A Novel Approach to Explore Edhi Foundation Knowledge for Ontology Construction

Muhammad Ahsan Raza[†], M. Rahmah[††], Fahad Qaswar[††], Roslina Abd. Hamid[††] and Sehrish Raza[†††]

[†]Department of Information Technology, Bahauddin Zakariya University, Multan, Pakistan
[††]Faculty of Computing, Universiti Malaysia Pahang, Kuantan, Malaysia
[†††]Institute of Computer Science and Information Technology, The Women University, Multan, Pakistan

Summary
The worth of the Edhi Foundation (EF) system depends on how well its structural knowledge can be extracted by EF users and staff to perform daily activities. Ontology has emerged as a semantic tool to represent the knowledge of a particular domain and thus is a good choice for the semantic organization of EF data. However, building an ontology that suits the needs of EF users is a challenging task. This study presents a novel approach that uses the UML class diagram (UCD) to construct an ontology for the EF system. We propose UCD-to-ontology transformation rules, that is, the ontology model that is used for eliciting OWL ontology. We test our approach for the successful interpretation of UCD features to OWL ontology elements and find that the system performs well with an average precision of 97.80%.

Key words:
Knowledge Management, Ontology Engineering, Ontology Validation, Semantic Web.

1. Introduction

In Pakistan, an increasing number of social welfare organizations are working with the aim of serving humanity and the betterment of their lives. The Edhi Foundation (EF) founded in 1951 has become one of the biggest and well-known nonprofit social welfare service providers in Pakistan [1]. The EF provides many services, such as shelter for deprived people, free hospitals and medical facilities, drug and rehabilitation services, national and international relief efforts, and ambulance service. More than 300 service centers of the foundation are operational across the country, including major cities, small villages, and remote rural areas. The EF knowledge system is evolving with the need to share information to the public and the workers and agents to improve their learning. The three major challenges to this knowledge sharing are as follows:
1) crafting a shared mutual understanding among the different users of the EF system (e.g., the public, government agencies, and staff);
2) organizing, utilizing, and accessing knowledge about human welfare services; and

3) facilitating the interaction between EF centers and users across different welfare services.

To meet these challenges, we consider developing a knowledge structure, namely, an ontology for describing the vocabulary (i.e., concepts, properties and relationship between concepts) of the EF domain. Furthermore, we adopt the OWL language to build an EF ontology because OWL is a W3C standard language that has a high level of semantic expressivity [2]. The new EF OWL ontology provides an unambiguous vocabulary to EF users, thus supporting interoperability among different welfare services, centers, and software agents. Furthermore, with a common ontology, developing an efficient decision support system with reasoning capabilities is possible.
Engineering an EF domain ontology requires accuracy and efficiency. If the ontology refers to an ambiguous relationship, then users do not acquire the necessary knowledge. In addition, accurate ontology development is a tedious and time-consuming task, especially for large systems, such as EF where information evolves over time.
This study focuses on engineering an OWL ontology for the EF domain while considering accuracy and efficiency. We devise a unified modeling language (UML)-based framework for ontology construction that follows four simple steps. In this framework, UML class diagrams (UCD) for the EF domain are created from EF data (i.e., documentation and user interviews) and used to build an ontology. Furthermore, the method outlines the rules to map UML diagrams into ontology vocabulary. The present approach is motivated by the lack of a model to engineer an ontology for the EF domain. Our contributions are as follows:
1) A UML-based approach for developing an ontology used in the EF knowledge system is developed.
2) Important transformation rules that map UML class level (UCL) diagram into ontology vocabulary are outlined while fully maintaining the domain semantics.

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