Georg Steinberger, Freising

Integrating Automated Process Data Acquisition in Agricultural Information Flows

Information is increasingly becoming a valuable resource, not only for „information driven plant production“ in precision farming, but also for the daily management of business and documentation tasks in farm work. The process data gathered during “machined” farming processes are of importance, too. Preliminary systems for process data acquisition are already available on the market. Research work for data acquisition systems [1] and analysis [3] started in 1999 and is being continued in the joint research project pre agro. Based on an architectural concept for data exchange in agriculture, various solutions are being developed to integrate the information originating from automated process data acquisition.

With the growing volume of data and information the demand for data transfer is increasing, too. To use once obtained data for different applications is one of the driving factors. Standardised interfaces are playing a key role and therefore the data transfer format agroXML was proposed for agriculture [2]. To automate the industrial data transfer, web services are gaining importance and can also be seen as a solution to automate data flow in the agribusiness value-added chain [4]. To open up this potential also for intra-farm processes, especially for precision farming, a service architecture for data exchange in agriculture was developed in the joint research project pre agro [6]. Distributed services, which are available via the internet, are coupled to a web service client, which is integrated in the Farm Management and Information System (FMIS) of the farmer. Thus data and functionality are linked to the farmer’s software.

Integration of process data

For an integration of process data into this architectural concept certain steps are required to be worked out:

- data have to be recorded directly during the execution of work, according to the information demands of precision farming
- and they have to be transferred to a data processing system without manual jobs to be done by the farmer.
- The data have to be analysed, aggregated and prepared for further use.
- The FMIS of the farmer needs mechanisms and tools to retrieve the data and work with them.

Agricultural Process Data Service

To use process data and the information, which is generated via different analysis methods, an Agricultural Process Data Service has been implemented [5]. This is one of the components to test the proposed architecture. Its design is depicted in *Figure 1*.

Data acquisition on machines is done by data loggers. One was developed according to the definitions of the TaskCotroller in the ISOBUS-Standard (ISO 11783). On the project farms commercial data acquisition systems are used, too. In time intervals between one and sixty seconds, GPS-data (time, location) and machine data (vehicle speed and engine rpm, fuel consumption, position of hitches, application volume, etc.) are recorded.

For data transmission between machine and server Bluetooth and GSM are used.

After the transmission to the server, data are pre-processed and stored in a data base (PostgreSQL). Data analysis is done directly on the data base using stored procedures, which can be programmed in a special data base language but are also controllable from

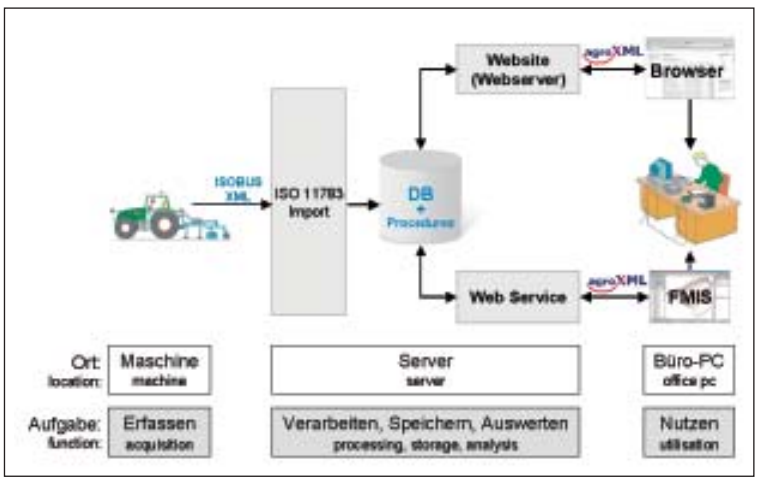

Fig. 1: Design and data flow of the Agricultural Process Data Service

Dipl.-Ing. agr. Georg Steinberger is research associate at the department of Life Science Engineering - Crop Production Engineering at Technical University of Munich, Am Staudengarten 2, 85354 Freising-Weihenstephan;
e-mail: *georg.steinberger@wzw.tum.de*

Keywords

Process data, information management

Acknowledgement

The work in this topic is done as sub-project 8 „Integration of automated process data acquisition in information flows“ of the joint research project pre agro, which is funded by the Federal Ministry of Education and Research, Germany.

AGROTRON K. EINEN KOMPAKTEN MIT VERGLEICHBARER AUSSTATTUNG GIBT ES NICHT.

Die SAME DEUTZ-FAHR Group wünscht Prof. Dr. Auernhammer alles Gute in seinem wohl verdienten Ruhestand.

SAME DEUTZ-FAHR

Mit dem neuen Agrotron K Profiline hat DEUTZ-FAHR einen Kompakten von 90-120 PS (66-88 kW) mit allen Vorteilen der erfolgreichen Agrotron-Reihe: 50 km/h, elektr. Steuergeräte, Comfortip, PowerCom S Armlehne, Kompaktkühlanlage, Agrotron-Freisichtkonzept, LS-Pumpe, Kostenkiller-Faktor und vieles mehr machen ihn zum Ausstattungs-Champion seiner Klasse. Testen Sie den Agrotron K Profiline jetzt bei Ihrem DEUTZ-FAHR Händler.

SAME DEUTZ-FAHR DEUTSCHLAND GmbH, www.deutz-fahr.de

DEUTZ FAHR

VERNUNFT FÜHRT WEITER.

external programs. With the supplement PostGIS the data base is able to process spatial information. E.g. the assignment of records to a certain field is executed with functions on the data base. The so far developed algorithms for analysis are able to aggregate data to work processes and actions by a stepwise generation of additional information, out of the raw data. Even the different stages of multiphase processes with repeated interruptions of work, e.g. to fill the tank of a sprayer can be detected and displayed. By the aggregation in the described way, data are prepared for a fast access.

To avoid direct access to the data base for data retrieval two different mechanisms are implemented. A website is used as a direct and graphical interface to the user. It is getting data dynamically from the data base. The user can navigate through the different farming processes via linked tables to get at the end the analysis of a process or download a specifically generated agroXML file. As a second mechanism a web service interface was configured according to the proposed architecture. Communication to the web service interface is done by farm management software, where a software component with an agroXML-client was integrated (by agrocom). The delivered information is used by the software to display the new farming processes as proposals for new records. Additionally the corresponding locations of the process data and field boundaries can be visualized.

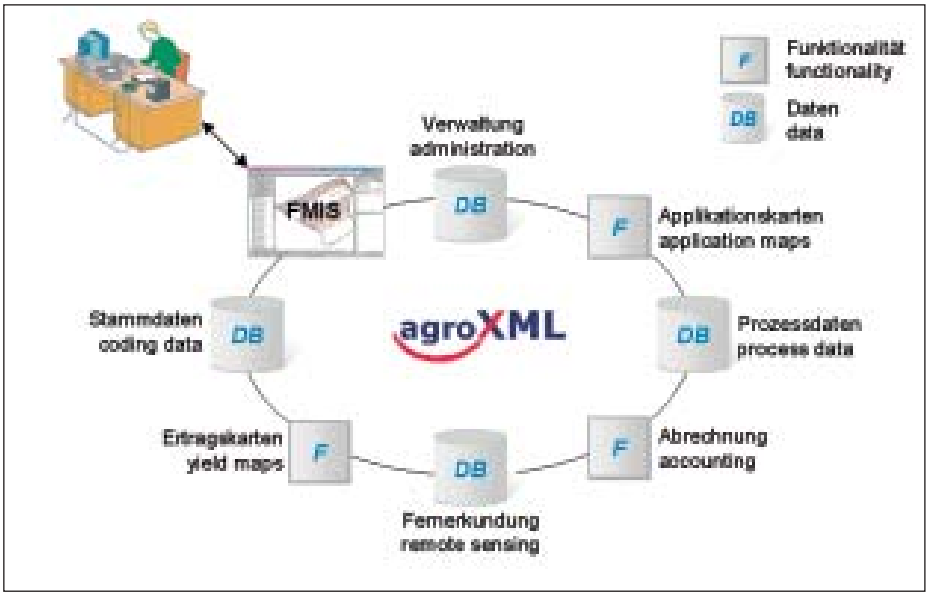

Fig. 2: Farm management software as entry to distributed service architecture in agriculture

Potentials

Via the implementation of the analysis of process data as a service, the advantages of this architectural concept can be opened up. Farming processes can automatically be booked in to farm management software. Frequently needed data can be stored on the local computer of the farmer (like the temporary files in a web browser). The original process data only have to be transferred in certain applications, but even there not necessarily. E.g. the pre-processed data can directly be delivered to a special web service for creating yield maps. In this application, the order with instructions for creating the yield map and the resulting map are transferred via the internet account of the farmer. The further data retrieval to accomplish the generation of the yield map is done in background via cascading web services. Processing and storing the data on a server enables a time and location independent access to the data and opens various fields for data usage. Additionally the resource-intensive data processing steps as well as the backup system are provided by the process data service.

Conclusion and outlook

So far the tests have confirmed the suitability of the proposed solution. By the integration into a service architecture for data management in agriculture new opportunities for handling and usage of data are established. For a successful introduction of such an information model standards are required. agroXML offers here the basis for first implementations. But for realizing the different interfaces for the different applications more efforts in standardization are necessary especially at an international level. Using web services with standardized interfaces agriculture benefits from a lot of the advantages. These are offered by today's information and communication technology and already prevail in industry. The farm management software is getting the role of a bridge to a pool of services with data and functionality, which can be connected via standardized interfaces (*Fig. 2*). This enables an individual adjustment of information processing and data transfer to single farm situations.

Literature

[1] *Auernhammer, H., M. Demmel and A. Spangler*: Automatic process data acquisition with GPS and LBS. AgEng, Warwick, 2000

[2] *Doluschitz, R., und M. Kunisch*: agroXML - ein standardisiertes Datenformat für den Informationsfluss entlang der Produktions- und Lieferkette. Zeitschrift für Agrarinformatik, (2004), H. 4, S. 65-67

[3] *Rothmund, M., and H. Auernhammer*: A web based information management system for process data designed with open source tools. Engineering the future, AgEng, Leuven, 2004 (CD-ROM)

[4] *Spilke, J., und K. Zürnstein*: Webservices - Beschreibung eines Ansatzes zur Anwendungskopplung und von Nutzensmöglichkeiten im Agrarbereich. Zeitschrift für Agrarinformatik, (2005), H. 2, S. 33-40

[5] *Steinberger, G., M. Rothmund and H. Auernhammer*: Agricultural Process Data Service (APDS). Agricultural Engineering for a Better World, Proceedings of XVI CIGR World Congress (CD-ROM), VDI-Verlag, 2006

[6] *Steinberger, G., M. Rothmund, D. Martini, C. Spietz, D. Mallon und E. Nash*: Integration von agroXML in eine landwirtschaftliche Geodateninfrastruktur. Landtechnik, 62 (2007), H. 2, S. 114-115