



Aerial data collection and automated ground intervention for precision farming

Feeding the World

- By 2050 we'll need to feed two billion more people
- Around 30% of the food is lost in the field
- Chemicals inputs have disastrous ecological impact

→ *Robotics can contribute to solve these pressing challenges*

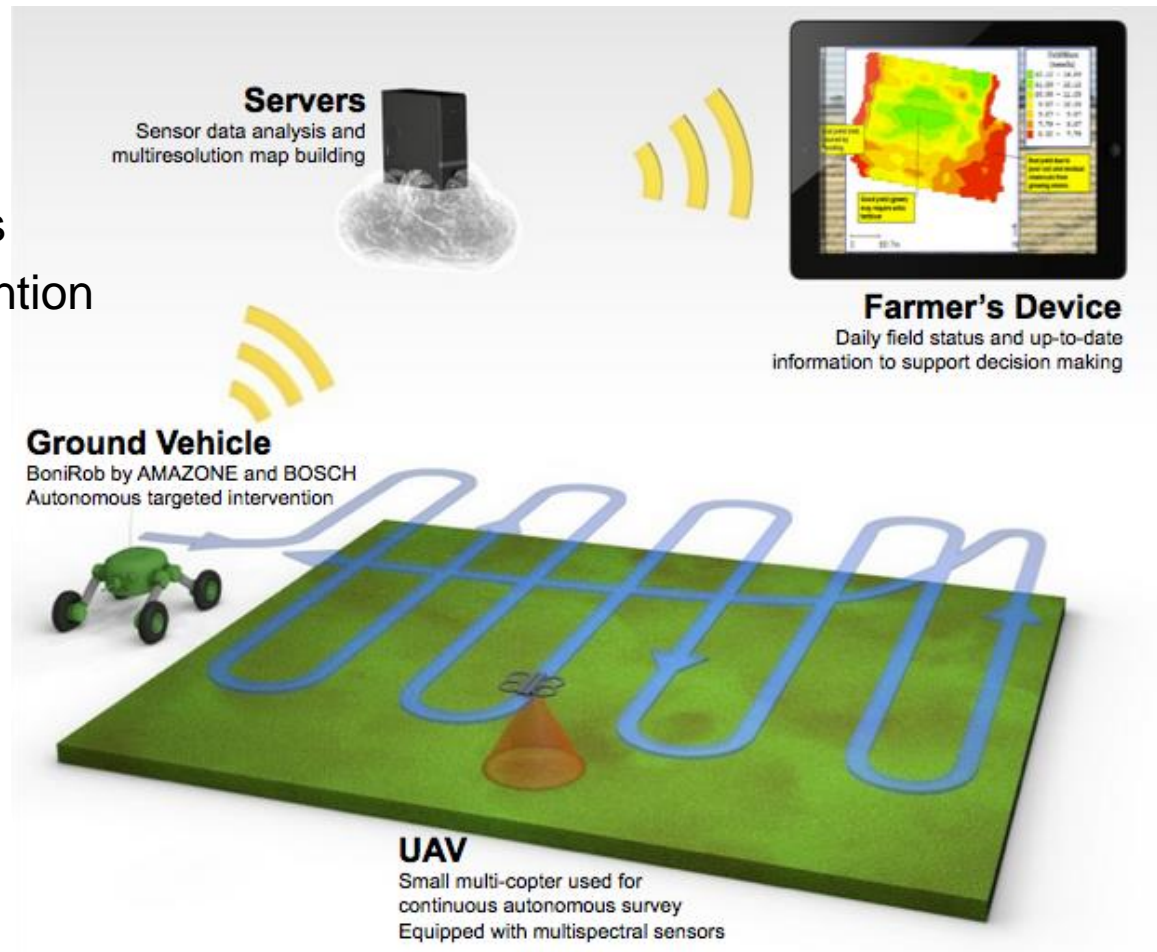
Flourish | Robotics to improve farming

Objectives

- Improve yields
- Minimize chemical inputs
- Minimize manual intervention

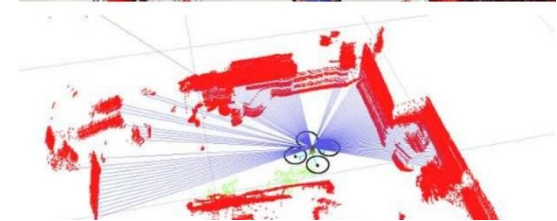
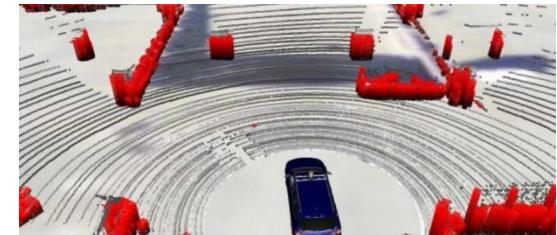
Approach

- UAV-UGV-Farmer collaboration
- Aerial survey using UAV
- Ground robot (UGV)
 - targeted deweeding,
 - selective spraying
- Farmer
 - Setting high level objectives



Flourish | Step changes thanks to robotics technology

- **UAV perception and navigation**
 - Multi-spectral 3D mapping
 - Robust estimation of crop health.
 - Autonomous navigation to map large areas
- **UGV perception, navigation and intervention**
 - Classification of crops and weeds in sensor data
 - Automated ground intervention
 - Navigation and terrain assessment in the presence of flora and changing weather conditions
- **Collaboration of Farmers, UAVs and UGVs**
 - Collaborative environment modelling
 - User interface for data analysis and decision making
 - Continuous survey using the UAV while minimizing soil compaction caused by the UGV.



Collaborative mapping



BoniRob agricultural robot

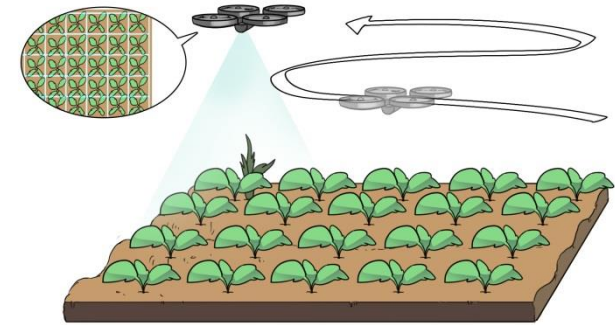
Flourish | Bringing robotics to farms

Highlights

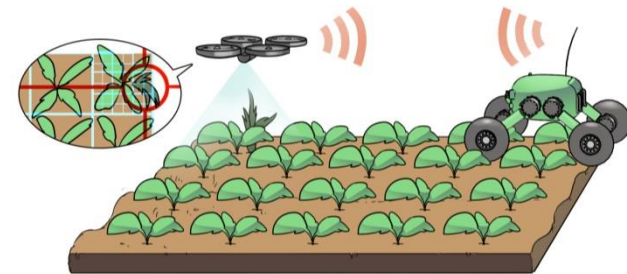
- Data validation with ground truth data at ETH research farms in Eschikon, Switzerland
- Demonstration at commercial farms near Hannover
- Continuous, automated data collection, analysis and corrective action through human, UAV and UGV collaboration.

Partners

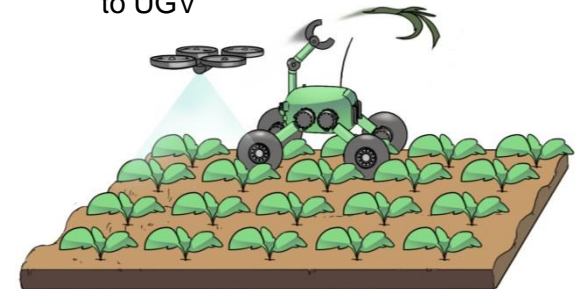
- ETH Zurich
- University Bonn
- University Freiburg
- Robert Bosch GmbH
- CNRS
- University Roma la Sapienza
- Agenzia Servizi Settore Agroalimentare delle Marche



- 1** UAV continuously collects a rich set of sensor data over the field



- 2** Data analysis system detects and communicates issues (eg. weeds) to UGV



- 3** On command, the UGV, equipped with a suitable end effector, enters the field and applies treatment.