WEB SERVICE BASED ARCHITECTURE FOR US NATIONAL CROP PROGRESS MONITORING SYSTEM

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1. INTRODUCTION

Crop development progress information is critical to decision makings in many public sectors and private sectors that concern of agricultural production, food security, and food price. Crop progress and condition reports have been periodically produced by the National Agriculture Statistics Services (NASS) of United State Department of Agriculture (USDA). NASS currently disseminates the information by compiling and issuing a weekly national crop progress and condition report, Weekly Weather and Crop Bulletin, and a weekly detailed crop progress report, Crop Progress Report, during the crop growing season. The results are subjectively sampled and estimated by field enumerators. Remotely sensed data has been used in the crop condition monitoring and crop progress monitoring though the application of the remotely sensed data is limited because of low (temporal, radiometric, and/or spatial) resolution and tenuous processing demands[1, 2]. This study applies the emerging Sensor Web technology and geospatial Web Services to design a Web-based system that connects sensor, crop progress monitoring models, and end-user. The goal is to reduce the latency from sensor observation to crop progress products by automating many of the workflow steps and to improve the usability of the end user product in a Web environment through standard interfaces.

2. RELATED WORK

Sensor Web technologies have been developed with many efforts. NASA AIST program funded 35 projects that focused on developing the technology and system and applying them in typical cases [3]. A general Self-adaptive Earth Predictive System (SEPS) framework was developed under those efforts. The framework leverages the advanced Sensor Web technology and innovatively coupled Earth Science Models and Earth Observing systems through open, consensus-based interfaces and services standards[4]. This framework is the base for the enhanced National Crop Progress Monitoring System to be developed. Many geospatial Web services have been developed and they can be re-used in the system since they followed well-known geospatial standards[5-7].

3. DESIGN PRINCIPLES

Several desired improvements for the existing National Crop Progress Monitoring System have been identified. The system design needs to meet the following desired requirements of the enhanced national crop progress monitoring system.

(1) The system should be capable to assimilate and prepare Earth Observing data for use in agricultural crop growth monitoring and improve their accuracy.

(2) The enhanced system should automate the process for end-to-end by using the state-of-art technology to efficiently apply Earth Observing research results and data in crop growth development estimate. Advanced data mining algorithms and models can be plugged-in to readily take advantage of resources available in the system.

(3) Systematic approaches should extend to integrate data, services (Web computer software programs), and dissemination through the Web, by prototyping, evaluating, and eventually operating a national crop progress monitoring system in a loosely coupled, standard-compliant, virtual Web environment.

(4) By integrating the Farm Service Agency Common Land Unit data, this standard-compliant system should provide overall and specific crop progress for individual crops from state level down to field level to meet different users' needs.

4. SYSTEM ARCHITECTURE

Figure 1 shows the top level architecture of the National Crop Progress Monitoring system. The design of the system is evolved from an open Sensor Web framework - Self-adaptive Earth Predictive Systems (SEPS). With the designed system, all data services are accessible through standard geospatial Web services. The reusability is assured. All raster data are served using Web Coverage Service (WCS). Geospatial processes, such as decision tree classifier, are implemented and managed using Web Processing Service (WPS). Workflow can be scripted in Business Process Execution Language (BPEL) and executed automatically using the BPEL execution Web service. The results will be stored, managed, and published in standard WFS or WCS, depending upon their nature, and readily available for further analyses. The system is extensible as long as the added Web service components follow open specifications.

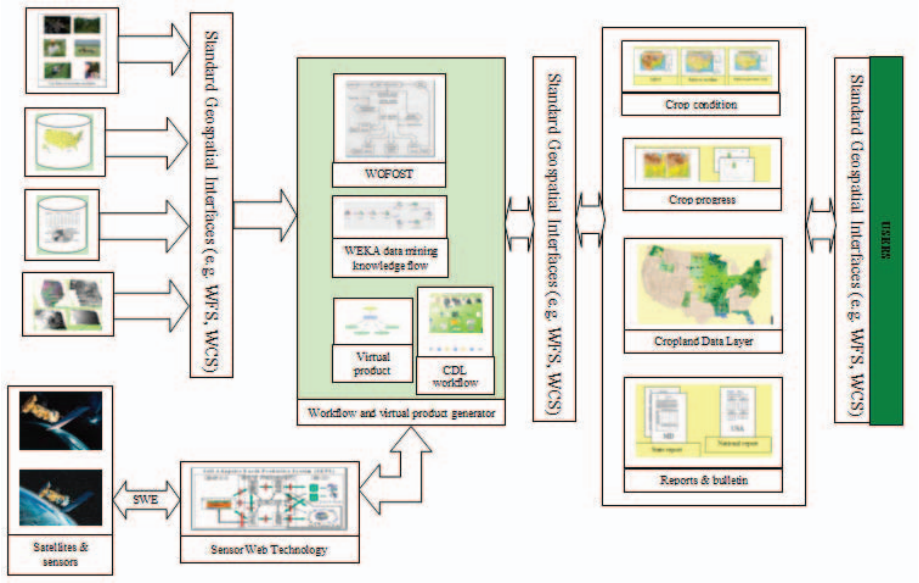

Figure 1. Top level architecture of the National Crop Progress Monitoring System

At the presentation level, the system is enhanced with interactive Web-based maps to visually express spatial differentiation of crop growth development and crop condition. Web Map Service (WMS) is the standard for publishing and embedding maps in reports and online publications.

5. CONCLUSION

A Web-based service architecture for the National Crop Progress Monitoring System has been developed. The system achieves the maximum extensibility as well as usability through adapting the emerging geospatial Web services and Sensor Web technology.

6. REFERENCES

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