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SPEAKR - Smart Processing & Environment for Analytics Knowledge Resources

Thomas de Almeida Rabelo[1]
Dinani Gomes Amorim[2]
Ricardo José Rocha Amorim[3]

Introduction: This research comes from the development of an architecture for the analysis of large amounts of heterogeneous data generated through intelligent services, as part of INES Project, involving several science and technology institutions[4]. This combines Big Data technologies (Oussous, 2018), ontologies (Guarino, 2009) and architectural standards (Amorim, 2006), adopted to obtain a flexible and interoperable architecture for the measurement, collection and analysis of data in diverse applications and their context. The architecture proposed here is designed to handle large and varied datasets created by intelligent services. It brings together Big Data technologies, ontologies, and established architectural standards. This mix aims to create a flexible and interoperable system, allowing us to effectively measure, gather, and analyze data from different applications and their contexts. This architecture offers a comprehensive solution for dealing with diverse data types. By using Big Data technologies, it can handle extensive and varied datasets. The addition of ontologies helps structure data representation and knowledge, adding depth to the analysis. Adhering to architectural standards ensures consistency, scalability, and compatibility within the framework. The main goal of this design is to adapt and work seamlessly across various applications, enabling smooth data management and detailed analysis. It emphasizes the importance of a unified system capable of handling different data types and sources, allowing for comprehensive analysis in different situations. Additionally, this design focuses on flexibility and interoperability, making it easy to integrate into various applications. By adopting this framework, the processes of data measurement, collection, and analysis become more streamlined and adaptable across different applications and their unique environments (Lai, 2020). **Objective:** The main objective is the development of an intelligent software platform aimed at extracting and analyzing large volumes of data from heterogeneous sources with the support of ontology-based metadata standards (Amorim, 2006). Specifically, the objectives was: (1) Propose a framework that addresses the use of ontologies and metadata standards in collecting data produced by sensors in the context of a Smart City (Yin, 2015), aligned with the FIWARE structure (Cirillo, 2019); (2) Systematize a reference structure related to the use of ontologies and metadata standards in Analytics

[1]Prof. Esp., FACAPE – Petrolina/PE. E-mail do primeiro autor: thomas.rabelo@facape.br.
[2]Profa. Dra. UNEB – Juazeiro/BA. E-mail do autor: dinaniamorim@gmail.com.
[3]Prof. Dr. UNEB, UNEB – Senhor do Bonfim/BA. E-mail do autor: amorim.ricardo@gmail.com.

[4] https://ines.org.br/

Knowledge (Akehurst, 2011); (3) Develop an ontology (ONTOSpeak) that captures the semantics of analytical metrics from metadata standards; (4) Develop software components that enable the translation of data from heterogeneous sources into the ontology; (5) Develop a validation/compliance service for standards based on ontologies; (6) Develop a semantic repository for data collected from sensors with a Big Data infrastructure based on the proposed framework. **Methodology:** Software Engineering and Design techniques was used in the development of the platform and the design of friendly interfaces that facilitate the use of intelligent services of analytics knowledge in contexts of heterogeneous data (Sommerville, 2011). It was expected to obtain a generic architecture and independent of the context, being able to be integrated in different business environments. Initially, a State-of-the-Art investigation was conducted to study proposed architectures, data representation ontologies in Smart City contexts, and intelligent services for massive data analysis, with a focus on Agribusiness, ultimately proposing a framework aligned with the FIWARE structure (Cirillo, 2019). Following this, experiments will be carried out using sensors in a case study within the scope of agribusiness. Subsequently, Software Engineering techniques will be employed for the design and implementation of a service-oriented platform. This includes constructing an ontology for representing heterogeneous data, as well as developing intelligent services for massive data analysis to provide relevant information about production processes in agribusiness and water management. **Results:** As main outcomes, the achieved results involve applications focused on Education. Among these, in the final stages of development, there's a validation/compliance service based on domain ontologies (Rabelo et al, 2017). Additionally, there's an ongoing development of a software component that translates data from heterogeneous sources in an educational context into the ontology. Furthermore, a Semantic Repository of Educational Data collected from sensors is under development, with a Big Data infrastructure based on a framework designed for virtual learning environments. The main contribution of the project lies in the development of a service-oriented architecture (Seinturier, 2012) to facilitate the extraction and management of massive volumes of data from heterogeneous sources, alongside the construction of an ontology based on metadata standards to ease data integration (Vidal, 2018). However, this contribution can be considered from two perspectives: (i) Technological, the proposed architecture will be generic and context independent. This will allow its integration into various business environments, potentially leading to considerable socioeconomic impact. The technology developed could be applied across different contexts such as Agriculture, Health, Education, etc., promoting the establishment of startups focused on specific businesses[5]; (ii) Scientific, the development of components within the proposed architecture will enable participation in both national and international projects, as there are currently no effective solutions compliant with the proposed architecture. With consider the following goals was achieved: Production of software that can be distributed nationally and internationally, although this is planned for the next stage of the research[6]. With continued research[7], the following objectives can be achieved: Supervision of pos doctoral stage and three scientific initiation works over 12 months. Publication of 3 (three) articles in national and international journals with a high impact index, rated as A in the CAPES Qualis system. **Conclusion:** This research achieved a versatile architecture model merging Big Data technologies, ontologies, and standardized frameworks, promising adaptable solutions

[5] Currently, research is underway in the context of fruit growing (https://agrolabs.space).

[6] Software implementation and distribution expected in 2024, in the context of Agrolabs Project.

[7] https://agrolabs.space/estatisticas-frutas/abacate/

across sectors. Scientifically, it fills critical gaps, fostering future collaborations. Accomplishing software distribution milestones and aiming for impactful contributions signify substantial progress and potential for continued advancements within the field. **Acknowlegment:** This work was partially supported by INES (www.ines.org.br), CNPq grant 465614/2014-0 and FACEPE grants APQ-0399-1.03/17 and PRONEX APQ/0388-1.03/14.

References

AKEHURST, Gary et al. Ontological supports of knowledge: knowledge creation and analytical knowledge. Management Decision, v. 49, n. 2, p. 183-194, 2011.

AMORIM, Ricardo R. et al. A learning design ontology based on the IMS specification. Journal of Educational Technology & Society, v. 9, n. 1, p. 38-57, 2006.

CIRILLO, Flavio et al. A standard-based open source IoT platform: FIWARE. IEEE Internet of Things Magazine, v. 2, n. 3, p. 12-18, 2019.

GUARINO, Nicola; OBERLE, Daniel; STAAB, Steffen. What is an ontology? Handbook on ontologies, p. 1-17, 2009.

LAI, Chun Sing et al. A review of technical standards for smart cities. Clean Technologies, v. 2, n. 3, p. 290-310, 2020.

OUSSOUS, Ahmed et al. Big Data technologies: A survey. Journal of King Saud University-Computer and Information Sciences, v. 30, n. 4, p. 431-448, 2018.

RABELO, Thomas et al. Comparative study of xAPI validation tools. In: 2017 IEEE Frontiers in Education Conference (FIE). IEEE, 2017. p. 1-5.

SEINTURIER, Lionel et al. A component-based middleware platform for reconfigurable service-oriented architectures. Software: Practice and Experience, v. 42, n. 5, p. 559-583, 2012.

SOMMERVILLE, Ian. Software engineering (ed.). America: Pearson Education Inc, 2011.

VIDAL, Juan C. et al. Ontology-based approach for the validation and conformance testing of xAPI events. **Knowledge-Based Systems**, v. 155, p. 22-34, 2018.

YIN, ChuanTao et al. A literature survey on smart cities. Sci. China Inf. Sci., v. 58, n. 10, p. 1-18, 2015.