Ontology Based Expert System for Pests and Disease Management of Cotton Crop in India

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ABSTRACT

In the agricultural domain, the main challenge is to present the new information and research to the farmers so that they can leverage the power of technologies to improve their agricultural practices and thereby the production. Huge amounts of agriculture-related data like weather data, soil health records, disease and pest are collected from different sources like web services, remote satellites, and a network of sensors. The authors’ ontology-based agro advisory system will help to bridge the gap between farmers and the agriculture domain experts. It has three main components: Cotton Ontology, Web services and Mobile Application Development. Protégé tool is used to develop ontology. The RESTful web services are programmed in Java using the JAX-RS/Jersey API and Eclipse IDE. RESTful web services are all developed and deployed on a cloud-based application server provided by Heroku. The farmers can access an application by android mobile. The Android user interface is created using Java, Android SDK-v1.4 and Eclipse IDE.

KEYWORDS
Agro-Advisory System, Mobile Application, Ontology, RESTful Services, Semantic Web, Service Oriented Architecture

INTRODUCTION

In the year 1994, the internet was opened to the general user and the era of information and communication technology has played a vital role which allows the user to access information from World Wide Web. The current search engines such as Google, AltaVista are searching information based on keywords. The keyword-based search engine does not allow a user to access relevant information very easily.

Due to the utilization of Semantic web technologies the user able to retrieve relevant information very easily. The semantic web is an extension of the current web in which information is given well-defined meaning, better enabling computers, and people to work in cooperation (Tim Berners Lee,2001). The semantic web gives importance to web page contents which allow computers or device to recognize contents of information in web pages as an individual can understand. It responds to user request based on the meaning of the query. The purpose of the Semantic web is to convert
unstructured or semi-structured into structural data for the web (Chaudhary, 2013). Ontology organizes the information in a semantic web with a structured framework. It can be used for representing knowledge of a particular domain.

The ontology is shared dictionary which depicts the individual, domain concepts, properties of individual, and relationship between concepts. The agricultural knowledge base can be created with the help of ontology.

Unfortunately, the knowledge base for the plant and crop production is not updated regularly as well as it is not correctly utilized by farmers. Currently, the research efforts are made for developing ontology with two methods which are automatic and semi-automatic.

The cotton crop pest ontology which developed by us is going to be used by farmers to submit their query related to cotton farming. The ontology able to answer any difficult query generated by farmers and it provides a relevant solution to farmers.

**RESEARCH MOTIVATION**

Agricultural has an important role in Indian Economy. About 70% population who lives in rural is doing agricultural activities. Nowadays, there is a huge quantity of data about agricultural domain such weather data, soil health card information, cropping pattern for different crop, disease and pests affecting to crop, prevention and cure techniques for disease and pests are retrieved from various types of resources such as web services, network sensors, satellite which are located remotely. The collected data are not utilized efficiently and optimally by the farmers due to an absence of medium which can flow the data between experts and farmers.

In the domain of agriculture, the farmers have queries regarding varieties of the crop, soil information, favorable climate condition for the crop, cultivation techniques, disease and pest affecting crop and prevention of it. Farmers express their queries in natural language which is answered by agricultural. Because of lack of time, and access it is not possible for experts to present physically to respond each query for every farmer. Due to an absence of the expert, the farmers may not able to understand the expert’s opinions or suggestions. In such scenario, there is a need for an agro advisory system which can bridge a gap between agricultural experts and farmers. We are motivated to develop an agro advisory system which can able to answer the queries of farmers which will help farmers in improving farming practices and yield production.

**RELATED WORK**

During literature survey, we found existing Agro Advisory systems like eSagu (P. Krishna Reddy, 2007), Agrisnet (Agrisnet, 2014), Kissan Kerala (KissanKerela, 2014), aAQUA (RamamrithamKrithi, 2004), mKrishi (ArunPande, 2009).

eSagu is a web-based recommended system for an agricultural domain. It uses web technology to resolve the problems of agriculture. The eSagu project initiated in Telangana city of Andhra Pradesh state. The meaning of eSagu is cultivation in the Telugu language. It exploits the inventions made in computing era to construct an agricultural information broadcasting system to spread the expert’s knowledge or expertise to the farmers which lead to increase in crop production. It is developed by Media Labs Asia. Its advice to the farmers for improving farm productivity. The farmer can send the status of their crop by sending text or photographs. Based on the status of crop agricultural experts give advice farmers.

The AGRISNET project was conceptualized with the vision of creating an interconnected technology-enabled network. The project aimed to integrate cross-functional processes of agriculture, so as to effectively and efficiently communicate informational services to the farming community through one-stop. It is web-based portal gives information for soil health card, weather, crop varieties, plant protection, and fertilizer to farmers. Through AGRISNET, the benefits of personalized/individual