Far East Journal of Electronics and Communications

http://www.pphmj.com
http://dx.doi.org/10.17654/EC017061553
Volume 17, Number 6, 2017, Pages 1553-1560 **ISSN: 0973-7006**

STROKE999 FOR QUICK STROKE SCREENING

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Abstract

Stroke is the third leading cause of death and primary cause of disabilities in Malaysia. Previous researches focused on creating stroke awareness. In this paper, Stroke999 mobile application is developed to perform a quick stroke screening for the public. The stroke screening scorecard was adopted from the national stroke association Malaysia (NASAM). Any user will be assessed according to its stroke risk factors such as blood pressure, atrial fibrillation, smoking, cholesterol level, diabetes, exercise, diet and family medical history. The mobile application then can automatically classify user's stroke risk factors under the categories of 'high', 'caution' or 'low' risks. The empirical results show that most respondents agree that it is user friendly, easy to use, good quality contents and it can be accessed at anytime and anywhere with any smartphones. Indeed, Stroke999 application is a useful tool to perform stroke self-screening for all users.

1. Introduction

Stroke is a sudden attack to the brain. It happens when the blood flow to

Received: June 21, 2017; Accepted: June 30, 2017
Keywords and phrases: stroke screening, risk factors, stroke risk classification.
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the brain is disrupted or when the blood vessel in the brain bursts and the blood spilled into the spaces in the brain cells [1]. The function of the brain as the nerve centre of the body is to control everything we do or think, including all the automatic functions like breathing. In order to work, the brain needs a constant blood flow which carries vital oxygen and nutrients to all the parts of the body. The moment when a blood vessel in the brain bursts or gets clogged, the blood flow stops and the brain cells get deprived of oxygen and nutrients. Stroke has emerged as the third leading cause of death in Malaysia [2]. It is the leading cause of adult permanent disabilities around the world. However, prospective studies on stroke in Malaysia are limited. To date, neither the occurrence of stroke nor its incidence has been recorded nationally. Although stroke is often viewed as a disease of the elderly, it affects younger individuals too. The average age of stroke patients in Malaysia is between 54.5 and 62.6 years [3].

There is a need for more stroke education with emphasis on adequate information about stroke risk factors to prevent stroke so that they can act promptly and appropriately by seeking immediate medical attention [4]. Notice that smartphones are rapidly gaining popularity in the medical healthcare [5-7]. *Stroke*999 android mobile application will help to assess our risk of having a stroke and it will classify stroke risks into three categories: high, caution and low risks. The benefits of using smartphones include portability, easy accessibility and location sensing frameworks that use a global positioning system (GPS) [8].

Our contribution comes from the auto-classification of stroke risk categories according to the NASAM stroke risk scorecard [9]. Based on our literature study, there is no mobile application which can classify our stroke risk category and direct the patients to the nearest hospital in Malaysia. Therefore, our aim is to explore the use of smartphone in performing the assessment of stroke risk factors with the hope to achieve the reduction of stroke cases in Malaysia.

The remaining of the paper is organized as follows: Section 2 is the literature review. Section 3 describes the proposed system architecture of

Stroke999. Section 4 discusses the results and findings. Lastly, Section 5 describes the conclusion and scope of future work.

2. Literature Review

Stroke can be categorized into two groups which are ischemic stroke and hemorrhagic stroke. Table 1 shows the stroke risk scorecard that is adapted from national stroke association. It is an easy tool that can determine a person's stroke risk [2]. The risk factors of stroke are blood pressure, atrial fibrillation, cholesterol, diabetes, smoking, overweight, exercise and family medical history:

(1) Blood pressure

A reading of 140/90 (mm/Hg) or greater is classified as high blood pressure. When blood pushes too vigorously beside the walls of the arteries, it can weaken them and eventually leads to a stroke.

(2) Cholesterol

Excess cholesterol level that is greater than 6.2 (mmol/l) contributes to plaque build-up in arteries, which can block blood flow to the brain and cause stroke.

(3) Diabetes

People with diabetes face a much greater likelihood of stroke because they often have other health problems and stroke risk factors, including high blood pressure, high cholesterol and heart disease.

(4) Atrial fibrillation

Atrial fibrillation is an irregular heartbeat where the heart's two upper chambers beat fast and unpredictably, which allows blood to pool in the heart. This situation can form blood clot and cause a stroke.

(5) Smoking or tobacco use

The habit of smoking will lower the oxygen levels in the blood, forcing the heart to pump the blood harder and blood clot can form easily. According to the national stroke association, smokers have twice the risk of stroke as non-smokers.

(6) Overweight or obesity

Being overweight or body mass index (BMI) = (27.5 to 29.9) along with sedentary and no physical activity increases the chances of high blood pressure or diabetes.

(7) Exercise

Being a couch potato and sedentary life will raise the risk of getting stroke.

(8) Family history

The chance of getting stroke is higher when a person's family member has had a stroke or had a heart attack at an early age.

Table 1. Stroke risk scorecard

3. Proposed System Architecture

The system architecture of Stroke999 is depicted in Figure 1. It comprises of basic stroke information, FAST method, risk factors of stroke and preset emergency numbers. The core functionality of *Stroke*999 would be the self-screening, classifying stroke risk and the real time information of the nearby hospitals with stroke unit. These tap functions help Malaysians to perform regular self-checks on the stroke risk.

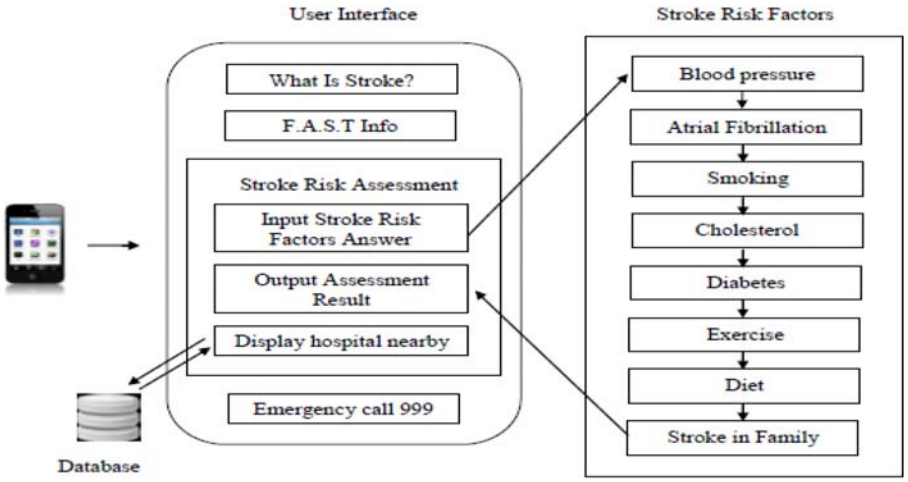


Figure 1. Proposed Stroke999 system architecture.

The self-screening comprises of the following items as shown in Figures 2(a)-(c).

The *Stroke*999 mobile application consists of various components which allow the users to choose based on their desired interest and needs. Figure 2(a) shows the screenshots for Stroke999 mobile application. The main page in Figure 2(b) consists of 6 main functions: (1) What is stroke? (2) Get information about FAST. (3) Get to know our risk of stroke. (4) Get information nearby hospitals. (5) Emergency call 999 and (6) Exit. Figure 2(c) describes the FAST method: warning signs of stroke such as having a crooked smile (F), weakness on the arms (A), slurred speech (S) and time to act quickly (T). The function “get to know you risk of stroke” consists of 8

important questions for the user to choose the answer based on their current health performance, living style and family history. The system will calculate the result and classify users into high risk, caution or low risk categories in terms of stroke. If the users are classified as high risk and caution, then are directed to the nearest hospital with stroke care.

(a) (b) (c)

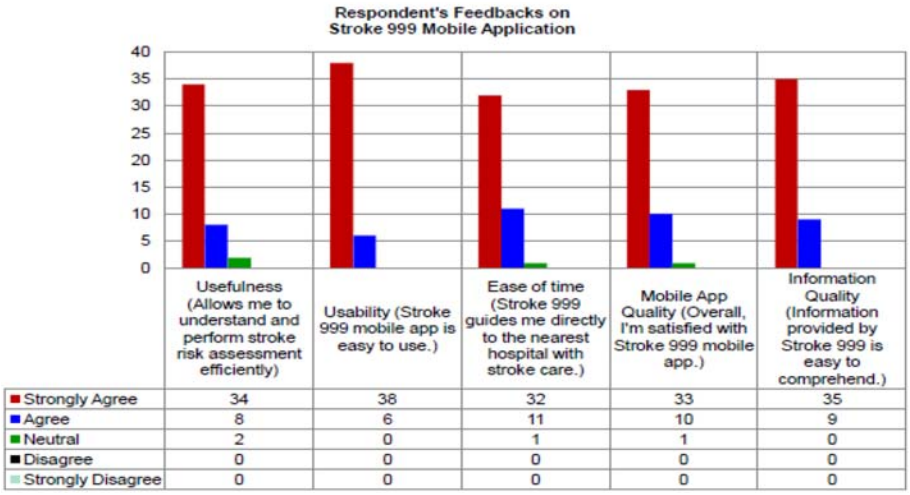
Figure 2. (a) Stroke999. (b) Main page. (c) FAST method.

4. Results

The system performance testing was conducted on 44 respondents from age between 18 and 51. The main objective of the experiment is to evaluate the system performance and to measure user's perception and acceptance level of *Stroke*999 mobile application. The respondents for the system performance testing were targeted amongst two different groups, which include the experts and 40 random respondents from different backgrounds as listed below:

Prior to the usage of *Stroke*999 mobile application, a short briefing was given to the respondents in order to ensure they understand the aim of the system testing as well as the respective functionalities in *Stroke*999 mobile application. The respondents will subsequently rate their user' experiences in

the designed questionnaires upon completion of the system performance testing. The results of the user acceptance testing are as shown in Figure 3.



	Usefulness (Allows me to understand and perform stroke risk assessment efficiently)	Usability (Stroke 999 mobile app is easy to use.)	Ease of time (Stroke 999 guides me directly to the nearest hospital with stroke care.)	Mobile App Quality (Overall, I'm satisfied with Stroke 999 mobile app.)	Information Quality (Information provided by Stroke 999 is easy to comprehend.)
Strongly Agree	34	38	32	33	35
Agree	8	6	11	10	9
Neutral	2	0	1	1	0
Disagree	0	0	0	0	0
Strongly Disagree	0	0	0	0	0

Figure 3. Stroke999 system evaluation results.

It was observed that a majority of the respondents agreed that *Stroke*999 mobile application allows them to understand and perform stroke risk assessment efficiently. Moreover, 86% respondents strongly agree (38/44 respondents) that Stroke999 mobile application is easy to use. Approximately 80% of the respondents claimed that the Stroke999 application provides quality information on stroke. Therefore, it can be concluded that Stroke999 application is a very useful to help the general public to perform quick self-screening for stroke detection and prevention.

5. Conclusion

Stroke999 mobile application has been designed to help Malaysian to classify individual risk factors into high risk, caution or low risk and automatically direct the user to the nearest hospital if he/she falls into low/ high risk category. One of the major advantages of this mobile application is that it is in a smartphone, therefore the user can access the Stroke999 mobile application anywhere, anytime 24/7 as it is not limited to a certain time and

use only. Stroke999 mobile application is accessible for the public as long as the users have an Internet connection and smartphone.

Acknowledgment

The authors would like to thank all staffs from University Teknologi PETRONAS who have either directly or indirectly contributed to this research project.

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