The Research on Patient Information Sharing System Based on Internet of Things

Ziyu Liao, Huiting Hu, and Jia Qiu(✉)

Guangxi Vocational Normal University, University East Road 105, Xixiangtang District, Nanning, Guangxi, China
86983577@qq.com

Abstract. As information technology develops in leaps and bounds, the Internet of Things (IoT) has gradually been applied into various fields and thus become one of the major determinants for the new round of economic development. The patient information sharing system based on IoT has effectively increased the work efficiency among medical staff and the diagnosis and treatment rates among doctors. Through the analysis on the status quo and the problems existing in domestic patient information sharing, the architecture, functionality and prospect of the patient information sharing system based on IoT were proposed, so as to provide thoughts for promoting the patient information sharing within hospital.

Keywords: Internet of Things · Hospital · Patient information sharing · Shared system

1 Introduction

The Internet of Things is a product of the information age and a platform for real-time information sharing, which can transform the information data people need into network data [1]. With the improvement of our living standards and the reform of medical system, the patient number increases in hospitals and the workload of medical staff keeps rising. Facing the situation where many patients seek for medical advice simultaneously, medical staff have an urgent need to take down their medical records, physical conditions and anamneses, judge the severity and emergency degrees of patients, and then prioritize the medical treatment for acute and severe patients accordingly. The establishment of patient information sharing system can effectively increase the diagnosis and treatment rate. The electronic medical record information of patients is imported into the patient information sharing system after integration for intelligent management. The system is featured by its easy retrieval, convenient utilization, fast transmission, etc. Through this system, medical staff can have a quick and comprehensive understanding of patient anamneses and thus improve their work efficiency.

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2 The Significance of Patient Information Sharing System

The patient information sharing system based on the Internet of Things (IoT) covers the patient name, age, blood type, emergency contact number, family medical history, anamnesis, past medical records, In the future, it will become an effective platform for medical information sharing, breaking down information barriers between medical institutions, and promoting high-speed transmission and sharing of medical information on this platform. Other information in the electronic medical record [2]. Patient information sharing system has a certain practical significance for hospitals to realize informatization, improve their diagnosis and treatment levels, and resolve the difficulties in cross-hospital referral. For example, it can effectively reduce the waste of medical resources, improve the work efficiency and diagnostic rate of medical personnel, and promote the sharing of patient information resources.

3 The Status Quo and Problems in Domestic Patient Information Sharing

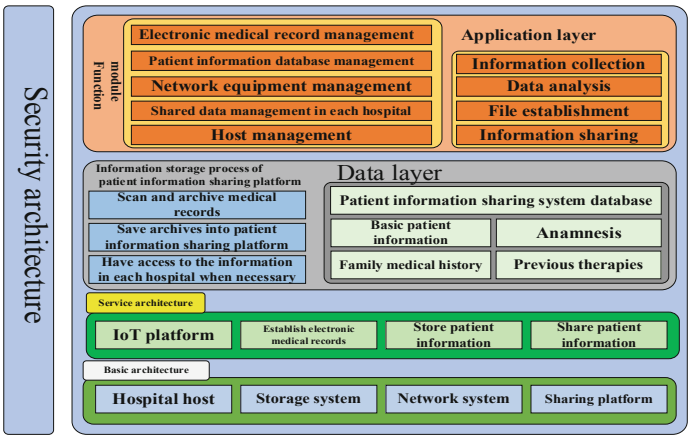
At present, the domestic patient information sharing is still in its infancy. As for infrastructure, a series of system and platforms in different types have been established. They can realize the information-based and data-oriented synchronous sharing of simple medical and health data for some scientific research services. The biggest problem in domestic patient information sharing is that there is no unified standard for the format and content of hospital electronic medical record; it incurs practical difficulties in integrating patient information across hospital. The second problems involves information security. If criminals steal the personal information on patients for illegal acts, one of those serious consequences will be that those victims have to take legal liabilities for those lawbreakers.

4 The Establishment of an IoT-Based Patient Information Sharing System

4.1 System Architecture

As shown in Fig. 1:

(1) Security component is the most crucial part in this system. During the process of system construction, this component realizes the function of stepwise reporting and receives the assistance from network security experts so as to help us jointly build the internal and external security of the system. This component monitors the cyber attacks by hacker in real time on the outer layer of the system. Once the system is attacked from the outside, security architecture will immediately take protective measures, sends out an alarm signal and strive to prevent the cyber attack from hackers in the first place. On the inner layer of the system, security architecture also monitors patient data in real time. After a doctor has checked patient information for a certain period of time, security architecture will prevent information disclosure through mandatory patient data deletion from the doctor terminal.



The Diagram on Overall System Architecture

Fig. 1. The diagram on Overall System Architecture

(2) Basic architecture refers to the foundation on which a system is built. The saved patient data are scanned and stored in the storage system of each hospital host. The network system required for the system is formed through IoT, 5G and other technologies. The network technology has become increasingly advanced in nowadays. The adoption of IoT and 5G technologies for data transmission, analysis and storage can ensure the security of patient information due to their novelty and fast transmission speed. Finally, patient data are uploaded to the IoT-based patient information sharing platform for communication, analysis and utilization by major hospitals.

(3) Service architecture serves as the channel for exchange among hospitals as well as between hospitals and patients. By virtue of IoT platform and according to the purpose of Internet of everything, wearable devices on patient can be employed to monitor their physical conditions. A healthy person can specify his basic physiological data, anamnesis, family cases, and previous therapies in advance by filling out an electronic collection form in a hospital so that those data can be stored into the patient information sharing system. Once the person encounters an emergency onset, doctors can refer to the information filled in by the patient in advance for a preliminary etiological analysis so as to save the diagnosis time and extend the valuable treatment time.

(4) The system function can facilitate hospitals and patients to have access to our system. An APP will be designed with both patient end and hospital end. Patients can check their data at any moment via the patient end, and require the hospital to explain the duration and purpose of their data use so as to ensure the trust of patients in the system. Additionally, patients can dispel their doubts by referring to resident doctors via the patient end. When doctors use patient information via the hospital end, they need to fill out their purposes and record the time at the beginning of their use. Moreover, hospitals can communicate with each other anytime and anywhere via the software. Many talents can get gather in the same platform, thus breaking

the spatial limitation. The system function will improve gradually as the system is updated; more functions will be added to provide convenience for the general public.

4.2 System Functions

(1) The development and application of electronic medical records in China is relatively late and is still in the exploratory stage. There is a lack of support from national laws and regulations, and a standardized system has not yet been formed. Therefore, in order to achieve intelligent development, hospitals should conduct more in-depth research on electronic medical record systems, in order to better meet the needs of hospital development and provide patients with intelligent and standardized case platforms [3]. By virtue of IoT technology, the data from various wireless medical devices are directly uploaded to the electronic medical record of the corresponding patient. This approach has cut the manual input procedure and synchronously uploaded the electronic medical record to the information sharing software in the patient's mobile device. It is necessary to integrate the data of medical testing, let everyone have their own electronic health records, standardize, and use cloud platform to solve big data problems [4]. Due to the existence of permission administration, electronic medical records can only be modified via a single host in a hospital, which enhances the security of patient data. The updated data will be sent to the sharing platform and the patient's mobile device simultaneously so as to ensure the accuracy and real-time performance of those data.

(2) Medical Equipment Management This network system is established by IoT and 5G technologies so the role of this system will be maximized after various medical devices with complex wirings are updated to wireless devices. Simultaneously, the system is also compatible with the manual wired data entry. After medical devices are connected to the system in a wireless manner, the system will generate a table on the operation conditions of various devices in a hospital host so as to facilitate medical staff in checking and managing those devices.

(3) Information Sharing via the System The IoT-based patient information sharing system can cooperate with major hospitals to collect and integrate the patient data from those hospitals and form a patient information database within the system. When there is a patient from other hospital, doctors can call up his or her diagnostic data and therapies in the original hospital from the system so as to make a quick and preliminary judgment on his or her condition.

(4) Exchange among Hospitals This system is connected with major hospitals, and contains the therapies and diagnostic analyses on numerous patients. As a result, when a lower-level hospital receives a patient with intractable symptoms, it can turn to a higher-level hospital for help and apply to refer to the data on patients with similar symptoms. Upon the consent from those patients, the hospital can review the characteristics of those symptoms and therapeutic options. In this way, the hospital can increase the cure probability and gain more time for treatment. All of the non-imaging information on patients can be saved in PDF format and uploaded to the central index server on a regular basis each day so that they can be accessed by clinicians in various hospitals upon patient consent [5]. During the normal cross-hospital academic exchange, those data can also be accessed upon patient consent for discussion among experts so that they can contribute to our medical cause.

4.3 Data Analysis

At present, some companies have made a patient information sharing system based on the system architecture we proposed, and surveyed 266 people including doctors, patients and their families in different hospitals in different townships through Wjx (a professional online questionnaire survey), with a recovery rate of 100%. The survey results show that most doctors and patients support the system positively, and only a few people do not support system application because they are afraid of leaking their own information, and the data of comparative experiments in various hospitals are obtained, as shown in Table 1 and Fig. 2.

According to Table 1, 89% of the 266 people surveyed support or can accept the establishment of the patient information sharing system. It can be seen that the patient information sharing system constructed according to the system architecture we proposed has been supported by most of the 266 respondents in the survey, which meets the needs of current doctor-patient personnel. According to Table 2, it can be seen that it has great advantages in understanding the patient's past medical history, finding

Table 1. Survey on safety of patient information sharing system [n = 60, n (%)]

Views on the system	Doctor	Patient	Family members of patients	Total number of people
Strongly support the establishment of a patient information sharing system and consider it a good thing	23(8)	45(16)	22(8)	90(33)
Support the establishment of information sharing system, but worry that the information security of patients is not guaranteed	34(12)	54(20)	33(12)	121(45)
Accept the establishment of information sharing system, but do not agree to include themselves in the system due to security issues (patients only fill in)	0	28(11)	0	28(11)
Oppose the establishment of an information sharing system, believing that the hospital is stealing patient information	8(3)	12(4)	7(2)	27(11)

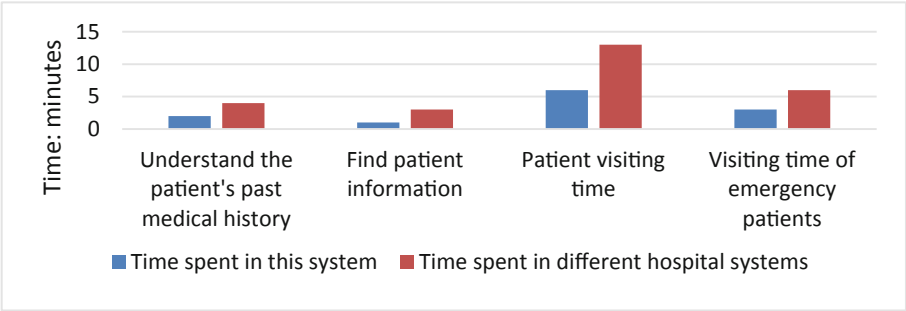


Fig. 2. Comparison between the system and the current system of each hospital

patient information, patient visiting time and visiting time of emergency patients in the processing procedures of local hospitals, and has high feasibility.

5 Thought and Prospect on the System

This system can trigger profound changes to the medical information in the current hospital where information interconnectivity is still unavailable. It can facilitate hospitals at a low level to seek help from those at a high level, simplify the referral between hospitals, and save plenty of diagnostic time. According to the 14th Five-year Plan for Comprehensive Medical Security published in September 2019 and the Opinions on Promoting the High-quality Development in Public Hospitals published in June, 2021, China will facilitate the in-depth integration between medical services and the new generation of information technologies, such as cloud computation, Internet of things and 5G. This system advocates national policies and operates under the guidance of policies. It allows patients to enjoy various convenient services provided by modern science and technology, effectively resolves the problems of difficulties in seeking medical treatment and high cost, and fundamentally mitigate the doctor-patient relationship. Therefore, it will gain a good prospect.

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