Insights from the corporate world

Innovation Trend “Smart Farming”

Prof. Dr.-Ing. Peter Pickel
Deputy Director
John Deere European Technology Innovation Center

Innovationstrend „Smart-Farming“ aus Sicht von Landtechnikherrstellern
Our Grand Challenges

Food (protein) security

Climate action & environment (GHG)

Sustainability

Precise Automation & Autonomy

Producing more with less

Independence

Derived Guiding Principles

Technology needs

Prof. Dr.-Ing. Peter Pickel | Juni 2018
Automated Driving

GPS / Glonass Satellites

Inmarsat

Signal accuracy
Satellite only ± 2 m
w/ Correction SF1 ± 15 cm
w/ Correction SF3 ± 3 cm
w/ Local base RTK ± 2.5 cm (repeatable)
Why don‘t we have autonomous machines?

⇒ Because of safety/legal issues
  • But driverless machines are the safest machines from the driver's perspective.
  • But the operational setting is endangered seriously.

⇒ Because of a lack of functional stability
  • Example: So long as there might be a pick-up (trailer) plugging a (service) person will be needed.

*Automation will have to „attack“ that gap*
*zero defect operation / disturbance management*
Our Grand Challenges

- Food (Protein) Security
- Climate action & environment (GHG)
- Sustainability
- Electrification
- Precise Automation & Autonomy
- Producing more with less
- Independence

Derived Guiding Principles

Technology needs
Electrification - Key Enabling Technology

- Efficiency
- Controllability and dynamic response behaviour
Electric system characteristics

- 2 servo-motors per row unit
Tractor Integrated Active Implement Guidance
Steering Tractor & Cultivator precisely

Detecting Crop Rows
Calculating Offset to Plants
Guiding Tractor & Cultivator

Maximize Weeding Success
Minimize Plant Losses
Agriloc

- Precise Seed Placement
- GNSS receiver development
- Satellite communication
Electrification - Key Enabling Technology

- Efficiency
- Controllability and dynamic response behaviour
- Using Renewable Energy
Vision

Decentralized Energy Supply in Rural Areas
HV-Tractor-Systems

2009

LIB-Off Road
intern
12kWh

eTour/econnect
extern
50kWh

BatteryBoôst
extern
105kW el. power
35kWh

SESAM Tractor
full electric
130kW el. power
130kWh

Prof. Dr.-Ing. Peter Pickel | Juni 2018
Sowjet Tractors until 1950s
Our Grand Challenges

- Food (Protein) Security
- Climate action & environment (GHG)

Derived Guiding Principles

- Sustainability
- Precise Automation & Autonomy

Technology needs

- Producing more with less
- Electrification
- Smart IoT integration
- Independence
Current Automation Story

Crop Protection with

Pesticide Application Manager (PAM)

Funded by

Federal Ministry of Education and Research

Based on a decision of the German Parliament
MyFieldConnect

- Automated Documentation & Reporting
- GPS Mapping & Remote Imagery
- Smart Harvesting Solutions
- Soil scan & nutrient sampling
- High Precision Mineral Fertilizer Application
- High Precision Organic Nutrient Application

Partner I
- API

Partner II
- API

Partner III
- API

MyJohnDeere

- RAUCH
- SULKY

20 | Prof. Dr.-Ing. Peter Pickel | Juni 2018
Adaptive Agricultural Production Systems providing:

- Technical intelligence (such as self-optimization)
- Self-reconfiguration in dynamic networks
- Defect compensation / zero defect operation

Adaptive Agricultural Production Systems becomes part of:

- A holistic, traceable, trustworthy food production
- Including blockchains and being embedded in a Mesh App and Service Architecture
Connectivity

- Internet of things, communication between everything
- Introduction 5G standards
- Extended positioning services
- Digital villages
- Secure farming
Digital Transformation in farming – deliverables:

- Traceability (agricultural product information in blockchains)
- Decision support systems will be replaced by Farm Management Information Systems
- Robotics in agricultural production chains
- Holistic farm models (e.g. digital farm twins), process information and evaluation including AI for imagery and sensors
Quotation of a Grandfather of Agricultural Engineering

Albrecht D. Thaer wollte, ...

dass man die „die Landwirtschaft als eine Fabrik, aber als eine sehr verwickelte Fabrik [betrachtet] und bei ihrer Betreibung alle Regeln [unterlegt], worauf der glückliche Erfolg der Fabriken beruht.“

Quotation from 1801 / Zitat von 1801

Agriculture shall be done in a way as if being an industrial manufacturing system, considering the processes of complex industrial production which have to be applied similarly to achieve the same fruitful success as the healthy manufacturing enterprises have