Control architecture for autonomous outdoor vehicles with attachments in complex applications

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In order to automate applications such as mowing embankments, drilling boreholes, uncovering pipelines with a suction excavator or felling and loading trees in the forestry sector, suitable coordination mechanisms between the carrier vehicle and the attachment must be developed (see fig. 1). There are often several options that need to be evaluated and selected depending on the situation. To complicate matters further, the chosen control strategy must be adapted to different disturbances of the environment.

To this end, the presentation will introduce a universally applicable control architecture. Based on suitable methods for the description of the drive and arm kinematics, the determination of suitable pathways for the carrier vehicle, planning approaches for adequate arm movements and sensor-based situation detection, a behavior-based control architecture will be introduced.

The basic idea of the control system is that the robot arms and the carrier vehicle are seen as separate intelligent units that pursue a task independently of each other. By decoupling the systems, the coordination and planning effort is reduced while at the same time the robustness of the control system is improved. At the end of the presentation the performance of the control architecture is to be demonstrated using the application problems mentioned above.

Fig. 1: System architecture applied to autonomous outdoor vehicles with attachments (mowing vehicle, drilling system, suction excavator, forest machine)