A Cloud Based Decision Support System Aimed to Contribute in Policy Making for Natural Disaster Related Incidents

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ABSTRACT

The main objective of the article is to employ cloud computing technology in order to develop the decision support system of an integrated platform aimed to aid decision makers in natural disaster incidents. This specific platform refers to the most commonly occurred natural disasters in Europe. The decision support system included in the cloud-based platform, is an advanced collection of data processing tools that provides the possibility to export useful conclusions for decision making about the urgent needs of families and children.

KEYWORDS

Cloud Computing, Cloud-Based Decision Support System, Decision Making, Decision models, Model-Based Policies, Natural disaster

INTRODUCTION

Natural disasters constitute a fundamental issue that can lead to several and important consequences to the citizens of the afflicted regions and interfere with the function of the society on a physical, financial and psychological level. Valid estimations raise the magnitude of the financial impact at the level of hundreds of billions of dollars per year – 353bn worldwide in 2017 (Benfield, 2018), 255bn in US only (Daniell, Wenzel, McLennan et al., 2016; Daniell, Wenzel, & Schaefer, 2016) (Daniell 2016a, 2016b) - and the number of affected people to 200 million (Arya, Boen, & Ishiyama, 2014) per year. Unfortunately, these numbers are expected to grow in subsequent years, mainly due to climate change that leads to increased heat stress, extreme precipitation, landslides, flooding, aridity, drought and water scarcity, as well as the increasing urbanization of growing populations and economies resulting in increased exposure and vulnerability (Bouwer, 2011; Working Group III & Edelhofer, n.d.).

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In a previous work, the authors proposed a cloud-based platform, which aims to contribute to the design of an integrated method for dealing with natural disasters in terms of decision making from a public health and safety point-of-view focusing primarily on children, being the most vulnerable population group (Tarousi et al., 2018). The platform consists of four main modules that serve an equal number of discrete purposes:

1. The education module that aims to educate children through serious games, about dealing properly with an event of a natural disaster.
2. The emergency instructions module that is activated during the incidence of the natural disaster and its role is to provide the appropriate instructions to its users (children and their families) in order to help them respond properly and on time.
3. The emergency emission module suitable for crises that aim to give the users the opportunity to emit a distress signal when they experience a critical situation and need the help of the emergency response teams and
4. The Decision Support System (DSS) as an extension of Data Processing.

In contrast with the first module that constitutes a preemptive measure, the three latter modules represent the integrated disaster management system that comes into action during and immediately after the natural disaster incident and utilizes text mining, data processing, advanced computing and networking tools in an effort to detect the kind and the magnitude of the occurring disaster and play a meaningful and effective role in the disaster management process. The integrated concept of the proposed platform is shown in Figure 1.

The platform is designed to work in the “cloud”, given that the volume, velocity, and variety of the necessary data demand advanced computing infrastructure technologies, appropriate for big data handling and intensive computations. Cloud computing is proposed as the optimal platform to satisfy these computing challenges (Martens & Teuteberg, 2012). The term cloud computing is defined as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell & Grance, 2011). The main feature of cloud computing is the ability to share the resources in order to succeed coherence and economies of scale. The sector of cloud computing has significantly evolved over the last decades (Guzek, Bouvry, & Talbi, 2015). Currently, many providers and service offerings have crowded this area, and cloud infrastructure, which was traditionally limited to single provider data centers, is developing rapidly, enabling the wider implementation of solutions characterized by high demand in computing resources.

The present paper focuses on the DSS capabilities of the platform, along with the advanced data analytics algorithms that are employed in order to cover the needs above needs above. The subsequent sections are organized as follows: The following section (“State of the Art”) includes selected pieces of relevant scientific literature, in order to establish an overview of the current state of the art and the variety of angles that researchers worldwide choose to attack the problem. The next sections (“Description of the Decision Support System”, “Discussion”) deal with the conceptual and functional presentation of the proposed platform components, and a generic discussion about its prospect, respectively.

STATE OF THE ART

F. Horita et al., analyzed AGORA-DS, a Spatial DSS that aims to combine Wireless Sensor Networks with Volunteered Geographic Information in order to improve flood risk management. This system is based on a conceptual model that conforms to interoperable standards (Sensor Observation Service and Web Feature Service) instituted by the Open Geospatial Consortium and its target is to collect,
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