論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Data Sharing and Consent Management of Electronic Health Record based on the Blockchain Technology
著者(和文)	テイント ダラ
Author(English)	Dara TITH
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第11606号, 授与年月日:2020年9月25日, 学位の種別:課程博士, 審査員:小尾 高史,奥村 学,熊澤 逸夫,小池 康晴,長谷川 晶一
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第11606号, Conferred date:2020/9/25, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨
THESIS SUMMARY

系・コース： Department of, Graduate major in	Information and Communication	系 コース	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of	(Engineering)
学生氏名： Student's Name	TITH Dara		指導教員（主）： Academic Supervisor(main)	Takashi Obi	
			指導教員（副）： Academic Supervisor(sub)		

要旨（英文 800 語程度）
Thesis Summary (approx.800 English Words)

Electronic Health Record (EHR) has been increasingly used as an effective method to share patients' records based on the patient's consent among different hospitals. However, it is still a challenge to access scattered patient data through multiple EHRs; and patients have difficulties to modify the consent after providing it to hospitals. In this thesis, we present our contributions to build a system to access patient records among EHRs without relying on the centralized supervisory system. In addition, patients can manage their consents flexibly, and healthcare organizations can get patient consents efficiently for variety of purposes. The dissertation consists of seven chapters as following.

Chapter 1 presents the essential aspects of the EHR such as the interoperability of the medical systems and the consent of information sharing. It then explains about the problems that current EHR system are facing to deal with management of patient's records while preserving the patient's privacy for exchange medical records across different medical institutions. After that, it explains about our research motivations for enhancing the medical records exchange and consent management across different EHRs. Then, it presents about objectives and contributions of our research for overcoming challenges in the EHR for medical information sharing. It also describes our research methodology for collecting, filtering and grouping resources, which we use them to design research plans for achieving our research's goals. Finally, it shows the brief descriptions of remained chapters, and our research publications and activities.

The following two chapters are about the state of the art and the works related to healthcare data management system, technologies which are used to enhancing security and preserving-privacy, and the blockchain technology and its applications.

Chapter 2 is divided into two parts. First part is about the basic regulations of building a medical system for the information sharing. Second part is about the technologies, which are invented by other researchers, such as encryption and decryption data methods, identity management in the information system and the access control techniques, which are used to manage the access in the organizations based on the role of user, context and access purpose.

In Chapter 3, we explain deeply about the blockchain technology, which is mainly used in our system. We describe the overview of this technology and other platforms, which are adapting the blockchain concept. Then, we did some surveys about the importance of using blockchain technology in the medical system by reviewing the existing researches. After that we present about the existing researches of prototype blockchain system for

exchange, aggregation, traceability and patient consent management of medical data in EHRs.

We finish explaining the state of the art so, we start describing our contributions.

In Chapter 4, it is about the proposed system model for integrating EHRs by showing the married between blockchain technology with existing security and privacy-preserving technologies, and applying them together. We also proposed some modification of the existing blockchain platform that we use for adapting to medical system use case. We did the proof-of-concept of our proposed system to make sure that the data is securely stored in the blockchain while maintaining the data owner's privacy and the security when transferring data to other parties.

Chapter 5 is about the improving of the proposed system for patient e-consent management for medical records sharing. We learnt about the existing purpose-based access control which applied in the conventional system. Based on the above knowledge, we designed the purpose-based consent for enhancing the access based on the accessing purpose that is not relied on the role hierarchy of the user. Finally, we did the experiment of applying the above consent model in our blockchain system.

For the above two models, we implement them in Java and Go programming language, execute them in the local network environment. Moreover, we compare our proposed system with the existing blockchain system. As the result, our propose system gains more advantages than another.

Chapter 6 is about the discussion of the proposed blockchain system and consent model. As the results, they complete each other to overcome the problem of sharing medical data based on patient consent. Simultaneously, they need the modification if we want to expand our models for solving the information sharing of other use case.

Finally, we conclude our research in the Chapter 7. We also explain our future works when we apply these models to hospitals and for adapting to GDPR's for the right of erasure.

In summary, our system models have high reliability and availability as well as transparency and traceability all that are common prominent features of the blockchain system. Especially, transparency and traceability are considered to be more important in dealing with patient consent to share patient data properly. We expect that our system can be used as a solution not only in patient data sharing between hospitals, but also in data donation for research purpose in biobank.