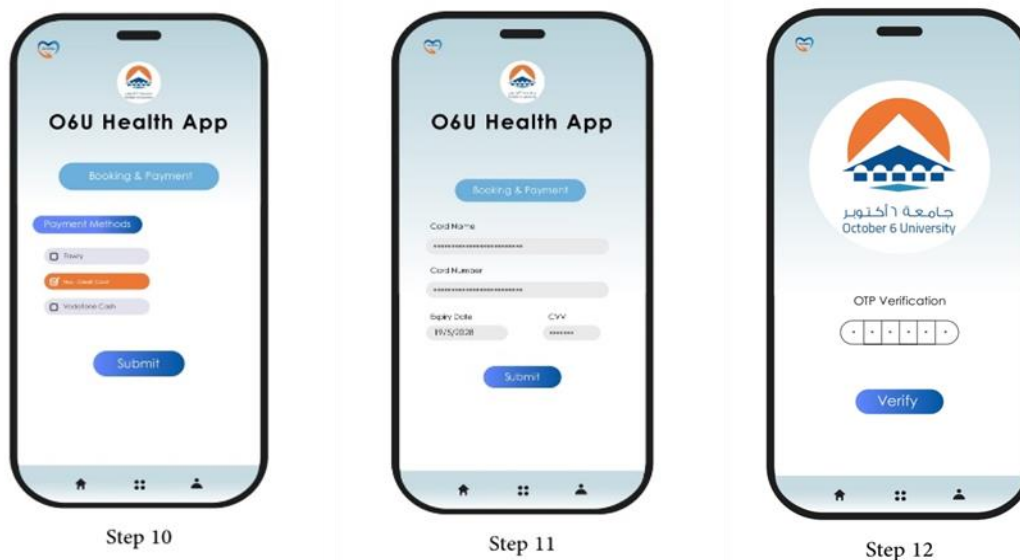

Figure 8. Payment methods.

Last, patients or students have the option to print their reservation tickets for their records, saving them time and ensuring that they have tangible confirmation of their appointment. Additionally, they receive the final confirmation message. *Figure 9* shows the visual aid.
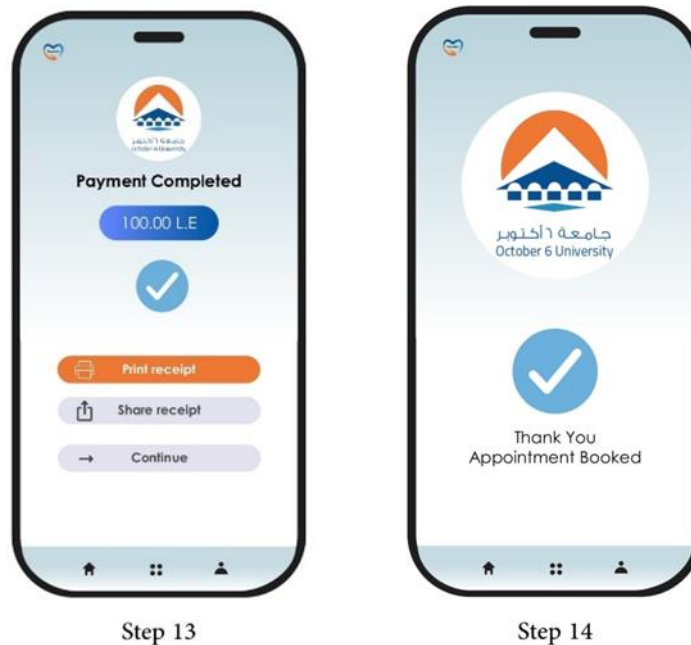
Figure 9. Printing receipt and final confirmation.

6. CONCLUSION

Medical appointment booking applications play a crucial role in enhancing healthcare accessibility, improving patient satisfaction, and optimizing resource management within healthcare facilities. These applications offer convenience, efficiency, and transparency in the appointment scheduling process, benefiting both patients and healthcare providers alike. The introduction of an online doctor appointment system has numerous advantages for patients and healthcare facilities. With a user-friendly interface, mobile accessibility, and customizable booking features, patients can easily schedule appointments without enduring long wait times or the inefficiencies of traditional booking methods.

User-Centred Design ensures that technology investments align with user needs and usability standards, fostering increased user engagement, enhanced system efficiency, and overall citizen satisfaction. Through the application of the UCD process, product design students at October 6 University successfully developed a medical booking application. This innovation not only streamlines the appointment process for October 6 University patients, saving time and resources but also contributes to the realization of digital transformation objectives for the institution and the nation at large.

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