Mobile Platform for Various Patients Case's Assessment via Telemedicine

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Abstract

Epilepsy is a defect in the transfer of electric badges inside brain cells. In general, this disease appears in childhood or in adults over age 65. However, this disease is called age-related disease because it may appear at any age of the human being. The aims of this paper are providing a completely mobile platform for epilepsy patients for most diagnostic tests normally available in various clinic centres, and making these tests are available to remote populations and rural communities where oncoming to medical clinic centres is hard or hopeless. In this platform, a medical information is available for remote physicians through access to the server that designed for medical information storage and analysis. The platform was designed to help physicians in the operations of any of the obtainable tests, to carry out them efficiently and accurately. This makes a remote physician to provide an expert opinion on a diagnosis and treatment options. To evaluate this platform, if epilepsy patients

used this platform can benefit from the short-term and long-term enhancements in health outcomes as well as the development of these services.

Keywords: Telemedicine; Healthcare Monitoring; Epilepsy Disease.

المستخلص

يمكن تعريف مرض الصرع بأنه خلل في نقل الاشارات الكهربائية داخل خلايا المخ. بشكل عام ، يظهر هذا المرض في مرحلة الطفولة أو البالغين فوق سن 65. ومع ذلك ، يسمى هذا المرض بمرض مرتبط بالعمر لأنه قد يظهر في أي عمر للإنسان. تهدف هذه الورقة إلى توفير منصة متنقلة بالكامل لمرضى الصرع لإجراء معظم الاختبارات التشخيصية المتوفرة عادة في مراكز العيادات المختلفة ، وإتاحة هذه الاختبارات للسكان البعيدين والمجتمعات الريفية حيث تكون مراكز العيادة الطبية قاسية أو ميؤوس منها. في هذا النظام الأساسي ، تتوفر معلومات طبية للأطباء عن بعد من خلال الوصول إلى الخادم المصمم لتخزين المعلومات الطبية وتحليلها. تم تصميم المنصة لمساعدة الأطباء في عمليات أي من الاختبارات التي يمكن الحصول عليها ، لتنفيذها بكفاءة ودقة. هذا يجعل الطبيب عن بعد لتقديم رأي خبير في التشخيص وخيارات العلاج. لتقييم هذه المنصة ، إذا كان مرضى الصرع يستخدمون هذه المنصة ، يمكنهم الاستفادة من التحسينات على المدى القصير والطويل الأجل في النتائج الصحية وكذلك تطوير هذه الخدمات.

1.Introduction

According to the World Health Organization (WHO), about 50 million people worldwide suffer from epilepsy, making it the most widespread neurological disease in the world, with 80% of people with epilepsy living in low- and middle-income countries. The aim of health services is to provide high standards Epilepsy of diverse health of income, sex and health status. Geographical location has a significant role in the ability of rural populations in remote areas to access essential health services. The telehealth

introduced a truth initiatives in the rural area to address these concerns, these platforms utilized electronic telecommunication in order to provide patients data access and physician consultations [1]. These technologies are already needed to medically access with various on-site equipment and physicians into the rural areas to perform the tests. There are different difficulties are facing this technology include accessing specialized medical services from rural community members. Telehealth experiments for epilepsy patients have been implemented. The main objective of this paper is providing most diagnostic tests in a mobile platform, this allowed the platform is available for all rural remotely communities where access is very hard. The role of web server here is storage and analysis the raw important medical information and providing this information of the epilepsy patients to the physicians directly [2]. The platform designed to present a big help for professional's physicians and low-level physicians [3]. This helped physicians to evaluate the medical cases accurately and efficiently in order to patients' gain a correct treatment. This system allowed to gathering a medical raw data, and consultation between physicians on the future trends of patients' cases according to these data of populations and individuals. The platform gate is log in through web page connected to a secure server that designed to store and analyze the raw data continuously and displaying major amounts of information [4]. The platform was developed to be able to give advance warning of health failures through continuous analysis of medical patient data. The platform was developed to be able to give advance warning of health failures through continuous

analysis of medical patient data over time. This has helped to give an ideal assessment of patients with epilepsy and chronic diseases [5]. The continuous patients monitoring will lead to present future medical plans according to the ongoing changes in test outcomes of the patients. The rest of paper consists of discussing the main portable unit related to the patient that connected with the WSN directly, the system of remote access and its functionality, and the objectives of the proposed of epilepsy patients telemonitoring. Finally, the discussion and results. Fig.(1), show the infrastructure of a mobile monitoring system for epilepsy patients[6][7].

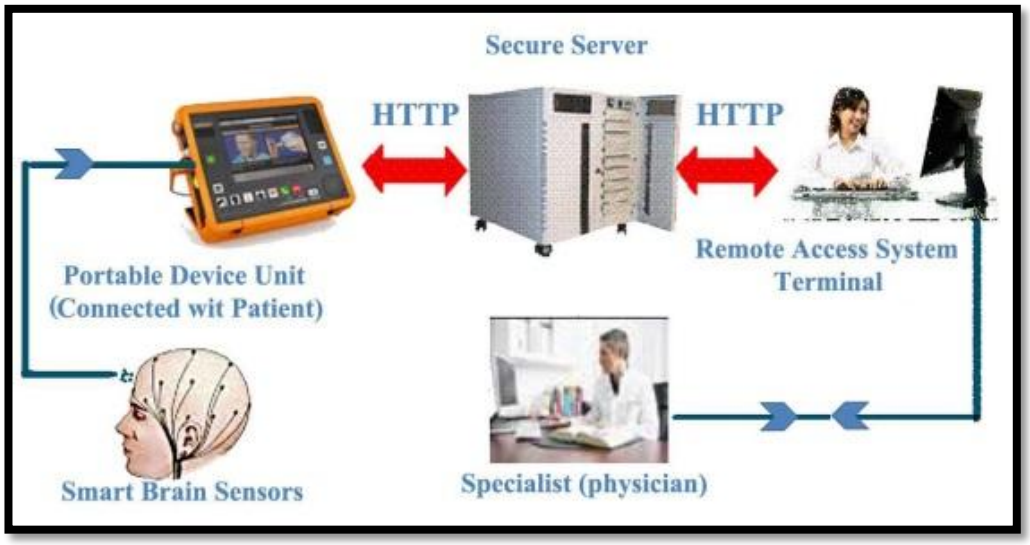

Fig.(1) Infrastructure of Mobile Monitoring system for epilepsy patients

2.Related Works

Many related works are introduced in the field of remote patients monitoring, and below refer to some articles here without full mention of some of the related work on healthcare monitoring via telemedicine:

- In 2014[8], Ayman M. Eldeib introduced an ITS (Interactive Telemedicine Solution) to automate and facilitate the

communication within the facility of healthcare through Protocol VOIP (Voice over Internet), uniform mobile phones, and Wi-Fi connectivity.

- In 2015 [9] , Z. Rebolledo Nandi, A. Chavez-Olivera, R. E. Cuevas-Valencia, A. Alarcon-Paredes, G. A. Alonso proposed a novel low cost mobile health care monitoring system was presented. The prototype is able to acquire ECG, blood pressure, SaO2 and temperature signals and show them graphically in an Android device without the impediment of the users to perform their daily normal activities.
- In 2016 [10], Matthias Gors, Michael Albert, Kai Schwedhelm, Christian Herrmann, and Klaus Schilling presented a generic and extendable telematics infrastructure offering flexible and mobile telemedicine for patients. The system offers a highly flexible and mobile telemedical support for patients.
- In 2016 [11], Anu Banerjee , R.A.Ramanujan and Saligrama Agnihothri present explains the development and implementation of a mobile ambulatory blood pressure monitoring technique in a Diabetes and Hypertension Clinic. In 2016[12] , J. R. Cuevas, E. L. Dominguez and Y. H. Velazquez Proposed the analysis, design and implementation of a telemonitoring system, to carry out a continuous control and remote monitoring of patients with CKD undergo a Peritoneal Dialysis (PD) treatment.

3. Telemedicine Environment

Telemedicine is a delivery of healthcare and telemedicine, such as, medical evaluation, physician advice and providing a necessary treatment for various medical conditions without visiting the patient. There are various types of telemedicine can be summarized as follows [13]:

3.1 Remote patient monitoring

Permits to monitor chronic patients remotely through home using portable medical devices that collect data from patients directly, and pass this data to the physicians immediately [14].

3.2 Storage-and-forward

It is also called asynchronous telemedicine, this type permits the providers to share the patient's data with a physician in another location, such as lab outcomes [15].

3.3 Interactive telemedicine

These type permits communicate real time between physicians and patients, this session can be achieved at patient home or at office via video conferencing software [16].

4. Patient Remotely Surveillance

Patient Remotely Surveillance (PRS) is a technology that enables to patients surveillance outside of classical clinical settings, which may reduce the cost of healthcare delivery and increased access [17]. PRS can significantly improve a life quality of the individual. PRS can be delivered through home and office, in addition, a patient family feels a comfort if the patient receives treatment near them [18]. The main feature of PRS is patient surveillance along time and analysis of physiological parameters

in order to early detection of deterioration. In the healthcare sector, the urgent need for wireless mobility is essential in order to save time and permit healthcare suppliers to assign more time to remotely educate and communicate with patients in the rural and remote areas[19][20].

When the Patient Remotely Surveillance by using monitoring tools such as wearable sensors and communication equipment, the recorded data for every patient is very significant for physicians to a proper diagnosis of the actual condition of the patients. This is the important concept of the healthcare system [21][22]. The patient is monitored remotely through a multimedia interface connected to a server managed by a specialized or staff. This interface is represented shown in fig(2) and the fig.(3), show the details of Epilepsy patients record through medical diagnosis[23].

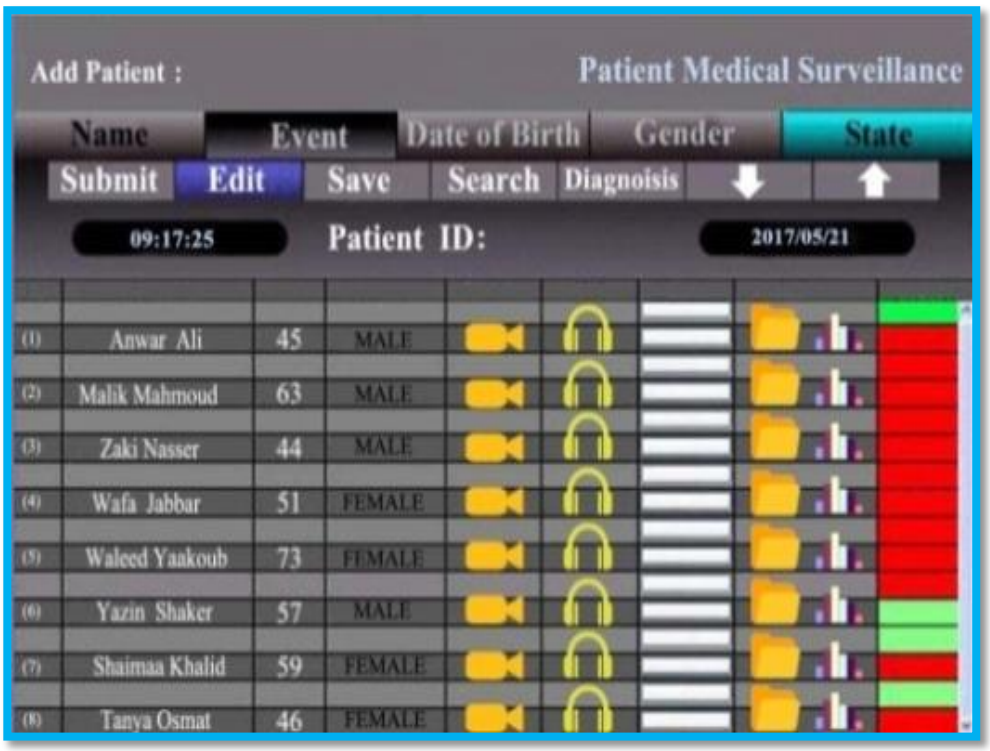

Fig. (2) Patient Remotely Monitoring Interface

EEG Record in Epilepsy : Patient	
Convulsion : Full Loss	Temperature : 35.5
Blood Sugar : (mmHg) : 120 / 80	Scum : Normal
Involuntary Movements : Random	Last Update : 20/8/2017

Fig. (3) Epilepsy Patients Record

5. Proposed System Components

The proposed system in this article consists of two main parts:

a. The mobile part (directly related to the patient)

b. Transmitter / Receiving remotely part

5.1. The Mobile Part:

The proposed acquisition system consists of an EEG, several electrodes (sensor coils) placed on the scalp (or caps or nets where poles are placed), to record the automatic electrical activity of the brain over a period of time. The electrical activity is captured by electrodes placed at specific points on the head, where the activity is multiplied by about one million times via an electronic system containing the EEG device. These electrical activities are documented as a waves form with a variable frequency on the paper of the device, or data can be stored immediately in the computer memory for the purpose of sending them respectively to the remote transmitter to the medical server on the other side. During the examination, brain performance is tested during sleep, as well as in different situations and settings for the purpose of assessing his or her health and assessing the degree of epilepsy. The number of waves per second in the test

is as follows: Delta–less than 4, 4–7, Alpha–8–12, and beta–more than 13 waves per second. The number of waves in this test relates to the patient's age and consciousness. All data are transmitted via a wireless network through mobile device or smartphone. The connect between medical web server and remote access system is based totally on encrypted protocol.

An android application is developed to help physicians and local health practitioners to gain an important patients information such as, images, phone numbers, sex, ID and etc., and then, guide the patients to a different test requested by remote physician. The voice recording is another tool presented by mobile phones to physician and patients in order to receive patients the appropriate treatment.

In order to ensure the access of EEG signal rapidly and short time, there is a compression algorithm are applied to be capable of dealing with the limitations of networks in order to transmit EEG signals to the remote patient's file and analyzed by Neurologist. Mobile phones or smartphone can be used to send/receive a copy of the prescription that can then be filled by physicians.

5.2. Transmitter / Receiving remotely

The transmitter and receiving remotely is both multimedia interfaces in both patient's side and server side. It is the backbone of the platform. It is responsible for information update, information authentication and saving biometric data through secure databases. This system consists of subsystems connected directly with the secured server, are EEG Information System, Images archiving, rapidly communication system,

electrodes (sensor coils) and procedure management system. This system was developed to be applied in remote areas. This system must be integrated to be compatible with various wireless sensor networks and in order to access the patient's files, a web interface was implemented.

The transmit/receive interface of remote access system supply a management interface of portable device unit user in case it is lost or stolen.

6. Telemedicine Monitoring Systems Components

In general, telemedicine systems consist of the following components:

1. Accessing directly to the system from a remote location in order to:
   a. Remote Programming using native programming tools.
   b. Remote Diagnostics.
   c. Troubleshoot equipment from anywhere
2. Accessing data from a distant site in order to:
   a. Data Collection.
   b. Data Visualization.
3. Event notification and response in order to :
   a. View/Acknowledge.
   b. Patients History, full access to patient's records.
4. Monitoring remote automation systems in order to :
   a. User Monitoring.
   b. System Monitoring.

The system permits to logged remotely to access the system details and monitor historical data for each patient and decide

what is the next course of action. After patients' data are displayed, the system permits to draw this data. Then, the remote specialist physicians can communicate with the local healthcare practitioner and therapists through the multimedia interface using the voice, images and video communication capabilities of the system.

The system has certain parameters used as a hazard signals for the patient will be used to trigger alarms. These parameters do not take into account all the information collected by the system and its growth over time. The first step in patient evaluation is setting alarms to help physicians to concentrate on patients with the serious conditions. In order to continuously analyze the patient's data, a new algorithm was developed to help the physicians to responsive emergencies to assist patients in efficient and accurate diagnostic.

7. Medical Evaluation of the Proposed System

The medical evaluation of the proposed system is determined through long-term improvements to patients, which appear during results. There is a sample of questions must be answered by patients to evaluate the system medically:

- The First query: Is the system are strong, sufficient, accuracy and easy to use?
- The Second query: Can the data be filtered according to analyzed it?
- The Third query: How often have the physician visited his patients? Have these visits been reduced?
- The Fourth query: Can the system continuously monitor epilepsy patients in rural and remote areas?

- The Fifth query: Can the system decrease the readmission of the EEG patients?
- The Sixth query: Can the system minimize the cost of healthcare in the rural and remote areas?

8. Conclusion

In this paper, providing a portable telemedicine platform for epilepsy disease was presented. This platform is almost available for all people in the rural and remote areas. This system proved a transmitted data is secure, accuracy in transmission and receiving between the patient portable unit and medical web server. The proposed system is available in everywhere and time. The system can be is applied to healthy volunteers who do not suffer from epilepsy to know how the system runs and how it works. The results of system using are compared with the results of using standard health care. Based on above, the system is evaluated according to the results and will provide the necessary assistance to determine the criteria for the optimal use of this system.

9. Recommendation

To ensure the success, it is recommended to apply system gradually to remote, rural areas and to work out a questionnaire to the results of its application to patients with epilepsy, from simple cases to advanced cases.

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