Internet of Things in Healthcare as an Innovative Form of Personalized Medicine

16

Ljubica Dikovic
https://orcid.org/0000-0002-4528-4014
College of Applied Sciences Uzice, Serbia

INTRODUCTION

According to the US National Intelligence Council, there are six technologies with potential impacts on the US interests out to 2025 (the US National Intelligence Council, 2009): Biogerontechnology; Energy Storage Materials; Biofuels and Bio-based Chemicals; Clean Coal Technologies; Service Robotics; Internet of things.

The great potential offered by the Internet of Things technology enables their wide applications in many areas of society, which would significantly increase and improve the quality of their functioning. By equipping various environments, i.e. domains, even with devices with primitive intelligence and modest communication capabilities, the communication of these entities with each other would be possible, with an aim to ensure data management. Such systems can be widely used in the following areas: Healthcare Domain; Smart Environment Domain; Personal and Social Domain; Transport and Logistics.

BACKGROUND

The Internet of Things (IoT) refers to wireless networks between objects (things). 'Things', i.e. objects, become entities with virtual properties which operate and communicate in smart spaces using intelligent interfaces.

Also, the "Internet of Things" is the general idea of things, especially everyday objects that are readable, recognizable, locatable, addressable, and controllable via the Internet - either via Radio Frequency Identification (RFID), Bluetooth, Wi-Fi, telephonic data services, wide-area network, or other means (the US National Intelligence Council, 2009).

In their research paper, Atzori et al. (2010) state that the Internet of Things can be realized in three paradigms: internet-oriented (middleware), things-oriented (sensors) and semantic-oriented (knowledge).

Over the last 20 years, continuous changes in the healthcare domain have taken place, caused by the wide use of information and communication technologies in the medical field. IoT plays a significant role in the broad range of healthcare applications which could be grouped as follows (Atzori et al. (2010)):

- Tracking of Objects and People (Staff and Patients);
- Identification and Authentication of People;
- Automatic Data Collection and Sensing.

DOI: 10.4018/978-1-7998-3479-3.ch134

The rapid growth of IoT has resulted in a massive growth of data generated by these devices and sensors put on the Internet. The physical-cyber-social big data consist of these IoT data, complemented by the relevant Web-based and social data (Sheth, 2016).

The Internet of Things has been identified as one of the emerging technologies in the IT field. The market adoption of IoT has been forecast to take 5–10 years (Gubbi et al. (2013)).

The Internet of Things (IoT) is a platform and a new paradigm for interconnecting electronic devices i.e. global communication among millions of electronic devices connected to the internet.

Personalized healthcare systems deliver e-health services to fulfill the medical and assistive needs of the aging population. Internet of Things is a significant advancement in the Big Data era, which supports many real-time engineering applications through enhanced services. (Jagadeeswari et al. (2018), Khan et al. (2018)).

E-health in Serbia has been the subject of some studies. It was concluded that information and communication technologies are rarely implemented (Milenkovic et al. (2012)).

IoT is a vision which refers to the humanization of technology.

IoT IN HEALTHCARE DOMAIN

Medical sensors are devices that measure a number of physical, chemical, or biological parameters and then transmit or report these data. Some sensors are designed to work outside the body, and others are implanted in the body.

In the healthcare domain, the Internet of Things in its essence covers the following (Li et al. (2009)):

- Body Area Network (BAN): the thermometers, smart t-shirts, smart devices and sensors for health, paper-based home pregnancy tests, etc. supporting personal medical treatment and healthcare.
- Wireless Body Area Network (WBAN): supporting remote medical treatment and healthcare.
- Local Area Network (LAN): the wireless access-based remote patient monitoring system, the smart devices as a hospital interface, pulse oximeter also known as the blood-oxygen monitor, etc.
- Wide Area Network (WAN): telemedicine solutions, distance medicine, etc.
- Very Wide Area Network (VWAN): the smart healthcare solutions as e-health services everywhere, no longer tied to physical locations.

Tracking involves memorizing the positions in real time (e.g. patient flow monitoring) in order to improve work processes in hospitals, but can also refer to the general tracking of motion (e.g. the access to certain rooms, warehouses or inventory material tracking such as blood samples and other materials necessary for the hospital functioning). Identification of patients includes activities, actions and tasks aimed at reducing incidents harmful to patients (e.g. wrong drug, dose, time, and procedures), the maintenance and updating of the complete medical archives in the digital form. Identification and authentication include protocols and procedures regarding the work of medical staff, which promotes morals and ethics of employees in order to increase patient safety. The automatic data collection and transfer involves the automation of various processes as well as the management of medical supplies. This function is supported by the integration of the Radio Frequency Identification (RFID) technology and other health information and technologies. RFID is a method of storing and downloading data remotely, using devices carrying tags. From the RFID group's point of view, the Internet of Things is the worldwide network of interconnected objects uniquely addressable based on the standard communication protocols