Developing A Semantic Ontology to Represent Knowledge About Thai Amulets

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Abstract

This study aims to construct a comprehensive ontology for Thai amulets that accurately encapsulates the scope of knowledge, structure, and concepts pertaining to this subject. The ontology development process encompasses three primary stages. The initial stage involves gathering expertise from specialists and relevant literature on Thai amulets. The subsequent stage examines individuals interested in amulets' behavior and information requirements. The final stage entails the creation of the ontology using the Protege program. This process is subdivided into three main tasks: 1) defining the objectives of the ontology, 2) constructing the ontology, and 3) evaluating the ontology. The development of the amulet knowledge ontology resulted in the establishment of 17 main classes and 20 subclasses. Structural efficiency was assessed using the OntOlogies Pitfall Scanner (OOPS!). Understanding the structural integrity of the amulets facilitates their dissemination and community utilization. Expert evaluations indicate that the ontology achieved a comprehensive efficiency rating of 4.63. Additionally, creating a semantic search system is deemed suitable for further development.

Keywords: *Ontology, Thai Amulet, Buddhist, Sacred Things.*

INTRODUCTION

A Phra Krueng, also known as a Thai Amulet, is a revered item that can be carried by individuals who have faith in the blessings of the Buddha. It is believed to provide protection from negative influences and enhance prosperity. Amulets are consecrated artefacts formed by amalgamating Buddhist principles with superstitious convictions, yielding an artefact that consolidates several religious elements into a single entity to fulfil psychological desires. Mitigate potential hazards or cultivate desired outcomes such as prosperity, achievement, etc. (Taisirkhot, Phakeaw, & Saiboonyuan, 2020). In modern times, Thai Amulets have become highly sought after and are often priced at a premium due to the belief that owning one brings blessings and divine favour. As a consequence, Buddhism became a profitable enterprise, with its beliefs being transformed into commercial advantages. For instance, the amulet's narrative was linked to historical tourist sites, generating economic benefits (Kerdnaimongkol, 2017). Amulet rental or purchase is a Buddhist commercial activity with significant economic significance and widespread recognition in Thai society.

The combination of valuing and beliefs led to a significant surge in purchasing, particularly for the widely sought-after amulets in society. Once there was a significant demand, the purchasing rate likewise increased proportionally. The amulet's appeal can be traced back to the cherished and adored reputation of the monks, who believed in mythological phenomena and had personal encounters with each amulet (Soontravanich, 2008). The Suan Dusit Poll (Suan Dusit Poll, 2023) has identified the five most popular amulets in Thai society, ranking them as follows: The individuals mentioned are 1) Somdet Phra Rajamunee Sameeramkhunupamajarn (Luang Pu Thuat), 2) Somdet Phra Phutthachan (Toh Promaramsi or Phra Somdet To), 3) Phra Ratchaphutthirangsri (Phra Phuttha Sothorn), 4) Phra Pittha Phra Ratchasangwara Phimon (Toh Inthasuwanno or Luang Pu Toh), and 5) Phra Racha Thammaphon (Luang Pho Ngern). The amulet's popularity can be attributed to the monks' reputation and experiences. Therefore, the price range encompasses many factors, often from three US dollars to one hundred thousand US dollars (Chantani, 2016).

As the level of popularity and demand rises, There has been a significant rise in interest and demand for information about amulets across all genders, age groups, and occupations. A study conducted by Chitiyaphol

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and Kwiecien (Chitiyaphol & Kwiecien, 2023) it was revealed that the younger generation in Thailand exhibits a higher propensity to acquire amulets than their predecessors. This change might be ascribed to the evolving trend in information-seeking behaviour concerning amulets in Thai culture. The reason for this is the advancements in digital technology that have altered how individuals seek information. By transitioning from traditional expert-led conversations to online social networks, The study also demonstrates that achieving successful search results depends upon the simultaneous effectiveness of quality storage and retrieval methods. Furthermore, different names and terms used in various models and genres also impact search efficiency. It also impacts the degree of efficacy in information retrieval. Encouraging users to search for information in a semantic system will efficiently address issues pertaining to data retrieval. Hence, it is imperative to develop a semantic search engine to enhance the data-collecting procedure for the amulet database.

Semantic ontology is another kind of knowledge organisation. It is a technique used to manage cultural information, commonly referred to as research in the field of Digital Humanities (University of Reading, 2023; Tuamsuk, 2018). Education teaching involves the ongoing interconnection of knowledge organisation, ontology creation, and semantic search systems development. Given the characteristics of this approach, we were tasked with creating a semantic web or semantic search engine system. This technology aims to handle data and make information easily accessible by organizing the data structure, connecting the data using ontologies, and describing the data collectively at the metadata level. These features would allow consumers to enter the semantic search systems' website and empower them to efficiently obtain, access, and utilise digital cultural information (Hoaihongthong & Kwiecien, 2022a). The semantic search system encompassed essential knowledge, from creating data structures to implementing ontology. To construct an ontology, it is necessary to have a systematic procedure for analysing and synthesising information about the studied subject and identifying ideas and linkages of knowledge. This approach provides a comprehensive understanding of the subject matter (Islam, Syed, & Shaikh, 2023).

Due to the requirement to retrieve information regarding amulets, Creating a semantic search system will facilitate access to knowledge and information on Thai amulets that fulfill these requirements. However, creating a successful semantic search system involves the implementation of an ontology to establish connections between many different kinds of information associated with amulets. Based on the considerations as mentioned earlier, the researcher recognised the necessity of creating an ontology to manage knowledge about Thai amulets effectively. This would involve systematically gathering information relevant to Thai amulets. Both knowledge derived from various information resources and expertise from experts are necessary to encompass current understanding. The acquired knowledge is organised into knowledge structure and attributes associated with amulets. The objective is to provide appropriate and pragmatic fundamental knowledge to facilitate the advancement of the semantic search system. Through this research The researcher utilised the theoretical framework of Uschold & King's ontology development concept (Uschold & King, 1995) to develop the following: The ontology development process involves three main steps: 1) establishing the aim of the ontology, 2) constructing the ontology, and 3) assessing the ontology. The researchers applied Protege, an open-source software developed by the Stanford Centre for Biomedical Informatics Research (BMIR) (Stanford University, 2024), as a tool for ontology development. Developing a Thai amulet ontology can facilitate the identification of essential terms that represent common ideas related to Thai amulet knowledge. Additionally, it can enhance the automation of dispute resolution and content management. This establishes a unified domain for Thai amulets, simplifying the process of searching for and understanding the connections between concepts within the specialised field of amulets. Additionally, it will decrease redundancy and enhance precision in retrieving information on amulets, hence augmenting accessibility to amulet-related information. This development will also improve the expansion of the creative economy associated with Buddhist commerce.

Research Objective

This study aims to clarify the scope of knowledge about Thai amulets and develop a semantic ontology relating to knowledge about Thai amulets.

LITERATURE REVIEW

Ontology and Knowledge Organization

Knowledge organisation systems play an essential role in categorising and facilitating the retrieval of information and documents resources (Mazzocch, 2018 ; Hjørland, 2008). Ontology and semantic search development are closely related approaches that utilise digital technology to enable search systems to comprehend differences in data meaning and provide access to the internet or information systems. Ontology and semantic search enhance the user's ability to retrieve and utilise information or knowledge efficiently (Hoaihongthong & Kwiecien, Development of Ontology for Knowledge of Traditions Common Culture of Countries in the Greater Mekong Subregion, 2022). Developing an ontology for Thai amulets involves carefully examining and combining information and understanding about Thai amulets, systematically defining concepts and connections of knowledge.

Noy (Noy & McGuinness, 2001) propose that establishing an ontology can enhance the efficiency of information access and knowledge sharing. It provides machine-readable explanations of fundamental concepts in the field and their connections. Ontology is a formal and precise specification of concepts within a specific domain. It includes the properties of each concept, which describe its many features and attributes, as well as any limitations on slots or aspects. A knowledge base consists of an ontology, a formal representation of knowledge, and a collection of unique classes, which are specific categories or concepts inside the knowledge base. Indeed, a distinct boundary exists between ontology and the knowledge base.

The components of ontologies typically consist of instances or individuals, which are specific examples of concepts or objects. Classes or sets represent collections of individuals, while attributes or properties describe the concepts. Relations are the connections between pairs of concepts, allowing ideas to be related.

Previous research has utilised ontology development to structure and represent knowledge structures across different domains effectively. For instance, the creation of the Folk Song ontology in the countries of the Mekong Subregion (Kaewboonma & Tuamsuk., 2018) or the development of an ontology for the knowledge of traditions and everyday culture in the Greater Mekong Subregion countries aims to build a semantic search system that utilises shared cultural knowledge (Hoaihongthong & Kwiecien, 2022b). In addition, developing an ontology for a recommendation system was intriguing. Specifically, the ontology was created to analyse MOOC classes for individual study to assist learners in finding lessons that align with their specific needs (Li, Chen, & Zhan, 2022). Similarly, the hospitality industry has embraced ontology development to suggest hotel rooms that align with guests' personalities and interests (Ojino, Mich, & Mvungi, 2022). Hence, creating ontology can enhance the efficiency of information retrieval systems in multiple domains.

Thai Amulets

The amulets are considered holy objects created by blending Buddhist principles with the virtuous behaviour of monks, accompanied by prayers that enhance the potency of Buddhism. Until it transforms into a renowned artefact that faithful people can easily acquire, protect, and carry. Amulets are currently regarded as sacred artefacts and have significant popularity in Southeast Asia, particularly among the countries in the Mekong Basin region. Consequently, it has transformed into Buddhist business goals.

Buddhist businesses leverage Buddhist ideas and faith by utilising Buddhist objects or symbols to generate money and seek commercial advantages. Kerdnaimongkol (2017) has categorised Buddhism into different commercial domains. However, the most renowned and economically prominent Buddhist commerce in Thai society is purchasing amulets. These amulets combine Buddhist ethical principles with mystical beliefs, transforming them into objects that fulfill psychological needs by preventing danger and generating desires for various outcomes, such as prosperity and success (Taisirkhot, Phakeaw, & Saiboonyuan, 2020).

Amulets possess economic value and serve as significant collections of information, including valuable knowledge deeply embedded within their artistic components and other attributes. This content covers various topics, including historical tales or legends about famous monks who created the amulets, philosophical ideas or beliefs, Buddhist ethical standards, and artistic elements. The researchers employed Gilliland's framework of

information objects (Gilliland, 2023), which identified three essential features of information resources: 1) Content related to what the object contains, such as knowledge of beliefs surrounding amulets or different mythical stories. 2) Context of the amulet indicates the who, what, why, where, and how aspects associated with amulet information, for example, the creator, the location where amulets were produced, and 3) structure of the amulet, including the shape of its components. The amulets possess comprehensive details as defined by Gilliland. Hence, the amulets serve as an information resource that may be utilised for analysing knowledge structure and developing ontology.

Research Methodology

For constructing this ontology for the purpose of organising and representing knowledge about Thai amulets. Using a conceptual ontology model, the researcher has attempted to identify the scope and conceptual framework encompassing amulet knowledge. The concept was utilised to create a semantic search system that facilitates the retrieval and utilisation of information and knowledge related to amulets. For the benefit of academia and commerce, the researcher developed a conceptual model that illustrated and comprehended the structure and interconnections of knowledge regarding Thai amulets. The researcher used a study methodology for ontology development based on the ideas proposed by Uschold & King (Uschold & King, 1995). This theoretical framework has been widely acknowledged and utilised in producing ontologies in numerous research studies. This enables the created ontology to be duplicated or expanded. It facilitates the dissemination and integration of knowledge across several disciplines and employs the Protégé software to construct ontology.

Protege and OOPS! (Roche & Perrot, 2022) are excellent tools for developing a semantic ontology about Thai amulets. Protege is an open-source ontology editor with an intuitive graphical user interface, making it accessible to beginners and experienced developers. It is widely used and supported, fully supporting the Web Ontology Language (OWL), which provides the necessary expressivity for modeling complex relationships and axioms related to Thai amulets. Protege integrates with reasoning engines, allowing developers to check the ontology's consistency, infer new knowledge, and detect logical errors.

OOPS! is an automated tool that scans an ontology for potential pitfalls, errors, and inconsistencies, ensuring the quality and reliability of the ontology (Debnath, Patel, Mazumder, Manh, & Minh, 2022). It covers many common modeling errors, provides targeted feedback, and can be integrated with Protege. Together, Protégé and OOPS! enable the creation of a rich and expressive ontology that captures the nuances and complexities of Thai amulet knowledge.

The specific information regarding the development is as follows.

Phase 1: Analyzing The Knowledge Structure Regarding Thai Amulets. This phase was designed to analyse data gathered from three sources: Thai Journal Online, Thai theses and research databases, and websites related to the publication of information about amulets in Thailand. Two hundred fifty-six documents pertaining to amulets were examined to analyse and develop the knowledge structure. Subsequently, the knowledge structures were organized, and their validity was verified by seven amulet experts.

Phase 2: Investigating The Utilisation of Thai Amulet Knowledge. We surveyed to examine the behaviours of amulet users regarding information usage. Data was collected through online surveys from 376 participants from several target groups, including academics, students, and amulet collectors. This phase explored how amulet information is applied in academic settings and for personal purposes. To understand the practical use of information on amulets, we explored challenges in implementing amulet knowledge and recommendations for creating high-quality tools for researching information on Thai amulets.

Phase 3: Developing A Thai Amulets Knowledge Ontology. The researcher utilised the knowledge structure acquired from the validity verification by amulets experts during Phase 1. This knowledge structure was then employed to construct an ontology using the development framework proposed by Noy and McGuinness (2001) and Uschold and King (1995), facilitating the development of the ontology structure and evaluation. The process of developing an ontology has several steps. Firstly, the ontology objectives are established. Secondly, ontology development can be accomplished by the utilisation of the Protégé version 4.0

programme (Musen, 2015), which is open-source software. This stage involves developing classes, subclasses, and their relationships. It also defines properties and creates keywords or data instances. Finally, the procedure is finalised with Step 3. The technical appropriateness of the ontology was assessed utilising the OntOlogies Pitfall Scanner (OOPS!) (Poveda-Villalón, 2021 ; Poveda-Villalón et al., 2014) for ontology evaluation. Subsequently, three experts in Thai ontology and amulets evaluated the content's accuracy and completeness, utilising a grading system ranging from 1 to 5. A rating of 1 indicated the lowest level of suitability, while a rating of 5 indicated the highest. Furthermore, to avoid potential errors, the researchers utilised WIDOCO (Garijo, 2017) to disseminate the developed ontology for greater interoperability across different systems. Overview of the process of creating an ontology. The summary, as shown in Figure 1

Because amulet knowledge encompasses not just ideas but also culture and origin, scholars have identified three different kinds of ontologies: a) The study conducted by Hoaihongthong & Kwiecien (2022a) focuses on the Semantic ontology of shared cultures and traditions in the Mekong Subregion countries. b) The Event ontology, developed by the Centre for Digital Music at the University of London (Raimond & Abdallah, 2007), is another topic of interest. c) The Location Ontology, created by the DBpedia Team (Al-Olimat, Thirunarayan, & Shalin, 2018), is also utilised to create the amulet ontology. However, because of variations in some scopes and contexts, the researchers adjusted certain classes or characteristics to ensure compatibility while maintaining the core concept of this research.
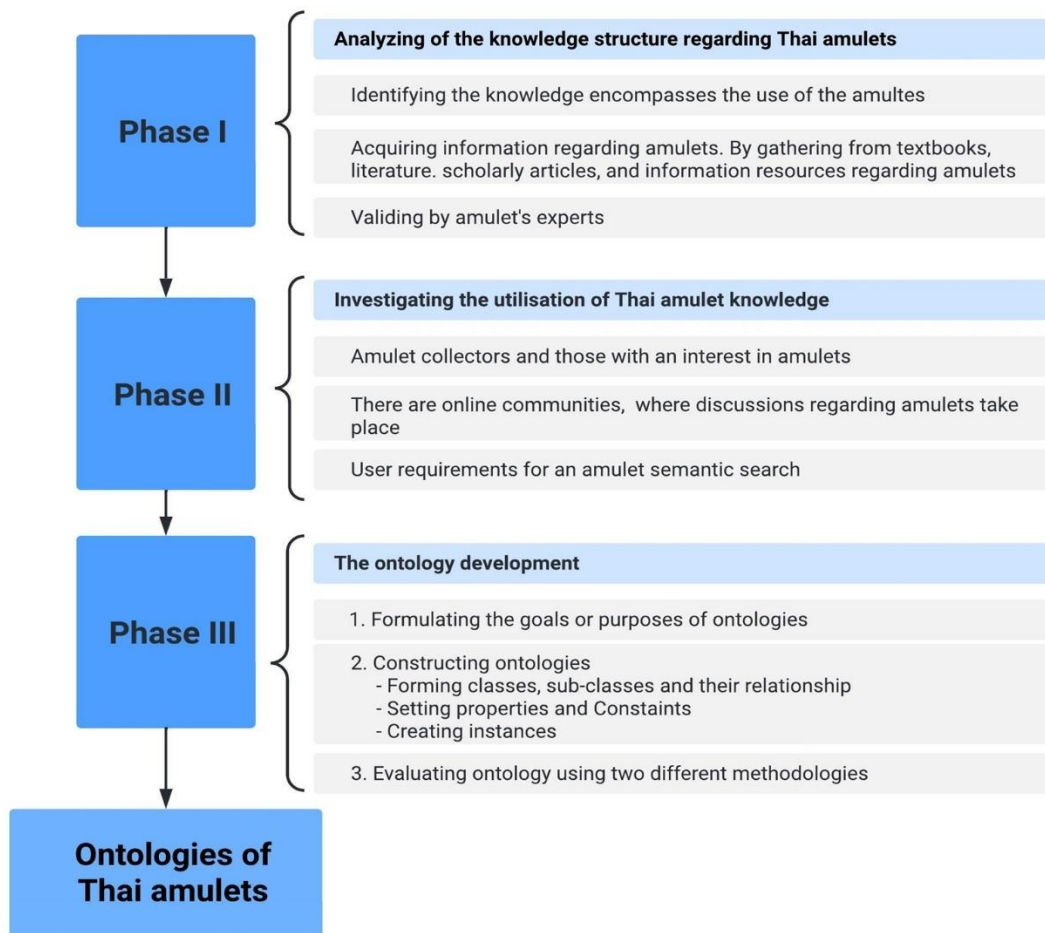

Figure 1: The ontology development

RESEARCH RESULTS

Identifying And Gathering Knowledge About the Amulet

Through numerous studies in textbooks, books, academic publications, websites, and verify with experts, it has been determined that the knowledge regarding Thai amulets may be categorised into four main areas: 1) The history of amulets, which involves the Buddhist period, The objective is to establish, a comprehensive collection of amulets, and monks, 2) Religion refers to the fundamental beliefs and teachings associated with two major religions, Buddhism and Hinduism. 3) Sculpture, distinguished by its complex patterns. Buddhist arts are disseminated through amulets, and 4) beliefs cover the nature of beliefs and actions of individuals who collect or venerate amulets.

Based on the assessment results from experts, all experts reached a consensus on the structure of amulet knowledge. However, there are also recommendations pertaining to historical matters. According to experts, the categorization of amulets should be based on Thai history rather than the history of Buddhism. To ensure comprehensiveness, it is necessary to include objectives pertaining to the production of amulets. To encompass the sacred character and details regarding the creator, including their professional career. The reason behind this is that the potency of the amulet aligns with the individual's personality and profession who created it. The researchers utilised it to enhance the knowledge structure in preparation for developing an ontology for amulet knowledge.

Investigating The Utilisation of Thai Amulet Knowledge

After surveying 376 users, including amulet collectors and those interested in amulets, it was discovered that 240 respondents (64. 0%) primarily sought information on amulets to achieve prosperity. The social media platforms were utilised as the primary sources and information sources for acquiring knowledge about amulets. There are online communities, such as Facebook or Line, where discussions regarding amulets take place. Out of the 189 people (67.5%) involved, there is a similarity in the kind of questions being asked. When conversing with friends or family, 160 individuals (42.6%) reported seeking advice, while 136 (36.2%) sought guidance from monks through conversation or inquiry. As shown in Figure 2 and Figure 3

User demand for an amulet semantic search system is high. Users prefer a system that promptly collects and displays amulet-related history, sculptures, principles, and beliefs ($\bar{x} = 4.19$) , followed by a system that searches for comparable meanings with various names. The mean value equals the amulet name search ($\bar{x} = 4.18$). Additionally, a system that accurately displays search results under specific conditions is needed ($\bar{x} = 4.14$). It offers customisable search conditions ($\bar{x} = 4.11$), is user-friendly, and is readily available online (x = 4.10). See Figure 4 for information.
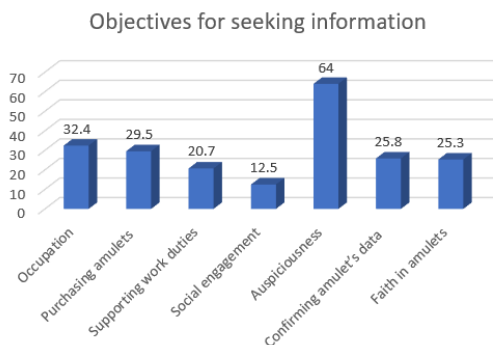

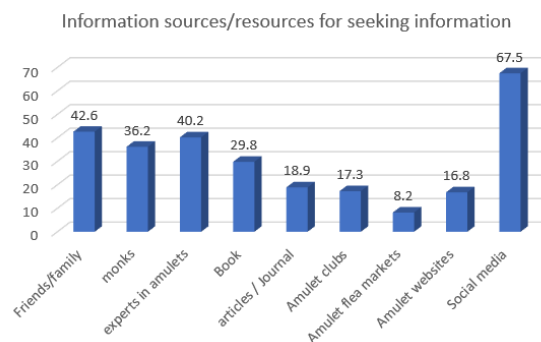**Figure 2:** The objectives for seeking amulet information

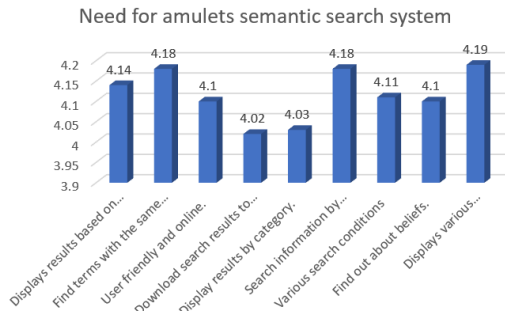**Figure 3:** Information sources/resources for seeking amulet information

Figure 4: Needs for amulets semantic search system

The Ontology Development

Formulating the Goals or Purposes of Ontologies

By examining the knowledge structure of amulets and studying users' behaviour and information demands about amulets and information systems, we have obtained the following results. The researcher has used them as an outline for constructing an ontology of amulet knowledge to be employed in designing and implementing a semantic search system.

The primary objective of the created ontology is to facilitate appropriate retrieval of information in amulet using relevant keywords.

Present comprehensive scopes of knowledge regarding amulets, including clear definitions, properties, characteristics, sample data, and relationships, to facilitate users' ability to acquire and obtain the information they require.

Constructing Ontologies

Forming Classes, Sub-Classes, and Their Relationship

The researchers compiled word lists from relevant documents. Subsequently, the terms mentioned above have been put to analysis to determine their meaning and identify any instances of redundancy. Subsequently, the key terms in the ontology were categorised into four main concepts: The topics covered in the content include 1) amulets, 2) monks, 3) beliefs, and 4) structure of amulets. Subsequently, the researcher analysed the concept of amulets and categorised them into 17 classes and 20 subclasses. As indicated in Table 1 and Figure 5.

Table 1 Thai Amulet class and subclass

Term Name		Definition
Class	Subclass	
Thai Amulet		Thai Talismans, also known as amulets, are small objects created using a mixture of Buddha's grace and Buddhist teachings.
	Shape	The physical shape of the amulet, such as a leaf-shaped, triangle, square, circle, or oval.
	Buddha Pose	The posture of the monks inscribed in the amulet
Renowned Monk name		The monk is knowledgeable and has magic and consecrate talismans.
Renowned Monk Types		The senior monk division and practice guidelines.
Temple		The name of the temple or location where the monks usually stay for meditation.
Creation		Creation Process refers to the process of Thai amulet creation.
Mass		The ingredient for Buddha amulet creation
	Metal	The ingredients for the Buddha amulet are made from Cinnabar and Bronze.
	Non-Metal	The ingredient for the Buddha amulet is sedges.
Rite		The method or process of making amulets, which is related to Buddhist rituals and Brahmanism
Buddha's holy goodness		The amulet contains the power to bring about positive occurrences.
Creator		The person who directs the creation of the amulet.
Color		The texture- the color of the amulet depends on the material used to create the amulet.
Belief		The belief is that having the amulet with a person will induce good things to happen.

| Term Name		Definition
Class	**Subclass**	
	Induce good things	Fortune: Unexpectedly, obtain the prices value pieces of stuff or huge an amount of money Safety: The safety from dangerous things Prosperity: The prosperity in various dimensions of life Merciful: Surrounded by good people and supporters from rhetoric skilled
	Guidelines	Lifestyle: Speaking clearly, refraining from lying or disparaging other people. Food: Foods that big animals should consume less of or stay away from
Sculpture		The art characteristics of the amulet's creation. For example, Dvaravati, Ayutthaya, Rattanakosin, Lan Na, and Lan Xang.
Craftsmen Type		The type of craftsmen might be from the village, the city, or the palace.
	The Palace Craftsmen	The type of craftsmen who learn to be skilled and well-planned for constructing artworks.
	The Village Craftsmen	The type of craftsman who used his experiences to construct artworks.
Place		The place where the amulet was found.
	Public Space	The public space, like a temple or historical site
	Domestic Space	The private area with the owner, like home, garden, and farm.
Storytelling		The incidents or stories from the amulet holder experienced
	Fortune story	Unexpectedly, obtain the prices value stuff or a huge amount of money.
	Safety story	Safety from accidents and dangerous things
	Prosperity story	Prosperous for occupation, education, and further studies in the higher level
	Merciful story	Surrounded by good people and supporter
Objective		To succeed in Buddhism, merit, business, and scholarship
	Make merit	To collect the individual merit for personal happiness
	Dedicate	To make the merir for the ancestors.
	Inherit religion	To support the Buddhism beliefs
	Commerce	To populous in doing business and merchant achievement
Location		The province which found the amulets
	LocationCountry	The country which found the amulets
	LocationCity	The city which found the amulets
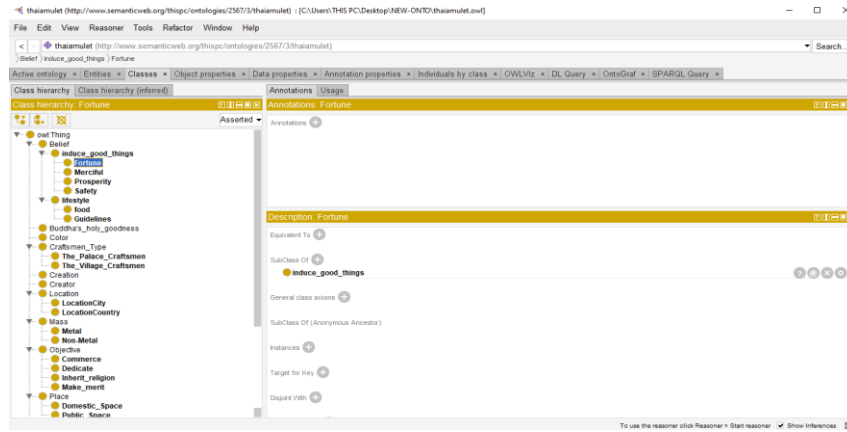
Figure 5 Screenshot of Ontology class of the Thai Amultes in Protégé

Setting properties and Constraints

The stage aimed to specify the class properties or the relationship between concepts to elicit the connection, components, and relationships in Thai amulet knowledge in concrete terms. To complete this stage, the researcher has defined two domains of relationships: is-a into seventeen classes and part-of into 20 part-of relationships, as shown in Figure 6.
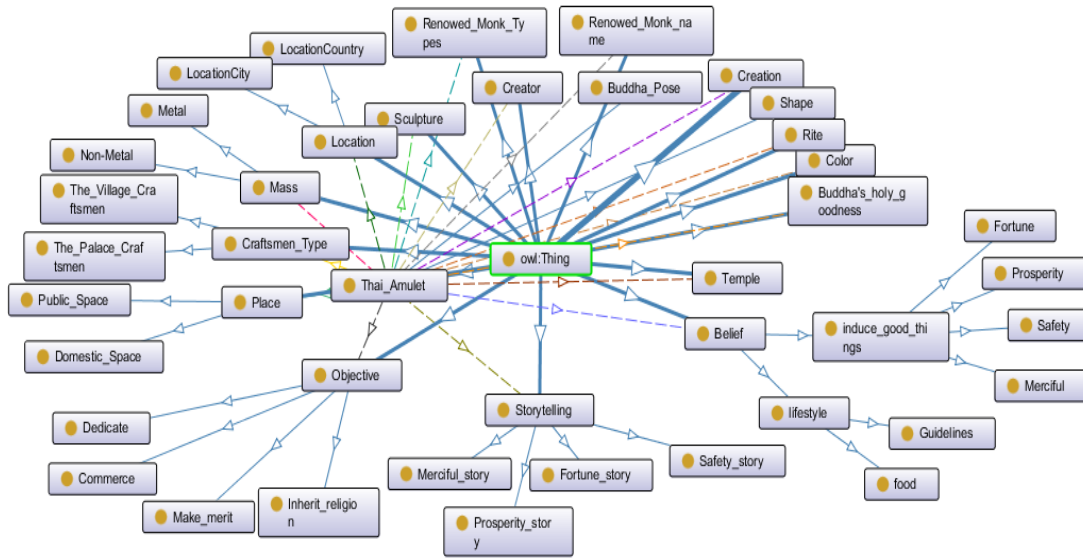
This step involves creating an instance of the concept or term defined in the ontology. Instances of classes and subclasses are created using instances. It is possible to establish connections between all aspects of the appropriate ontology. Table 2 displays an example instance of Luang Pu Thuat. All instances have been set to include all classes and their associated subclasses. Every class has numerous members who act as exemplars, such as the Luang Pu Thuat amulet. This amulet is also known by various names, such as Pha Ko or Phra Luang Pho Thuat, a renowned monk from the Ayutthaya period. Consequently, a type of sculpture existed throughout the Ayutthaya period. People interested in collecting Luang Pu Thuat amulets do so due to their belief in the amulets' ability to protect themselves from potential harm. Particularly in the context of accidents, Wat Chang Hai is the temple where Luang Pu Thuat lives. It is located in the southern region of Thailand, as shown in Table 2.

Table 2 The Example of the instance of Thai Amulets

Class	Subclass	Types of Relationship	Class Constraint	Instance

Thai Amulet		hasAmuletsName	string	Luang Pu Thuat
		hasAmuletsOtherName	string	Phra Kho
		hasAmuletsOtherName	string	Phra Luang Phor Thuad
Belief	Safety	hasBeliefName	string	Protection
		hasBeliefName	string	Safety
Temple		hasTempleName	String	Wat Chang Hai
sculpture		has sculpture Name	string	Ayutthaya

Ontology Evaluation

In this study, the ontology evaluation was divided into two approaches as follows:

1) The ontology evaluation through OOPS! -Ontology Pitfall Scanner! is an error-checking program that validates the correctness and interoperability of the ontology. In this stage, the developed ontology was examined in.owl format by Ontology Pitfall Scanner (OOPS!) on the website http://oops.linkeddata.es/ automatically evaluates ontologies and was compared to the ontology with entries in Pitfall Catalog. After reviewing the errors in previous studies and categorizing them, the study has been categorized into three main aspects: Structural, functional, and usability-profiling, as shown in Figure 7.

Figure 7 The ontology evaluation with an error-checking program

The amulet ontology evaluation results found that there were errors in name-defining features named *hijacking* errors in the five cases because the researchers did not include namespace names in the ontology structure. To solve the error, the researcher changed the namespace to *Thaiamulet* to use as a reference to prevent duplication for interoperation processes.

Efficacy Evaluation Ontology Information Retrieval Ontology

Following the evaluation of the ontology using the Oops programme, the researchers asked an assessment of three experts to evaluate the efficacy and applicability of the ontology in developing a semantic search system. The evaluation results are presented in Table 3.

Table 3 The Result of the Thai Amulets Ontology Evaluation

No.	Statements	Levels of agreement		
		$\bar{x}$	S.D.	Levels
1	**Determine Scope**	**4.56**	**.527**	**Highest**
1.1	Relevance of Ontology to Thai amulet knowledge	4.33	.577	High
1.2	Coverage of Thai Amulet Knowledge Ontology	4.33	.577	High
1.3	Suitability of the Thai amulet knowledge ontology for use	5.00	.000	Highest
2	**Define classes/concept**	**4.56**	**.511**	**Highest**
2.1	Concepts defining can describe Thai amulet knowledge	4.33	.577	High
2.2	Appropriateness of Super-Class division in ontology	4.33	.577	High

No.	Statements	Levels of agreement		
		$\bar{x}$	S.D.	Levels
2.3	Appropriateness of Sub-Class division in ontology	4.33	.577	High
2.4	Appropriateness of data type in ontology	5.00	.000	Highest
2.5	Appropriateness of term in ontology	4.67	.577	Highest
2.6	Appropriateness of constraints in ontology	4.67	.577	Highest
3	**Define properties**	**4.67**	**.500**	**Highest**
3.1	Appropriateness of properties	4.67	.577	Highest
3.2	Appropriateness of relationships	4.67	.577	Highest
3.3	Appropriateness of relationship model	4.67	.577	Highest
4.	**Instance of class**	**4.83**	**0.408**	**Highest**
4.1	Appropriateness of common definitions across instances	4.67	.577	Highest
4.2	The proper syntax used in instances	5.00	.000	Highest
5.	**Application to ontology development**	**4.67**	**.516**	**Highest**
5.1	Validity and reliability of the ontology	4.33	.577	High
5.2	Ontologies can applied to the development of semantic search systems.	5.00	.000	Highest
	Total	**4.63**	**.433**	**Highest**

Experts reviewed the Thai amulet ontology and agreed it was highly accurate and thorough, with an average rating of 4.67. To discuss ontology concerning the many stages of its development. The experts ultimately agreed that the instance of the class was highly accurate and appropriate, with the highest average rating of 4.83. This was followed by the property definition, which had an average rating of 4.67. The score for defining the scope of the Amulet ontology and the definition of classes and concepts had an equal mean value of 4.56. The expert assessment results indicate that the produced amulet ontology is precise and can be utilised to advance the semantic search system.

Promoting the Ontologies on the World Wide Web (WWW) Using WIDOCO

This approach focuses on generating ontology documentation that comprehensively explains the ontology for ontology developers, teams, and individuals with expertise or involvement in ontology communities. This document seeks to provide a comprehensive understanding of ontology and its implementation within a technology environment. By providing an overview of the ontology and introducing each aspect, developers may quickly familiarise themselves with it and efficiently implement it for future advancements. This study utilised WIDOCO, an open-source software application for documenting ontologies, as part of the semantic web tool (Garijo, 2017). Consequently, developing the ontology would be more dynamic, executed effectively, and capable of being used again for ontology applications. The process for presenting the ontologies involves three steps: 1) choosing a template for the Ontologies Web Languages file, 2) uploading information, and 3) submitting the amulet data. After the preparation, all knowledge files in the amulet will be uploaded and shown on the website http://www.semantic-pra.info/semantic_doc/index-en.html, as seen in Figure 5. as demonstrated in Figures 8 and 9.
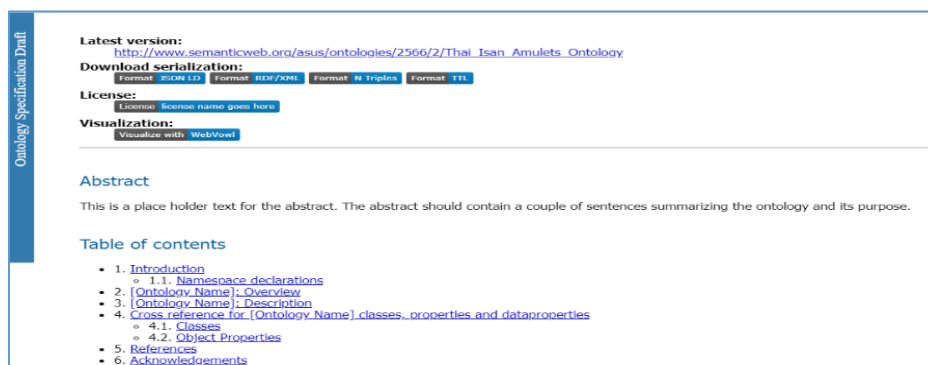

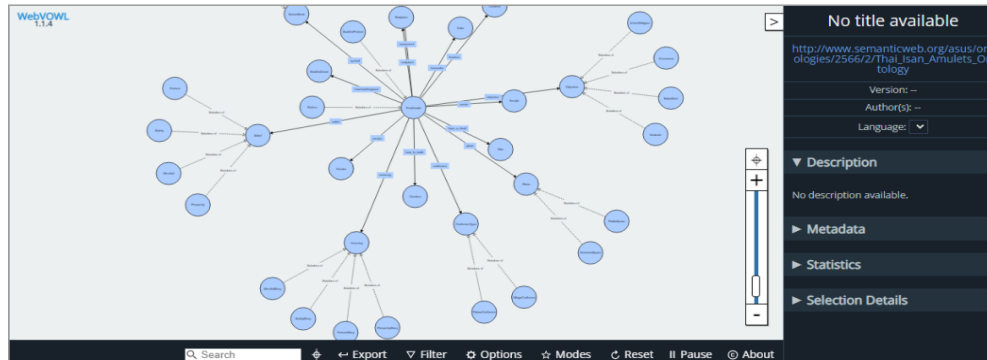**Figure 8** Details for the Ontology Documentation for promoting on the World Wide Web

Figure 9 The Ontology Structure on WebVOWL

CONCLUSION AND DISCUISSION

Developing the knowledge ontologies about amulets into distinct and specialised ontologies known as Domain Ontologies. The study findings demonstrate the specific knowledge involved within amulets, including information about amulets, renowned monks associated with different types of amulets, beliefs or stories transmitted by mouth, shared with newspapers or websites, and customs related to amulets followed by believers. This time, the amulet ontology has been utilised to its full scope, supporting its application in building a semantic search system. The findings of this study align with the findings of Chansanam's study (Chansanam, Kwiecien, Sutthiprapa, & Supnithi, 2021), which examines the development of Thai tattoo designs' ontology and alignment with Thai society's beliefs. The evolution of the Thai tattoo ontology revealed 24 main classes, including categories such as beliefs, patterns, and rituals comparable to those examined in this study.

Since an ontology serves as a keyword repository that defines concepts within a specific field, the index storage format can be shared across different applications by duplicating the knowledge base. To be utilised in different situations, the structure can be enhanced or expanded with extra knowledge, enabling its application in new contexts. The researcher has extracted relevant data from pre-existing ontologies and modified them to align with the specific domain of investigation. The researcher has extracted relevant material from preexisting ontologies and altered them to align with the specific domain of investigation. There are three ontologies, each composed of the following: The study was conducted by Hoaihongthong & Kwiecien (2022a). The semantic ontology of knowledge regarding the shared cultural traditions of the Mekong Subregion countries identified three common categories within the amulet ontology: Belief, Purpose, and Place. The Event Ontology, established by the Centre for Digital Music at the University of London (Raimond & Abdallah, 2007), is relevant to the amulet event. It utilises classes and class descriptions, including the Place class. 3) The DBpedia Team (Al-Olimat, Thirunarayan, & Shalin, 2018) has created the Location ontology, which includes the Location class and its subclasses, namely the country class (Location country) and the city class (LocationCity). Expanding the scope of ontology enhances its usability for improved interoperability.

The ontology development pertaining to amulets allows for the classification of their usage benefits into the following categories:

Educational Advantages. This study provides a comprehensive compilation of information regarding amulets. derived from documented sources such as textbooks, research papers, and scholarly publications as well as from stories shared by experts, including both academic specialists and experts specialising in amulets. This will be advantageous for pursuing additional academic research, or future studies on amulets.

Advantages of establishing semantic search systems Due to this research. A study has been conducted to examine the information needs of users interested in amulets or collectors of amulets. The study has identified the features of information usage and the specific requirements of users when using the system. Subsequently, the researcher can construct an ontology that encompasses the authentic information utilisation attributes of users. It can be utilised to create advanced search features that fulfil the intricate information requirements of users, such as searching for amulets that align with specific beliefs. or seeking amulets with comparable Buddhist

attributes. Furthermore, the created ontology systematically gathers and documents a lexicon pertaining to amulets. Explain the correlation between terms Assists in resolving the issue of word repetition. Alternatively, it may involve having a diverse range of appellations for amulets, locations, or other terms.

Advantages For Other Elements of the Application. The examination of amulet ontology has revealed that Thai people's continuous commitment to Buddhism is seen in the enduring cultural practices of society. These factors led to the emergence of Buddhism-related commerce, involving both the purchase of amulets and the fabrication of amulets, as well as the growth of high-value tourism businesses. The ontology development in this study will have numerous effects on individuals who have faith in amulets, enabling them to access information and knowledge to make informed decisions regarding the value of their purchases or to study the specifics of amulets, thereby greatly supporting the commercial aspect of Buddhism in Thailand.

Furthermore, this advancement in amulet ontology can be applied in various ways, including creating a digital learning hub for collecting and exchanging knowledge among amulet enthusiasts. Alternatively, building a system for selecting tourist destinations related to amulets to serve religious tourists, both Thais and foreigners, such as Chinese, Singaporeans, and Malaysians. This group's number of tourists has recently surged significantly.

Future Work

We aim to create the next phase of Thai amulet ontology, including Buddhism and regional types and a more comprehensive range of options. By integrating folk beliefs and behaviors, this ontology strengthens the relevance of Thai culture. It has ties to Thai folklore, Buddhism, and the arts. Refinement of property definitions, modeling intricate linkages, and incorporating historical and temporal dimensions to track amulet designs and meanings throughout time are necessary to improve semantic representation.

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Conflicts of Interest

The authors declare that there is no conflict of interest

Institutional Review Board Statement

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