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ScienceDirect

Procedia Computer Science 69 (2015) 86 – 95

Procedia Computer Science

7th International Conference on Advances in Information Technology

# Mobile Diagnosis System with Emergency Telecare in Thailand (MOD-SET)

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**Abstract**

This paper presents a Mobile Diagnosis System with Emergency Telecare functionality applied in Community Health Centers and hospitals in Thailand. The system results from an integration of two previously released applications: a tele-diagnosis system (TEDIST) and a smartphone based emergency report system (SPEARS). The functionality of these separate systems have been integrated and enhanced with a speech-to-text function, which users (or potential patients) apply to communicate with the system by speaking into their phones. A rule-based expert system is controlled by medical professionals regarding the automated diagnosis results. The emergency response component can communicate with local emergency services from hospitals and other organizations in order to find the nearest facility for help and support in case of emergency. Tests of the user interface and system tests have been carried out and have shown encouraging results.


Peer-review under responsibility of the Organizing Committee of IAIT2015

*Keywords:* Telemedicine; Telecare; smart help care; health technology; assistive system; diagnosis system; smart phone

## 1. Introduction

Thailand has consistently sought to increase the ratio of physicians to population. And indeed, the figures have improved but mostly in urban areas of the country and in the main tourism regions: Bangkok, Chiang Mai, Pattaya

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Peer-review under responsibility of the Organizing Committee of IAIT2015
doi:10.1016/j.procs.2015.10.009

and Phuket. The overall picture of the public health sector is not convincing when we look at the ratio mentioned above in the context of ASEAN countries, see Table 1. There are two ways to improve this situation in every country involved; either the number of physicians is increased at a higher rate than the population growth or the reach out of physicians is extended to more patients. Whereas the increase of the number of physicians takes a considerable amount of time, the extension of outreach by physicians can be supported in short time with the help of technology as is proposed in the remainder of the paper.

The World Health Organization (WHO) adopted the following definition of telemedicine: "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities"[1].

Table 1. Physicians per 1,000 people (2010, World Bank[1])

| | |
|---|---|
| Singapore | 1.9 |
| Brunei | 1.4 |
| Malaysia | 1.2 |
| Vietnam | 1.2 |
| Myanmar | 0.5 |
| Thailand | 0.4 |
| Laos | 0.3 |
| Indonesia | 0.3 |
| Cambodia | 0.2 |

In this paper, we adopt the following definitions:

*Telemedicine* is the use of telecommunication and information technologies in order to provide clinical health care at a distance. It helps eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities.

*Telehealth* is the delivery of health-related services and information via telecommunications technologies. Telehealth could be as simple as two health professionals discussing a case over the telephone or as sophisticated as doing robotic surgery between facilities at different ends of the globe.

*Telecare* is the term for offering remote care of elderly and physically less able people, providing the care and reassurance needed to allow them to remain living in their own homes.

Telemedicine applications build a relatively new field of study and application in Thailand; the infrastructure of ICT had hampered widespread use of the Internet for using medical information. With recent improvements made, health and technology professionals will be able to work out novel applications and systems to help advance telemedicine for the benefit of the people.

This research represents the integration and modification of two previously released systems: TEDIST[1] (a tele-diagnosis system for minor complaints) and SPEARS[2] (a smartphone-based emergency report system). We have added such features as speech-to-text to deal with the input of symptoms and conditions by voice with the help of extraction and matching of keywords. The emergency telecare system is capable of supporting the rescue of patients with serious complaints in due time.

In this paper we report on the Mobile Diagnosis System with Emergency Telecare in Thailand for diagnosing certain conditions that people can use to establish contact with Community Health Centres by mobile phone for handling personal diagnoses and emergency situations. The emergency telecare system can retrieve the current location of the emergency via GPS, convey messages to emergency services and send help immediately. The system uses speech or text as an input method for individual patients' symptoms, which are taken by a rule based expert system for the analysis of conditions and appropriate diseases. Doctors have the opportunity to give prescription online to the patients they are responsible for, and. patients' data are then stored in a Personal Health Record (PHR) for further analysis.

This paper is organized as follows: after a view on related work, we first outline the design and implementation of the system, which is followed by an overview of the system architecture covering two integrated components (tele-diagnosis and Telecare). Then, we report succinctly on user interface and system test results. Finally, conclusions are drawn and further work is indicated.