TECHNISCHE HOCHSCHULE DEGGENDORF

SchmuFruKI

A REAL-TIME METHOD FOR DETERMINING THE WEIGHT PROPORTION OF CROP AND SOIL

Weitere Infos:

Project title

SchmuFruKI – A real-time method for determining the weight proportion of crop and soil.

Short title

Design and development of robust data acquisition system for mobile machines

Introduction

The main goal of the project is to develop a real-time method for determining the weight proportion of soil adhering to freshly harvested crops in a truck load, using sugar beets as an example. Utilization target is to develop a device able to measure and control cleaning on harvesting machines more precisely. This minimizes humus removal from the field and transports less soil to the processing factory. Therefore, it is required to generate a representative data set, designing an AI model and porting it to a target device.

Aims

The generated dataset needs to involve various data sources and the target value. The recording environment is an agricultural machine loading crops onto a truck at the edge of the field. The data sources are measurement variables captured by a multispectral camera (MSI) and two CAN bus systems as well as process parameters taken by the factory also containing the estimated weights that is of interest for the data analysis of this project.

Methods

The selection of appropriate sensors and the determination of relevant data harvesting locations are crucial steps. The chosen data sources align with the features used by human estimators and systems involved in the beet processing pipeline. Specifically, a multispectral camera has been selected and an interface to the CAN bus systems of the overloading machine has been developed. Recorded parameters of the processing factory contain the weight share and further process parameters, which are subsequently added to the dataset.

Furthermore, the data recording system on agricultural machines needs to be robust to meet the required reliability focusing on robustness, storage size, exchangeable storage units, energy preconditions, robust sensor interface slots, automatic switch-on mechanism and time synchronization among involved system devices. Another necessity is to optimize the recording conditions to protect the image acquisition against stray light and spot overexposure. On the other hand, the data acquisition software implements monitoring threads to automatically start-up and shut-down the recording device according to the machine’s ignition pin state, automatically trigger a recording based on a defined CAN signal and cyclically check the storage consumption.

Results

To ensure system reliability and accuracy before its installation on the harvesting machine, the system needs to be validated. This validation focuses on achieving valid and reliable time synchronization, as well as ensuring a reliable recording trigger and data acquisition from connected sensors and data sources.

Additionally, the system’s behavior is assessed in the production environment of the agricultural machine. The storage consumption is monitored to determine the need of storage exchange to provide continuous recording during operation. The sample rates are evaluated to ensure the system is collecting data at the desired frequency, integrity and accuracy. The system availability is documented to guarantee continuous operation.

Project participants

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- ROPA Fahrzeug- und Maschinenbau GmbH

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- Verband Bayerischer Zuckerrübenanbauer e. V.

  - Südzucker AG – Plant Plattling (associated by Verband Bayerischer Zuckerrübenanbauer e.V.)

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funded by

Bayerisches Verbundforschungsprogramm (BayVFP) of the Free State of Bavaria

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