

A Practical Real-Time Vital Sign Monitoring System in Thailand

Rattakorn Poonsuph, D.Sc.

Abstract— a real-time monitoring system of patient's vital signs is an important process in a hospital. The system could provide better quality of life for a patient during stay in the hospital. The paper introduces a vital-sign monitoring system using a computer tablet in Kluaynamthai II Hospital, Thailand. The system has been used for process improvement in the hospital and for enhancing the healthcare responsiveness for their patients. The system, which comprises of an application server, a messaging server, and applications in IOS platform, which provide a systematic approach and standardize the hospital process in which the reduction of the operation costs and promptly respond to patient risks. The system is also able to measure and calculate modified early warning score (MEWS) score in real-time from vital sign data and ready to notified relevant physicians or nurses in a ward. This allows bi-directional physician and medical staffs' communication via private social networks. The novelty of the system grants the hospital moving forward to the digital realm with typical equipment and trouble-free implementation. As a result, the hospital practically operates the system with more than 100 patients in past six months.

Index Terms— Alert System, Healthcare, MEWS, Vital Sign.

I. INTRODUCTION

The hospital management and healthcare quality are challenged issues in Thailand. Since 2002, Thai's government has provided universal health care program for Thai citizen. The National Health Security Office (NHSO) of Thailand allocated funding through the Universal Coverage (UC) program. The program became a handful for lower-middle income households. Originally, patient required a co-payment charged of \$1 for a treatment [1]. People, who are eligible for the program, received a gold card, which allows them to access services in their health district as a primary care. Funding of the program comes from national revenues, which allocated to contracting hospital or health care units for primary care annually on a population basis. However, the allocated funds per treatment charges are often lower than equivalent treatment charges provided by most insurance providers. The hospitals or health care units are not getting enough money from the funding formula to keep up with the cost of providing medical services. While as, the hospital business in Thailand has seen remarkable growth and high competition as the country strives to position itself as a world-class destination for health care.

The hospital management, thus, is facing a major challenge to enhance health care quality of services whereas reduce its operating costs. A classical resolution for optimization is a

process reengineering, which is a general philosophy that indicates that when a new technology appears, there is an opportunity to reengineer the systems. A hospital process reengineering is an initiative that was based on new technology such as mobile device, smart-phone and computer tablet.

The research paper comprises into three parts. The first part is related works and research concept. The second part is the software design which starts from requirements, architecture, software design and user interface design. The last part is the experimental results and the conclusion.

II. RELATED WORKS

There are a number of researches addressing the use of mobile devices to improve the health care services. Many of these researches deal with taking patients' vital sign values. Most researches are centered on the manufacturing of vital sign measuring devices. These devices may be directly attached to the patient's clothing or uses a wire wrapping around the patient's limb. Such wired measuring devices are a result of a research created by T. Klingenberg [2]. His research focuses on mobile wearable devices for long term vital sign monitoring which has improved the horizon of the wireless recording devices for monitoring vital sign values.

The device records the ECG, the blood pressure and the skin temperature and includes a 3D-acceleration sensor for the determination of the movements during recording. The research of Francis E.H.Tay [3] has published a topic on MEMS Wear-bio-monitoring system for remote vital signs monitoring which has improved the remote vital signs monitoring system, which integrates wireless body area network (WBAN) and personal digital assistant (PDA) phone technology. Four different physiological signs, e.g., ECG, SpO₂, temperature and blood pressure, can be continuously acquired. The researches of Lin Xu, *et al.* [11][12][13], provide a similar concept of the vital-sign equipment that was attached with a patient and transmit vital-sign data via wireless communication[14].

Regardless of the aforementioned researches, there has been no real application of said devices on actual patients due to the unsuitable physical condition of the patients. Furthermore hospice care would not be possible while said devices are attached and operational on patients. These devices are also special devices which cannot easily acquire from the local vendors and require implementing a complex system to handle with these devices.

Hospital regulations in Thailand dictate nurses to take various vital sign values from patients such as blood pressure, temperature, and input and output of bodily fluids. The vital sign measuring and recording processes may occur more than