
Knowledge as a Service for Agriculture Domain

Asanee Kawtrakul

Abstract

Three key issues for providing knowledge services are how to improve the access of unstructured and scattered information for the non-specialist users, how to provide adequate information to knowledge workers and how to provide the information in situations requiring highly domain-specific, related and time critical information. This paper introduces a platform of knowledge acquisition and services, called CyberBrain, which using ontology as a backbone. Based on specially designed ontology and engineering, the system ensures that knowledge service could be improved the user benefit. Users are presented with the necessary information closely related to their information need and thus of potential high interest.

Introduction

The agricultural domain is one of the most significance domains in need of multimedia knowledge management that can aid farmers, extension workers and researchers in their daily information search. However, sources of these data are scattered at several locations and websites with heterogeneous formats that offer structured information to large volumes of unstructured information. Moreover, the needed knowledge has been too difficult to find since the traditional search engines return ranked retrieval lists that offer little or no information on the semantic relationships. As a consequence, many approaches elaborate web search by combining standard web search with ontological background knowledge, called Semantic web search. However, even if the semantically related information has been found, often overload since there is no content digestion. Accordingly, one-stop shop knowledge service for the users or knowledge workers, especially non-specialist users is needed in order to reduce time browsing and reading to find out how various information are related and where each falls into overall structure of the problem domain such as how to solve the problems of pest.

Since the benefits from knowledge accessing, only gained by others who have online and ready access to the information, a new knowledge services for knowledge transfer with different strategies including knowledge delivery are needed for multi-types of the end users. In order to provide the knowledge services that could improve the user benefit, the system needs to go beyond providing not only their information requested but necessary information added.

In this paper, Cyberbrain is introduced as a platform equipped with ontology and reasoning capabilities to acquire, process the knowledge and provide the users with the necessary information closely related to their information need and thus of potential high interest.

Issue of Knowledge services

There are keys issues for providing knowledge services

- how to provide adequate support to knowledge workers in situations requiring highly domain-specific and time critical information

- how to improve the access of unstructured and scattered information for the non-specialist users

The above issues bring to the development of robust, extensible but user-friendly semantic based knowledge access with the following functions:

- to structure and present the domain knowledge objects (Text documents, images, graphics, maps video, audio recording) at the level of cognitive capabilities of intended users, in the enriched information spaces underlying a given domain specific ontology, visually rich and adaptable style, facilitating filtering and aggregation,
- to turn the web browser into a comprehensive, rich client platform for aggregating the disparate elements through a variety of relationships, and in general to enrich their view using thematic map or semantically driven navigation,
- to find the way of representing the information expressed in the unstructured text, to amalgamate all the available data for a particular collection,
- to deliver information or knowledge that meet the needs of intended users and allows for corrective actions,

CyberBrain: A Framework of Knowledge Acquisition and Services

Figure 1 shows an overview of knowledge acquisition concept and knowledge services customized to different users and a tailored summary based on the user's initial query. Ontology is used for both information extraction and integration. At extraction level, task-oriented and real-world taxonomy ontology are used to construct information schema and scenario construction. At integration level, demand-driven or pragmatic-oriented ontology is used to aggregate information from multiple heterogeneous sources. The developed system is consisted of three main components as shown in Figure 1.

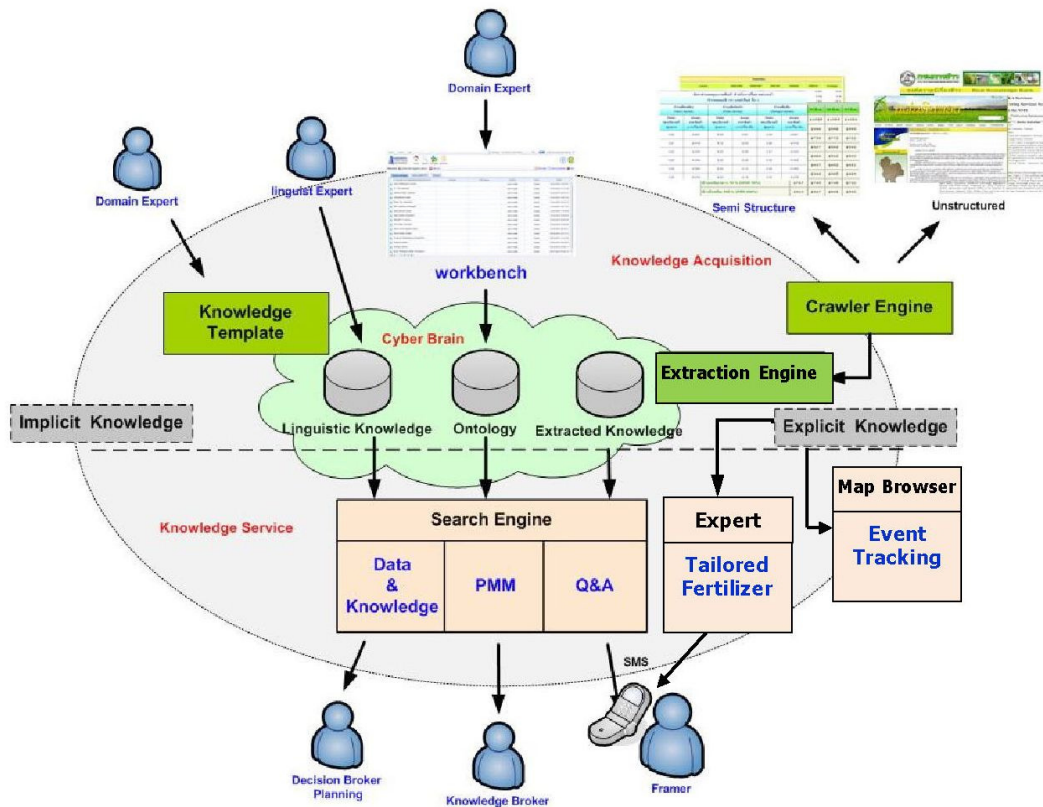


Figure 1 A Framework of Knowledge Acquisition and Services

- Distributed Information Gathering. The information, both unstructured and semi-structured documents are gathered from many sources. Periodic web crawler and HTML parser are used to collect and organize related information. Domain-specific parser are used to extract and generate metadata for interoperability between disparate and distributed information. The output of this stage is represented in RDF format.
- Knowledge Portal Construction. Ontologies are used as a key to facilitate both information extraction and integration. There are two types of integration: summarize into relational database; such as <Rice varieties and yield, Disease dispersion, Pest characteristics >, and document hyperlink such as Product processing, Cultural practice and Fertilizing. Additionally, the process of knowledge extraction from text is needed to pursue the goal of generating useful knowledge, such as general symptoms of plant diseases, from the large amount of text. The output of this stage is structured knowledge and rules.
- Knowledge Service Provision. Four different target users groups, i.e., farmers, researchers, SME and Intelligent Command Centre, are distinguished by different viewpoints that are characterized by each user's interest. At this stage, knowledge tracking and summarization are applied for knowledge service provision. Moreover, K-service in the form of Knowwhat, Know-why, Know-where, Know-when, Knowhow, and Know-who has been also provided.

Figure 2 shows the platform for providing the knowledge services. Four different target users group are distinguished from the different points of views depending on their objective, interest, affectation and benefit.

- The farmers require some useful information, i.e. how to analyze the type of pests, or symptom of plant diseases and how to protect plant from diseases,
- The researchers prefer to track the problems and literate the previous researches,
- Small and Medium Enterprise requires to follow up the state of business,
- Intelligent Command Center of the Government needs portal of Executive information, cross sector analysis, and Intelligent Real-time warnings/ alerts ovent tracking.

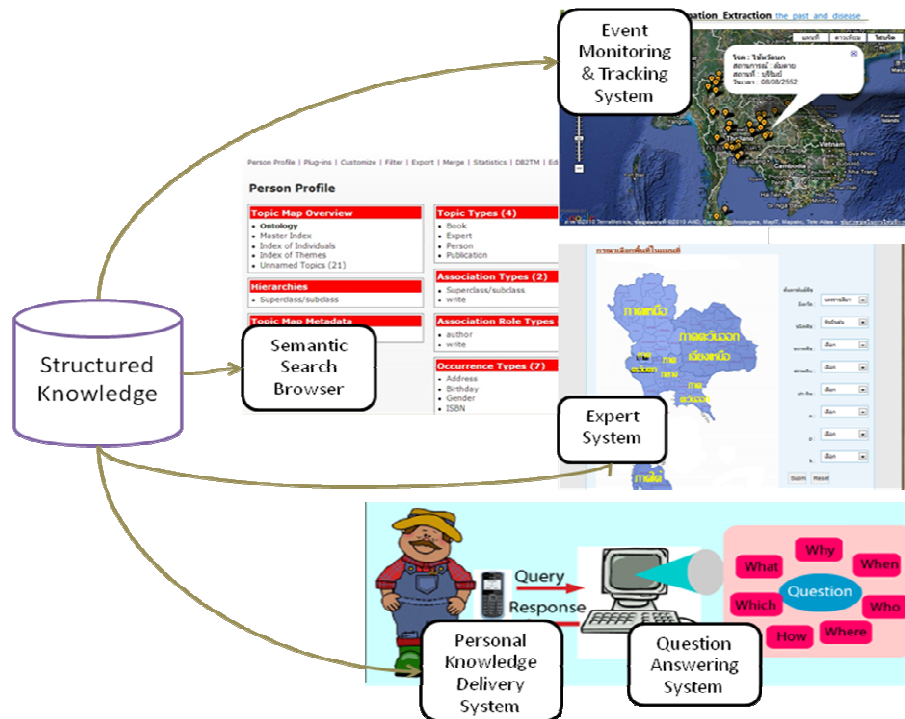


Figure 2 Multi-types of knowledge services for different knowledge consumers

Based on ontology, knowledge services platform is developed for combining several strategies for modeling the target of questions and optimizing the extractions of the answers. Besides presenting the possible answers to a given question, the system can offer additional information based on the answer's type:

- an integrated answers for one-stop shop of knowledge accessing,
- multimedia answers that are image related with the answer of what kind of disease or pest analyzing from symthom, photos of who will be the contacted person for giving the consultant, and video for answers the procedures of methods of preventing, planting,
- a map for answers that are location names of disease dispersing,
- personal knowledge delivery through sms.

Scenario 1: PMM based Knowledge services

Providing information and knowledge services with collecting and maintaining weakly structured text sources is time-consuming activities. This project targets for building specific services and knowledge infrastructures to support decision-making and problem solving in Agriculture domains. This collaboration project is currently implemented by using Orchid, Rice, Casava and Rubber domains. The generated PMM

(see Figure 3) consists of Disease Problems identification, huMan experts who could solve that disease problem and the Method for solving the disease problem both in corrective and preventive ways.



Figure 3 A model of PMM for providing knowledge service

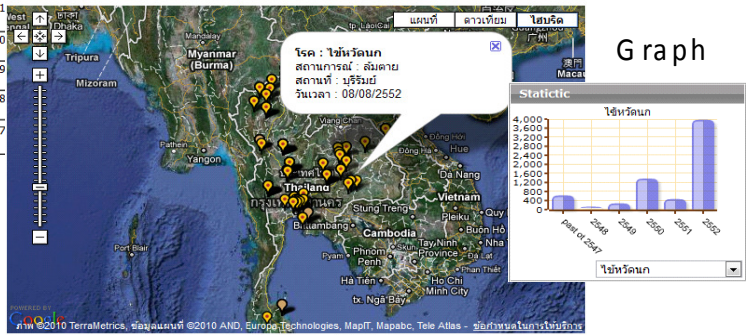
Scenario 2: Event tracking and Monitoring

To provide adequate support to knowledge workers in situations requiring highly domain-specific and time critical information, as was the case during the outbreaks of disease. During those outbreaks, information service providers had an urgent need to communicate with the target end-users and to participate on the rapidly evolving state of the outbreak. For this reason, knowledge accessing and delivery are being increasingly applied to support knowledge broker to transform the information and to support decision making of government or communities.

Table

ลำดับ	โรคที่ระบาด	สถานที่	เวลา	สถานการณื
8883 f x	ไข้หวัดนก	เวียดนาม	1/1/2552	ติดเชื้อ มนุษย์
8882 f x	Google map with Information Extraction the past and disease			
8881 f x				
8880 f x				
8879 f x				
8878 f x				
8877 f x				

Spatial information



Graph

Figure 4 Global disease outbreak monitoring through the map

Figure 4 shows a customizable portal collecting information from a multitude of distributed data sources, mapping this diverse information onto spatial information system such as google earth, and providing users with a coherent information.

Specific services provided by this portal will include event tracking, e.g., of disease outbreaks, with a multi-channel alert system disseminating information about a specific event, event type, region, etc.

Scenario 3 Multimedia knowledge asset management: Case study Kasetsart University Radio Network

Figure 5 shows a portal of multimedia knowledge for providing services through the radio network of Kasetsart University. Starting with radio-broadcast content collection, the related and necessary information either text format or video format will be integrated as complementary knowledge.

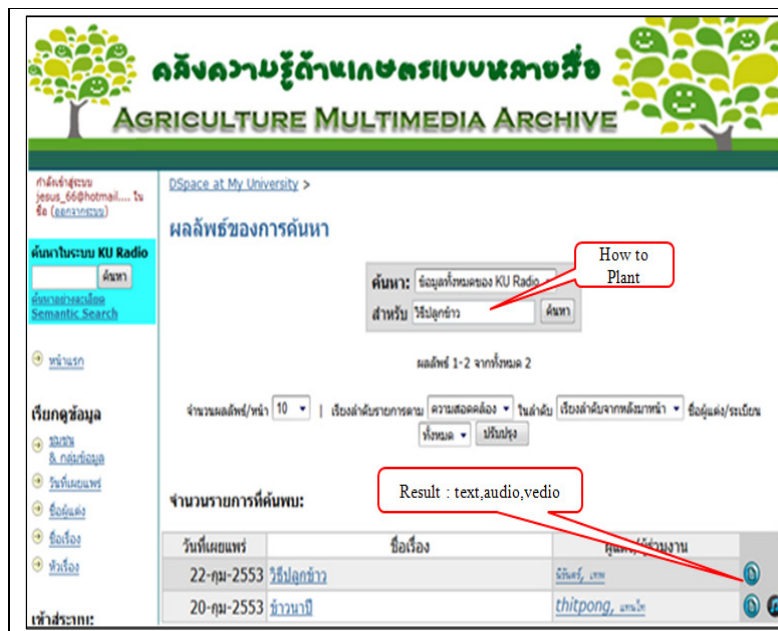


Figure 5 A service of multimedia knowledge

Scenario 4 Delivery Information

Knowledge service via a mobile phone as “a right information for a right man at a right time” is a challenging task. Therefore, Short Message Service (SMS) is a better way for giving knowledge service, especially automatic interchange of short text messages, by providing the information from an automatic Question & Answering System. Nowadays, providing a knowledge service through SMS is not limited to only a Question-Answering Services System, but also for such one-way services as early warning systems, for example, a Tsunami Alert System¹, a FloodSMS – Early Detection and Warning of Catastrophic Flooding via SMS², etc.

Discussion

- The key success factors for knowledge sharing
- The governance and multisectoral engagement
- System and data Interoperability
- Infrastructure
- Human Capital Development such as ICT training Center for the community.

Contact:

Asanee Kawtrakul

National Electronic and Computer Rechnology Center,

National Science and Technology Development Agency, Thailand

Department of Computer Engineering, Kasetsart University, Thailand

Email: asanee.kawtrakul@nectec.or.th

¹ <http://www.wap.ait.ac.th/tsunami.html>

² <http://www.netsquared.org/projects/floodsms-%E2%80%93-early-detection-and-warning-catastrophic-flooding-sms>