Methods and Services of Data Processing for Data Logged by Automatic Process Data Acquisition Systems

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Documentation in crop production – why?

Optimised farm management:
- Machinery use
- Resource Management
- Operational planning

Optimised crop management:
- Fertilizing / plant protection
- Tillaging
- Site specific farming

Documentation = Information

Traceability:
- Consumers trust
- Food industry
- Subsidy granting

Fleet management:
- Joint machinery use
- Machinery rings
- Contractors
Requirements of a documentation system

- Stability of data acquisition
- Completeness of data
- Safety of data
- Realtime acquisition
- Georeferenced data
- Easy and quickly to use

Automatic process data acquisition on machinery including GPS-positioning

Almost automated data processing on the PC
Automated process data acquisition with GPS and LBS

**Task - Controller**
- Controller "ESX" (by STW)
- LBS \( L_b \) for communication

**Algorithms for acquisition of:**
- position data
- LBS-base data
- available process data from IMI

**DGPS**
- Trimble AgGPS 132
  (Omnistar correction service)

**LBS Fieldstar**
(by AGCO/Dronningborg)
- Terminal
- Com Unit

**DOS Drive**
- (Omni Drive)
- Data log on PCMCIA card

**LBS Bus**
 draft force (EHR)

**Fendt Bus**

**Implement Indicator IMI**
- 16 Bit processor with CAN controller
- flash = 512k Byte
- RAM = 256k Byte
- EEPROM = 16k Byte
- LBS \( L_b \) for communication on LBS-Bus

**defined informations:**
- working width
- mounting position

**process data:**
- working status, -area, -distance, -time
- total time, total area

**PC**
- analyzing with IMI\( \text{lyzer} \)
  (SQL DB) with queries and reports

**target values**

(Auernhammer et al., 2000)
Automated process data acquisition with GPS and LBS

- Communication by the Agricultural BUS-System **LBS** (following the DIN 9684 or ISO 11783 standard)
- Positioning by the Global Positioning System **GPS**
- Implement identification and sensor data feed-in by the Implement Indicator **IMI**
- Tractor identification, data pre-processing and data logging by the **Task controller**
- Implement controlling by the **LBS-Terminal**

→ Recording process data with a frequency of 1Hz

(Auernhammer et al., 2000)
Automated process data acquisition with GPS and LBS

Data contents:

- **GPS**: Position, date and time
- **Tractor**: Identification and process data
- **Implement**: Identification and process data

(Auernhammer et al., 2000)
Electronic data processing – which way to choose?

Problems with local software packages on farmers’ PCs:

• Software installing and using often needs support
• Software needs to be updated
• Farmers often don’t use the software efficiently
• There are various possibilities for making mistakes using the software

Advantages of a server-sided data processing:

• The data evaluation system can be developed further on without local updates
• Farmers don’t have to care about making mistakes at data processing
• Farmers don’t have to spend a lot of time to introduce in a software
• Expensive support on the local PCs is avoided

DECISION
Developing of an ‘Internet based data management system’
The Idea of an Internet based data management system

Server-sided data processing and keeping

Technik im Pflanzenbau
Which software components are used for the DMS?

Server:
- An UNIX based operating system (Open Source Software)
- A MySQL database system (Open Source Software)
- A PHP parser (Open Source Software)
- A Webserver (Open Source Software)
- Some scripts to include the additional needed data processing functions

Client:
- A common web browser (delivered with the operating system of Windows PCs)
- A small adjusted data transfer tool based on free DOS utilities

All used software components are for free or parts of the existing clients.
Data flow in the Internet based data management system
Data flow in the Internet based data management system

Important functions of data processing:

- **Spatial classification:**
  Detects the area or field a data record belongs to

- **Job extraction:**
  Detects jobs and summarizes operational statistics

- **Mapping:**
  Attaches geo-information to operational jobs

- **Farm statistics:**
  Summarizes operational data to overview information regarding machinery, work and fields
Requirements for providing the information in the Internet

**Safety**
- Password protection
- Individual data access
- Protection from data loss
- Secure connections

**Information content**
- Sensible information
- Individual adjusted
- Overviews
- Detailed analysis

**User interface**
- Easy to use for farmers
- Clearly arranged
- Modular structure

**Data interface (data export)**
- Geo-data (GIS analyses)
- Operational data (field indices)
- Job data (accounting programs)
Modular structure of the online data management system

Authentication → User level
> Timespan level
> Farm level
> Field level

Master database

Schedular job overview

Job selection
- Detailed views
  - GPS-data download → geo-information
  - invoice generating → data transfer
  - data export → data interface for agricultural software (planned)

Overview
- Schedular
  - spatial not allocated data
- Graphical
  - operating times
  - operating areas
  - operating costs

Total views
Area specific views
Machinery specific views

Invoice database

Printing invoices

Invoice data export → data interface for accounting routines

Auto Process Data Acquisition © Rothmund, Demmel, Auernhammer 2003
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Technik im Pflanzenbau
Suchergebnis in der Datenbank Automatische Prozessdatenerfassung

Hinweise zum Suchergebnis


Traktoreinsatzeiten auf den Betriebsflächen

![Graph showing tractor usage times on farm areas](image-url)
Conclusions

• Documentation will be the base of many agricultural applications in the future

• Automatic data acquisition is the fit way to realize a spatiotemporal high-resolution and safe documentation

• The huge amount of raw data needs to be processed by a easy to use and safe data processing system

• An Internet based data management system can provide safety and effective information management for the farmers - avoiding problems with local installed software

• In the project on hand a first approach has been realized using just free software components

• The system should be developed further on and standards for data interfaces should be defined

• Reservations of the farmers regarding the server-sided data processing could be decreased by publishing more information and education
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