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CROPS: Clever Robots for CROPS



Wednesday, March 18th, 2015

This project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 246252

CRO^pbS  "Clever Robots for Crops"

The partners



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Partners

1	WUR Greenhouse Horticulture	WUR	NL	Research Institute
2	University of Leuven BIOSYST-MeBioS (Mechatronics Biostatistics and Sensors)	KULEUVEN	BE	University
3	Ben-Gurion University of the Negev Dept. of Industrial Eng. and Mngmt	BGU	IL	University
4	University of Ljubljana Faculty of mechanical engineering	UNILJ	SI	University
5	Umeå University Department of Computing Science	UMU	SE	University
6	Università degli Studi di Milano Department of Agricultural Engineering	UNIMI	IT	University
7	Instituto de Automatica Industrial	CSIC	ES	Research Institute

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Partners

8	Technical University Munich Institute of Applied Mechanics	TUM	DE	University
9	Case New Holland Belgium N.V.	CNH	BE	Multinational Industry
10	INIA Quilamapu	INIA	CL	Research Institute
11	Force-A	FORCE-A	FR	SME
12	Festo AG	FESTO	DE	Multinational Industry
14	Swedish University of Agricultural Sciences	SLU	SE	University
15	JENTJENS Machinetechnik B.V. (left the consortium mid 2013)	JENTJENS	NL	SME

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Some fact and figures

- FP7 EU project within Theme NMP: Nanotechnologies, Materials and new Production Technologies
- Type of funding scheme: Large-scale integrating Project
- Call: Automation and robotics for sustainable crop and forestry management
- Start date: Oct. 1st 2010, end date: Sept. 30th 2014



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Some fact and figures

- Budget: 10.2 million Euro
- EU financial contribution 7.6 million Euro for a period of 48 months
- 13 (was 14) partners from 10 countries



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The people



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Objective

Intelligent sensing and manipulation for sustainable production and harvesting of high value crops.



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Applications (demonstrators)



Sweet pepper, apples, grapes, precision spraying, obstacle avoidance in forestry



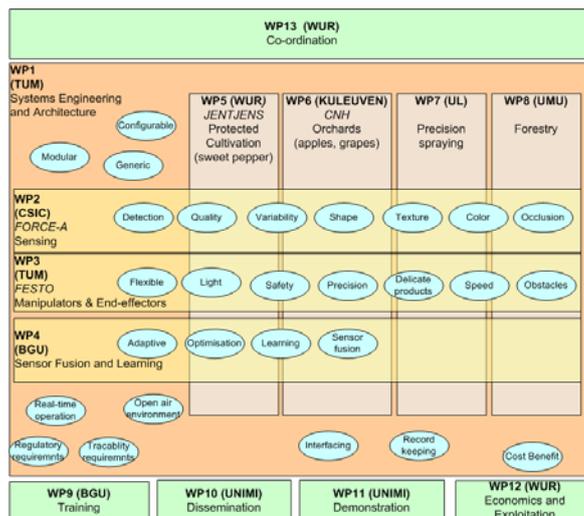
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Workpackages



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CROPS: universal robot platform



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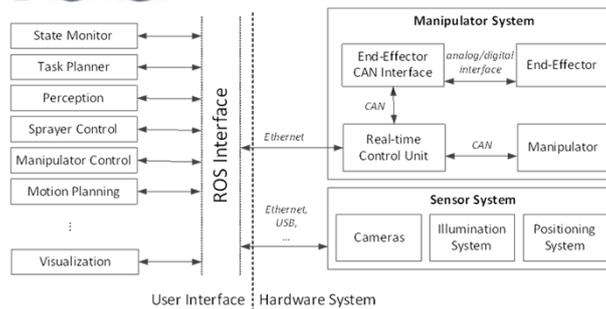


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Implemented hard- and software architecture

ROS Robot Operating System



Main partners:



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Sensing



Main partners:



13



Sensing ripeness and diseases



Multiplex Mx330, disease detection (Force-A)



Ripeness sensor based on fluorescence measurement (Force-A)

Main partners:



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Manipulators



First prototype, also used for precision spraying



Second prototype, used for sweet pepper harvesting

Main partner:



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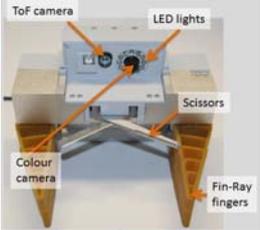
Manipulators



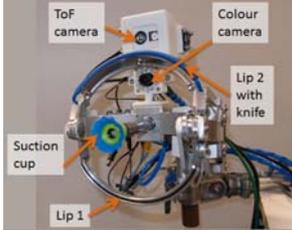
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Endeffectors



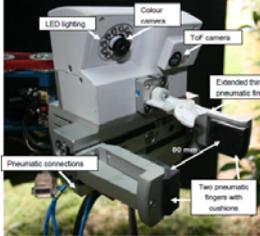
Sweet pepper



Sweet pepper



Grapes



Apples

Main partners:



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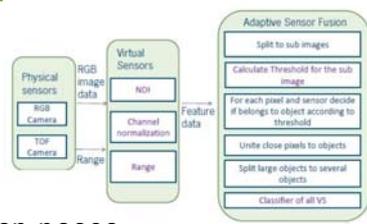


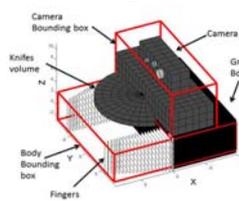
Spraying

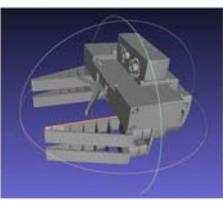


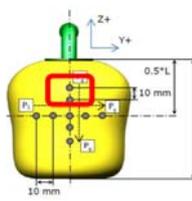

Adaptive sensor fusion and learning for grasping

- adaptive sensor fusion
- determining successful grasp poses









Main partners: אוניברסיטת בן-גוריון בנגב Ben-Gurion University of the Negev



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Sweet pepper harvesting



This part was co-funded by the Dutch Horticultural Product Board and the Dutch Ministry of Economical Affairs



Platform for sweet pepper harvester

Main partner:  WAGENINGEN UR
For quality of life



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Sweet pepper harvesting



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Apple harvesting



Wall of fruit



Platform for apple harvester. Robot is inside

Main partners: 



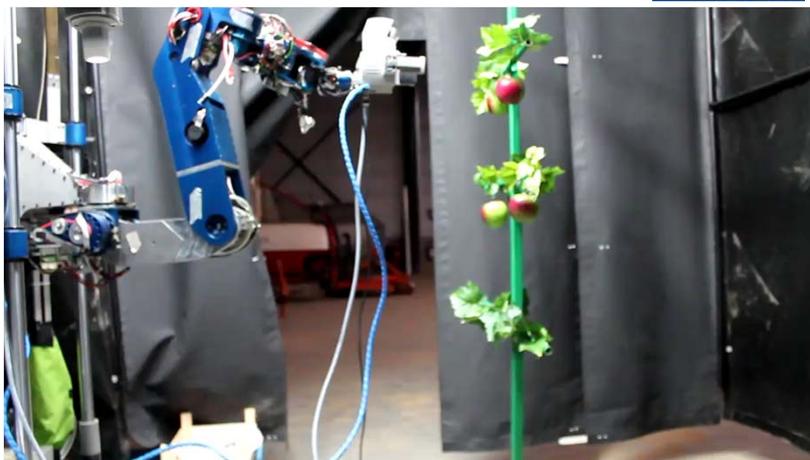
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Apple harvesting (laboratory)





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Apple harvesting (orchard)



KATHOLIEKE UNIVERSITEIT
LEUVEN

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Grape harvester



Open crop



Gripper for grapes

Main partners: KATHOLIEKE UNIVERSITEIT
LEUVEN



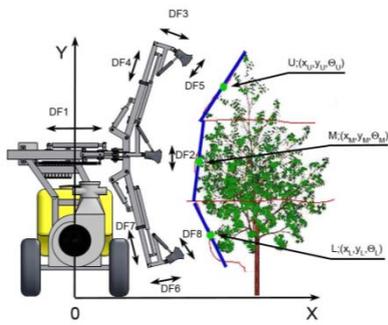
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Canopy optimised sprayer



Design



Implementation

Main partners:



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Ben-Gurion University of the Negev



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Canopy optimised sprayer



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Precision spraying



Spraying only the infected spots

Main partners:



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Precision spraying



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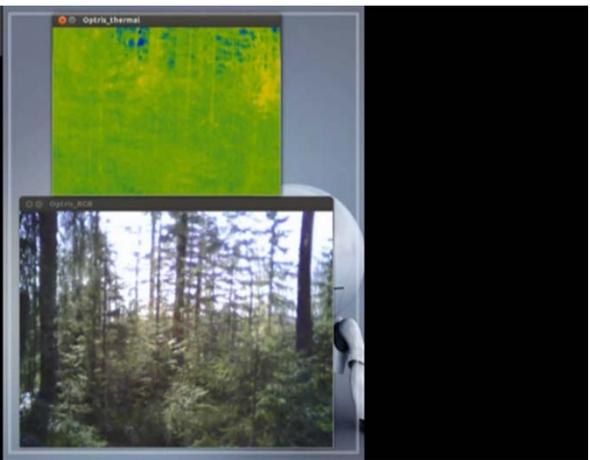
Forestry

Obstacle avoidance, f.e. humans

Main partners:




Swedish University of Agricultural Sciences







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Economics

Simulation tool developed to calculate the investment space

Application	Desired Robot Performance	Investment space
Sweet pepper harvester	Cycle time to harvest one sweet pepper = 6 sec	One robot system and one manipulator = € 196.000
Apple Harvester	Cycle time to harvest one apple = 6 sec	One robot system and two manipulators = € 74.500
Canopy optimised spraying	Spray saving due to: - beginning and end of row = 5% - uneven distribution = 12% - saving varying leaves density = 15%	One sprayer = € 61.475

Main partner:







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Follow up

FESTO

Finray fingers, 3D-printing



Application for food industry, injection molding



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Follow up

ForceA
SEE TO ACT

Ripeness sensor using optical fiber

Before

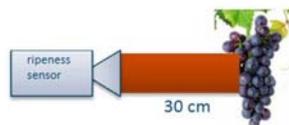


2.5m optical fiber

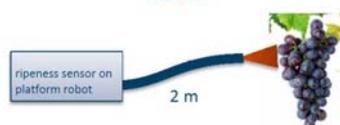
After



Before



After



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Follow up

- New EU- project



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HORIZON 2020
The EU Framework Programme for Research and Innovation

Sweet Pepper Harvesting Robot

Jan Bontsema, coordinator

Partners:



WAGENINGEN UR
For quality of life



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Ben-Gurion University of the Negev



קמל
UNIVERSITY



Irmato



PROEFSTATION



de tuindershoek

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 644313



Sweeper

SWEEPER: sweet pepper harvesting robot

- Some facts:
- Budget: M€ 4.6
- EC-contribution M€ 4.0
- Period: Feb. 1st, 2015 – Jan. 31st, 2018
- H2020 EU project within the program Industrial Leadership, Information and Communication Technologies
- Call: ICT-23-2014: Robotics, Innovation Action (Robotics Use case)



Website: www.crops-robots.eu



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Website: www.sweeper-robot.eu





HORIZON 2020
The EU Framework Programme for Research and Innovation



Thank you for your attention

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