

Department:	Electrical Engineering and Information Technology
Group:	Electronic Measurement and Signal Processing (EMS)
Responsible professor:	Prof. Giovanni Del Galdo
Supervisor:	Jonas Gedschold (jonas.gedschold@tu-ilmenau.de), Tim Erich Wegner
Position:	Research assistant / Hiwi (Research project or thesis possible)
Period:	6 month

Multi-Sensor-Fusion for Crop Monitoring in Agricultural Environments

Description:

- Sensor-assisted crop state monitoring is a long-established trend for agricultural applications (keyword smart farming) and allows e.g. yield prediction or automated harvesting of fruits
- Our goal is to investigate sensor fusion between optical and microwave sensors to increase the reliability and quality for fruit state estimation
- The very diverse sensing technologies allow the observation of a rich feature set like visual texture and radar scattering properties. Additionally, the radar waves can penetrate the outer peel of the fruits due to the low frequencies allowing “to look inside”.



Figure 1 - Multi-Sensor-System

Tasks:

1. Exploration and visualization of datasets from a field test including data from a stereo camera, two different radar systems, GPS, Inertial Measurement Unit (IMU)
2. Extraction of sequences including specific landmarks (watermelons with certain IDs referenced by external RTK / GNSS)
3. Comparison of landmark measurements between different configurations (dynamic field test, static field test, laboratory measurements)

Your Skills:

- High interest and good knowledge in signal processing (sampling rate conversion, filtering, ...)
- High interest and good knowledge in (clean) python programming
- Basic knowledge of (Ultra-Wideband) radar
- Optional: Knowledge of the Robot Operating System (ROS)
- Optional: Knowledge of data fusion concepts
- Language: German / English

Further Reading:

- Time-domain Analysis of Ultra-Wideband Scattering Properties of Fruits, Available from supervisor
- <http://wiki.ros.org/ROS/Tutorials>
- W. Elmenreich. “An Introduction to Sensor Fusion”. In: Research Report 47/2001 (May 2002)
- Handbook of Ultra-Wideband Short-Range Sensing, Jürgen Sachs, Chapter 4.5.2
- <https://www.tevel-tech.com/> (Example for industrial solutions)
- Clean Code – A Handbook of Agile Software Craftsmanship, Robert C. Martin