

A Solution to the Digitization of Healthcare Institutions in Developing Countries

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Abstract

Healthcare institutions in developing countries are facing numerous obstacles in the digitization of patient records. Previous solutions like EHR have had disappointing results as they require more time consumption from healthcare professionals, who prefer to spend this on observing more patients. We propose a technology to assist the doctors in their daily routines and aim to reduce the gap and allow patients to get the care that they need, especially in Government hospitals of developing countries.

Keywords: Healthcare digitization; Digital notepad; Electronic healthcare record; Internet of things

Abbreviations: IOT: Internet of Things; EHR: Electronic Healthcare Record; JWT: Json Web Token; OIDC: Open ID Connect; UID: Unique Identifier

Introduction

Developing countries like India have a rapidly growing population, creating issues to meet the requirements of health institutions. The ratio of doctors versus the patients touches to 1:10189, whereas, the recommended ratio by World Health Organization is 1:1000 [1,2]. This is an issue that requires more than just the employment of doctors, it is vital to make the limited time of each healthcare professional as efficient and valuable as possible.

Recent Electronic Healthcare Record (EHR) solutions have focused on the patient, creating more work for healthcare professionals [3] and hence these systems have not been taken forward. Familiarizing with new software requires time and training for healthcare professionals, which is commonly undesirable. There is an evident demand for an inexpensive and practical system comfortably manageable by them, with minimal technological interaction and emphasis on attending patients. These programs should help them in their daily procedures so that they can attend a greater number of patients with ease.

In the world of digitization, new technology brings new processes; however, we want to prevent creating more workload for healthcare professionals. Nevertheless, patient records need to be safely and easily managed and maintained by physicians. Therefore, the goal of this project is to bring digitization to healthcare institutions without modifying their current operational routines [4].

Observations

Thorough literature research has been conducted, papers published in several databases; including IEEE, NCBI and Science Direct have been analyzed. From the outcomes gathered, a solution is proposed.

Physician issues

A study performed by Stanford Medicine demonstrated satisfaction of two thirds of healthcare professionals, however, problems are regularly reported. A large proportion of healthcare professionals, 69%, believe that their time spent on EHR could have been better used on patients. The study also demonstrates that 62% of their day is spent on office and EHR tasks. Half of them also claim that EHR distracts them from their regular clinical effectiveness [5].

A study at the National Centre of Biotechnology Information US shows how more time was spent on EHR screens compared to paper record and observing patients at clinical encounters. The time spent on looking at the screen during EHR visits was far greater than the paper chart visits. Patient and physician interaction is very important [6].

Another issue which is most common is poor user experience of an EHR application. It drops the productivity of a physician if EHR is not properly designed [7]. In a research it was proved that computer experience influences the attitude of using a health record system greatly. A poorly designed system, constantly pushing notifications will frustrate healthcare professionals and cause them to completely avoid any EHR system [8].

Data breach

There are many cases reported in the past about the data breach from an organization [9]. Data breach can happen from an automated as well as from a manual process. For e.g. Most of the government hospitals in India maintain a paper based patient observation file. Unauthorized personnel can easily read or scan anyone's health history and leak the information.

As many hospitals are going digital, it becomes very important to integrate such system with the existing EHRs where not only medical studies are scanned and saved on the servers but doctors observations as well.

Solution

Digital notepad

With implementation of the digital notepad, healthcare professionals can continue to write their observations and notes on paper. These can be transferred and saved in pdf format to the EHR system with a simple button press, built on the notepad. Through employment of the digital notepad, the healthcare professionals will not have to adapt their

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routines and there will be minimal compromise in bringing digitization to healthcare institutions.

Process description: The aim of this project is to develop a hardware device easily integrable with existing EHR systems, so patient data can be transferred securely. With use of the digital notepad, healthcare professionals can efficiently write and save data on the provided template paper by the hospital and use the stylus as a writing device. The stylus with this notepad does not use any ink, however the notes are live streamed onto the system. This makes the template pages reusable and environmentally considerate (Figure 1).

Authentication with IOT device: Internet of things (IOT) [10] device authenticates the request using open Id connect protocol (OIDC) [11]. EHR application should acquire the JWT token [12] from an identity provider using application id and the secret. The token should be sent with the request to the IOT rest end point [13]. The token will get expire after some time. The expiry time is set by the identity provider. A new token will be re-issued using the same way it was acquired initially.

Modification in EHR application: When the healthcare professional selects the patient they are observing from EHR appointment dashboard, it should send patient UID and the JWT token to a rest endpoint of the IOT device.

IOT device application: A windows 10 IOT core [14] operating system is used to run a C# application [15] in IOT device. This application is responsible for the communication between digital notepad and EHR. The C# application is continuously listening for incoming messages from EHR application. It rejects all the requests which do not contain the JWT token or not coming from a trusted source. The C# application receives the patient UID and starts the session for the patient under examination. The application will create a Bluetooth connection with the digital notepad and start a virtual canvas internally (Figure 2).

As soon as the healthcare professional starts writing on the digital notepad, it passes the X and Y coordinates of the stylus to the IOT device which further draws it on the virtual canvas. The clear button on the notepad can be used to clear the canvas, bringing it back to the initial state and clearing the session.

With the submit button, the IOT device generates the image from the canvas and creates a PDF file. This pushes the data to the EHR system for that patient in a secure HL7 protocol [16] format and clears the session. Pseudo-code is described below in Figure 3.

Ease of Access

The primary objective of this solution is to reduce the technological interaction as much as possible. Reducing interaction with the EHRs will allow the healthcare professionals to prioritize the patient. With a single

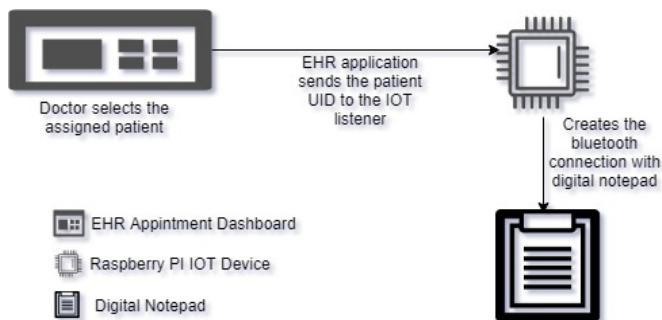


Figure 1: Digital Notepad connection.

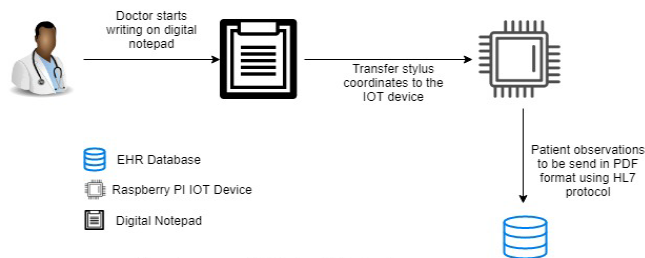


Figure 2: Digital Notepad transfer.

```

In the selected patient UID endpoint
{
    If JWT token is valid
        && request referrer address is trusted
        && patient UID is valid
        Continue;
    else
        Terminate and reject the request
        break;

    -Pair Bluetooth with the digital notepad

    -Register call backs for writing, submit
    and cancel from digital notepad and start a
    canvas screen

    if Data received for writing call-back
        -draw X and Y coordinates on the canvas

    if Submit button call-back received
        -Generate image of the canvas screen
        and convert it into pdf file
        -Send pdf file to EHR database using
        HL7 protocol

    if Cancel button call-back received
        -Clear the session and canvas for the
        current patient and bring it to initial
        state
end
}
    
```

Figure 3: Images of Pseudo-code.

push of a button on the digital notepad, all written patient observations will automatically save on to the EHRs database without any interaction with the computer.

Adaptation

Healthcare professionals do not have to change the way they work currently. Instead of dealing with poor user interface of a data entry form, alerts or performance related issues, they are simply writing on a paper.

Cost

The advantage of this system is that it is very cost effective. The current cost of a motherboard like Raspberry PI is not more than \$10 and the digital notepad is \$50.

This price can be lowered if ordered in bulk. The software development kit (SDK) will be open source which will be used to integrate with the existing EHRs system.

Implementation of security

The EHR generates a JWT token using an Open ID Connect identity provider. It then passes the JWT token to the IOT device, which will

then validate any incoming request. Once validation has taken place, it will also validate the patient UID with an end point provided by the EHR web API, using an HL7 secure protocol. Once the patient UID is validated successfully, it creates a Bluetooth connection with the digital notepad.

Conclusion

There is no doubt about the benefits of an EHR. This research paper focused on identifying issues specifically faced by developing nations and proposing an easy and cost effective solution. Less productivity, poor user experience, lengthy data entry forms are main physician problems which leads to attending fewer patients in an area where doctor patient ration is not even close to the developed countries. Hence make it difficult for these nations to adapt the digitization in the hospitals. With the help of digital notepad this problem can be resolved.

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References

1. Hency T (2019) CSR: India is facing shortage of 6 lakh doctors. The CSR Journal.
2. Mathai N, Shiratudin MF, Sohel F (2017) Electronic health record management: Expectations, issues and challenges. J Health Med Informat 8: 265.
3. MEDHOST Solutions Corp (2014) It's time to meet physicians' concerns about EHRs.
4. How doctors feel about electronic health records. National Physician Poll by the Harris Poll. Stanford Medicine.
5. Asan O, Smith P, Montague E (2014) More screen time, less face time-implications for EHR design. J Eval Clin Pract 20: 896-901.
6. Rizvi RF, Marquard JL, Hultman GM, Adam TJ, Harder KA, et al. (2017) Usability evaluation of electronic health record system around clinical notes usage-an ethnographic study. Appl Clin Inform 8: 1095-1105.
7. Steiner K (2014) Factors Explaining Physicians' Acceptance of Electronic Health Records.
8. The 10 biggest healthcare data breaches of 2019, So Far. Latest health data breaches news.
9. Menachemi N, Collum HT (2011) Benefits and drawbacks of electronic health record systems. Risk Manag Healthc Policy 4: 47-55.
10. Blazona B, Koncar M (2007) HL7 and DICOM based integration of radiology departments with healthcare enterprise information systems. Int J Med Inform 76 Suppl 3: S425-S432.
11. Atzori L, Iera A, Morabito G (2010) The Internet of Things: A survey. Computer Networks 54: 2787-2805.
12. Welcome to OpenID Connect. Available from: openid.net/connect/
13. JSON Web Tokens are an open, industry standard RFC 7519 method for representing claims securely between two parties.
14. Liew Z (2018) Understanding and Using REST APIs.
15. Windows for Internet of Things.
16. C# Guide (2018) by Microsoft.