Android HealthCare Applications using Blockchain

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Abstract— A mobile application is deployed to collect health data using various sensors from personal wearable devices, manual input, medical devices, and synchronize data to the cloud for data sharing with healthcare providers and health insurance companies. To preserve the integrity of health data, within each record, a proof of integrity and validation is permanently retrievable from cloud database and is anchored to the blockchain network. Moreover, for scalable and performance considerations, the proposed system adopt a tree-based data processing and batching method to handle large data sets of personal health data collected and uploaded by the mobile platform. By developing a web application to find out nearest location of healthcare providers and health insurance companies. In the proposed system, KNN (K-Nearest Neighbours) and Haversine algorithm is used to provide information about health data and for further processing. This project represent a Blockchain-based approach to sharing user data to healthcare providers and health insurance companies.

Key words: Healthcare, eHealth, Privacy, Wearable Devices, Mobile Platform, Permissioned Blockchain

I. INTRODUCTION

It is a very exciting time for healthcare system, healthcare providers and information technology (IT). Due to improvements in genetic research, health care is witnessing an innovative approach to disease prevention and treatment that incorporates an individual patient's genetic makeup, lifestyle and environment. Simultaneously, IT advancement has produced large databases of health information, provided tools to track health data and engaged individuals more in their own health care. In health care and information technology would faster transformative change in the field of health IT.

It is a very exciting time for health care and information technology (IT). Due to improvements in genetic research and the advancement of precision medicine, health care is witnessing an innovative approach to disease prevention and treatment that incorporates an individual patient's genetic makeup, lifestyle and environment. Simultaneously, IT advancement has produced large databases of health information, provided tools to track health data and engaged individuals more in their own health care. Combining these advancements in health care and information technology would foster transformative change in the field of health IT.

The rising of wearable technology contributes to the digitalization of the world. Wearable technology refers to networked devices embedded with sensors which can be worn comfortably on the body or even inside the body to collect health data and tracking activities thus serving as a convenient tool to monitor personal health. With the availability of rich health data in the cloud, health insurance companies can make more strategic policies according to individual characteristics.

However, challenges are arising since more health data can be collected from both wearable devices and EHR systems. First, patients become more concerned about the privacy of the health data.

II. PROBLEM STATEMENT

In recent years, the rise of wearable technology and the Internet-of-Things has brought great opportunities and challenges to the healthcare domain. Enabled by cloud computing and big data analytics, the data collected from individual devices contributes to big health data and valuable insights can be derived. Hospitals and medical institutions can use these data to link with other Electronic Health Record (EHR) data, such as clinical notes, to facilitate health monitoring, disease diagnoses and treatment. Health insurance companies can make detailed and strategic policies according to individual characteristics, benefiting customers to choose flexible insurance plans according to their needs.

A. Goals and Objectives

1) To collect data from Hardware device.
2) To share data between individuals.
3) To collaborate data between individuals and healthcare providers, as well as insurance companies.
4) To improve the detecting and health monitoring performances.

B. Existing System

In existing system, such bands are available but they are showing only information to the user about their health condition. Data are storing in cloud and health data are very privacy sensitive in nature. Existing system has centralized in nature it cannot give guarantee about security.

C. Area of Project

1) Blockchain:

Blockchain usage in healthcare and research, aiming to clarify the implications of blockchain as an infrastructure for healthcare use cases including privacy preservation for predictive modeling, increasing interoperability between institutions at a large scale, immutability of health records, health insurance claim process improvement, health information exchange, healthcare delivery models with artificial intelligence, identity management, monetization strategies and data provenance requirements.

2) Machine Learning and Internet of Things:

Wearable Devices serve to transform original health information into human readable format and then the data is synchronized by the user to their online account. Each account is associated with a set of wearable devices and possible medical devices. When a piece of health data generated, it will be uploaded to the Blockchain network for record keeping and integrity protection.

III. SYSTEM ARCHITECTURE

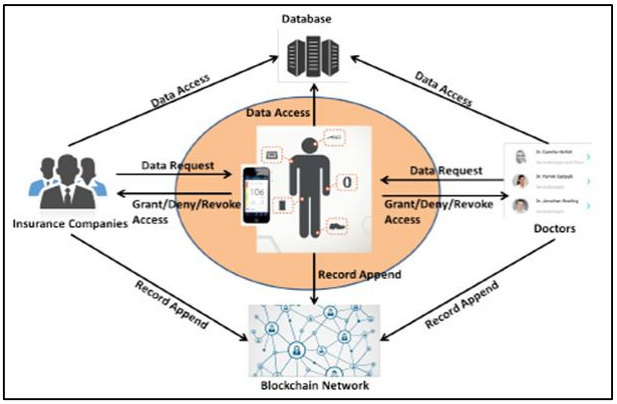


Fig. 1: Architecture

Six components are incorporate namely user, wearable devices like digital watches, healthcare provider, insurance company, the cloud database, police station and the blockchain network. System users collect data from wearable devices which monitor patient health data such walking distance, sleeping conditions, heartbeat. Wearable Devices serve to transform original health information into human understandable format and then the data is created by the user to online account.

Every data request and corresponding data access is recorded on blockchain. The blockchain network is used for health data collected from both a wearable devices like digital watches and healthcare providers, each of data entry is uploaded to blockchain network for integrity protection. For personal health data access from the healthcare provider and the health insurance company. The insurance claims can also be recorded on the blockchain in cloud database for user.

IV. MATHEMATICAL MODEL

Let S be the Whole system which consists:

S= {IP, U, OP}.

Where,

- IP is the input of the system that contains band, android phone and user abnormal condition.
- U is the User procedure applied to the system to process the given input that include after identifying abnormal condition then generate alert and send notification.
- OP is the output of the system that includes detect abnormal condition successfully, generate alert and send notification.

1) User :

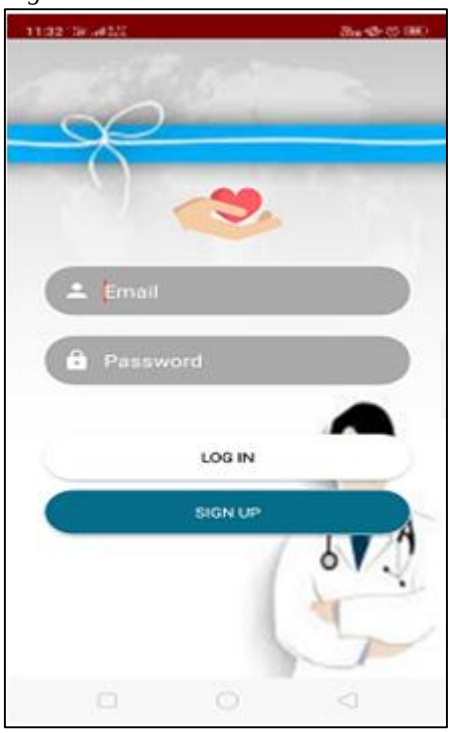
- Input: {sensor data, touch pad, band}
- Process:{sense abnormal condition of user, generate alert, send notify}
- Output:{alert notify to parents and hospital, police station}

2) Sensor data:

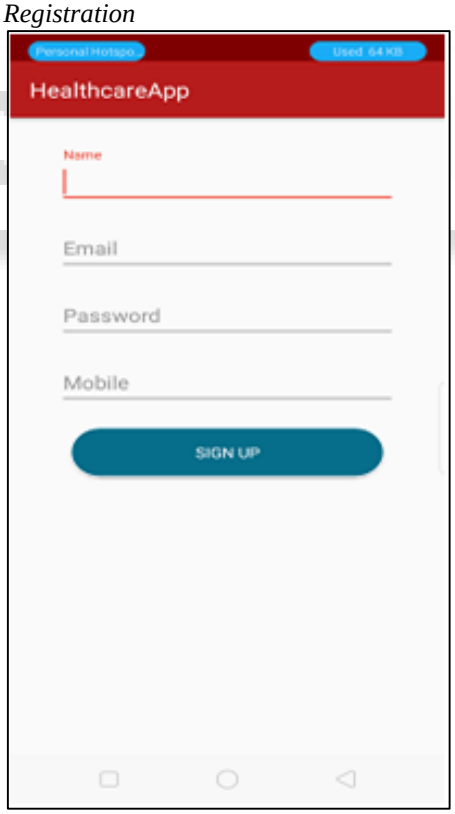
- Input: {user heart bit, accelerometer}
- Process:{detect abnormal condition of user on the basis of heartbeat, generate alert}
- Output :{Alert generated successfully}

B. Screenshot

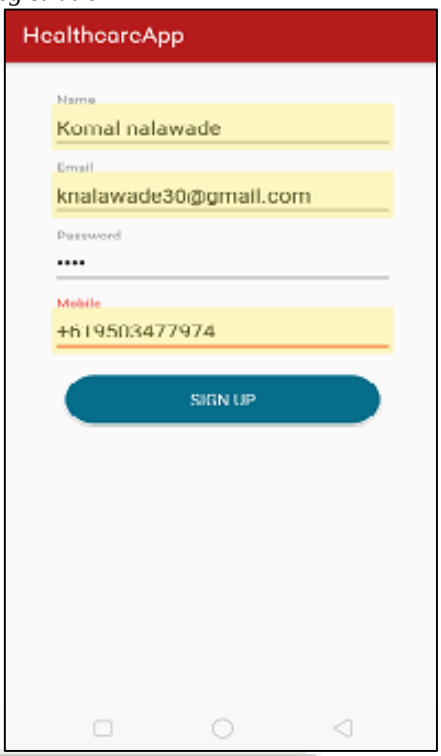
1) User Login



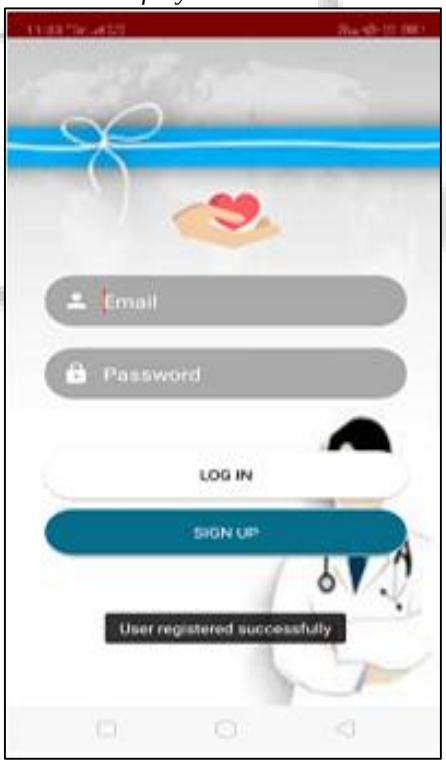
2) User Registration



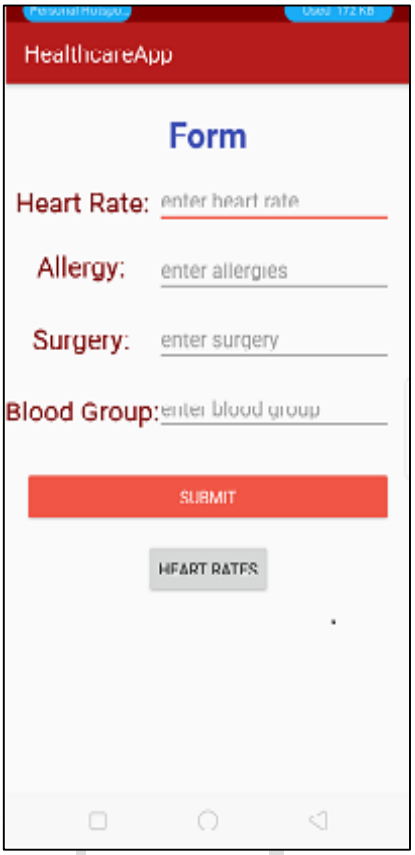
3) Fill Registration



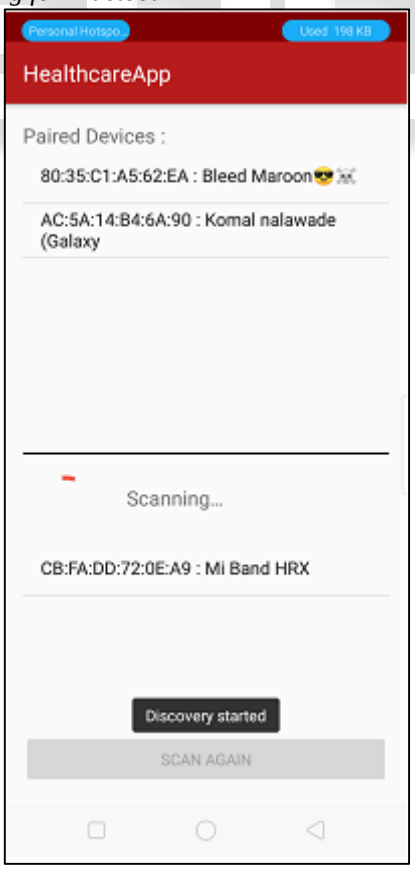
4) Registered Successfully



5) Add Information



6) Scanning for Bluetooth



7) View Form

ACKNOWLEDGMENTS

A mobile application is deployed to collect health data from personal wearable devices, manual input, and medical devices, and synchronize data to the cloud for data sharing with healthcare providers and health insurance companies. To preserve the integrate of health data, within each record, a proof of integrity and validation is permanently retrievable from cloud database and is anchored to the blockchain network.

REFERENCES

[1] L. J. Kish and E. J. Topol, "Unpatients-why patients should own their medical data," Nature biotechnology, vol. 33, no. 9, pp. 921–924, 2015.
[2] X. Liang, S. Shetty, D. Tosh, C. Kamhoua, K. Kwiat, and L. Njilla, "Provchain: A blockchain-based data provenance architecture in cloud environment with enhanced privacy and availability," in International Symposium on Cluster, Cloud and Grid Computing. IEEE/ACM, 2017.
[3] D. K. Tosh, S. Shetty, X. Liang, C. A. Kamhoua, K. A. Kwiat, and L. Njilla, "Security implications of blockchain cloud with analysis of block withholding attack," in Proceedings of the 17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing, ser. CCGrid '17. Piscataway, NJ, USA: IEEE Press, 2017, pp. 458–467. [Online]. Available: https://doi.org/10.1109/CCGRID.2017.111
[4] R. C. Merkle, "Protocols for public key cryptosystems," in Security and Privacy, 1980 IEEE Symposium on, April 1980, pp. 122–122.
[5] T. O. of the National Coordinator for Health IT (ONC), the National Institute for Standards, and T. (NIST), "Use of blockchain in healthcare and research workshop," 2016.
[6] I.Jolliffe. Principal component analysis. Wiley Online Library, 2005.
[7] F. Pukelsheim. The three sigma rule. The American Statistician,48(2):88–91,1994.
[8] G. A. Seber. Multivariate observations, volume 252. Wiley. com, 2009.
[9] Y. Wang, J. Yang, H. Liu, Y. Chen, M. Gruteser, and R. P. Martin.
[10] Sensing vehicle dynamics for determining driver phone use. 2013

