

PanayHub: Digital Ontology with ChatBot on Folk Tales, Myths, and Legends
from Panay Island

A Special Problem Proposal
Presented to
the Faculty of the Division of Physical Sciences and Mathematics
College of Arts and Sciences
University of the Philippines Visayas
Miag-ao, Iloilo

In Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science in Computer Science by

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December 2, 2024

Abstract

Currently, little work is being done on the development of digital ontologies, particularly that of the folklore of Western Visayas. Thus, the researchers aimed to create a chatbot that is able to provide insights and details regarding Panayanon folk narratives which include, myths, legends, and folk tales. Specifically, the researchers aimed for the creation of a knowledge base of Panayanon folk narratives, and subsequently, development and training of a chatbot to understand and answer inquiries about Panayanon folk narratives.

Keywords: Philippine folk literature, Ontology-based system, Chat bot

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Chapter 1

1 Introduction

1.1 Overview

Philippine folk literature is the body of oral literature of the Filipino people. Folk literature typically undergoes classification into three categories: folk narratives, folk speech, and folk songs. Myths, legends, and folktales are included in the category of folk narratives, a form of literature that provides a narrative through prose or verse, and will serve as the focus of this project. Myths and legends are both regarded as truthful accounts of the past that provide explanations for the origins of entities in the environment. However, myths are often sacred and linked with religion, whereas legends tend to be secular in nature. On the other hand, folktales are fictitious prose narratives typically employed for entertainment purposes (Eugenio, 2007). In addition to their roles in explaining origins or providing entertainment, these three forms of folk literature often function as mediums for the communication of morals, traditions, and beliefs of the Filipino people. Eslit (2023) explored 10 popular folklores in the Philippines, examining their portrayal of Filipino culture and identity. Common themes in the analyzed folklore include environmental importance, respect for elders, and justice. These forms of folk literature have played significant roles in the conveyance and instillment of key values, traditions, and identity within particular ethnolinguistic groups. However, as Eugenio (2007) notes, there is a significant lack of collections of Philippine folk literature. Consequently, research on Philippine folk literature presents difficulties due to its wide dispersion across the country, the necessity for translations, and the rapid decline of this literary form, which limits available research. While there has been some work addressing these challenges, access has been limited due to cost and dated nature.

According to (Dimzon & Dimzon, n.d.), there exists no digital ontology of Western Visayas folklore as digital ontology development was a new area of research. Their pioneering work serves as the start of the digitization of the Western Visayas folklore and is the basis of the researchers' work. With this, researchers propose the development of an ontology-based chatbot capable of answering questions and providing information about folk narratives, particularly those from Panay.

Jepsen (2009) offers a practical definition of ontology. Specifically, ontology as "a method of representing items of knowledge (ideas, facts, things—whatever) in a way that defines the relationships and classifications of concepts within a specified domain of knowledge." A chatbot is a software agent with the capability for engaging in human-like conversation. The researchers aim to provide the chatbot with knowledge and understanding of the relationships between concepts found in Panayanon folk narratives, which enables it to answer queries about them. Through the proposed system, the creation of a central hub of knowledge on Panayanon folk narratives facilitates the streamlining and acces-

sibility of research and education on Panayanon folk narratives. Furthermore, the proposed system contributes to the preservation and promotion of cultural diversity and heritage, as globalization heightens the threat of the deterioration and disappearance of cultural heritage (UNESCO, 2001).

1.2 Problem Statement

The body of knowledge regarding Philippine cultural heritage, specifically Philippine folk literature, remains limited. Despite efforts to collect and analyze this literature, the accessibility of such research is constrained by the cost of resources and the outdated nature of existing works. Eugenio (2007) affirms the lack of comprehensive collections and accessible resources on Philippine folk literature, resulting in significant challenges in the study, documentation, and promotion of this literary form.

Damiana Eugenio, recognized as "Ina ng Folklor ng Pilipinas" by the U.P. Folklorists, Inc. and the U.P. Folklore Studies Program, has made significant contributions to the preservation of Philippine cultural heritage. Her book *Philippine Folk Literature: An Anthology*—the first volume in a seven-volume series—compiled over 150 texts and selections of proverbs and riddles from across the Philippines. However, due to the rapid digitization of global information and the fact that her works are now over 15 years old, their accessibility continues to diminish.

Recent efforts have sought to address this issue, with projects like the Aswang Project, created in 2006 by Jordan Clark. This project serves as an online resource for Philippine folklore, featuring articles about various myths, creatures, and spirits found throughout the country. Furthermore, in the terminal report of Dimzon and Dimzon (n.d.), they have collected and digitized Panayanon myths and legends by creating ontologies using Web Ontology Language (OWL). However, their work is not made publicly available and has not included folk tales from Panay; gaps remain in the collection of Panayanon folk narratives, which the researchers aim to explore further.

In the field of chatbots, Shawar and Atwell (2007) note that chatbots are designed to accommodate users' natural tendency to express their wishes through speaking, typing, or pointing (Zadrozny et al., 2000). Consequently, chatbots present potential as educational tools, particularly as information retrieval systems. By offering quick and convenient responses similar to human interaction, chatbots hold promise for facilitating research and education. This potential is evidenced by the rapid growth of OpenAI's ChatGPT, an artificial intelligence chatbot that gained one million users within days of its launch (Mortensen, 2024).

1.3 Research Objectives

1.3.1 General Objective

The researchers aim to further expand the original digital ontology by Dimzon and Dimzon (n.d.), and develop a chatbot equipped with the ontology-based framework to answer questions about Panayanon folk narratives. Ultimately, the project output should be able to contribute to the preservation, accessibility and study of Panayanon folk literature.

1.3.2 Specific Objectives

Specifically, the researchers aim to:

1. Enhance the existing ontology by introducing story elements as new classes, such as events and settings. Through this, additional details of the new folk narratives can be captured and queried.
2. Expand the scope of the existing ontology by adding new entities, attributes, and relationships from Panayanon myths, legends, and folk tales.
3. Develop a prototype chatbot capable of understanding English questions and responding with accurate and appropriate information from the enhanced and expanded digital ontology.

1.4 Scope and Limitations of the Research

The primary focus of this project is on the expansion and enhancement of the original digital ontology, which was first developed by Dimzon and Dimzon (n.d.). The scope of the folk literature analyzed for the digital ontology will be limited to folk narratives originating from the island of Panay, specifically myths, legends, and folk tales only. Further, these stories will be limited to those available during the project timeline, relying on existing research, expert consultations, and accessible resources. By building upon and expanding the original ontology, the researchers will ensure comprehensive coverage of the key entities and relationships within Panayanon folk narratives.

The native languages used in Panayanon folk narratives are Panayanon languages, namely Hiligaynon, Aklanon, and Karay-a. However, the language used in the development of the ontology and the chatbot will be in English. This is to ensure ease of use in academic and global contexts, thereby improving the accessibility of the ontology to a broader audience. Character names and other proper nouns will be kept in the original language to preserve authenticity. To enhance the scope of the ontology, new classes will be created, such as events and settings, which were not present in the original ontology. The researchers will be consulting with literature experts to ensure that the new classes are relevant. As such, more classes may be introduced based on the suggestions of experts.

The chat bot will primarily be used as the tool for information retrieval from the ontology. It will be developed as a prototype, focusing on demonstrating feasibility rather than full-scale deployment. Multilingual capabilities, advanced natural language processing for more complex queries, and deployment-level optimizations are beyond the scope of this project. Future projects may address these limitations.

1.5 Significance of the Research

The study holds significant value for the field of Panayanon cultural heritage and preservation for the following reasons:

The proposed system addresses the problem identified by Eugenio (2007) regarding the lack of published collections of Philippine folk literature. By serving as a central repository of knowledge for Panayanon folk narratives, the system is expected to facilitate easier access to Panayanon folk literature for researchers, students, educators, and the general public.

Additionally, the system seeks to address the issue of the decline of Panayanon oral literature by systematically collecting and digitizing these oral traditions, thereby contributing to their preservation for future generations.

Chapter 2

2 Review of Related Literature

This chapter discusses the features, capabilities, and limitations of existing research, algorithms, or software that are related/similar to the Special Problem.

2.1 Ontologies in Computer Science

This chapter contains a review of research papers that: One of the ultimate goals of ontology as a philosophy is to provide a definitive, exhaustive classification of entities across all spheres of being. However, in the context of computer and information science, this goal has transformed into the pursuit of creating a single unified system that resolves the differences of terminologies and concepts used across diverse data and knowledge-based systems (Smith, 2012). In fact, in their study on ontologies and knowledge-base systems, Kharbat and El-Ghalayini (2008) claimed that ontology has been an emerging computer science discipline for decades. They also concluded that ontologies formalize the semantics of a domain of knowledge by explicitly describing the elements that comprise the domain. This meant that ontologies consisted of concepts that describe the internal features or attributes of an entity, as well as properties that describe the relationships between these entities.

2.1.1 Applications of Ontologies

The aforementioned properties of ontologies in Kharbat and El-Ghalayini's study meant that ontologies are capable of performing a broad range of tasks across diverse research areas. The tasks that are relevant to the study include: the integration of heterogeneous data sources to overcome semantic heterogeneities (Lacroix & Critchlow, 2003); the creation of knowledge bases (Noy, McGuinness, et al., 2001); deriving aspects of information systems at run time (Guarino, 1998), and the construction of an ontology-based retrieval system that can assist end users in browsing and understanding domain concepts (Baker et al., 1999). Furthermore, Munir and Anjum (2018) stated that, with the recent dramatic increase in the use of knowledge discovery applications, there is a growing complexity in terms of the database search requests that the end users are supposed to write to retrieve the information that they wanted. Munir and Anjum (2018) stipulated that these difficulties are attributed to the need for the end users to have a good understanding of the complex structure of databases, and the semantic relationships that exist between different data within the database. It is through the use of ontologies for knowledge representation and interactive query generation that researchers were able to improve the interface between data and search requests, increasing the accuracy of the result sets to the user search requirements. Building upon these applications of ontologies, the study adopts a similar approach, creating an ontological knowledge base that consolidates, organizes, and classifies Panayanon myths, legends, and folk tales that also depicts the settings, character relationships, and themes that are embedded in these Panayanon stories.

2.2 Ontology Development

2.2.1 Ontology Construction

Yadav, Narula, Duhan, Jain, and Murthy (2016) further expounds on the core components that form an ontology. These components of ontologies include: a set of concepts that can serve as nodes in the representation of an ontology; an optional set of properties related to the concepts, these properties can also be summarized as the values of the concepts; a set of relational properties that implies relationship between two or more concepts, often generating a hierarchical path from one concept to another; a hierarchy of concepts and a hierarchy of properties as a result of the relational properties linking one concept to another; a transitive property relation that expands and allows for logical inference on relationships between properties; i.e., if Property A is related to Property B, and Property B is related to Property C, then Property A will be necessarily related to property C; symmetry and inverse symmetry relations among properties; domain values related to properties that define the level of properties within classes, indicating that concepts that share the same property values have the same domains; range values related to the properties which can either be an interval, a list of elements, or a character; and minimum and maximum cardinality for each concept-property pair that define how many properties are

associated with a particular concept. These core components of ontologies will be applied in developing the ontology for this study.

Yadav et al. (2016) also listed the basic steps in constructing ontologies. According to their study, the first step in constructing ontologies is determining its scope. These include defining the structure of the ontology as well as the values that are associated with the ontology. Next, is the consideration of reusing ontologies. Yadav et al. (2016) stated that it's possible to re-use recent ontologies in defining the schema of the new ontology that is to be constructed. Third, is the enumeration of terms, where all terms must be clearly specified, together with the domain and range of the ontology. Fourth, is the definition of the taxonomy, where all terms are organized in a hierarchy. For example, if A is a subclass of B, then every instance of class A must be an instance of B. Fifth, is the definition of properties, which includes specifying the properties that link the classes while organizing them in a hierarchy. Next, is the definition of facets which is defined as the hierarchy of homogeneous terms that describe an aspect of the domain where each term in the hierarchy refers to a different concept (Giunchiglia, Dutta, Maltese, & Farazi, 2012). For example, if a domain is space, then facets might refer to bodies of water, land formations, and administrative divisions. Finally, the last step of ontology construction is the definition of instances within the ontology. The steps outlined by Yadav et al. (2016) will be applied in constructing the ontology for this study. This includes the reuse of an existing ontology, building upon it by incorporating additional concepts, classes, and all of the other aforementioned core components to expand the ontology's scope and application.

The construction of the ontology will be done through Protege, an open-source knowledge requisition system written in Java (Yadav et al., 2016; Jain & Singh, 2013). More specifically, it's an ontology development editor that is capable of defining ontological concepts or classes, properties, taxonomies, and class instances. Protege supports ontology representation languages like OWL. Aside from constructing ontologies, Zhao, Zhang, and Zhao (2012) states that Protege is also capable of parsing an Ontology model using a Protege-based OWL API. Protege is able to: load an ontology model from the OWL file; collect the classes, subclasses, object properties, data properties; and find the domain and range relevant to a particular object property. The study will be using Protege Desktop v.5.6.4 in developing the ontological database for the Panayanon stories.

2.2.2 SPARQL for Ontology Querying

SPARQL 1.1 is a set of specifications that provide languages and protocols to query and manipulate RDF graph content on the Web or in an RDF store. The standard SPARQL Query Results are written in an XML Format, and in three other alternative formats: JSON, CSV, and TSV (Picalausa & Vansummeren, 2011). SPARQL 1.1 is the query language the Protege uses to retrieve, and

manipulate ontological data.

2.2.3 PAROT for Natural Language Conversion

PAROT is a dependency based framework used for converting natural language (NL) queries of the user into SPARQL, the query language for databases making use of ontologies (Ochieng, 2020). PAROT was created to address the shortcomings of existing NL to SPARQL tools like AquaLog, CASIA@12, Querix, AutoSPARQL, K-Extractor, and SPARK in handling queries that contained the following conditions: opposing scalar adjectives, negation, numbered lists, and compound sentences. According to Ochieng (2020), these NL to SPARQL tools drastically decrease in their precision and recall values when encountering any of the four conditions stipulated. PAROT is able to handle compound, negation, numbered list, and scalar adjective based questions. According to Ochieng (2020), it is highly successful in converting NL to SPARQL, outperforming the gAnswer system when it comes to answering complex questions with the QALD9 dataset. The study will be using PAROT to convert natural language statements of the end user to SPARQL queries for retrieving data from the study's ontology.

Chapter 3

3 Research Methodology

This chapter lists and discusses the specific steps and activities that will be performed to accomplish the project.

3.1 Research Activities

3.1.1 Data Collection

The researchers will collect Panayanon myths, legends, and folktales from reliable resource persons. Other sources may be explored, including written records, research papers, and digital archives. For validation, the collected folk narratives will be presented and consulted on by the researchers with literature experts from the UPV Division of Humanities and Center for West Visayan Studies to verify the authenticity of the collected folk narratives.

The expected outcome of this process is a comprehensive and authentic collection of folk narratives that reflects the breadth and richness of Panayanon culture. This step is scheduled to start in December 2024 and must be accomplished halfway through January 2025, with a total duration of one and a half (1.5) months.

3.1.2 Ontology Enhancement

The researchers will engage in extensive consultations with experts from the UPV Division of Humanities and Center for West Visayan Studies. They will focus on creating new classes for the digital ontology, specifically story elements such as events and settings which are not present in the current ontology. Other possible classes may be explored. This will also be used to ensure consistency with standards in the field of literature.

These new classes will be designed utilizing Protégé, an open-source ontology editor that supports OWL (Web Ontology Language) for formalizing domain knowledge. Each new class will be defined in terms of its relationships with other entities to create a structured and interconnected narrative representation. Protégé features such as logical constraints and reasoning will be utilized to ensure consistency and to infer relationships that enhance the semantic depth of the digital ontology.

The expected outcome is an enhanced ontology structure that has more depth of information on Panayanon folk narratives than the original. This step is scheduled to start in mid-December 2024 and must be accomplished halfway through January 2025, with a total duration of one (1) month.

3.1.3 Ontology Expansion

To follow good practices in the field of literature, the researchers will consult with experts to gain insights into the analysis of folk narratives, the identification of key story elements, and the contextual relationships between entities. With this, the researchers will closely read and examine each story from their collection, looking for relevant story elements and relationships. From their findings, they will expand the digital ontology by populating it with new stories, entities and relationships based on the enhanced ontological structure.

Protégé will be utilized for ontology expansion for its extensive support in OWL files and SPARQL querying, reasoning and consistency checking features, as well as collaboration features. Throughout this whole process, the researchers will present and consult with literature experts from the UPV Division of Humanities on the expanding ontology to validate the findings and ensure consistency with conventions and practices in the field of literature.

The expected outcome is an expanded ontology that includes new details from the collected folk narratives based on the enhanced ontological structure. This step is scheduled to start in mid-January 2024 and must be accomplished by the end of April 2025, with a total duration of three and a half (3.5) months.

3.1.4 Chatbot Development

In this step, the researchers will develop a chatbot prototype that can handle English queries from users, query the ontology to search for relevant data, and present the information to the user in comprehensible English sentences. Specifically, the researchers will utilize Python as the primary programming language, incorporating natural language processing (NLP) libraries such as

SpaCy or NLTK to analyze and process user queries. For converting natural language queries into SPARQL queries, PAROT (Ochieng, 2020) will be utilized as it supports queries containing compound sentences, negation, scalar adjectives and numbered lists.

The SPARQL queries will then be sent to an Apache Jena server where the OWL file of the ontology will be hosted. Finally, the query results will be formatted into English through NLP techniques. With each iteration of the chatbot, the researchers will perform tests to verify chatbot query accuracy and response relevance, assess user interaction with the chatbot, and measure response times and optimize as needed.

With this chatbot, users will be able to interact with the ontology in natural language. This is in pursuit of data querying, which is Manansala, Bruskiewich, and Naval (2007)) third and final pillar of ontology frameworks. The prototype chatbot will only serve to demonstrate the feasibility of chatbots as an information retrieval tool of the digital ontology.

The expected output is a chatbot prototype that can semantically understand complex user questions in English, and answer them with accurate information from the ontology in a natural language format. This step is scheduled to start in February 2024 and must be accomplished by the end of May 2025, with a total duration of four (4) months.

3.1.5 Documentation

The researchers will document relevant results and information throughout the project. It shall cover data, methodology, results, and analysis. Additionally, insights and validations provided by expert consultations and testing phases will also be documented. Google Docs will be used for its simplicity and familiarity with the researchers, and Overleaf will be utilized for final formatting.

Applying software engineering principles, the researchers will also create diagrams such as use case diagrams, and sequence diagrams. For diagrams, computer assisted software engineering (CASE) tools will be utilized. The software will also be documented and stored in a GitHub repository.

This step ensures that all information has been transparently communicated for future reference to be used by other researchers and interested parties. The expected output is complete project documents, including technical details, the software itself, and a final project report. This step is scheduled to start in December 2024 and must be accomplished by the end of May 2025, with a total duration of five (6) months.

3.2 Calendar of Activities

Table 1 shows a Gantt chart of the activities. Each bullet represents approximately one week worth of activity.

Table 1: Timetable of Activities

Activities (2025)	Dec	Jan	Feb	Mar	Apr	May
Data Collection	••••	••				
Ontology Enhancement	••	••				
Ontology Expansion		••	••••	••••	••••	
Chatbot Development			••••	••••	••••	••••
Documentation	••••	••••	••••	••••	••••	••••

Chapter 4

4 Preliminary Results/System Prototype

4.1 Original Ontology

As illustrated in Figure 1, the original ontology by Dimzon and Dimzon (n.d.) does not contain story details but rather the classification of the different oral traditions found in the cultures of Western Visayas. This presents the knowledge gap that the researchers propose on exploring. Specifically, the ontology will be expanded with story elements for the Myths, Legends, and Folktales entities present in the current iteration of the ontology.

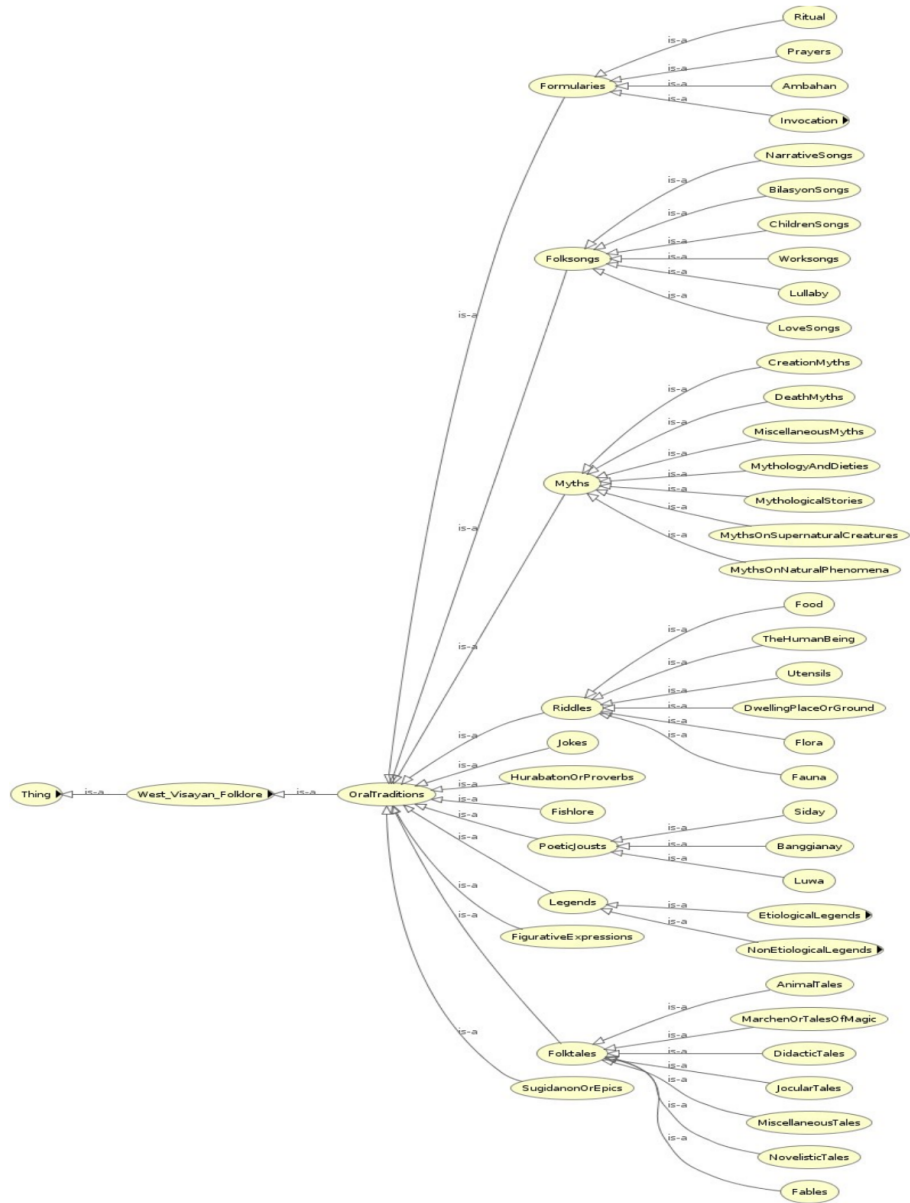


Figure 1: Diagram of The Original Ontology by Dimzon and Dimzon (n.d.)

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A Resource Persons

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