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Review Article

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Pervasive Computing For New Design In Big Data Analytics Software Development: Requirements Engineering Perspective

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Abstract

In recent years, the field of big data has been rapidly growing and has become a crucial aspect of many industries. The ability to collect, analyze, and interpret massive amounts of data has enabled businesses to make more informed decisions and has led to the development of new products and services. However, with the increase in data volume, velocity, and variety, traditional software development methods have become inadequate. This has led to the emergence of new design approaches that can handle the complexities of big data.

Big data is very important nowadays for business organizations to make smart decisions based on insight gained from the big data. These benefit the organization to be competent in the market as well as to maximize their profit. However, there is a high rate of big data software project failure. This is due to a lack of new design approaches that can handle different dimensions of requirements for big data.

The objective of this paper is to show how the pervasive computing / pervasive requirements engineering approach should be considered for big data software development based on different perspectives in pervasive environments to design new software.

Keywords: Pervasive Computing, Ubiquitous Computing, Requirements Engineering, Pervasive Requirements Engineering.

1. Introduction

Pervasive computing can play an important role in the design of big data software applications, especially from a Requirements Engineering (RE) perspective [1, 2]. Pervasive computing emphasizes the need to consider the impact of technology on society as a whole and to design systems that are flexible, adaptable, and scalable [3]. From an RE perspective, this means that the requirements for the system must be elicited and analyzed in a variety of contexts and environments, taking into account the needs and goals of all stakeholders, including end-users.

Mauro defined big data as "Big data represents the information assets characterized by such a high Volume, Velocity, and Variety to require specific technology and analytical methods for its transformation into Value" [4]. These attributes are known as the Vs characteristics of big data [5]. In recent years, the field of big data has seen exponential growth in the amount of data being generated and collected. This has led to an increased demand for software that can effectively manage and analyze this data to gain insight. However, the traditional software development approaches are not sufficient to handle the unique challenges posed by big data. This has led to the consideration of emerging approaches for new design, one of which is pervasive computing. In the context of big data software development for data analytics, pervasive computing can help to ensure that the system is designed to meet the needs of all users and that it is scalable, flexible, and adaptable to changing requirements [1, 2].

Pervasive Requirements Engineering (PRE) can be particularly useful in the development of big data software applications, where the requirements for the system are likely to be complex and diverse. The PRE approach emphasizes the importance of understanding the needs and goals of all stakeholders, including end-users, and the impact of technology on society as a whole. It also focuses on the use of appropriate tools and techniques to elicit, analyze, and manage requirements in a pervasive computing environment [1, 2].

In the context of big data software development for analytics, PRE can help to ensure that all stakeholders are involved in the requirements engineering process and those requirements are elicited and analyzed in a variety of contexts and environments. This can help to ensure that the system is designed to meet the

needs of all users and that it is scalable, flexible, and adaptable to changing requirements [1, 2].

According to Saha and Mukherjee, "Pervasive computing is about making our lives simpler through digital environments that are sensitive, adaptive, and responsive to human needs" while Abdulsattar and Al-Omary defined it as "The existence of embedded microprocessors in the surrounding objects around us such that people are unaware of their presence...." Abdulsattar and Al-Omary further explained that pervasive originated from pervade meaning being diffused throughout. Pervasive computing has the potential to revolutionize big data software development by providing new design approaches that can improve software performance, scalability, and flexibility [6, 7].

Pervasive computing is a design approach that focuses on creating software systems that are seamlessly integrated into the user's environment. This approach is particularly useful in big data software development, where the software needs to be able to process and analyze vast amounts of data in real-time. Pervasive computing enables the software to be distributed across multiple devices and platforms, allowing it to leverage the computing power of these devices to process the data more efficiently.

2. Why Pervasive Computing for New Design in Big Data Software Developments?

In this article, the authors describe the role of pervasive computing in big data software development from a requirements engineering perspective. Therefore, the authors discuss the benefits of pervasive computing for big data software development as follows.

2.1. Real-time Data Processing

Real-time data processing refers to the ability to analyze and make decisions on data as it is generated or received, without any delay [8]. One of the benefits of pervasive computing in big data software development is its ability to provide real-time analysis. Traditional software development approaches are often batch-oriented, meaning that the data is processed in batches at specific intervals. This approach is not suitable for big data, where the data is constantly being generated and changing. In real-time data processing, the data changes frequently and rapidly due to one of the Vs characteristics of big data - velocity. Velocity refers to the speed at which data is generated, processed, and analyzed. With the increasing volume and variety of data, it has become crucial to handle data at high velocities. Real-time data processing enables organizations to handle and analyze data streams with high velocity, allowing them to make faster and more informed decisions based on the most up-to-date information. Pervasive computing enables the software to analyze the data in real-time, providing immediate insights that can be used to make informed decisions [9, 10].

2.2. Improved Scalability

Pervasive computing enables software solutions to scale easily by leveraging the power of distributed computing. This allows businesses to process large volumes of data efficiently, without compromising on performance [9, 11].

2.3. Increased Flexibility

Pervasive computing provides greater flexibility in software design by enabling the integration of multiple devices and platforms. This allows businesses to develop software solutions that can work seamlessly across different environments and devices [12].

2.4. Enhanced User Experience

Pervasive computing can enhance the user experience by providing personalized and context-aware services that are tailored to individual preferences and needs [13].

2.5. Handling Complexity

One of the key benefits of pervasive computing in big data software development is its ability to handle the complexity of the data. Big data is often unstructured and comes from a variety of sources, making it difficult to manage and analyze using traditional software development approaches. Pervasive computing enables the software to be designed in such a way that it can handle this complexity and extract meaningful insights from the data [1, 2].

3. Conclusion

Pervasive computing has the potential to revolutionize big data software development by enabling distributed processing, semantic interoperability, and real-time processing. From a requirements engineering perspective, pervasive computing can help improve the quality of big data software by enabling better requirements elicitation, analysis, and validation. These could be an enabler of invention/ new design in two ways. First, it can inspire the scientific community in the area to come up with new technology to overcome challenges in computing environments like big data. Second, it can take over routine tasks so those scientific communities get room for creativity to come up with new designs.

Thus, using pervasive computing, it is possible to design new analytic software for big data to overcome challenges raised in big data application development due to real-time processing, scalability, interoperability, flexibility, and complexity issues of software requirements.

As a concluding remark, the authors believe that pervasive computing has the potential to transform the design of big data software applications specifically from a requirements engineering perspective. By providing real-time feedback on user behavior and preferences, improving data quality through real-time monitoring, and streamlining data processing through distributed computing technologies, developers can create more effective and efficient big data software applications. As big data continues to play an increasingly important role in business operations, leveraging pervasive computing will become essential for staying competitive advantage in the marketplace.

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