

Chapter 3

An IoMT Architecture for Patient Rehabilitation Based on Low-Cost Hardware and Interoperability Standards

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ABSTRACT

The convergence of the internet of things, microcontrollers, health-based sensors and cloud-based systems can play a significant role in smart healthcare, by providing more accurate insights and better health data to patients, sustaining quality patient care. These areas combine to establish the IoMT concept, which has boosted the design of novel solutions to improve patient healthcare. This chapter aims to propose a novel, IoMT-based architecture for a rehabilitation system. It is based on the integration of low-cost and easily obtainable hardware with rapid prototyping and interoperable software to assemble a system capable of detecting shoulder movements and transmitting that information. The information is later processed by a central unit, and the data is prepared and presented to the patient so that he can adapt his posture during the exercises to better match what was prescribed by the health professional.

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INTRODUCTION

The developments of modern medicine bolstered the eradication of a range of illnesses, lowered the mortality rate of some diseases and transformed some mortal syndromes into more manageable chronic diseases (Shryock, 2017). Hence, it can be stated that scientific knowledge can prolong life. However, it may have an adverse effect on some. People that live longer will, on average, have more diseases (Diener & Chan, 2011). In addition, the elderly will soon constitute a significant part of the total world population (He et al., 2016). For these reasons, a larger emphasis shall be placed on providing services at home for those who need it the most. To achieve that, it is necessary to discover and develop new methods to monitor diseases and activities, therapy responses and patient safety in a non-intrusive and ease to use manner, e.g., electrodermal activity has been correlated with emotional arousal and used as an indicator of stress (Pakarinen et al., 2019). The concept of home hospital (or home treatment) aims to create conditions that support the reintegration of patients who do not require permanent hospitalization (but need continued care) into their normal routine, family, and social environment. Recent advances in wearable devices have created new opportunities to collect patient data in a non-intrusive manner (Lu et al., 2017). Wearable monitoring devices are an important tool which can be used to assess patients' health status, disease progression and treatment effects, and have the ease of performing the same tasks that a computer or mobile device could perform. Even so, these tools still require experts and specialized medical personnel that are responsible for treatments and prescriptions. The responsible physician shall be assisted by these tool systems so that he has more time: the goal is to free up human resources to focus on the most important elements of treatment by taking advantage of wearable monitoring devices whenever possible.

This chapter aims to propose a novel architecture created with IoMT technologies to support the treatment of rehabilitation patients. It is based on established communication protocols so that all the involved parties – physicians, patients, or institutions - can communicate, access, and understand the data.

The remaining sections of this document are organized as follows: the background section contains an extensive review of the key topics required to have a better understanding of this chapter and the architecture that is put forward; then, the IoMT Architecture for Patient Rehabilitation section presents the proposal of the IoMT architecture for patient rehabilitation based on low-cost hardware and interoperability standards. At last, the conclusion summarizes the main ideas raised from this chapter and puts forward some topics for future developments.

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