German Research Center for Artificial Intelligence

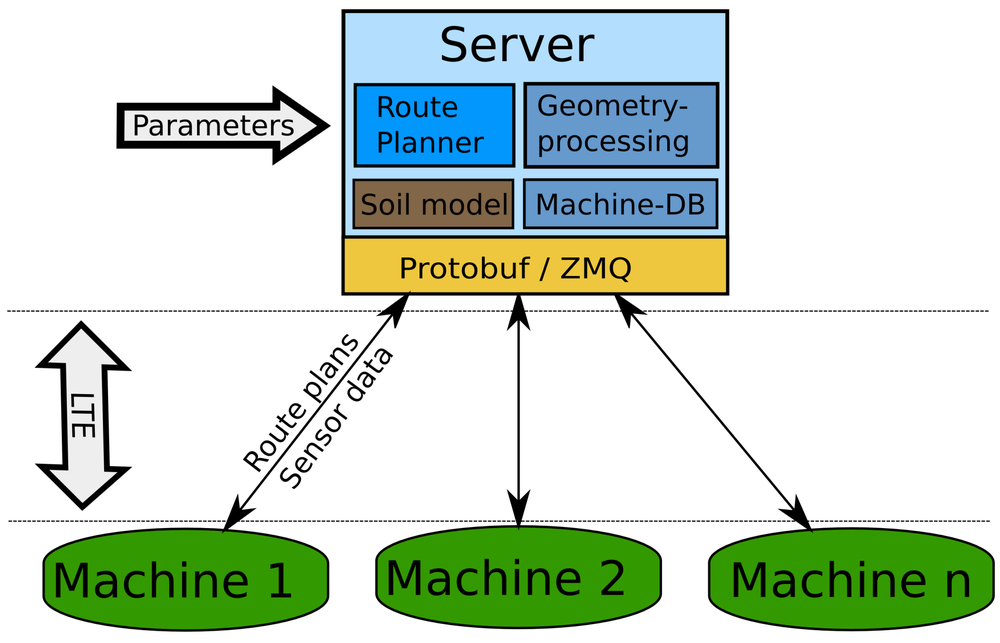
Towards a planner for machine coordination in maize harvesting ensuring soil protection

An assistance system for soil protection

Automation and optimization are becoming increasingly important in agricultural processes. In addition to improvements in efficiency, soil protection is gaining attention. As part of the project SOILAssist a real-time assistance system for agricultural machines will be developed. The assistance system facilitates spatial and temporal process planning and coordination of several cooperative machines. For the maize harvesting process the planning system will coordinate the harvester and additional machines by providing the drivers with plans that ensure soil protection.

The user interface of the assistance system will provide different views:

- The initial configuration of the harvesting process.
- Overview about states and positions of all machines.
- Overview about the full plan.
- A local view with driving instructions as well as machine and sensor data.



Client-Server architecture for machine coordination

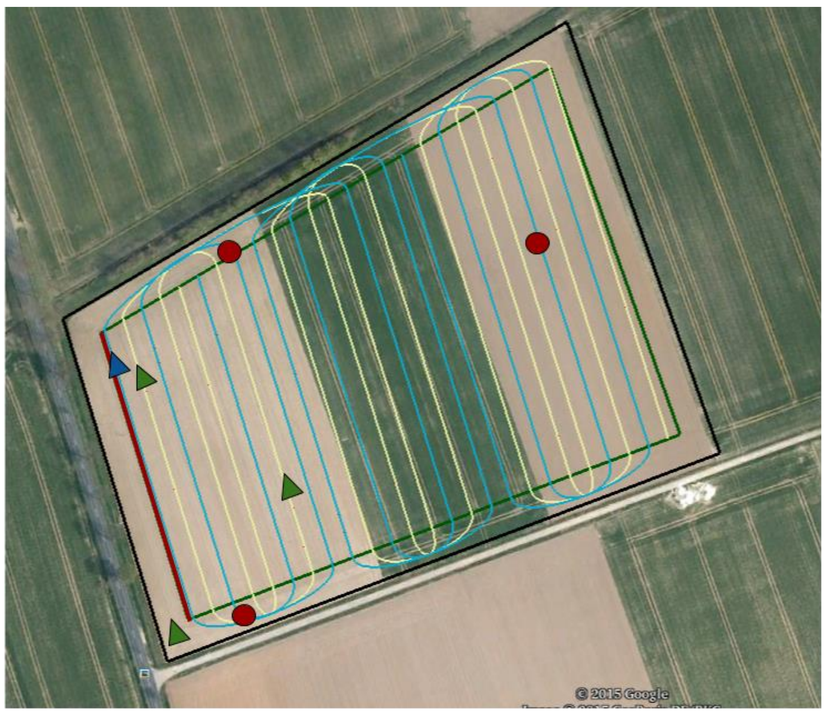
System architecture

The assistance system relies on a client server architecture in which the main software modules are implemented on a server. It collects and integrates data from different machines. The planner creates route plans that coordinate the different machines and it adapts plans at execution time. Android tablets are used on the machines to provide a user interface and to collect and send sensor and machine data to the server.

Communication Framework

Different software modules communicate with a light-weight, language and platform independent communication framework based on Protocol Buffers and ZeroMQ. Interfaces are defined as messages in Protocol Buffers. ZeroMQ is used as a messaging library for distributed architectures.

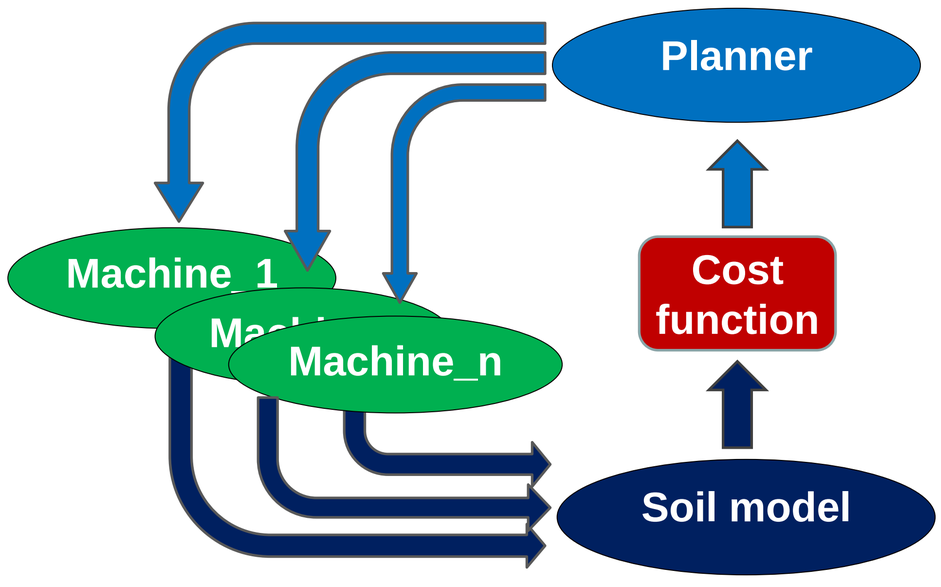
Currently, the programming languages C/C++, Java and Python are supported by the communication framework.



Plan coordinating multiple machines

Integrating a soil model into the planning process

The planning system will optimize the paths of the machines based on a soil model that will be developed at the Thünen-Institute and the Christian-Albrechts-University of Kiel. The soil model will be used by the planner as a cost function indicating the damage on the soil induced by driving with a given weight, speed, and tire inflation pressure. The planner may decide to change the machines paths, reduce the maximum load capacity or propose to adapt the tire pressure.



Integration of the soil model into the planning process

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BonaRes SOILAssist

Authors:
Sebastian Stock (sebastian.stock@dfki.de)
Stefan Stiene (stefan.stiene@dfki.de)

Contact:
DFKI Bremen & University of Bremen
Robotics Innovation Center

Director: Prof. Dr. Frank Kirchner
E-mail: robotics@dfki.de
Website: www.dfki.de/robotics