

Possibility for improvement in Namibian health and drug development: eHealth security for fingerprint authentication

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Abstract

Background : Electronic health (eHealth) records an important component of eHealth comprises more than eHealth records such as telemedicine and pharmacovigilance improve the quality of healthcare by making patients' health information easily accessible, thereby improving efficiency and reducing the cost of healthcare service delivery. Fingerprint authentication plays an essential role in the facilitation of eHealth through the fast, secure, accurate, and reliable identification of individuals. However, eHealth faces several security challenges that need to be addressed. This study endeavors to evaluate the system of fingerprint authentication developed by Liquid Inc., and also, to evaluate some literatures reviews were conducted on eHealth focusing on the Namibian situations.

Methods : (1) A test developed by Liquid Inc. was used to evaluate Liquid Engine's system of fingerprint authentication.

(2) Literature reviews were conducted on eHealth focusing on the Namibian situations; the shortage of resources in daily clinical practice as well as clinical trials.

Results : (1) It takes approximately 3 seconds to scan 5 million pieces of data for fingerprint authentication by Liquid Engine, and approximately 1,000 seconds by a competitor.

(2) eHealth information can exist in three states: storage, transmission, and processing.

(3) Methealth Namibia Administrators (Pty) Ltd currently provides administration services to >200,000 people in Namibia and its Health SmartCard is a first of its kind in Africa.

(4) eHealth can compensate for the shortage of medical doctors in Namibia by means of telemedicine enabling emergency medical intervention.

(5) The Namibia Medicines Regulatory Council accepts New Drug Applications (NDAs) for Active Pharmaceutical Ingredients (APIs) using clinical trial data of other countries only; a big issue in terms of drug safety. eHealth can be used for pharmacovigilance to improve such situations.

Conclusion : (1) The proposed Liquid Engine system with its unique patent can contribute to eHealth.

(2) Namibia is an emerging country with great opportunities for remarkable economic growth following improvements in the provision of healthcare, drug development, and related legislation such as Good Clinical Practice.

Key words

electronic health (eHealth), fingerprint authentication, outsourcing offshore

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1. Background

According to the World Health Organization (WHO), electronic health (eHealth) records is the use of information and communication technologies (ICT) for health¹⁾. Telemedicine, defined as the “use of communication networks for delivering healthcare services and medical education from one geographical location to another”²⁾ can improve access to health services, particularly for people in remote areas^{3,4)}, and improve the quality, effectiveness, and outcomes of these services.

eHealth is considered essential for healthcare systems with limited resources that are facing increased demand owing to an ageing population that requires advanced treatments⁵⁾. It is becoming indispensable to medical professionals who require access to vital information in their daily medical practice, and to clinical trials, as time and money can be saved through central monitoring and source document verification without having to visit a number of medical institutions participating in a trial. Telecommunication may also bolster access to care or improve health care quality, effectiveness, and outcomes. Special attention is paid to ways in which delivery systems are reformed and may increase the use of eHealth and telemedicine. However, eHealth faces several security challenges that need to be addressed. Given this backdrop, we

evaluated the system of fingerprint authentication developed by Liquid Inc. to facilitate the use of fingerprint authentication, which plays an important and basic role to identify individuals with speed and accuracy as well as provide trust worthy security.

2. Methods

(1) We utilized a test developed by Liquid Inc. to evaluate the speed of access to Liquid Engine’s fingerprint authentication database (Table 1); (2) We conducted a literature review on eHealth focusing on the Namibian situation including the Biometric Access Control for eHealth records; the website for the Health SmartCard developed by Methealth Namibia Administrators (Pty) Ltd; a newspaper article concerning the grave shortage of medical doctors in Namibia; and regulations for clinical trials found on the Medicines Regulatory Council website.

3. Results

3.1 Results of the test to evaluate the Liquid Engine system of fingerprint authentication

The test revealed that it takes around 3 seconds to scan 5 million pieces of data for fingerprint authentication by Liquid Engine, while a competi-

Table 1 Fingerprint authentication by Liquid Engine and a competitor

<ul style="list-style-type: none"> ● Liquid Engine is a system that is developing biometric authentication technology for large data set analysis. ● According to the general and specific criteria and related software, a model for evaluating Fingerprint authentication registry software was proposed. ● Based on the proposed model, its validity and reliability was evaluated. The evaluation model used Windows 7 SP1 (Professional/Enterprise/Ultimate).
<ul style="list-style-type: none"> ● Common software and hardware used by Liquid Engine and a competitor: Software: OS: Windows 8.1 Hardware: ①Windows Tablet Think Pad 10 (20C1S00U00); ②Fingerprint Scanner (FS88H)

tor takes around 1,000 seconds.

Other points of comparison between Liquid Engine and a competitor are shown in Table 2 and Liquid Engine’s advantages are shown in Fig. 1.

The test conducted on Liquid Engine was validated by experts from Liquid Inc., and can therefore be used as a comprehensive standard evaluation tool for measuring efficiency and effectiveness thereby improving the performance of fingerprint authentication registry software.

3.2 Biometric Access Control for eHealth records

José R. Díaz-Palacios et al. (2013) showed us that biometrics, together with new hardware and software technologies, can address concerns regarding the preservation of privacy with pre-hospital emergency cases⁶⁾ (Fig. 2). Telemedicine would improve mobility and would facilitate the process of scanning a patient’s fingerprint⁶⁾. In promoting eHealth through telemedicine, privacy

Table 2 Comparison of the software/system of Liquid Engine and that of a competitor

	Liquid Engine	Competitor
Card	Fingerprint Only	Card + Fingerprint
Cost	Low (local server + cloud)	High (need to develop the high spec data-center)
data storage	Liquid original data (hard to steal, rebuild)	Raw image data (easy to steal, rebuild)

Fig. 1 Advantages of the Liquid Engine system

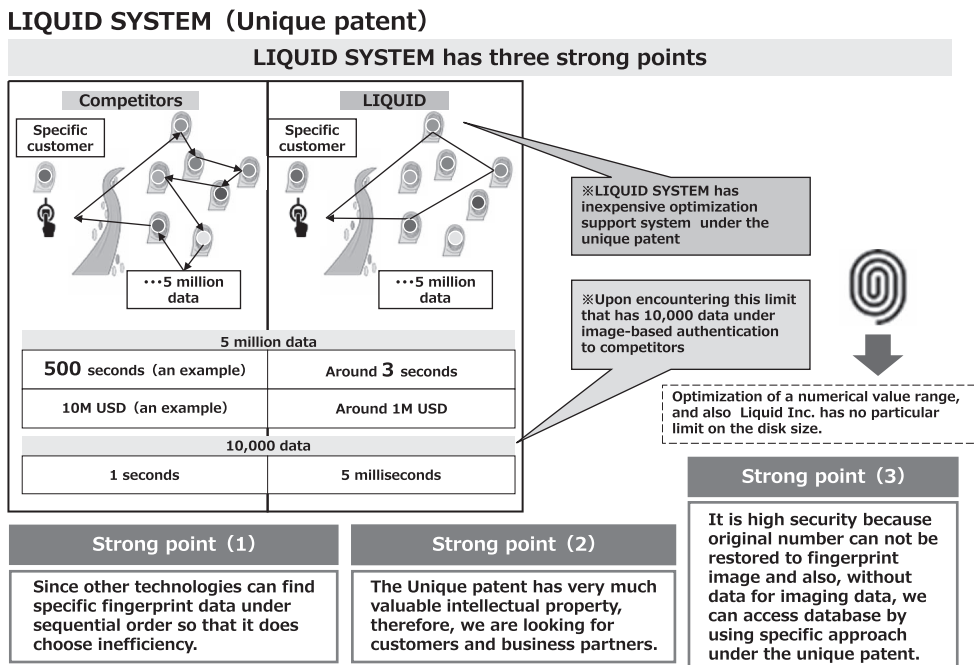


Fig. 2 Security challenges in eHealth by Liquid Inc.

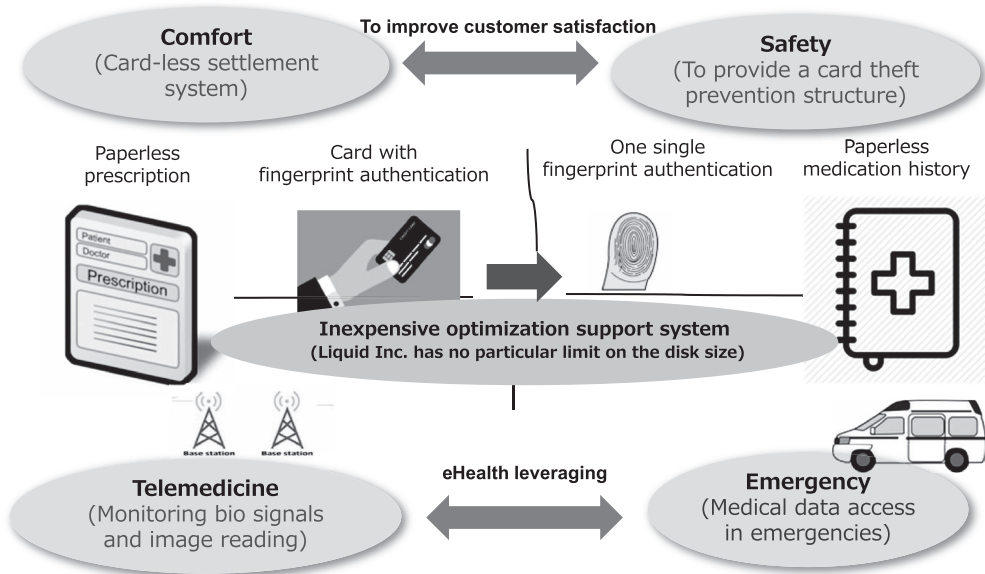
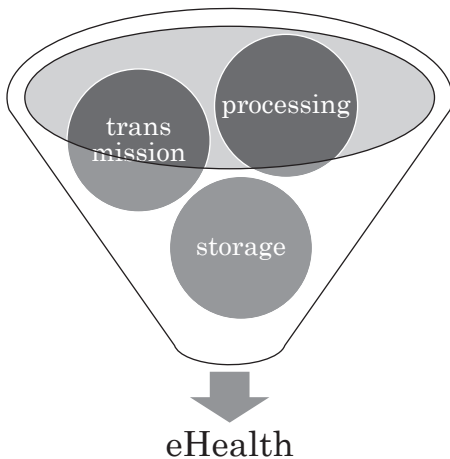


Fig. 3 Concept for eHealth



Additionally, in promoting usage of eHealth in ordinary medical practice, it is important to recognize that eHealth information can exist in three states: storage, transmission, and processing⁶⁾ (Fig. 3). eHealth data are stored in a secure remote location and can be transmitted to clinical practices or to public health institutions. It can be used for central monitoring in clinical trials, as well as in emergency care situations. Information and Communication Technology (ICT) solutions ensure the correct processing of data.

3.3 The Health SmartCard by Methealth

Namibia Administrators (Pty) Ltd, MNA

Methealth Namibia Administrators (Pty) Ltd, (MNA) is an independent Namibian company providing administration and managed health care services to medical aid funds in Namibia. MNA strives to be the medical aid fund administrator of choice and aims to provide affordable, innovative healthcare solutions⁷⁾. The company currently provides administration services to >200,000 individ-

protection is considered one of the fundamental issues. The electronic nature of health information introduces certain vulnerabilities that increase the possibility of security breaches occurring. As shown in Fig. 1, Liquid Engine has the advantage of high security because original numbers cannot be restored to fingerprint images.

uals in Namibia ⁷⁾. Two of the funds that are benefitting from the Health SmartCard, which is first of its kind in Africa, are the Namibia Medical Care Fund (open fund) and Bankmed Namibia Fund (closed fund).

The Health SmartCard is a state-of-the-art biometric fingerprint system; however, the SmartCard has an IC chip which enables registration for a specific finger print ⁷⁾.

3.4 Critical shortage of medical doctors in Namibia

According to the Namibian newspaper, New Era, dated September 24, 2014, there were only four state employed doctors responsible for over 70,000 people. These people were believed to be wholly dependent on state hospitals, as they had no access to private medical schemes ⁸⁾. This translates to an average doctor -patient ratio of one doctor per 1,700 patients and this figure could even be higher when those with no access to private medical assistance in urban areas are included ⁸⁾. This means that patients in outlying areas have to travel

to Windhoek where they can benefit from telemedicine. In emergency cases, telemedicine, along with eHealth, enables us to send clinical data to hospitals prior to the arrival of the ambulance so that the hospital can prepare for the appropriate therapy in advance (Fig. 4).

Thus, eHealth can compensate for the shortage of medical doctors in Namibia through telemedicine which enables emergency medical intervention.

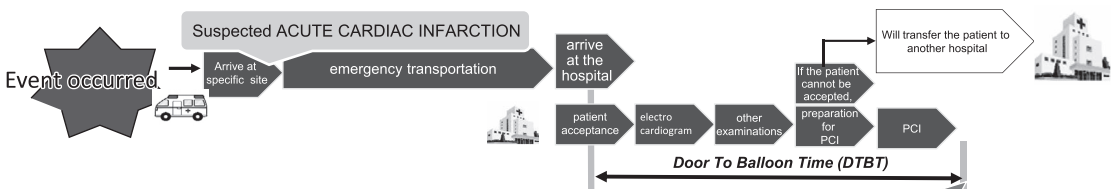
3.5 Big issue with clinical trials in Namibia

At present the Namibia Medicines Regulatory Council accepts New Drug Applications (NDA) for Active Pharmaceutical Ingredients (API) using clinical trial data of other countries only ⁹⁾. This causes huge issues in terms of drug safety. For example, in 2016, a female infant of two years died after receiving a vaccination. Her death is under investigation. It was also revealed that 21 babies countrywide have died since 2006 after receiving certain vaccines ¹⁰⁾. eHealth for pharmacovigilance can be used to avoid such situations.

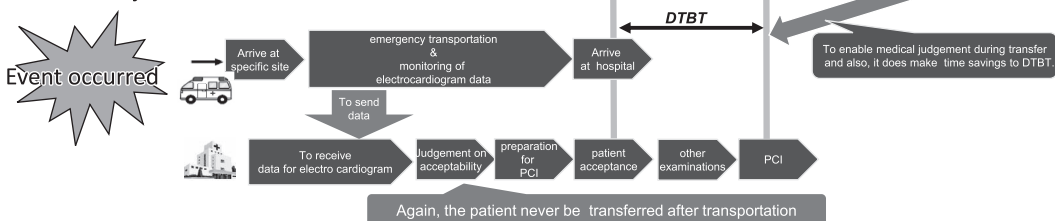
Fig. 4 Application of eHealth for a typical emergency

By using cloud server to 12-lead electrocardiogram, early finding and treatment of ACUTE CARDIAC INFARCTION is possible, which can lead to improvement of the prognosis of the delivered patient.

< Current Situation >



< New system >



eHealth can be used for conducting clinical trials of NDAs, and post-marketing surveys and pharmacovigilance of vaccinations within a legal framework which includes informed patient consent.

4. Discussion

Fingerprint authentication with Liquid Engine developed by Liquid Inc. can help address shortcomings in eHealth security and the Namibian health system. Liquid Engine has a unique patent (Japanese Patent No. 5977899) and the application for an overseas patent has already been submitted. This means that introducing this product to the Namibian market should be simple.

Fingerprint authentication will offer a sense of security and convenience to patients and physicians. However, to remain ahead of the emerging security threats posed by eHealth, healthcare organizations are moving away from traditional approaches to future oriented systems using biometrics technology. Japan has conducted the world's first telemedicine experiments employing WINDS ultra-high-speed internet satellite, nicknamed "KIZUNA,"¹¹⁾ and we are going to conduct an eHealth feasibility study for Namibia and Japan. We must also pay attention to the issue of offshore software development¹²⁾.

Japan will be responsible for developing the core technology and software offshore, but some software development can be done locally in Namibia. This must be made clear beforehand to avoid misunderstandings between the two countries^{11, 12)}.

With regards to the critical issue of NDA and pharmacovigilance in Namibia, we currently have a great opportunity to improve the regulatory framework for pharmaceutical affairs. Namibia will likely establish a new law for the implementa-

tion of clinical trials under Good Clinical Practice¹³⁾. In this event, many new businesses and jobs will be created to monitor clinical trials by emerging private companies, such as the Contract Research Organization (CRO) and Site Management Organization (SMO)¹⁴⁾.

Namibia will have hospitals specializing in the conduct of clinical trials utilizing eHealth emerging technologies. It is expected that Namibia will introduce many cutting-edge innovations from pharmaceutical companies with foreign currency and will learn about pharmaceutical affairs from the Singapore example¹⁵⁾ because Singapore has some similarities with Namibia as follows;

- 1) Namibia has a small population.
- 2) Namibia has a national policy with the e-government.
- 3) Namibia has a lot of naïve patients who do not have any experience in clinical trials.
- 4) Various ethnic groups can be flowed into Namibia from various regions; Angola, Zambia, Zimbabwe, Botswana and South Africa.

Considering these points, Namibia shows great potential to introduce new industries with the slogan "rich country" by using clinical trials.

Therefore further investigation with respect to health improvement and drug development in Namibia is currently in progress at our institute, the University of Namibia.

5. Conclusion

In conclusion, (1) Liquid Engine with its unique patent can contribute to eHealth security through the optimization of a numerical value range without imaging data. This also means it is not necessary to consider the limits of disk sizes.

Liquid Engine can therefore contribute to the optimization of eHealth through its core features

of: storage, transmission, and processing.

(2) Namibia is an emerging country in terms of health improvement as well as drug development, which provides great opportunities for remarkable economic growth along with the establishment of legislation for Good Clinical Practice.

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Conflicts of interest

Liquid Inc. is interested in utilizing the results of our study for possible business development purposes, although financial gain is not directly expected from this study.

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ナミビアにおける保健医療および 新薬開発に関する改革の可能性： 指紋認証システムによる電子医療の個人情報保護

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4) 国立オシャカーテ病院

5) 株式会社Liquid

抄録

背景：電子医療記録は、大変重要な要素（遠隔医療や市販後調査）が含まれており、保健医療の改善の役に立つので、患者の利便性を考慮したアクセスは重要となり、保健医療サービスの効率性や費用の削減に関する改善は課題とされている。指紋認証は電子医療において、迅速、安全、正確で信頼できる個人認証を提供する役割を持っている。しかしながら、電子医療はいくつかの解決すべき課題を抱えている。そこで、この研究では株式会社Liquidが開発した指紋認証システムおよび、ナミビアの現状に関わる電子医療の諸問題を扱っている論文を使い課題の解決を試みた。

方法：(1) 株式会社Liquidが開発した指紋認証システムLiquid Engineの評価。

(2) ナミビアの電子医療の課題に則した文献のレビュー；日常の医療資源の不足や臨床試験の諸問題。

結果：(1) 株式会社Liquidのシステムは500万のデータにアクセスするために3秒から5秒の時間を要するが、他社は1,000秒程度の時間を要する。

(2) 電子医療は3つの重要な相（蓄積、移動、移行措置）を持っている。

(3) Methealth Namibia Administrators (Pty) Ltdは、Health SmartCardをアフリカで最初に導入し、ユーザーの数は20万人を超えている。

(4) 電子医療は、遠隔医療を導入することで、ナミビアの医師不足や救急医療の問題を補うことができる。

(5) ナミビア当局のThe Namibia Medicines Regulatory Councilは、外国の臨床試験データのみで新薬の承認を与えているが、電子医療は薬の安全性や市販後調査の状況を改善することができる。

結論：(1) 株式会社Liquidの特許を保有する指紋認証システムは電子医療に貢献できる。

(2) ナミビアは保健医療や医薬品開発において発展途上の面を持つ国だが、GCPなどに関する法令を整備することで、飛躍的な発展の機会とそれを遂げる可能性を持っている。

キーワード

電子医療, 指紋認証, 海外への外注

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