Automatic Process Data Aquisition with GPS and LBS

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Abstract for oral presentation at AgEng Warwick 2000
Session Information Technology or Precision Farming

Aims
Information technology is more and more part of agricultural machinery for monitoring and control. It offers several informations of the utilization and of monitoring and control parameters without additional costs. Unfortunately only a small rate of all used implements on a farm are so called "intelligent machines". The majority of it is "stupid" and will be in the near future too. To get an overall benefit of IT in farm machinery all implements may have at least a minimum of intelligence for identification and for communication.

Method
The established system consists of three units. GPS offers position and time. LBS (Landwirtschaftliches BUS-System; mobile agricultural bus system) by the DIN standard 9684 guarantees the communication between tractor, implements and farm management computers. For the implement identification an new device was defined. It is part of the implement and can be either mounted on it or can be integrated in the bus connector with a flexible connection to the implement by a steel rope or a chain. The implement indicator (IMI!) represents in the communication network a unique node like a mini ECU. In a basic configuration it only provides initialization, alive messages and a simple icon. Enhanced versions can be equipped with different sensor interfaces to get online process informations of working width, working depth etc. (fig. 1).

Figure 1: Structure and data example of automated data acquisition with GPS, LBS and IMI.
To get an unique implement identification within one farm the IMI is programmed basically by the manufacturer or by the supplier. Also a reprogramming feature is available via the LBS terminal for on-farm use when changing implement parameters or when selling a used implement and replace it by a new one using furthermore the available IMI.

Results
The IMI-project lead to a new LBS activity. It was the main reason for the creation of a LBS library as an open source. All needed LBS features are implemented by $\theta++$ objects, which hide the complexity of the protocol and provide an easy to use interface to the specific applications. This way either IMI’s or other LBS driven devices can use the communication in standardized shape very fast with low costs. The more systems this library use the fewer interpretation problems will occur.

First prototypes where established and tested together with low cost LBS-terminals both in lab and in field tests. They have been used for the creation of different data acquisition modules on different sampling rates and different aggregation levels.

Also the data exchange to the farm management computer has been established together with the creation of a farm database management system on the experimental farm.

The data analyzes are under discussion and will be realized during the next two month. It is the aim to create and establish standardized analyzing routines with commercially available software systems.

Assessment
The established system closes a gap in the on-farm data acquisition. It is based on standardized system units. The newly created LBS-library is another standard and can be used by everyone for quick and reliable LBS installations. The adoption to specific requirements of the farm specific data acquisition is simple and can be done either by the manufacturer or by the farmer himself.

Conclusions
With GPS and LBS comes automatic data acquisition to the farm use. More and better informations will be available for cost accounting, field management purposes and for the documentation of field work as a contribution to sustainable agriculture.