

# The Internet of Things based Medical Emergency Management using Hadoop Ecosystem

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**Abstract**—The prevalence of Internet of Things (IoT) in medical health care is bound to generate the massive volume of heterogeneous data due to the millions of medical sensors attached with various patients' body. Therefore, to process such amount of heterogeneous data in real-time to take emergency actions in critical health situation is a challenging task. Therefore, to address such issues, we proposed Hadoop-based medical emergency management system using IoT technology, which involves a network architecture with the enhanced processing features for collecting data received from millions of medical sensors attached to the human body. The amount of collected data is then forwarded to the Intelligent Building to process and perform necessary actions using various units such as, collection unit, Hadoop Processing Unit (HPU), and Analysis and decision unit. The feasibility and efficiency of the proposed system are evaluated by implementing the system on Hadoop using UBUNTU 14.04 LTS coreTMI5 machine. Sample medical, sensory datasets and real-time network traffic are considered to evaluate the efficiency of the system. The results show that the proposed system efficiently process WBAN sensory data.

**Keywords**— *Big Data; IoT; Healthcare; Intelligent Building;*

## I. INTRODUCTION

Recently, Healthcare system in IoT recognized as a revolution in ICT since the rapid development has been started at the beginning of 21st century. In Healthcare system's applications, the wireless body area network (WBAN) offers a novel archetype for wireless sensor networks (WSNs) in monitoring biomedical sensors. These sensors can be attached to human body or clothes and can be used to measure the parameters associated with the human body. The measured values can be collected and relayed to the main server using Internet Protocol Version 6 (IPv6) over Low-Power Wireless Personal Area Network (6LoWPAN) [6] by passing through some gateway node in order to generate results. For such application, a suitable example, i.e., ZigBee technology can be employed that uses IEEE 802.15.4 [7].

Many IoT based architectures have been proposed to monitor the health of the people using IoT. Yang et al. [8] proposed iHome open Health-IoT platform based on intelligent medicine box and pharmaceutical packaging (iMedPack). Some other approaches intend to integrate wearable devices to achieve better IoT for the e-healthcare system [9]. However, in any IoT based medical care system, the amount of data collected from the sensor nodes should be accessible anytime

and everywhere that requires continuous network connectivity, which results in generating massive volume of data (called as 'Big Data'). According to GSMA, the total number of devices connected to each other will be 24 billion until 2020 [10]. In such circumstances, the Healthcare system will face a critical challenge of available bandwidth.

On the whole, the previously proposed techniques only cover a limited scope of the Healthcare. Moreover, these techniques are not that much efficient to handle the massive volume of heterogeneous data to generate real-time action in case of emergency. Therefore, a desirable system is required that is capable of taking care of the human beings (patients in home, people outside home, and in cars) from all the features, which not only covers the required medications, but can also perform a continuous monitoring of the patients, car accidents, and remote diagnostics and taking actions at real time. The mentioned challenges can only be catered through fast collection and aggregation, parallel and efficient processing of incoming high-speed medical, sensory data. For this reason, Hadoop-based medical emergency management system using IoT technology is proposed. In the proposed system, the human body uses wearable devices or other physical body sensors that measure blood pressure, pulse/heart rate, diabetes, etc. The measured data is then transmitted to the primary medical device (PMD) using Bluetooth or Zigbee IEEE 802.15.4, then to Intelligent Building (IB) through 3G/LTE/WiFi Internet via gateways. IB provides the backbone of the proposed system that process massive volume of the incoming stream of data by capturing and aggregate the data in its Collection Unit. Afterward, the collected data is sent to Hadoop Processing Unit (HPU) for further processing and computations. Finally, the Analysis and decision unit responds to the system based on the results generated by HPU. The main contribution of this work is summarized as follows. The system Architecture is proposed and implemented using Hadoop to process and analyze the massive volume of medical, sensory patient data at real time. Moreover intelligent building concept is introduced, which is mainly responsible for managing, processing, analyzing incoming sensor data and finally make decisions intelligently. This does not only handles the massive volume of data but also gives feedback to the users "anytime-anywhere-anyhow". The whole system is implemented in a real environment using Hadoop on UBUNTU 14.04. Sample medical, sensory datasets are tested to evaluate the proposed system.