ATLAS Multisensor Box

A crucial component of the ATLAS research project is the design, implementation and application testing of a sensor system that can be coupled to tractors and narrow-tracked vehicles by means of a three-point linkage (cat.1, 2 and 3).

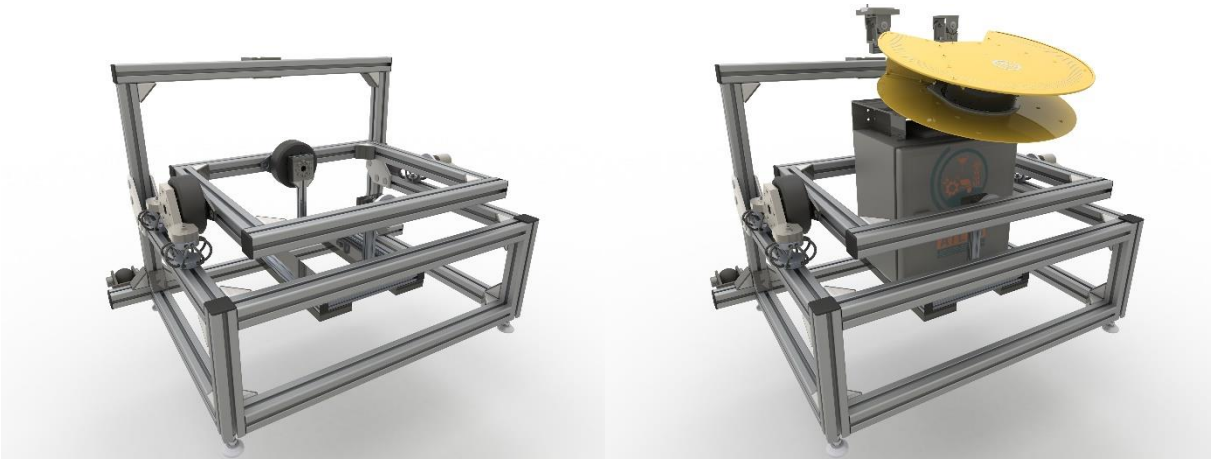
The sensor box is intended to use optical sensors such as a LIDAR sensor (Light Detection And Ranging) or a 3D vision system, consisting of RGB-D depth cameras and a stereo camera to generate a spatial image of the driving route, in order to enable autonomous operation of the vehicle. A SICK MRS-LMS1000 sensor is used as LIDAR. The 3D vision system consisting of Intel® RealSense™ cameras is a development of the project partner CNR (Consiglio Nazionale delle Ricerche).

At the same time spectral indices of the soil, plants and plant components are to be recorded. Different spectral cameras can be used to capture these indices. Therefore, the multi-sensor box is designed to be compatible to different spectral cameras. The spectral indices provide information about soil moisture, chlorophyll content and drought stress of the plant, which is important information for the farmer. Afterwards, the information of the spectral indices and this "digital twin" of the field or plantation can be merged. In this way, a volumetric estimate of the yield can be calculated.

A communication of the multisensor box with other external sensors is also planned. The acquisition of data and their processing is done by computer units within the multisensor box.
For example, the Generic Control Box of the project partner Robot Makers.

While driving, the sensors connected to the tractor are exposed to vibrations and shocks, which are significantly influenced by the nature of the ground driven over and the driving speed of the vehicle. These vibrations lead to measuring errors of the optical sensors, which has a negative effect on the subsequent data processing. To minimize these errors and, in the best case, to prevent them completely, the sensor system is mechanically damped and actively stabilized.

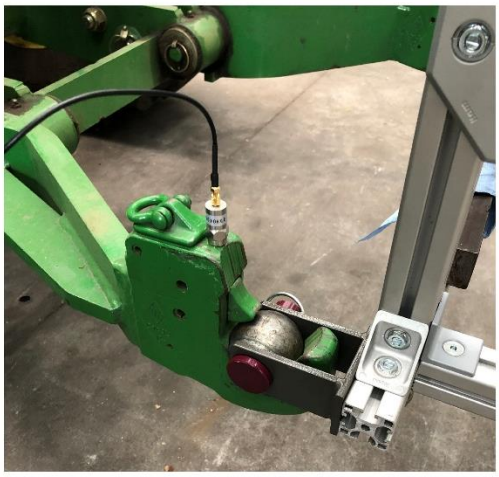
The stabilization by means of gimbal suspension is driven by brushless DC motors, which ensures that the sensor box maintains its horizontal alignment while driving. Rolling motion about the X-axis of the vehicle (in the direction of travel) and pitching motion about the Y-axis (transverse to the direction of travel) are compensated up to an inclination of ±22.5°.



In order to reduce the transmission of vibrations of the drive, a passive damping by flexible polymer components is mounted in the lower and upper link hooks. For this purpose, balls and sleeves made of elastic plastics are being manufactured using a 3D printing process and examined for their damping behavior.

Ultimaker TPU 95A - Thermoplastic polyurethane

Druckwege GmbH TYPE D flex - model UV resin



In addition, a damping by means of wire rope dampers, which are mounted between the active, gimbal-mounted stabilization and the mounting frame, is being examined for its suitability to reduce the movement of the sensor box in the Z-direction. The energy supply of the stabilization, the computers and the sensors in the multi-sensor box is ensured by an ISOBUS connector.

Partners in this work package who are working closely together on the development of the multi-sensor box are AEF, CNR, CERTH, Fraunhofer, Robot Makers and TH Köln.