

A Smart Healthcare Kit for Home Healthcare

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Submitted: 16 Dec 2022; **Accepted:** 22 Dec 2022; **Published:** 24 Dec 2022

Citation: Chou, C. Y., Hsu, D. Y., Chou, C. H. (2022). A Smart Healthcare Kit for Home Healthcare. *J Math Techniques Comput Math*, 1(3), 232-237.

Abstract

In response to the aging population, the National Health Insurance Administration relaunched the Integrated Home Healthcare Plan in 2016. This policy encourages physicians to walk out of the consulting room and visit the homes of patients with limited mobility and difficulty seeking medical treatment. The COVID-19 pandemic has recently changed the way people used to live. In particular, people with limited mobility and difficulties seeking medical care can now choose home healthcare to receive treatments [1]. Home healthcare services not only allow people to stay in a familiar environment and be accompanied by family members but also reduce the risk of infection when going out for medical treatments. During the pandemic, in addition to acquiring the required medical services at home, people can also receive vaccinations smoothly and pandemic prevention information. Further, in implementing the hierarchical medical system and avoiding the risk of infection during return visits, hospitals may transfer the follow-up healthcare of discharged cases to the grassroots clinics to jointly build a complete healthcare network of the hierarchical medical system and implement local healthcare.

Keywords: Integrated Home Healthcare Plan; Internet of Things; prescription Slip; Cloud Service Procedure; Vital Sign; Medical Image; Case Management System; Face Recognition; Fingerprint Recognition; Remote Healthcare; Natural Language Processing.

Introduction

Many elderly people living at home or patients with chronic diseases cannot go far away from their respective homes because of their limited mobility due to age or diseases [2]. It is inconvenient for the elderly and people with limited mobility to see the doctor and get medicines in clinics or hospitals regularly as it takes a lot of time and effort or requires mobility. Thus, the medical staff must organize an integrated home healthcare team to take the initiative to provide complete healthcare in the elderly and patients' homes. However, there are still many obstacles in practice. For instance, when the medical staff performs home healthcare, they must carry medical equipment and devices to the patient's home, which is a great burden for physicians and nursing staff. Therefore, it is crucial to overcome practical obstacles to effectively establish an integrated home healthcare team composed of medical staff that will take the initiative to visit patients' homes [3].

When carrying out home healthcare, physicians need to bring card readers, PCs, and backup batteries for diagnoses, in addition to mobile medical devices. If physicians lack medical equipment for diagnoses, they cannot effectively assess changes in their patients' conditions. Further, information is dispersed when there is a lack of an integration platform connecting medical equipment with medical records, which can act as the basis for long-term tracking and analysis. Therefore, this study proposed a smart healthcare kit integrated equipment platform [4]. This paper is organized as follows. Section 2 explores the home healthcare Internet of Things (IoT) model [5]. The functions of the smart healthcare kit are discussed in Section 3, while solutions for home healthcare are presented in Section 4[6]. Finally, this article ends with future outlooks for home healthcare in Section 5[7].

Home Healthcare IoT Model

In the past, after cases were submitted for acceptance applications,

caregivers or physicians who received the acceptance applications would immediately contact the cases and confirm the date and time of the visits (see Figure 1). Before the visits, family members would be requested to take their national health insurance cards to the consulting rooms for scanning and making appointments for home visits on selected dates. When physicians conducted home visits, they would carry medical equipment and instruments to pa-

tients' homes for diagnoses, particularly for collecting medical images. After the diagnoses, physicians would return to the consulting rooms to create case files and produce case visit forms before issuing prescription slips [8]. Patients' respective family members would be asked to make another appointment to scan the patients' national health insurance cards and obtain medicines in the clinics or hospitals.

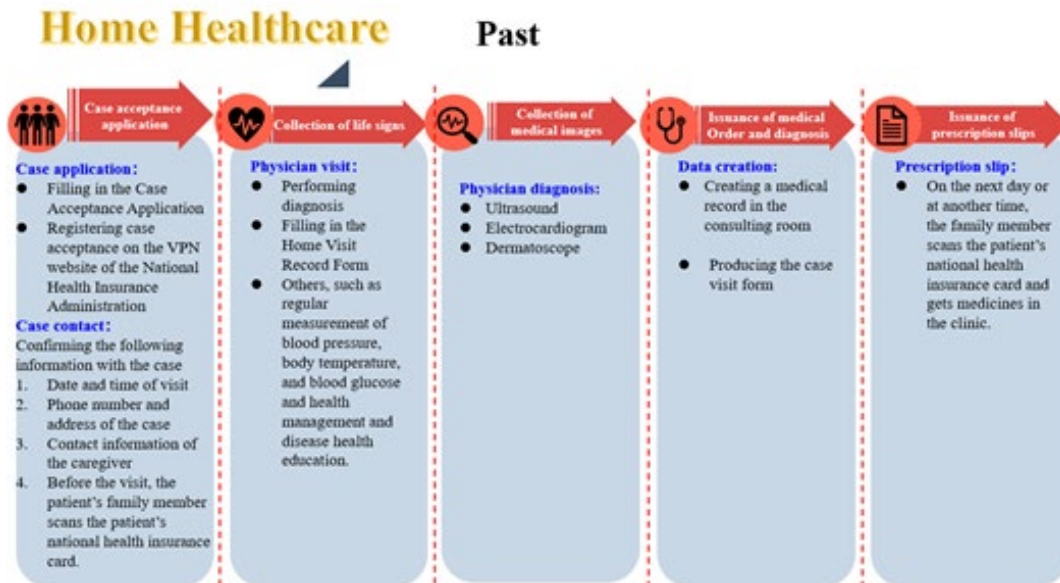


Figure 1: Schematic Diagram of Past Home Healthcare

The present home healthcare is shown in Figure 2, and the home healthcare IoT model is presented in Figure 3. The blocks of the home healthcare and the home healthcare IoT model are divided respectively to develop the cloud service procedure, as shown in

Figure 4[9]. By simply taking the smart healthcare kit for home visits, physicians can easily collect vital signs and medical images, issue comments, diagnoses, and prescription slips, and directly upload the above information into the case management system [10].

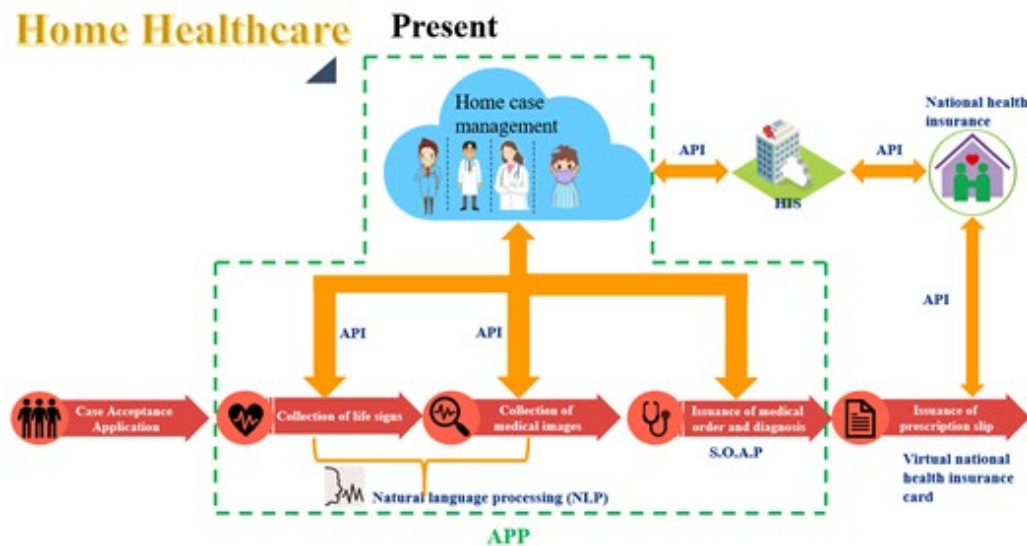


Figure 2: Schematic Diagram of Present Home Healthcare

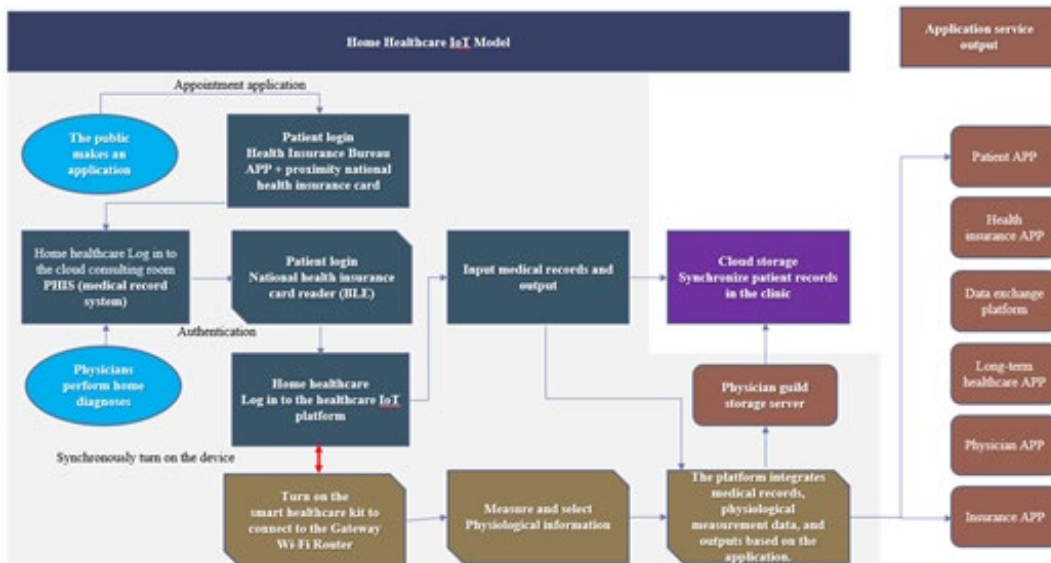


Figure 3: Home Healthcare IoT Model

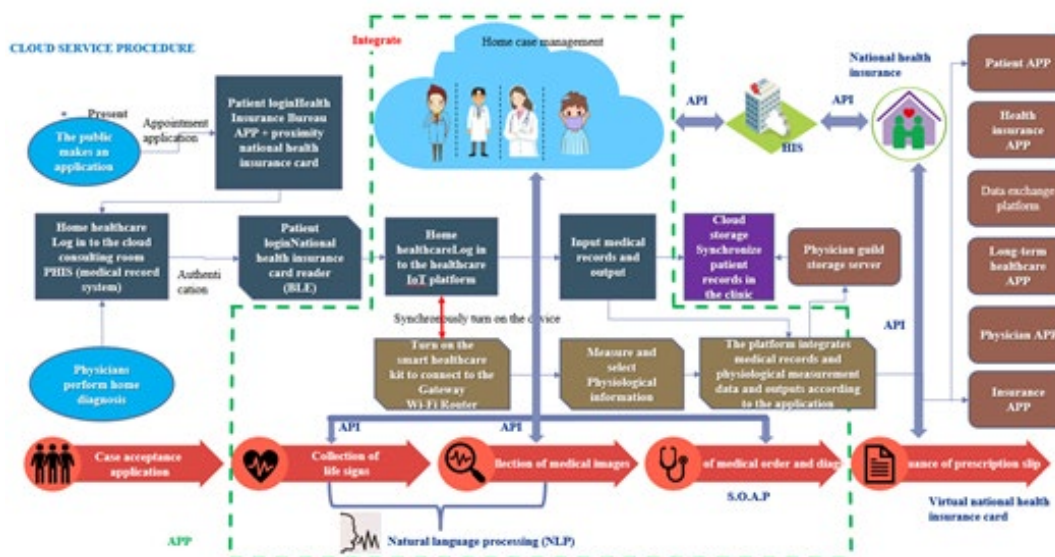


Figure 4: Cloud Service Procedure

Functions of the Smart Healthcare Kit

After arriving at the patient's home, the physician opens the smart healthcare kit (see Figure 5) [11]. The physician can log in using face or fingerprint recognition and by entering the account password. Then, the smart healthcare kit will be automatically connected to the 5G system [12]. The smart healthcare kit contains medical equipment for physiological measurements, ultrasound, and combined diagnostic sets. It also contains a power supply system, a 5G system, and a card reader to store and supply electricity and connect to the internet. A power supply is provided to the medical equipment, which is connected to the internet through the smart healthcare kit. Further, after patients plug in their national

health insurance cards, physicians may begin diagnosing [13].

For home and remote healthcare diagnoses, information, such as life signs and medical images, can be automatically stored in the home case management system. By using natural language processing (NLP), medical records and precautions are automatically stored in the home case management system [14].

After the diagnosis, the physician issues a prescription slip and returns the relevant information to the home case management system.

Home healthcare

Smart healthcare kit

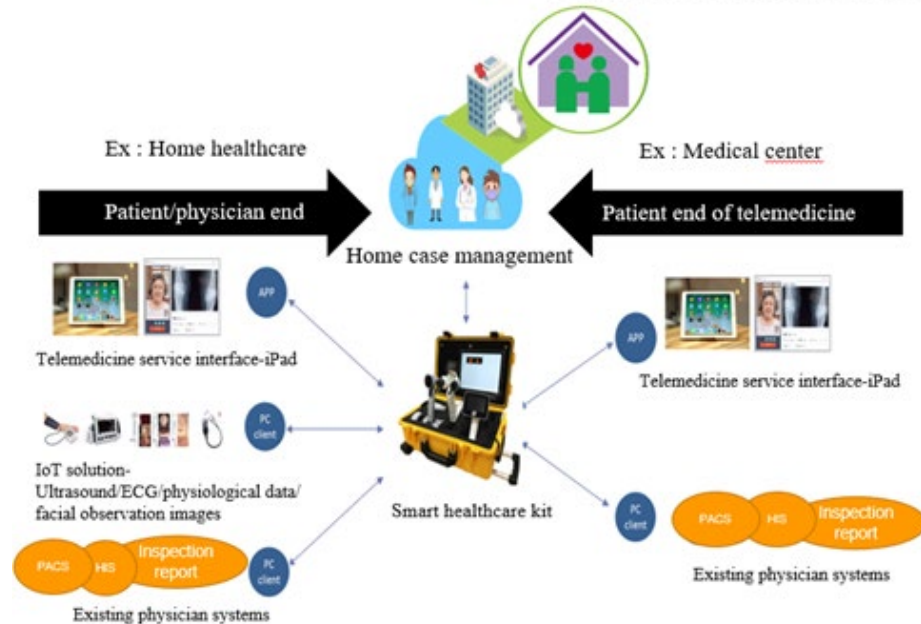


Figure 5: Schematic Diagram of Smart Healthcare Kit

Solutions for Home Healthcare

Communication

The dispatch system (case acceptance, execution, and case closing) was developed to integrate the time of the physician, nurse, and case. After the information is inputted into the system, the system automatically displays the available time points of the three parties within a month. It helps the physician sort out the distance among the cases' homes and automatically designs the best path for the physician to visit the cases' homes.

Data integration

Through natural language processing (NLP), the measurement information can be recorded and transcribed. The physician inputs the diagnosis record of the case conveniently and then locks it temporarily. During the return visit, the physician confirms the diagnosis record again and uploads it to the VPN. The physician may need to visit five cases in a day, and the expenses cannot be modified after uploading to the VPN. Thus, to avoid making wrong and hurried decisions, the physician has to re-confirm before uploading [15].

Mutual communication

At present, most of the elderly take care of each other; they are the weakest link in information ability. As the elderly find it challenging to use smartphones, they hope to have a set of devices with manual button devices, such as emergency buttons, which can help them release information.

Future Outlooks for Home Healthcare

Simple networking device:

- It supports a variety of device networking functions, allowing medical equipment to upload measurement information.
- It synchronously supports the network of mobile devices, laptops, and smartphones.
- It is ready to use, and no setting is required; it reduces inconvenience caused by failure to set.
- It avoids the lack of network signal in some diagnosis areas and can be combined with a wired extension antenna to improve the signal required for work.

Medical digital physiological information measurement equipment:

- It is qualified digital equipment according to the TFDA (with networking interface).
- It can export digital files to facilitate subsequent transmission and analysis.
- It improves the accuracy of physician diagnoses and judgments and reduces the difference in physician diagnosis experience (AI model).

Cloud clinic system:

It supports inputs from various interfaces to reduce hardware requirements and improve the diagnosis and record quality, making queries for patients' data easier. The system prevents judgments caused by human memory errors and reduces the burden of declaration. Data preservation is safe and simplifies physicians' diagnoses. Meanwhile, physiological data can be imported into the

system to improve the integrity of medical records [16].

Health information integration platform:

□ It supports medical device data integration and application output.

□ It manages the medical equipment status and establishes maintenance mechanisms.

□ It connects to the cloud diagnosis system (PHIS) to integrate patients' medical records and measurement data to establish personalized health records [17].

□ According to the client's needs, it can provide measurement data suggestions on the healthcare unit's end (functions of the AI model) [18].

□ On the patient's end, it can provide long-term data tracking and establish communication channels for family members.

□ It can integrate the recovery and assessment of service exports and service results on the government's end.

Overall, a complete system is required for home healthcare. With the help of modern technologies, such as the smart healthcare kit, the networking device, the cloud service system, and the health information integration platform, healthcare, security, and well-being services are provided to users at home [19]. Using the concept of the home healthcare IoT model, the smart healthcare kit connects all devices and systems, which is very convenient and practical for both home healthcare and remote diagnoses [20]. Therefore, more research and development are needed in this field to develop a smart healthcare kit with complete functions while ensuring system reliability.

Patents

A patent was produced from the research work reported in this manuscript. The method of continuous force generation and the force transition mechanism are under the protection of Taiwan's Intellectual Property Office, as an invention patent, with publication/patent number M634333, application number 111202524, entitled: "Smart medical box".

Author Contributions: Writing—original draft preparation, Chun-Yang Chou, and Chun-Hung Chou; writing—review and editing, Chun-Yang Chou, Ding-Yang Hsu and Chun-Hung Chou. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the research center for healthcare industry innovation, national Taipei university of nursing and health sciences.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The research data related to this work are included within the manuscript. For more information on the data, contact the corresponding authors.

Conflicts of Interest: The authors declare no conflict of interest.

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