A Low Cost, Modular Robotics Tool Carrier For Precision Agriculture Research

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Current research within agricultural crop production focus on using autonomous robot technology to optimize the production efficiency, enhance sustainability and minimize tedious, monotonous and wearing tasks. But progress is slow partly because of the lack of flexible and low cost robotic platforms suitable for research within precision agriculture. This paper presents Armadillo, a $50k field robotic tool carrier with a modular design which makes the robot configurable and adaptable to a wide range of precision agriculture research projects. Armadillo weighs around 425 kg and consists of two 18x80 cm footprint track modules each with an integrated 3.5 kW electric motor, gear and motor controller. The track modules are mounted on the side of an exchangeable tool platform which allows an adjustable width and clearing height of the robot. The 48 V lithium power pack lasts 10 hours of operation. Armadillos industrial grade Linux based FroboBox computer runs the FroboMind architecture which is based on the Robot Operating System (ROS) by Willow Garage. FroboMind is a novel generic architecture that has been implemented and successfully tested on different field robots. It has been developed for research within precision agriculture and the design is highly modular in order to optimize with respect to extensibility, scalability, short development time and code reuse. All FroboMind software components used for the Armadillo robot are released as open-source. A prototype of Armadillo has been developed and tested as part of ongoing research projects within sustainable and organic weeding in row crops and orchards. Based on the experiences obtained, the first public version of Armadillo has been constructed and delivered to the University of Hohenheim, Germany. Current activities focus on further improving the Armadillo hardware and software and application to new research projects.

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