AGRIHUB
INSPIRE
HACKATHON
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FINAL REPORT ON CHALLENGE #7:

Machinery monitoring, **Analysis, processing and standardization of data from agriculture machinery for easier utilization by farmers**

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Number of participants: 14

INTRODUCTION

- Background of the challenge

Agricultural machinery significantly influences the economic profitability of crop management. How to operate machinery on the field and achieve the best result in farming business? Data collection from running machines in time and location or meteo sensor on the field can be one of basic controls for farmers.

From a technical point of view the monitoring system involves tracking of the vehicles position using GNSS combined with acquisition of information from on-board terminal or field sensors (CAN-BUS, ISOBUS) and their online or offline transfer to GIS environment in the **ISO XML format.**

- Full explanation of the challenge defining the scope of the effort.

Data collection will be done at medium-sized farms, where it will serve for an evaluation of tractors work during operation such as soil tillage, fertilization, sowing and application of nutrients and chemicals for crop protection.
Similar monitoring of meteo data will be tested at the enterprise which is offering services for farmers for assessing the quality of work for customers.

Data controlling and visualization will be in first step, next step will analyze data with focus on:

- Evaluation of the economic efficiency of machinery operations within the fields - farm
- Precise records of crop management treatments
- Management of machinery operations – increasing the efficiency of planning of crop management
- Control of requirement for field operations:
    - control of pass-to-pass errors and overlaps, coverage of maintained area and recommended work speed;
    - control of applied input material in comparison to prescribed rates;
    - on line monitoring of weeds;
    - on line monitoring of weather.

Visuals Tracking the machinery fleet which allows localization of farm vehicles in real time. This information provides an overview of current operations of machines and is crucial for the planning of field work and an evaluation of machines usage in time.

Evaluation of economic efficiency of the crop management treatments within the fields. A prerequisite is the identification of fields and tractor equipment for the accurate estimation of field job costs based on the fuel consumption and used and working time.

Evaluation of machinery passes on the soil environment. This includes detailed analysis of the tractor trajectories within the fields considering the site specific conditions. The aim is to estimate the negative effect of machine tracks on the soil environment (especially soil compaction) and compliance of agro-environmental limits (nitrates directive, GAEC, protection of water resources, other protected areas etc.)

Open for future update local changes

Collection online data from crop status like weather information or photos from crop status

METHODOLOGY

The **methodology** of the report contains the sections that describe the progress and results achieved for the entire challenge.

- Team description The team contains 14 people and was composed fromAGCO experts, experts on IT and solution was also discussed with farmers
- Technical Background - the focus is on connection of existing APIs of AGCO with system for FArmTelemetry, which was developed in the past by Lesprojekt and introduced a new solution on market AGCO API is open, but

current analysis is focused on the status of machinery. Goal is offer information needed for FMIS

- Description of the process of solution we tested importing data coming from AGCO API to Senslog and integrating it with the former Farm Telemetry concept. We collected ideas and feedbacks from users.
- Data & Equipment list LPIS data for Czech Republic, Data from FArm Nemecek

Field boundary downloaded from Czech government farm portal (by name and password) in 1 Shapefile (polygon) format and S-JTSK projection (Czech national grid). Shapefile format was split to each field (9 fields with area of each less than 5 hectares, 13 fields with area of each between 5 and 10 ha, 15 fields bigger than 10 ha of each) total 33 fields. Then transformed to the WGS-84 projection.

Beside the task data, also GPS positioning data are also shown:

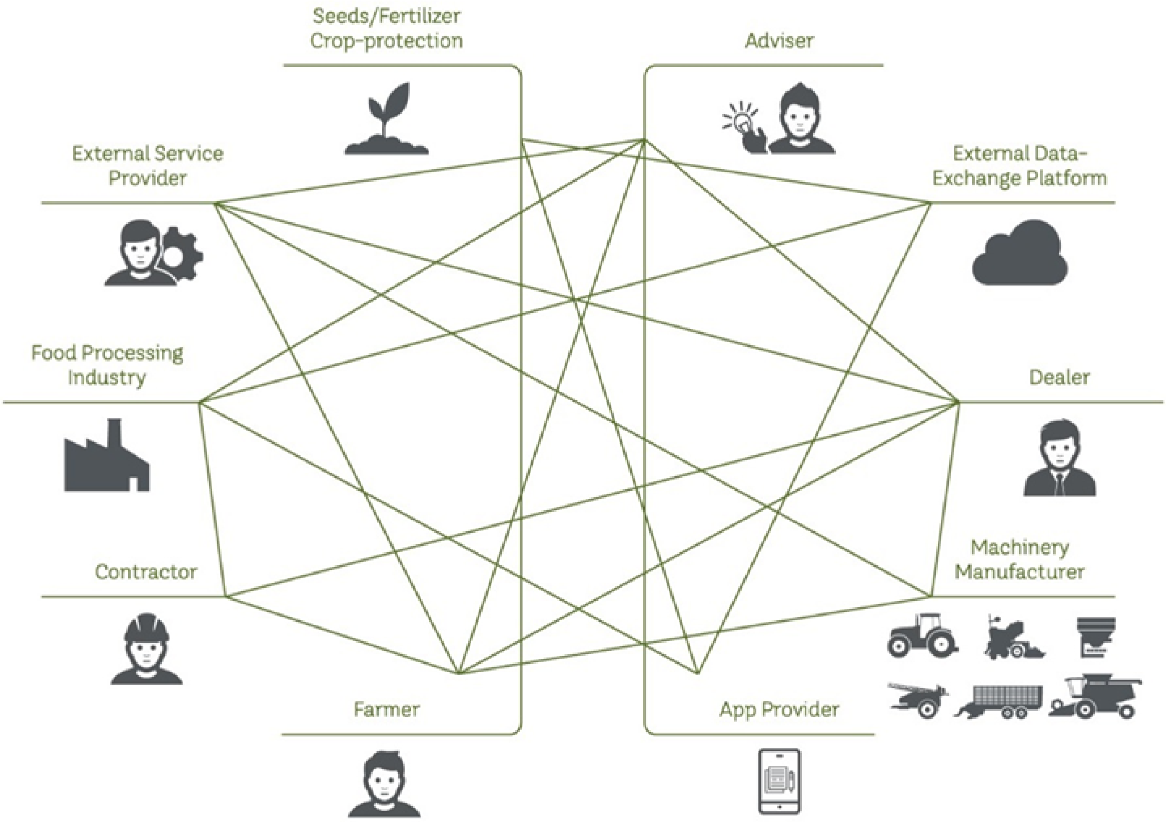
- Position
- Date, time
- Fuel usage/time [l/h]
- Fuel usage/area [l/ha]
- Engine speed [1/min]
- Rear PTO [1/min]
- Front PTO[1/min]
- Rear power lifter position[%]
- Front power lifter position [%]
- Required traction [N]
- Speed with slip[km/h]
- Real speed [km/h]
- Working width [mm]
- Worked area[ha]
- Stretch in worked position [km]
- Remaining stretch[km]
- Time in working position [h]
- Remaining time[h]
- Fuel usage [l]

- Detailed implementation plan
  a. preparing Mocku ups and specification of system December 2021
  b. Testing interoperability of data on base of data from Nemecek farm December 2021
  c. January and February solution prototyping
  d. March June Solution terrain testing

- Analysis of needs of stakeholder groups
  - Farmers - we start analyse functions needed for farmers

  - Farm´s advisory - dealers (Externals service provide - agronomy, machine technology, IT) - we met one group
  - Food processing industry . we look on traceability production needs
  - Contractors - we met one group

Common situation today:
next image describe current situation, when most of communication is peer to peer, we are working on brokerage collaborative concept, where all people will be able to communicate on one place. We are in contact with Challenge 8



- Experimental results

Testing data in ISOBUS export format were parsed and imported to the FarmTelemetry module of the SensLog solution. Appropriate transformations of data were necessary to get compliance of the SensLog data model.

The problematic part in the integration process was encoding the list of ISOBUS operation codes to follow observations and sensors scheme of the SensLog model. The automatic integration process was designed and implementation is planned in the future steps.

Observations produced by tractors were processed by the FarmTelemetry module, some corrections and manual editions were necessary as the original FarmTelemetry processes were designed on different types of telemetry units deployed in tractors during previous projects.

An example of the FarmTelemetry visualizations of data is depicted in the following Figure.

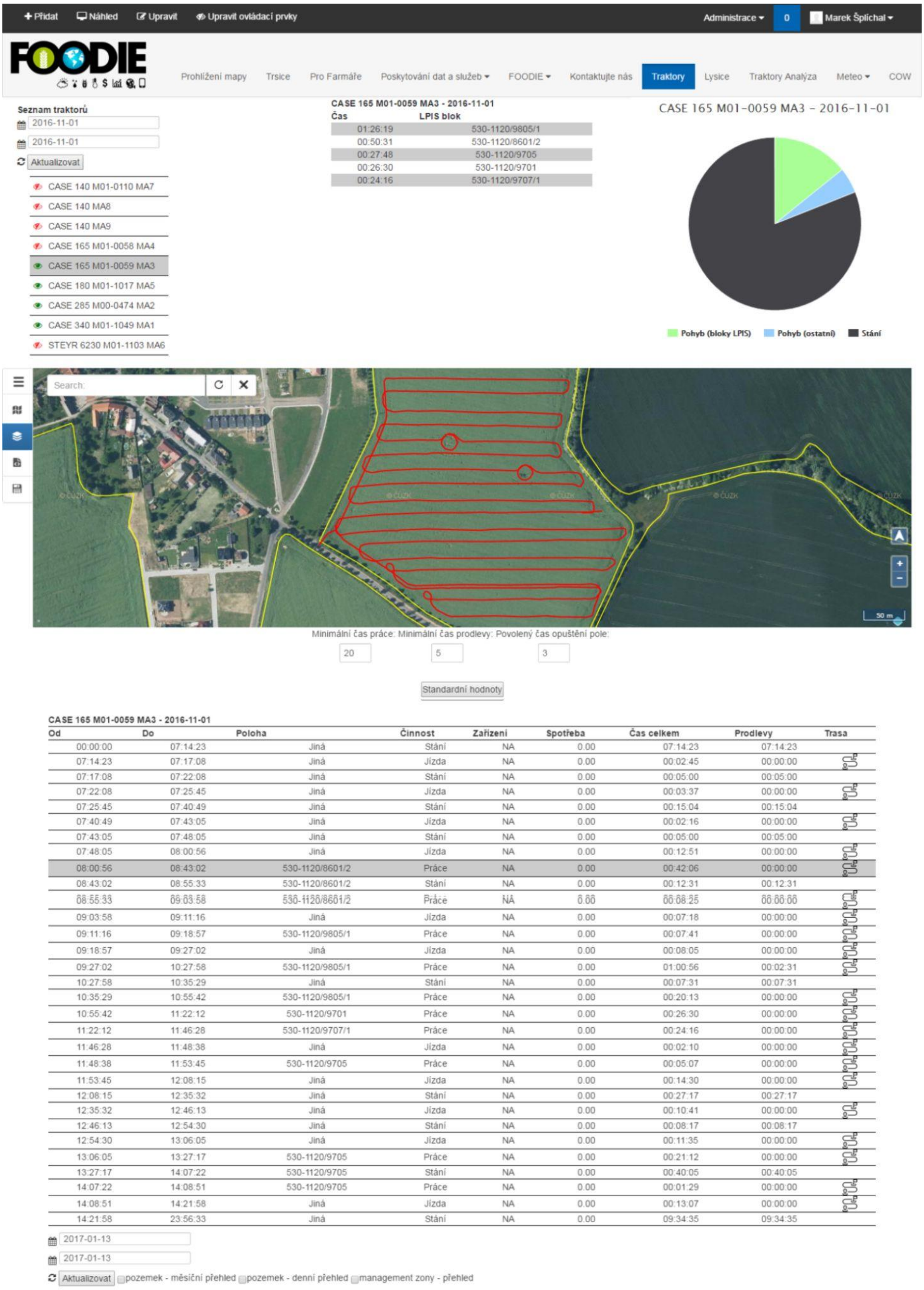


Figure - Example of FarmTelemetry interface for final users

FarmTelemetry user application provides overview of active tractors in selected time range, overview of LPIS blocks where selected tractor was operating. Then pie chart of tractor utilization during selected time period divided into standing, transfer and operation.
Map view shows tractor trajectory in selected time period and map contains orthoimagery together with LPIS blocks.
Remaining table is the worklog of the selected tractor during the selected period with information of LPIS blocks, connected devices and fuel consumption if available.
Overview and summarized operations per field block is available but was not tested during the hackathon as there was a short period of telemetry data.

FINDINGS & CONCLUSION

- Discussion of the results and findings

Implementation consists out of 6 main functions

- Live View
- Process Data (Tasks)
- Send Data (Tasks exchange)
- Guidance Information Transfer
- Documentation
- Reports

The task planning before sending it to the tractor and the task evaluation, post processing and documentation when the finished task is sent back to the interface. Important is also documentation and quick reports. By the mentioned steps we want to implement follow:

- simplifies data exchange
- reduces administrative overhead
- improves efficiency
- independent organisation
- all suppliers may participate

- Further improvements

We prepared a mockup and basic analysis of the system. Now we will come to implementation according to plan.