



The 6th International Conference on Current and Future Trends of Information and
Communication Technologies in Healthcare (ICTH 2016)

Performance Evaluation of Server-side JavaScript for Healthcare Hub Server in Remote Healthcare Monitoring System

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Abstract

With the help of a small wearable device, patients reside in an isolated village need constant monitoring which may increase access to care and decrease healthcare delivery cost. As the number of patients' requests increases in simultaneously manner, the healthcare hub server located in the village hall encounters limitations for performing them successfully and concurrently. In this paper, we propose the design tasks of the Remote Healthcare Monitoring application for handling concurrency tasks. In the procedure of designing tasks, concurrency is best understood by employing multiple levels of abstraction. The way that is eminently to accomplish concurrency is to build an object-oriented environment with support for messages passing between concurrent objects. Node.js, a cross-platform runtime environment features technologies for handling concurrency issue efficiently for Remote Healthcare Monitoring System. The experiments results show that server-side JavaScript with Node.js and MongoDB as database is 40% faster than Apache Sling. With Node.js developers can build a high-performance, asynchronous, event-driven healthcare hub server to handle an increasing number of concurrent connections for Remote Healthcare Monitoring System in an isolated village with no access to local medical care.

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Peer-review under responsibility of the Program Chairs

Keywords: concurrent application; asynchronous I/O; server-side JavaScript; healthcare hub server; Internet of Things; remote healthcare monitoring system; Node.js; web services;

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1. Introduction

The idea of devices connected with each other leads to an enormous systems based Internet of Things (IoT) such as IoT-related healthcare systems. The implementation of these IoT-related healthcare is based on the definition of the IoT as a network of devices connected with each other in order to capture and share useful data through wireless connectivity and Internet access capabilities that connect to a central processing and controlling server in the cloud¹.

Remote Healthcare Monitoring (RHM) is a technology to enable monitoring of patients reside in an isolated village with no access to effective health monitoring of conventional clinical settings². However, most of RHM technologies follow a general architecture that consists of four components². First component is variety of sensors on a device that is enabled by wireless communications to measure physiological parameters. The second component is a local data storage on the coordinator mobile device (smartphone) at patient's site that interfaces between sensors and centralized data repository and healthcare monitoring hub server. The coordinator device is equipped by wireless connectivity such as Wi-Fi or 3G/4G LTE enabled internet to send collected physiological data to healthcare providers. The third component is a centralized repository to store data sent from sensors, local data storage, diagnostic application, and healthcare providers. The last component is the diagnostic application software that send a real-time alert to the patient based on the analysis of collected data by triggering a series of actions previously agreed upon by the patient and medical practitioners. In this paper, we use the term healthcare hub monitoring server for referring to the third and fourth component. The Fig.1. shows the architecture for RHM system.

The healthcare hub monitoring server of the RHM system aims to handle a large number of requests from patients in a concurrency manner at the point to handle treatment recommendations efficiently. Concurrency is the tendency of things that happen at the same time in a system. Concurrency is particularly important in RHM system that have to react to outside events in real-time and that often have hard deadlines to meet³. As the number of patients' requests increases in simultaneously manner, the healthcare hub server located at the village hall encounters limitations for performing them successfully. Therefore, this RHM application fails to detect deterioration of patient's health, slows down predefined actions previously agreed upon by the patient and the doctor. As consequences, number of emergency department visits increases, hospitalization and duration of hospital stays increase healthcare delivery costs. In addition, patient cannot receive real-time alerts which are a series of actions that take place automatically without the help of doctors. These alerts remind the patient to take some precautions for instance. This situation can cause the death of patient when the doctor cannot receive new data and the patient's history from the healthcare hub server. Furthermore, the patient should not benefit any immediate medical attention.

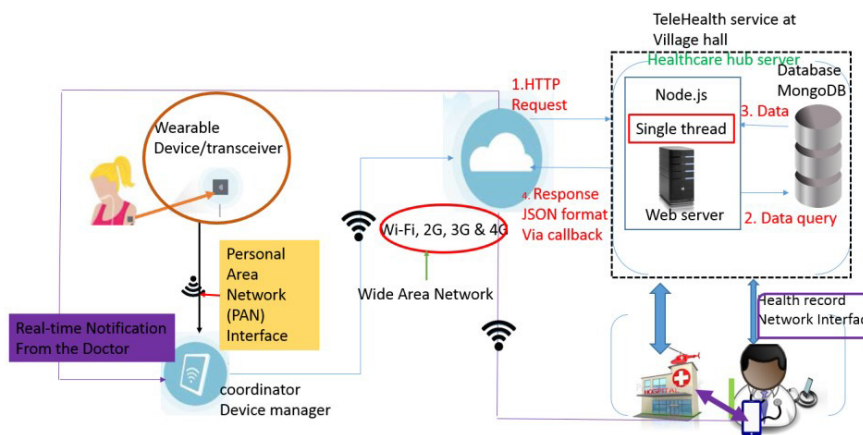


Fig. 1. Architecture of Remote healthcare monitoring system in an isolated location with no access to local medical care.

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