Prefarm Solution - MapServer as a Services Support Tool for Farmers to Make Fast Decision in Crop Production, Precision Farming System

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Abstract

The system of Precision farming guarantees a detail monitoring of data and information, which are necessary for successful decision in crop production. The system is designed for data collection from several sources. The data are collected by Service Company and farmers mainly, but also labs, Research institutes or University can be also involved. Difficulties of technologies, which are currently and continually involved in this system, argue against its practical using system by farmers. Service Company wants to create a suitable environment not only for data collection, but also for the high quality of the information distribution to customers. First of all, data exchange between Service Company and each farm individually must be built on powerful tool and environment. One of such tools is the PREFARM MapServer placed on Internet web site. PREFARM Mapserver is developed and build to help the farmers to make a right decision on collected data and information. Above mentioned tools can be used by farmers with different computer scale. According to that, Service Company is more or less involved to farmer support and decision making system on the crop production.

Keywords: Precision farming, MapServer, GIS, PREFARM, GPS data collection, Decision making system

Material and Methods

Technology of Precision farming guarantees a success of this system in the market. Difficulties of technologies, which are currently and continually involved in this system, argue against its practical using by farmers. In this case, Service Company wants to offer a suitable environment not only for data collection, data processing, but also for the high quality of other information related with farm management and crop production. The practical distribution of result to customers helps them ensure a variable application of result on the field. The most important part of services is a technology of data collection, system of data processing. Remote sensing, crop scanning and soil sampling for management zones classification means presentation for farmers or other users the simplification of the difficult operations and recommendations including economic calculations. Professional service on the market in this area using a follow tools:

• navigation system GPS with or without Differential GPS
• environment of Geographic information system (GIS)
• internet as a tool for data transport, data presentation,
• map server technology, web mapping services (wms / raster)
The complex advisory and service system on the market is based on results of field trials in different crops and locations. The data for WEB processing are prepared and stored by service organization and farmers. Central database store data as follow:

- Soil measuring (EM 38 data, soil type data)
- Soil sampling (lab analysis for Phosphor, Potash, Magnesium, Calcium, soil pH….)
- Crop scanning (NDVI data created from satellite or airborne pictures)
- Yield data from yield monitor created during harvest
- Other remote sensing data (N-sensor scanning)
- Agronomies, field management data (crop rotation, variety, data of applications, weather conditions…..)

The main point of system is to collect different data the easiest way on the field and on the farm, and then use collected data for data processing via web tools.

Open source solution Mapserver. Inside of services was developed mobile interface for this Open Source solution and also there were implemented OGC standards (WMS) for utilization of data in distributed system. Connection with another open source systems (GRASS, etc), was established. Current solutions are Internet Mobile Systems, including analytical tools. The most successful and currently used application from service system is „GIS server for precision farming application with mobile access“. It is focused on to increase the agricultural profitability and to reduce the fertilizer and chemical bad influence on surround environment.

System provides analysis as follow:

1. Field area calculation – number of hectares for crop rotation, field cutting
2. Detection of variability in the field area, time progress,

- 1999
- 2002
- 2004
- 2006

3. 1999 -2006, Phosphor content in topsoil, % of categories

4. Variable rate (VRA) and multivariable rate (MVRA) recommendations for basic fertilizer application(P, K, Mg, Ca and Nitrogen)
5. Cost saving - economic calculation

![Cost saving chart](image)

7. History – Traceability

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Management zones is a result for of map analysis to get an optimal amount of each input in crop production founded on variability of soil characteristic and the other factors conditioning a crop yield. In this case, analysis can be done in one time for one field, group of fields, or whole farm with the same or similar conditions for crop planning. In the system can be set location with very high resemblance of soil conditions or the other elements and monitored characteristic. The GIS in farm management allow to us analyze data and yearly results from Crop production on farm.

**Discussion**

Farm management forms collect necessary tasks, which contain ownership and renting plan management for soil, monitoring of seedling plan and plant production for each field. In the European context, one of the most important results is simply explaining data of results to end user, and train him, how to work with system and what the benefit from is?

First of all, we have to pay attention for system of data collection, which is depend on accuracy, density and repeating in time. Easy work with data in central database is one of the most important characteristic of the system. The main aim was prepare solution accessible from office and also from field. Other advance of system is follow:

- Transparent result of data analysis (Maps and tables)
• Easy data access (map view, tabs, statistic, new notes)
• Multifunction level of using in farm or company (chairman, lawyer, crop manager, driver)
• Traceability – complete notes (crop plan, fertilizer using….)
• Possibility of another database connection (WMS, cadastral maps….)

Precision farming is a system focused on keeping a detail record in farming, when each task of operation is recording to the field as the smallest element, but each task is capture to specific location (part of the field). Farmer can achieve lower cost or increase a yield of the crop by using this technology. Precision farming manage very precise application of chemicals and fertilization according to really needs on the field and by this methods farmer can decreasing also bad influence of using chemicals in farming, which is very important for surround environment.

The collaborative environment provides a possible area for farmers, EO data providers and other organization to communicate, share and exchange information. Also can be notified any recent changes to the coverage and portfolio of related products and services.

The implementation of Web based technologies specifically an OGC compliant WMS and WFS to assist the user in describing the area of interest and in retrieving appropriate product details from the catalogue.

Mainly methodologies, which are based on analyses of satellite or airborne imagery, offer possibilities to start with precision farming without small initial investment on the side of farmers. Practically, before the service company start to present a collected data and result to farmers, the data must be uptake and tread in central database.

Conclusion

The Mapserver demonstrate knowledge management system based on Interoperable Web Services and mobile platform. The implementation demonstrates possibilities of remote data analysis and data access. This is running demonstration of developed systems; the goal of system will be knowledge support, co-operation of research with practice, help to the services providers, but also the farmers. The system has to take into account the spatiality of agriculture production and could support a great number of very small farmers without necessary investment from their side. It is expected, that services providers or farmer organizations will provide this system. These providers are often organized in regional structures and associations. This solution is first step to next GRID based knowledge systems and open knowledge to large scale of users.

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