Towards Precision and Reliability in Autonomous Agricultural Robots -Abstract

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The market for robotic mowers for both private and public buildings is growing fast, and market stakeholders are now trying to develop a bigger and greener model for large-scale lawn-mowing of for instance public parks, golf courses and sports fields. This is the main goal of the AutoTurf project, i.e. to develop, test, and document a solution for energy efficient and automated turf care on large grass-turfs. Based on an innovative commercial autonomous robot, which the partner company (Sidis, now Vektor Dynamics) is currently developing, a foundation for a final concept of fully functioning autonomous lawn care has been created. So far, there are no approved autonomous robots in the market that covers the requirements of larger, high-end machinery.

This dissertation investigates challenges and solutions within the application and commercialization of such autonomous agricultural and lawn-mowing mobile robots, specifically those targeted at providing autonomous, unsupervised lawn-mowing services for larger areas; an application area where many solutions already exist on a smaller consumer scale, such as battery powered robotic lawnmowers. These are turf-areas which today are serviced with riding mowers, and where the use of smaller robotic lawnmowers is not sufficient or desired. In a broader sense, the work is closely related and applicable to the application fields of autonomous and precision agriculture.

The challenges in these applications differ from the consumer market by having much larger, more expensive, and more dangerous machines, which necessitates the use of more advanced planning, control and command functions, as well as more advanced sensors and processors.

Three areas of interest are investigated in the thesis: complete coverage path planning, positioning & perception and path-control, which relate to the three challenges of guidance, navigation & control, or express as statements "where do I want to go", "where am I"' and "how do I get there". For each of the areas of interest, an analysis has first been carried out, then a solution for the AutoTurf robot has been developed, implemented and tested, thereby demonstrating their applicability to the autonomous turf-care challenge.