Chapter 31
An Architecture to Implement the Internet-of-Things using the Prometheus Methodology

Bogdan Manațe
West University of Timişoara, Romania

Florin Fortiş
West University of Timişoara, Romania

Philip Moore
Lanzhou University, China

ABSTRACT

The rapid expansion of the Internet of Things (IoT) will generate a diverse range of data types that needs to be handled, processed and stored. This paper aims to create a multi-agent system that suits the needs introduced by the IoT expansion, thus being able to oversee the Big Data collection and processing and also to maintain the semantic links between the data sources and data consumers. In order to build a complex agent oriented architecture, we have assessed the existing agent oriented methodologies searching for the best solution that is not bound to a specific programming language of framework, and it is flexible enough to be applied in such a divers domain like IoT. As complex scenario, the proposed approach has been applied to medical diagnosis and motoring of mental disorders.

1. INTRODUCTION

This paper presents a multi-agent system for IoT technology: Illustrative scenarios are presented to show how the proposed architecture may function in real-world applications, the proposed approach has been targeted for medical diagnosis, motoring and interventions of metal disorders.

The recent advances in information technology enable the surrounding objects to use to exchange information using the Internet protocol. The myriad of connected objects, encompassed by the the Internet of Things (IoT) paradigm emphasizes the need for fast and reliable data storage solutions.

DOI: 10.4018/978-1-5225-9866-4.ch031

The network enabled by the IoT framework offers seamless integration of various types of physicals objects and which are continuously exchanging information one with the other and with the environment. The multitude of possible interactions between the connected objects open new horizons for different fields such as house monitoring, assisted living, industrial automation, smart agriculture, smart environments, smart cities, and many others.

Because the IoT paradigm is seen as a connector for many related fields, further investigations are required to determine how heterogeneity of the collected data influenced the system performance.

The rapid development of the intelligent 'things' influences the expansion of the Internet of Things, which is now supporting new kinds of advanced interactions. Thus, the interconnected devices become part of a ubiquitous network composed of heterogeneous nodes capable of sharing and processing data, and proactively acting.

The context can be determined with ease from the data collected from the intelligent devices, therefore the system can respond with suitable information for every situation. The information collected from the intelligent devices usually represent a wide range of parameters like environmental, human body parameters or data about the localization.

Because of the heterogeneous characteristic of the devices incorporated in a IoT ecosystem, many research papers relay on multi-agent approaches for handling the different aspects of the architecture. An agent-based hybrid service delivery for coordinating the IoT and some of the 3rd party service providers was presented in (Wang, Zhu, & Ma, 2013). The proposed architecture enables the third party service providers to create, deploy, execute and manage services over the Internet of Things.

On the other hand, the use of multi-agent systems in software development has two major benefits given by the reusability and composability of the agents and by the higher level of abstraction introduced by the agent oriented programming paradigm, as stated in (Bergenti, 2003). Since the inception of the Agent Oriented Programming paradigm, more than 20 years ago, a number of methodologies for developing multi-agent systems have been described, offering the basis of a set of standards for the software industry (Shoham, 1993).

Mental disorders impose significant socio-economic and geo-political challenges which, if not addressed, have the potential to overwhelm the ability of healthcare systems globally to accommodate the growing demands both in human and resource management terms. The ability to provide technologically enhanced treatment options with the desire to improve the quality of life for patients and carers alike only serves to exacerbate the demands placed on healthcare provision.

From a treatment perspective there is a need to implement systems where patients can be diagnosed, treated, and monitored following treatment to detect relapse. Such systems must incorporate triage, treatment in both hospital and domestic settings, and monitoring in the community. Diagnosis and treatment requires a multi-modal approach in which both physiological parameters (e.g., heart function, temperature, and Galvanic Skin Response (GSR) etc.) are combined with cognitive metrics (brain function using for example Electroencephalography (EEG)).

This paper considers the practical challenges in realising the goal on achieving the effective monitoring of patients with mental disorders in hospital, community, and domestic settings. We consider a range of potential solutions including sensor- based monitoring (data collection and the potential for intelligent sensors incorporating pre-processing of raw data), the use of Cognitive Behavioural Therapies (CBT) in both face-to-face and online approaches, and the development of novel Psychometric Scales for use in triage, diagnosis, and monitoring of patients based on real-time and predictive data processing. We conclude that effective patient monitoring will provide benefits for all stakeholders in the management