



Android Application for Epilepsy Detection and Monitoring

Dalia Nashat*, G. Z. Khalifa, M. G. Mohamed, N. Abd Alraheem

Mathematics Department, Assiut University,
Egypt

Abstract— Over 50 million people worldwide have epilepsy, and nearly 90% of epilepsy occurs in developing countries. 30% of people with epilepsy have seizures that can cause brain damage and death. First aid and immediately help are very important in epileptic seizures. Unfortunately, epileptic seizures cannot be completely controlled by medication or surgery. The current detection devices for epileptic seizures are not integrated system to cover all patient requirements. Moreover, these devices are expensive. Therefore, a more sensitive and integrated detection system is highly desirable for the efficient detection of epileptic seizures. In this work, we propose an integrated android application that provides early detection of epileptic seizures, patient localization, tracking and monitoring services with health aid. The proposed system based on monitoring body activity (i.e. movement) with GPS (Global Position System) in mobile phone. Once epileptic seizures occurs, the proposed application alerts patient's caregivers with his status and GPS position. Moreover, the proposed application appears some information for first health aid on the system screen.

Keywords— Epilepsy, Android Application, GPS, Monitoring, Localization

I. INTRODUCTION

Epilepsy is a disorder in which nerve cell activity in the brain is disturbed, causing repeated seizures over time [1-2]. Epilepsy symptoms vary depending on the type of seizure. Seizure may cause confusion, a staring spell, uncontrollable jerking movements of the arms and legs and loss of consciousness or awareness [3].

In common type of seizure, the patient loses consciousness and usually collapses. The loss of consciousness is followed by generalized body stiffening (called the "tonic" phase of the seizure) for 30 to 60 seconds, then by violent jerking (the "clonic" phase) for 30 to 60 seconds, after which the patient goes into a deep sleep (the "postictal" or after-seizure phase). During grand-mal seizures, injuries and accidents may occur, such as tongue biting and urinary incontinence [4].

While medications and other treatments help many people of all ages who live with epilepsy, 25% of the world's (50 million people) continue to have seizures that can severely limit their school achievements, employment prospects and participation in all of life's experiences. It strikes most often among the very young and the very old, although anyone can develop epilepsy at any age [5-6]. The first aid and immediately help are very important in a seizure time. The earlier the detection and treatment we do, the better prognosis and health patients have [7].

In this work, we propose an integrated android application that provides early detection of epileptic seizures, patient localization, tracking and monitoring services with health aid. The proposed application based on monitoring body activity (i.e. movement), GPS (Global Position System) in mobile phone. Once epileptic seizures occurs, the proposed application alerts patient's career with his status and GPS position. Moreover, the proposed application appears some information for first health aid on the mobile screen.

In this study we propose an integrated detection android application for epilepsy patients that provide:

1. Sensitive and early detection of epileptic seizures.
 - Based on monitoring body activity.
2. Patient localization and tracking.
 - Using GPS to know the exact location of the patient.
3. Health aid.
 - Alerts patient's career with his status and GPS position.
 - Give alarm for surrounded people during seizure.
 - Appear some information for first health aid on the system screen.

The reminder of this paper is organized as follows. Section 2 introduces the related work of our scheme. Section 3 describes our detection scheme in detail. Section 4 provides the related performance evaluation. And finally, Section 6 concludes this paper.

II. RELATED WORK

There are few detection devices available for epileptic seizures such as devices that attached to the bed or mattress, devices that can be worn that detect if a person falls over and Epilepsy Detect device which provided SMS signalling

with GPS location [8-13]. All these devices are not integrated to cover all patient requirements and introduce the immediately aid for epilepsy patients.

SAMi [14] is a sleep activity monitor watch carefully for unusual activity at night and send video information to iOS device such as an iPhone or iPod Touch. The SAMi app records and analyzes the video for unusual activity. When an unusual event is detected, it sounds an alarm and records live audio and video from the SAMi network camera.

Other detection devices such as SmartWatch and Embrace [15-16] detect abnormal movement and issues text and phone call alerts to designated contacts, such as caregivers and family members. Text messages and phone calls can be sent to multiple caregivers at the same time. The call Alerts include the physical location of patient according to the GPS. The main disadvantage of these devices that they are not compatible with all mobile systems to send phone call alerts. For example, SmartWatch is compatible with Samsung Galaxy, HTC, LG and Nexus. Moreover, their prices are relatively expensive, so it is not suitable all patients. Also, they need activation fee and monthly subscription.

III. THE PROPOSED APPLICATION

To have a full understanding of the importance of the proposed application to epilepsy patients in Arabic countries, we designed a questionnaire in Arabic as shown in Fig. 1. This questionnaire was uploaded on estebyan website [17]. Also this questionnaire was distributed between 50 persons in Egypt to know their opinion about our proposed application.

السؤال	نعم	لا	الى حد ما
1 هل تجد استخدام تطبيقات المحمول؟			
2 هل تهتمك تطبيقات المحمول؟			
3 هل تجد في تطبيقات المحمول سهوله في الاستخدام؟			
4 هل تعرف كيفية التعامل مع مريض الصرع؟			
5 هل تعرف مدى خطورة مرضى الصرع وانها قد تؤدي الى الوفاة؟			
6 هل يمكنك التمييز بين نوبة مرضى الصرع واي نوبة مرض اخرى؟			
7 هل تعرضت في حياتك اليوميه لمقابلة مريض صرع اثناء نوبته ولم تتمكن من انقاذه؟			
8 هل تعرف الاسعافات الاولييه لنوبة الصرع؟			
9 في ضوء معرفتك... هل يوجد تطبيق هاتفي يساعد مريض الصرع اثناء نوبته؟			
10 هل من المفيد وجود تطبيق هاتفي يساعد مريض الصرع اثناء نوبته؟			

Fig. 1 The questionnaire which uploaded on estebyan website [17].

The main idea of our proposed application is to first detect epileptic seizure based on the patient body vibration and give the patient chance to cancel this detection if there is no seizure (e.g. if patient in activity and forget to stop the application). Then, the application specifies the patient location based on GPS and alerts patient's caregivers with his status and location by text message. Finally, the necessary first aid for the patient will appear on the mobile screen with alarm to notify surrounded people to help him.

When the application used by the patient for the first time, he specifies the following information:

1. Three caregivers (i.e. their names and phone numbers).
2. Help message that will be sent to caregivers (e.g. I have seizure).
3. The suitable first aid for his case, it is recommended to fill by his specialist doctor.

The present application was implemented on android operating system which based on the Linux kernel and developed by Google. Android is designed for touch screen mobiles such as smart phones and tablet computers. The advantage of this operating system is providing access to a wide range of useful libraries and tools that can be used to build rich applications [18].

This application is conducted using the following software:

A. Eclipse

Eclipse is an integrated development environment (IDE) comprising a base workspace and an extensible plug-in system for customizing the environment. It is written mostly in Java. It can be used to develop applications in Java. Eclipse is used to provide the application with the required environment for programming by installing the required platforms.

B. SQLite

It is the most widely deployed database engine, as it is used today by several widespread browsers, operating systems, and embedded systems, among others. SQLite program used to add and create databases.

C. SDK

The eclipse SDK includes the Java development tools for Java developers. Users can extend its abilities by installing plug-ins written for the Eclipse Platform, such as development toolkits for other programming languages, and can write and contribute their own plug-in modules.

IV. RESULTS

We first analyzed the questionnaire results to know the importance of our proposed application as shown in Fig. 2. This figure clarify that more than 90% cannot deal with epileptic seizure and more than 70% confirm that this application will help epilepsy patient during seizure.

Fig. 3 shows the home screen of our application that will appear for first time user. User should write his name and his password and his mail for first time and presses submit. All these information will save in the database of the application using SQLite. After this step user move to the next screen as shown in Fig. 4 which allows user to sign in to the application according to user name and password. This screen also can give all required information about using application from Help button. Also, user can rest his password from Reset button and the new password will send to his register mail.

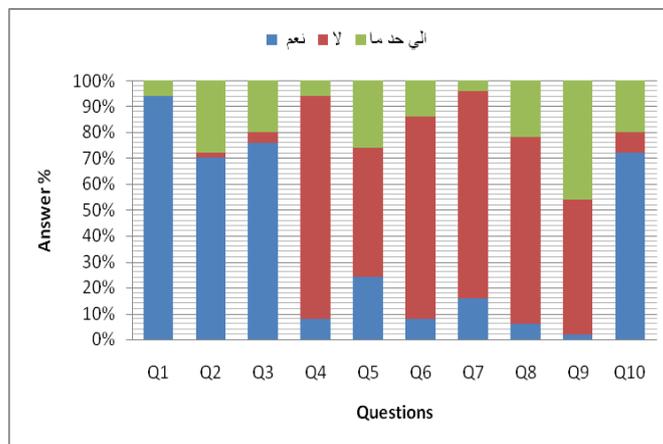


Fig. 2 The questionnaire answers analysis



Fig. 3 Home screen

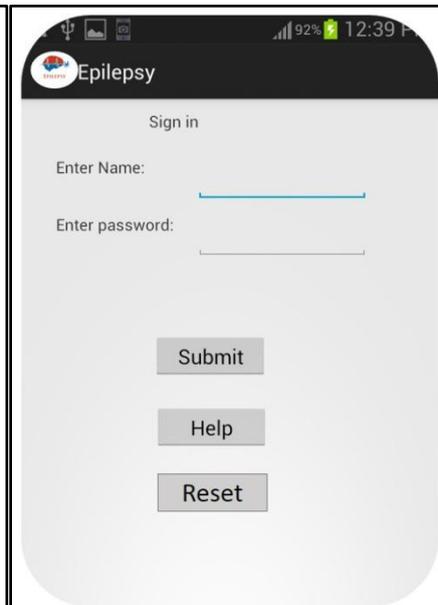


Fig. 4 Sign in screen

After signing in, user will fill required information for his caregivers as shown in Fig. 5. AddMember button specify name, phone number and message that will be sent during seizure for each caregivers. Using this button user can add at most three caregivers and his suitable first aid (it can be written by Arabic or English) from first aid button as shown in Fig. 6. From View and Delete button, user can view, modify or delete related information for each caregiver. Edit Message button allows user to modify his alert message at any time.

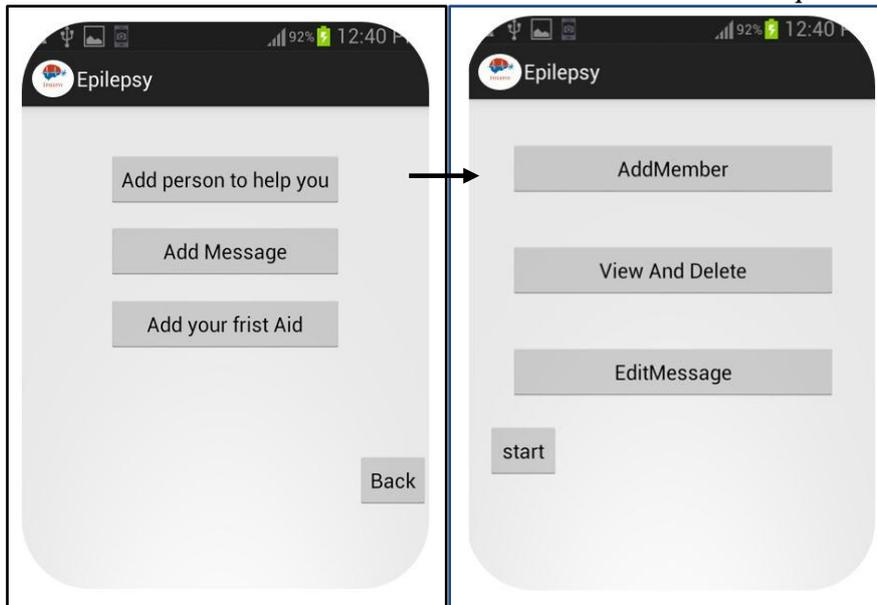


Fig. 5 caregivers screen

Fig 6 Add Member

After user completed the previous steps, the application can be started from start button. When epileptic seizure occurs at any time, the application give alarm to surround to help the patient and the first aid will appear on the mobile screen at the same time as shown in Fig. 7. As mentioned before user can cancel false alarm (e.g. during activity) from Dismiss button. Also, SMS contains the patient's location and help message will be sent to his caregivers.

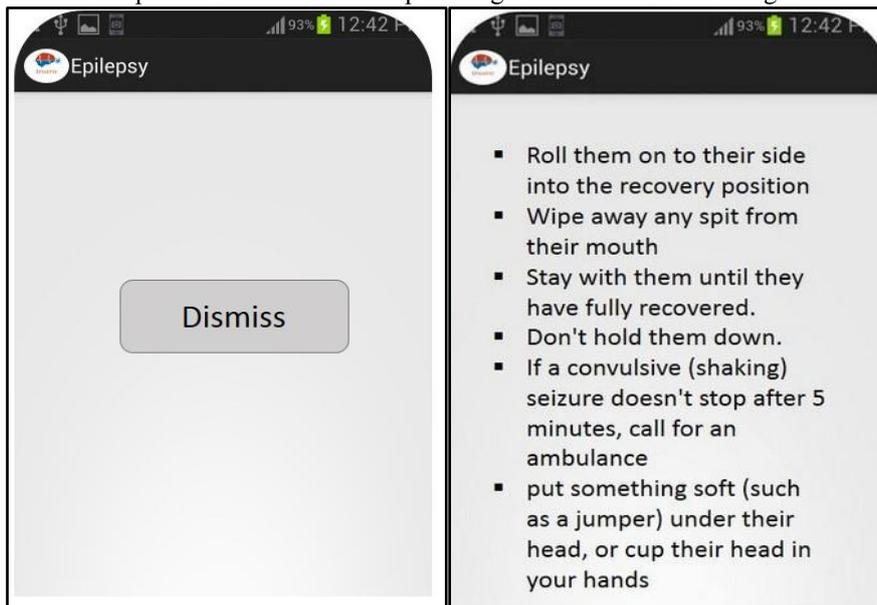


Fig. 7 Dismiss and first aid screen

V. CONCLUSIONS

This work introduces simple and practical android application for detection epileptic seizure, specifying patient's location and introducing health aid. The proposed application provides early detection of epileptic seizures, patient localization, tracking and monitoring services with health aid. Once epileptic seizures occurs, the proposed application alerts patient's caregivers with his status and GPS location. Moreover, the application appear some information for first health aid on the mobile screen. Especially for senior care and patients who do face a risk, we expect people, who install this application on their mobile phones, would have more effective care and help from others. It can be rapidly deployed in any outdoor environment.

We plan to further improve our application on the future by making it able to call the nearest specialist hospital during seizure based on patient's location. Moreover, we will enhance our idea to design integrated device that can detect seizure based on movement, temperature and also blood pressure.

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