CULS Prague
Czech republic 2013

FRE

Field Robot Event

Program Booklet

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Content

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Welcome to the Field Robot Event 2013 in Prague

International contest for student's teams known as Field Robot Event has reached its 11th year of organizing. And it is a great pleasure for me to welcome all participants of the contest at Czech University of Life Sciences in Prague.

From the very beginning, the aim of the contest was to encourage the student's interest in agricultural machinery development. After ten years of organizing the Field Robot Event it is possible to say that it is a very important meeting for designer's teams, for knowledge exchange and cooperation in the field of automation in agriculture. Talking about Universities as institutions giving education and performing research activities, but also realizing dissemination of new information and know-how to the whole society and practice, the Field Robot Event is directly the right activity. It also helps in internationalization of universities, in technologies transfer and mutual contact with practice.

Almost 160 participants are registered for the contest this year making up 20 university teams from all around the Europe – from Finland to Spain and from the United Kingdom to Turkey. This means that this year is again broke records from last years concerning numbers. The contest will be held in university trial fields sown with Sunflower. It could be a symbol for generosity and wealth which gives us the Nature and I believe that this symbol brings a great number of contacts and cooperation and also new information – the best treasure, for all the participants.

Thanks to the organizers and their effort for perfect contest preparation and management and I wish all the participants unforgettable experience and nice stay at our university campus during this year of Field Robot Event.

prof. Ing. Jiří Balík, CSc.

Rector CULS Prague

11th Field Robot 2013 in Prague

From June 27 to June 29 2013 the Field Robot Event will take place in Prague (Czech Republic) and will be organized by the Czech University of Life Sciences Prague.

The word "robot" was firstly used in history as early as in 1920 in the theatre play R.U.R - Rossum's Universal Robots written by Karel Čapek. The author of the term ROBOT was his brother Josef Čapek. It is really symbolic that in 2013, the ROBOT will come back to the place of its origin!

When the precision farming idea was born in 80´ties in the last century, many new terms were introduced into agriculture practices and new trends for agricultural machinery development were established.

It is obvious that our life will be more and more connected with automation and electronics. Therefore, we can expect also step forward in intelligent behaviour of robots connected with really precisely defined work conditions and self-adaptability to this environment. Field Robot Event can show a direction for agriculture machinery and field operations development in future to some extent.

On the occasion of FRE 2013 it is a pleasure for CULS Prague to invite all teams of robot designers arising from students to participate on 11th year of this international open-air contest. Teams should prepare the unique robots which will be able to cope with prepared difficult tasks. The contest will evaluate your creativity, precision and show how real your wishes and ideas are. The contest is also a great opportunity to meet people from your field of interest and exchange ideas and experience and possible chance for further cooperation.

The fact, that the field robot contest has been held in Europe already 10-times supports 11th annual competition of Field Robot Event in the row demonstrating that from mere idea to real using of robots in agriculture has become a significant international event which annually invites more and more teams for competitive contest. The idea of robotic farming connects individual competition teams and also provides scope for the exchange of ideas, establishing cooperation and new friendships.

We are proud of having the opportunity to organize the 11th edition of the Field Robot Event in Prague in 2013.

The Field Robot Event will be organized by Department of Agricultural Machines, Czech University of Life Sciences Prague. We invite students as well as professional teams to participate in the open air Field Robot Event 2013 in Prague. The event will take place in the school experimental field in Prague – Suchdol.

We also believe that many visitors will find their way to the event. Event introduces agriculture as a fast developing branch in which the most advanced technologies are increasingly used.

We are looking forward to your participation. We hope that you will take away pleasant memories and experiences from your stay at CULS Prague. We wish you a pleasant stay.

Milan Kroulík
Senior lecturer of Department of Agricultural Machines
Faculty of Engineering
Czech University of Life Sciences Prague
Projectleader Field Robot Event 2013

Disciplines for the 2013

Last year the robots were brought between roses. After one year the robots returns to perform their tasks on field. This time will not be maize, as was previously events, but the competition areas will be sown with sunflower plants. Five competing tasks will be prepared. Traditional tasks will consist of the correct orientation and navigation in the crops. The link with precision agriculture will be primarily noticeable in the third task, where will be prepared combination of tasks consisting of real weed plants detection and damaged plants.

Popular disciplines belongs Freestyle, where the teams will present work of a robot of their own design. With regards to the last annual was highly appreciated the team cooperation. This is also back this year. Individual competition teams will be asked to work together.

General rules

Because we are developing autonomous robots, it is NOT allowed to follow the robot with laptop, controller or other devices. One person is allowed to follow the robot, without any electronics. This person only can reposition the robot in case the path is not followed or in case of emergency press a button on the robot.

During the tasks the robots will have to wait in a Parc Fermé, so that no further testing or modification is possible. Between the tasks there will be a 10 minute break for the teams to prepare their robots for the next challenge (change batteries, …).

From the moment a robot is given permission to start, it must start within one minute. If the robot doesn't start within this time, it has one more chance to start after all other teams. If it does not start within one minute for the second time, the robot is disqualified for that task.

Large robots and/or robots with a probability of destroying the field will always start after the other robots have performed their tasks AND after all second chances restarted.

Awards

Performance of competing teams will be assessed by an independent expert jury. Besides measuring will be evaluated creativity and originality especially in tasks Cooperation and Freestyle. There will be an award for the first three ranks of each task. The basic, advanced and professional tasks together will yield the overall winner of the Field Robot Event 2013.

If two or more teams have the same number of points for the overall ranking, the team with the better placements during all three tasks will be ranked higher.

Task 1: "Basic"

Within three minutes the robot has to navigate through long curved rows of sunflower field. The goal is to cover as much distance as possible. On the headland, the robot has to turn and return in the adjacent row. There will be no plants missing in the rows. This task is all about accuracy and smoothness of operation within the rows.

At the beginning of the match it will be told whether starting is on the left side of the field (first turn is right) or on the right side (first turn is left). This is not a choice of the team but of the officials. So, make sure your robot is able to perform both options! A headland of 1.5 meters will be available for turning.

Assessment:

1. The distance travelled in 3 minutes is measured. If the end of the field is reached within 3 minutes, the total time counts. Distance and time are measured by officials;

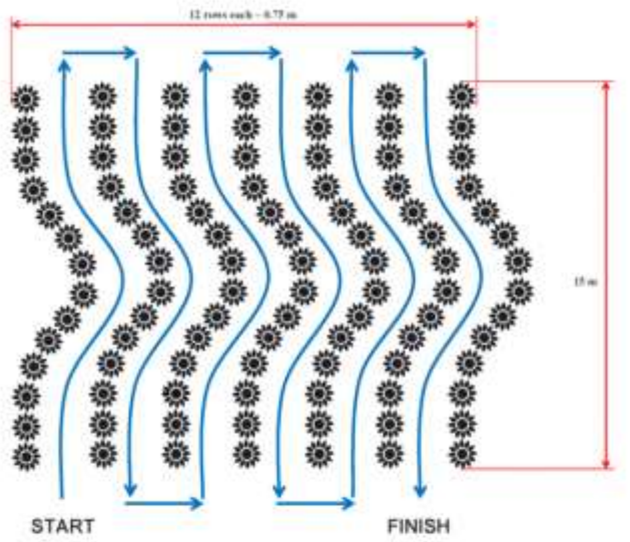
2. Manual intervention within the rows results in a penalty of 3 meters (per touch). The number of touches is counted by the officials;

3. A manual intervention at the end of a row to help the robot entering the next row will be punished with a penalty of 5 meters. The robot should make the turn by itself;

4. Destroying a plant (e.g. kinked sunflower stem) results in a penalty of 1 meter (per plant). The officials will decide whether a plant is broken or not.

5. Distance and time results in a team ranking.

6. Numbers 1 to 3 will be rewarded with a prize for their achievements in this task. This task, together with tasks 2 and 3, contributes to the overall FieldRobotEvent2013 Championship. Points will be given as follows (similar to Formula1 point system): First place in this task: 10 points - Second place: 8 points - Third place: 6 points - …5-4-3-2-1-1-1-1… points. Participating results in at least 1 point. Not participating in this task results in 0 points.



Task 2: “Advanced”

In real conditions, vegetation is not fully balanced and obstacles may be presented in the fields. Also the shape of the land where the opposite sides are not parallel is considered as a standard. We will approach these conditions in the second task

The robot should cover as much distance as possible within 5 minutes while navigating between straight rows of sunflower plants. The robot has to follow a certain pre-defined pattern over the field. At various places in the sunflower field, plants will be missing in either one or both rows over a length of maximally 1 meter.

Further obstacles (such as electricity pylon) can be moved in the rows and block the path of the robot. The robot has to move backwards and continue with the coded pattern. The coded pattern takes blocked paths into account.

The headland border may not be perpendicular to the crop row orientation. The difference in length of two subsequent rows will be less than 1 meter. A headland of only 1.5 meters will be available for turning.

Coding of the row-pattern through the sunflower field is done as follows. S means start, L means left-hand turn, R means right-hand turn and F means finish. The number before the L or R represents the row that has to be entered after the turn and the single number 0 means return in the same path. So, 2L means: enter the second row after a left-hand turn. 3R means: enter the third row after a right hand turn. The code row-pattern will be given as (example): S - 3L - 0 - 2L - 2R - 1R - 5L - F.

The code of the pattern is made available to the competitors 10 minutes before the start of the competition. Competitors do not have the opportunity to test it in the sunflower field.

Assessment:

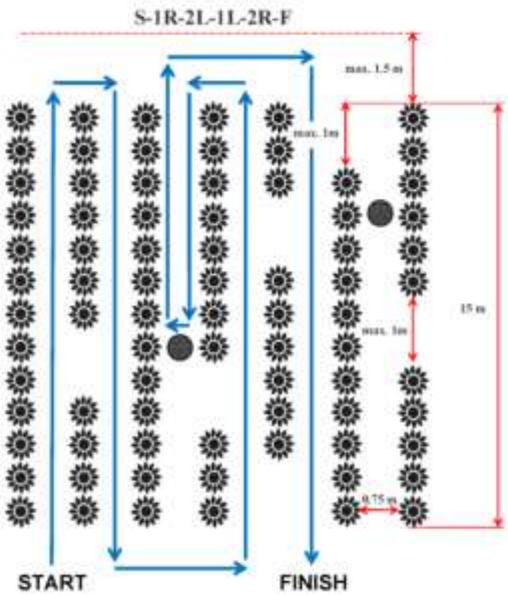
1. If the robot enters the wrong row after the headland turning, if there is intervention during the headland it results in placing the robot back to the start and re-start the task. The distance travelled in 5 minutes is measured. If the end of field is reached within this time, the total time counts. Distance and time are observed by officials;

2. Manual intervention within the rows results in a penalty of 3 meters (per touch). The number of touches is counted by the officials;

3. Destroying a plant (e.g. kinked sunflower stem) results in a penalty of 1 meter (per plant). The officials will decide whether a plant is broken or not.

4. The best result achieved during the interval of 5 minutes will be counted will be counted in the final evaluation. Distance and time results in a team ranking. Numbers 1 to 3 will be rewarded with a prize for their achievements in this task. This task, together with tasks 1 and 3, contributes to the overall Field robot event 2013 championship. The following sequence for the overall points is used: 10-8-6-5-4-3-2-1-1-1-1… Not participating in this task results in 0 points.

The following picture shows an example of how the track could look like for task 2. The gaps in the rows and the drive pattern will be different at the real event!



Task 3: "Professional"

The third task is again based on the real requirements of precision agriculture. This will be a combined task, which will consist of three subtasks that will be performed simultaneously during journey.

Subtask 1: Navigation through long curved rows of sunflower field

Subtask 2: The weed plant detection and finding signalization

Subtask 3: The infected plants detection and finding signalization

Subtask 1: Within five minutes the robot has to navigate through long curved rows of sunflower field. On the headland, the robot has to turn and return in the adjacent row. There will be no plants missing in the rows. This task is all about accuracy and smoothness of operation within the rows. At the beginning of the match it will be told whether starting is on the left side of the field (first turn is right) or on the right side (first turn is left). This is not a choice of the team but of the officials. So, make sure your robot is able to perform both options! A headland of 1.5 meters will be available for turning.

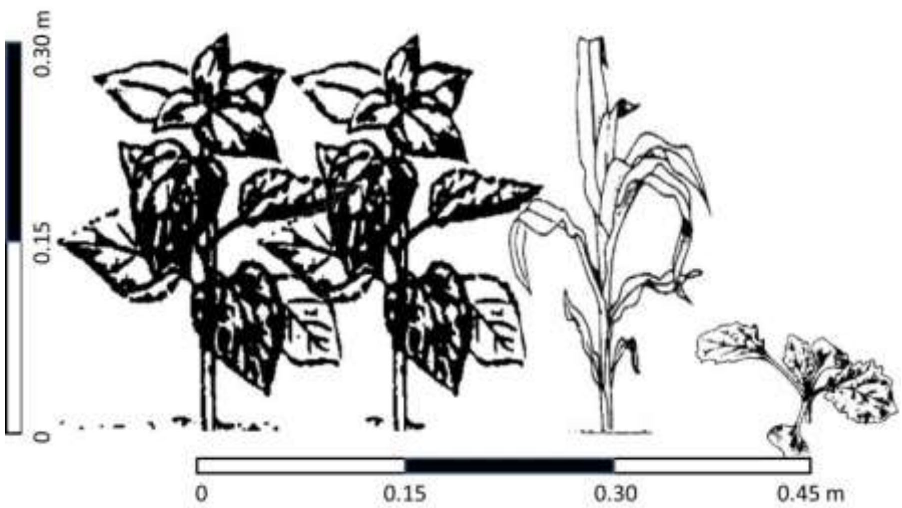
Subtask 2: In the sunflower plants rows real weed plants patches will be randomly distributed. In this case, maize and oil seed rape (canola) will present weeds. Minimum of 2 plants will represent the patches. The successful detection has to be characterized by an audible and visual signal. Additionally it must be shown on which side of the row the weed has been detected.

Subtask 3: Selected plants of sunflower in a row will show damage or pest infestation. Minimum of 2 plants and maximum of 4 plants of infected plants will represent patch. The successful detection has to be characterized by an audible and visual signal. Additionally it must be shown on which side of the row the infected plant has been detected.

Assessment:
Subtask 1: A manual intervention within the rows, a manual intervention at the end of a row to help the robot entering the next row and destroying a plant (e.g. kinked sunflower stem) results in a penalty of 1 point (per touch) or 1 point (per plant). The number of touches or plants is counted by the officials. The distance travelled and time will be measured. Measured values will be used in the event of the same result among more teams.

Subtask 2 and 3: 5 points will be given for each correct detection. Incorrect detection results in a penalty of 5 point.

Destroying a plant (e.g. kinked sunflower stem) results in a penalty of 1 meter (per plant). The officials will decide whether a plant is broken or not. Penalty sum, counted for 5 minutes interval, will be subtracted from the best achieved result.



Task 4 "Freestyle"

Robots are invited to perform a free-style operation on the field. Fun is important in this task as well as an application-oriented performance. One team member has to inform the jury and the audience about the idea. For the "Freestyle" challenge, the team should prepare an application related to the use of sunflower fields. Teams will have a time limit five minutes for presentation.

Assessment:
The jury ranks the idea and the robot performances at the end of the task, both with a mark from 1 to 10. These points are added and the team with the highest score gets 10 points, second position 8 points etc. According to the previous mentioned sequence: 10-8-6-5-4-3-2-1-1-1-1…

This task is optional and will be awarded separately. This task does not contribute to the overall Field Robot Event 2013 championship.

Task 5 “Cooperation”

On the third day groups of two teams will participate in a cooperative freestyle task. The teams will be chosen by the organizer and will be pronounced as early as possible. So there is much time to prepare. The groups choose their own task but it has to be a task with two robots working together. The field can be changed as desired. For this purpose there has to be a communication between the robots. This is a nice step forward in technology because communication between field robots will be very important in the future. Everything is possible in this task as long as it is cooperative. Teams will have a time limit five minutes for presentation.

Assessment:

The jury ranks the idea and the robot performances at the end of the task, both with a mark from 1 to 10. The idea and the quality (communication) of the cooptask are most important. These points are added and the team with the highest score gets 10 points, second position 8 points etc. according to the previous mentioned sequence: 10-8-6-5-4-3-2-1-1-1-1…

This task is optional and will be awarded separately. This task does not contribute to the overall Field Robot Event 2013 championship.

Field Robot Event 2013 - Program

Registration will be open from Wednesday, 26th of June from 16:00

Thursday, 27th of June: Field Robot Preparation

Time	Location	Task
10:00 - 18:00	Field	Finishing robots / testing in the field
10:00 - 18:00	Field	Prague sightseeing tour
11:15 - 14:15	Student restaurant	Lunch
16:45 - 18:15	Student restaurant	Dinner

Friday, 28th of June: Contest-Day 1

Time	Location	Task
07:00 - 12:00	Field	Finishing robots / testing in the field
08:00 - 10:00	Round hall	Breakfast
10:30	Round hall	Briefing of team captains
11:15 - 12:15	Student restaurant	Lunch
12:30	Field	Closing of test area
12:45	Field	Contest opening
13:00 - 18:30	Field	Contest (Task 1 - Task 4)
13:00 - 14:00	Field	Contest (Task 1)
14:30 - 15:30	Field	Contest (Task 2)
16:00 - 17:00	Field	Contest (Task 3)
17:30 - 18:30	Field	Contest (Task 4)
19:00 - 23:00	Round hall	Awards of Field Robot Event (Task 1 - 4) After-event-party including University brewery excursion, BBQ and music.

Saturday, 29th of June: Contest-Day 2

Time	Location	Task
08:00 - 09:00	Round hall	Breakfast
09:00 - 09:15	Round hall	Information about cooptask and coopteams
09:15 - 11:45	Field	Adjusting robots / testing in the field
11:45	Field	Closing of test area
12:00	Field	Contest opening
12:15 - 13:00	Field	Contest (Task 5)
13:00	Round hall	Awards of Field Robot Event (Task 5) and closure of Field Robot Event

Competitors – Fieldrobots

1. Banat

Team & Robot name		Banat
	Team members	Prof. DumitruTucu Ass. Prof. Sorin Bungescu Lect. Sorin Nanu Ph D Mihaela Tilneac Catalin-Adrian Pisoiu Catalin Almasan Gheorge-Ciprian Dobra
	Team captain	Cristian-Leonard Fitz
	E_mail	fitzcristian@gmail.com
Team background:	Institution	USAMVBT & UPT
	Department	Agricultural machinery, Automation & Computer science
	Contact address	Bungescu Sorin USAMVBT Timisoara, Pavilion ”George Bungescu”
	Street/ No.	CaleaAradului, No. 119
	Zip code	
	City	Timisoara
	Country	Romania
Homepage		
Robot data		
	Robot	

	hardware description	
Chassis	W x L x H (in cm)	40x35x18
	Weight (kg)	10
	Model/make	Aluminium profiles made
	Number of wheels	4
	Drivetrain conception	Chain transmission
	Turning	Speed difference
	Battery time:	30 min
	Is alternative battery set available?	yes
	Rain resistance	approximately
Used sensors:	Camera	We hope
	Sonar	yes
	Laser	-
	Compass	-
	GPS	-
	Gyroscope	Possible
	Odometry	-
	IR	-
	Sharp	-
	Other sensors:	-
Control		
	Robot software	

	description	
	Interface	
On which tasks will you participate?	1 2 3 4 5	1 2 we hope 3 and 4 not decided on 5
Task 1	Short description of navigation algorithm	Using the data acquired from distance sensors,the robot will give to it's motor drivers PWM values acordingly.
Task 2	How your robot detects blocked row (obstacles)?	Using sonar sensors.
Task 3	How do you recognize weed (maize, oil seed rape)?	Hopefully using a video camera. Colour based plant recognition
	How do you recognize damaged plants?	Hopefully using a video camera. Colour based plant recognition
	Which device do you use for signalization?	Either an LED,BUZZER or maybe both.
Task 4	Please describe shortly the presentation of free style task	
Sponsors	Claas Stiftung, Mewi	

2. B.L.L.E.

Team & Robot name		B.L.L.E.
	Team members	Stefan Larsen Thomas Korsgaard
	Team captain	Daniel Madsen
	E_mail	danma08@student.sdu.dk
Team background:	Institution	University of Southern Denmark
	Department	Mærsk McKinney Møller Institute
	Contact address	RoboLab, hal J, Det Tekniske Fakultet Syddansk Universitet
	Street/ No.	Niels Bohrs Alle 1
	Zip code	5230
	City	Odense
	Country	Denmark
	Homepage	fieldrobot.dk
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	27 x 70 x 22
	Weight (kg)	20
	Model/make	
	Number of wheels	4
	Drivetrainn conception	Individual Controlled Motors Kinematic Articulated Steering
	Turning	70cm
	Battery time:	1hour
	Is alternative battery set available?	no

	Rain resistance	yes
Used sensors:	Camera	No
	Sonar	No
	Laser	Yes
	Compass	No
	GPS	No
	Gyroscope	Yes
	Odometry	Yes
	IR	No
	Sharp	No
	Other sensors:	Accelerometer
Control		
	Robot software description	ROS-based
	Interface	Start/stop buttons and SSH
On which tasks will you participate?	1 2 3 4 5	1,2,4 and 5
Task 1	Short description of navigation algorithm	Row detection -> keep max distance to rows -> if no rows -> turn
Task 2	How your robot detects blocked row (obstacles)?	Obstacle detection using laser range scanner.
Task 3	How do you recognize weed (maize, oil seed rape)?	We can't
	How do you recognize damaged plants?	-
	Which device do you use for signalization?	-
Task 4	Please describe shortly the presentation of free style task	The robot is waterproof, so something with water.
Sponsors		Kongskilde

3. Bullseye

Team & Robot name		Bullseye
	Team members	Cornelis Cnossen Arjen van Dueren den Hollander Matthijs van Haperen Albert Jol Dirk Oorbeek Krijn Schetters Toon Tielen
	Team captain	Krijn Schetters
	E_mail	krijn.schetters@wur.nl
Team background:	Institution	Wageningen University
	Department	Farm Technology
	Contact address	Plant Sciences Group
	Street/ No.	Bornsesteeg 48
	Zip code	6708 PE
	City	Wageningen
	Country	The Netherlands
	Homepage	www.robatic.nl
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	50*110*60
	Weight (kg)	35

	Model/make	LT-2.0i
	Number of wheels	4
	Drivetrain conception	Direct drive
	Turning	Double Ackermann
	Battery time:	1h45m
	Is alternative battery set available?	Yes
	Rain resistance	Yes, with use of umbrella
Used sensors:	Camera	2 (Allied Vision Guppy)
	Sonar	
	Laser	1 (Sick LMS 111)
	Compass	1 (Xsens)
	GPS	
	Gyroscope	1 (Xsens)
	Odometry	8 (encoders and potmeters)
	IR	
	Sharp	
	Other sensors:	
Control		
	Robot software description	
	Interface	Labview

On which tasks will you participate?	1 2 3 4 5	1,2,3,4,5
Task 1	Short description of navigation algorithm	Laser scanner scans the rows and with that information we make a preferred route with an intersect and a slope.
Task 2	How your robot detects blocked row (obstacles)?	Using laser scanner, which recognizes objects.
Task 3	How do you recognize weed (maize, oil seed rape)?	Using vision, comparing colours/shapes
	How do you recognize damaged plants?	Using vision, comparing colours
	Which device do you use for signalization?	LED lights and a patlite for signalization with lights and a speaker for a sound signal.
Task 4	Please describe shortly the presentation of free style task	Precision farming, seeding. The jury types a couple of letters, for instance "FRE" and the robot will seed a pattern that results in the letters on the field.
Sponsors		Farm Technology Group WUR, Agrifac, SBG, Reesink TH, Mammoet, Scholten Awater

4. Ceres III

Team & Robot name		Ceres III
	Team members	Dennis Gralke Andreas Niessen Dominik Borst Karel Heijnen Ruud van Seggelen Frank van Gennip(Teacher) Odiel Coopmans(Teacher)
	Team captain	Martin Kloet
	E_mail	R.vanseggelen@student.fontys.nl
Team background:	Institution	Fontys Hogescholen Venlo
	Department	Mechatronica
	Contact address	t.a.v. J.W.M.H. van Gennip
	Street/ No.	Tegelseweg 255
	Zip code	5912 BG
	City	Venlo
	Country	Netherlands
	Homepage	www.fontys.nl
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	67 cm* 50cm* 90cm
	Weight (kg)	Unknown.
	Model/make	
	Number of wheels	4

	Drive train conception	Differential
	Turning	Front and back steering
	Battery time:	Unknown
	Is alternative battery set available?	Yes
	Rain resistance	Yes
Used sensors:	Camera	Yes
	Sonar	No
	Laser	No
	Compass	No
	GPS	No
	Gyroscope	No
	Odometry	No
	IR	No
	Sharp	No
	Other sensors:	No
Control		
	Robot software description	Labview, I^2C, UART
	Interface	Labview
On which tasks will you participate?	1 2 3 4 5	1,2,3
Task 1	Short description of navigation algorithm	End of row, turn right, end of row turn left.
Task 2	How your robot detects blocked	Vision Software

	row (obstacles)?	
Task 3	How do you recognize weed (maize, oil seed rape)?	Vision Software, not the correct green
	How do you recognize damaged plants?	Vision Software, not the correct green
	Which device do you use for signalization?	Lights and a buzzer.
Task 4	Please describe shortly the presentation of free style task	-
Sponsors		Fontys

5. Cornstar

Team & Robot name		Cornstar
	Team members	Peter Berk Peter Lepej Jurij Rakun Izidor Vehovar Matej Zupanc Matjaž Brodnjak
	Team captain	Miran Lakota
	E_mail	jurij.rakun@um.si
Team background:	Institution	Faculty of Agriculture and Life Sciences, University of Maribor
	Department	Biosystems engineering
	Contact address	Jurij Rakun
	Street/ No.	Pivola 10
	Zip code	2311
	City	Hoce
	Country	Slovenia
	Homepage	http://www.fk.uni-mb.si/fkbv/
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	40 x 60 x 40
	Weight (kg)	13

	Model/make	Custom made
	Number of wheels	4
	Drivetrainn conception	4 wheel drive
	Turning	Two-axes steering
	Battery time:	2 h
	Is alternative battery set available?	Yes
	Rain resistance	Yes (moderate)
Used sensors:	Camera	DBK31UA03
	Sonar	/
	Laser	TiM300
	Compass	Venus638FLPx
	GPS	HMC6352
	Gyroscope	/
	Odometry	/
	IR	Sharp 2Y0A02
	Sharp	Sharp 2Y0A02
	Other sensors:	/
Control		
	Robot software description	Linux + ROS, custom written software
	Interface	Command line interface
On which tasks will you participate?	1 2 3 4	Hopefully all

	5	
Task 1	Short description of navigation algorithm	By using custom developed SLAM (Simultanious Localisation and Mapping) navigation algorithm + our own navigation control node for navigating thought the maze.
Task 2	How your robot detects blocked row (obstacles)?	With the help of a laser scanner
Task 3	How do you recognize weed (maize, oil seed rape)?	Recognition based on colour segmentation
	How do you recognize damaged plants?	With the help of colour segmentation that distinguishes colour difference between healthy and damaged plants.
	Which device do you use for signalization?	LED, Nozzles
Task 4	Please describe shortly the presentation of free style task	The robot will remove the weed plants between the rows and between each plant.
Sponsors		Sick, The Imaging Source, Boundary devices

6. CRISIS

Team & Robot name	Team FLARB	Cultivational Robot with Innovative Sunflower Inspection System (CRISIS)
	Team members	Riemer van der Zee Daniel de Valk Hink de Haan Leon Colijn
	Team captain	Epke Paulus van Smeden
	E_mail	lcolijn@xs4all.nl
Team background:	Institution	NHL
	Department	Engineering
	Contact address	
	Street/ No.	Bote van Bolswertstraat 15
	Zip code	8921CD
	City	Leeuwarden
	Country	The Netherlands
	Homepage	
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	50x60x40

	Weight (kg)	
	Model/make	Pickup-truck/custom
	Number of wheels	4
	Drivetrain conception	Bobcat
	Turning	Fast
	Battery time:	30 mins
	Is alternative battery set available?	yes
	Rain resistance	yes
Used sensors:	Camera	Yes
	Sonar	No
	Laser	Yes
	Compass	Yes
	GPS	Yes
	Gyroscope	No
	Odometry	Yes
	IR	No
	Sharp	No
	Other sensors:	Inclination
Control		
	Robot software description	ROS based
	Interface	Smartphone
On which tasks will you participate?	1 2 3 4 5	1, 2, 3, 4
Task 1	Short description of navigation algorithm	Path finding

Task 2	How your robot detects blocked row (obstacles)?	Laser
Task 3	How do you recognize weed (maize, oil seed rape)?	Camera
	How do you recognize damaged plants?	Camera
	Which device do you use for signalization?	Lights/Horn
Task 4	Please describe shortly the presentation of free style task	Fertilization
Sponsors		SBG, VCK Industries, Pioneer, NHL Hogeschool

7. Dionysus

Team & Robot name		Dionysus
	Team members	Kit Franklin Chirs White James Thomas
	Team captain	Richard Green
	E_mail	rsteele@harper-adams.ac.uk
Team background:	Institution	Harper Adams University
	Department	Engineering Department
	Contact address	Engineering Departmentm
	Street/ No.	Newport, Shropshire,
	Zip code	TF10 8NB
	City	Edgmond
	Country	United Kingdom
Homepage		
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	1m x 2m x 1m
	Weight (kg)	75 kg

	Model/make	Kymco quadbike based robot
	Number of wheels	4
	Drivetrain conception	IC engine through CVT
	Turning	3m
	Battery time:	N/A
	Is alternative battery set available?	N/A
	Rain resistance	IP55
Used sensors:	Camera	
	Sonar	Yes
	Laser	Yes
	Compass	
	GPS	Yes
	Gyroscope	Yes
	Odometry	Yes
	IR	
	Sharp	
	Other sensors:	Yes
Control		
	Robot software description	SAFAR
	Interface	MRDS
On which tasks will you participate?	1 2 3 4	4

	5	
Task 1	Short description of navigation algorithm	
Task 2	How your robot detects blocked row (obstacles)?	
Task 3	How do you recognize weed (maize, oil seed rape)?	
	How do you recognize damaged plants?	
	Which device do you use for signalization?	
Task 4	Please describe shortly the presentation of free style task	It will drive around
Sponsors		Harper Adams University

8. DoubleTrouble

Team & Robot name		DoubleTrouble
	Team members	Pyry Piirainen Bjarne Boström Tommi Forsman Jerri Rantio Heikki Järvi Tommi Rautio Inder Sehra Tino Tuominen Severi Savukoski Timo Oksanen (instructor) Jari Kostamo (instructor) Matti Pastell (instructor)
	Team captain	Pyry Piiraiinen
	E_mail	pyry.piirainen@aalto.fi
Team background:	Institution	Aalto University University of Helsinki
	Department	Automation & Systems Machine Design Agrotechnology
	Contact address	Automation & Systems Department
	Street/ No.	PL 15500 (Otaniementie 17)
	Zip code	FI-00076
	City	Aalto
	Country	Finland
	Homepage	http://autsys.aalto.fi/en/FieldRobot2013
Robot data		
	Robot hardware description	

Chassis	W x L x H (in cm)	40 x 80 x 40(+mast) cm
	Weight (kg)	20-25kg + freestyle module
	Model/make	Completely custom made
	Number of wheels	4
	Drivetrainn conception	4wd, 4ws, axles independent
	Turning	various turning patterns
	Battery time:	30-60min
	Is alternative battery set available?	yes
	Rain resistance	resistant to light rain
Used sensors:	Camera	Industria camera, Pixelink (x2)
	Sonar	4x SICK ultrasound distance sensors
	Laser	1 x SICK LMS100
	Compass	3d magnetometer
	GPS	only for logging
	Gyroscope	Murata SCC-1300
	Odometry	Wheel odometer (encoders)
	IR	none
	Sharp	none
	Other sensors:	4x SICK point laser distance sensors
Control		
	Robot software description	MATLAB & Simulink models code generated C code, integrated in C# using Visual Studio, OpenCV, Windows CE, Windows XP, Codevision AVR for microcontrollers, Kvaser CAN-bus

		adapters
	Interface	Local and remote (WLAN) user interfaces
On which tasks will you participate?	1 2 3 4 5	all
Task 1	Short description of navigation algorithm	Algorithms of different levels of complexity for positioning, navigation and headland manouvering
Task 2	How your robot detects blocked row (obstacles)?	Laser scanner –based algorithm
Task 3	How do you recognize weed (maize, oil seed rape)?	Image processing algorithm created with OpenCV library
	How do you recognize damaged plants?	Image processing algorithm created with OpenCV library
	Which device do you use for signalization?	Buzzer and blinking lights to signal direction
Task 4	Please describe shortly the presentation of free style task	We will demonstrate precise no-tillage seeding which is achieved by a special module installed in the middle of the robot. Drills on both sides of the robot drill holes into the ground where seeds are dropped.
Sponsors		AGCO / Valtra (main sponsor), SICK, Murata, Laserle, Koneviesti, Suonentieto, HP Infotech, Suomen kulttuurirahasto, Maatalouskoneiden tutkimussäätiö, Henry Fordin säätiö. Also Aalto University and University of Helsinki have supported the team.

9. Eduro Team

Team & Robot name		Eduro Team
	Team members	Stanislav Petrásek Jan Roubíček Tomáš Roubíček
	Team captain	Martin Dlouhý
	E_mail	md@robotika.cz
Team background:	Institution	Czech University of Life Sciences
	Department	Department of Agricultural Machines
	Contact address	KZS
	Street/ No.	Kamycka 129
	Zip code	165 21
	City	Prague 6 Suchdol
	Country	Czech Republic
	Homepage	http://robotika.cz/competitions/fieldrobot
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	38 x 65 x 64
	Weight (kg)	22
	Model/make	Eduro Maxi HD
	Number of wheels	3
	Drivetrainn conception	Differential

	Turning	Radius? At place, i.e. 0
	Battery time:	Approx 4h
	Is alternative battery set available?	no
	Rain resistance	Partial - umbrella
Used sensors:	Camera	x
	Sonar	-
	Laser	x
	Compass	x
	GPS	-
	Gyroscope	-
	Odometry	x
	IR	-
	Sharp	-
	Other sensors:	-
Control		
	Robot software description	The main control program is written in Pyhon. It communicates via CAN bus to dedicated modules for motors, sensors, arm and basic user interface.
	Interface	
On which tasks will you participate?	1 2 3 4 5	All of them
Task 1	Short description of navigation algorithm	Depending on the height of plants camera or laser will be used to recognize the left/right plants. They will define obstacles and in given radius (say 1 meter) is selected the biggest gap where to navigate.

Task 2	How your robot detects blocked row (obstacles)?	Laser is used for obstacle detection. If the gap is smaller than robot width it will turn in place and return in the same row.
Task 3	How do you recognize weed (maize, oil seed rape)?	At the moment the plan is to use camera and detect slight color differences. An alternative is usage of laser and recognition of different types of leafs.
	How do you recognize damaged plants?	Color detection.
	Which device do you use for signalization?	LED combined with sound generator.
Task 4	Please describe shortly the presentation of free style task	Optional. Manipulation with hay packs via arn from FRE2012.
Sponsors		LMS100 from SICK (participation at SICK Robot Day 2010)

10. FloriBot

Team & Robot name		FloriBot
	Team members	Björn Eistel Jens Seifried Benedict Bauer Michael Gysin Felix Binder
	Team captain	Torsten Heverhagen Torsten.Heverhagen@hs-heilbronn.de
	E_mail	AndreasKlingert@gmail.com
Team background:	Institution	Hochschule Heilbronn
	Department	Mechanics and Electronics
	Contact address	
	Street/ No.	Max-Planck-Str. 39
	Zip code	74081
	City	Heilbronn
	Country	Germany
	Homepage	www.floribot.de
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	42 x 63 x 50
	Weight (kg)	20

	Model/make	Coroware Explorer
	Number of wheels	4
	Drivetrain conception	4 Wheel D Chassis with Skid Steeringrive Articulate
	Turning	
	Battery time:	2hours
	Is alternative battery set available?	yes
	Rain resistance	yes
Used sensors:	Camera	
	Sonar	
	Laser	yes
	Compass	
	GPS	
	Gyroscope	
	Odometry	yes
	IR	
	Sharp	
	Other sensors:	RFID?
Control		
	Robot software description	ROS Fuerte(Linux)
	Interface	USB, Wifi, Bluetooth
On which tasks will you participate?	1 2 3 4 5	1 2 3 4

Task 1	Short description of navigation algorithm	Potential field method
Task 2	How your robot detects blocked row (obstacles)?	Potential field method
Task 3	How do you recognize weed (maize, oil seed rape)?	?
	How do you recognize damaged plants?	Histogram method with Laserscanner
	Which device do you use for signalization?	Pan-Tilt-Unit with pointer
Task 4	Please describe shortly the presentation of free style task	Retrace previously placed RFID Markers
Sponsors		Sparkasse Heilbronn, NeoBotix GmbH

11. Flower Power

Team & Robot name		Flower Power, Team DTU
	Team members	Mikkel Bjerregård Mikkel Sørensen Johan Ingibergsson
	Team captain	Kenneth Hoe
	E_mail	naa@elektro.dtu.dk
Team background:	Institution	Technical University of Denmark, DTU
	Department	Department of Electrical Engineering
	Contact address	Automation and Control
	Street/ No.	Elektrovej , Build 326, DTU
	Zip code	Dk 2800
	City	Kgs. Lyngby
	Country	Denmark
	Homepage	www.iau.dtu.dk/~k388h1
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	28 x 48 x 38
	Weight (kg)	9
	Model/make	DTU SMR
	Number of wheels	4
	Drivetrainn conception	Belt Drive

	Turning	Ackerman
	Battery time:	45 min
	Is alternative battery set available?	Yes
	Rain resistance	In progress
Used sensors:	Camera	Yes
	Sonar	No
	Laser	Yes
	Compass	No
	GPS	No
	Gyroscope	Yes
	Odometry	Yes
	IR	No
	Sharp	No
	Other sensors:	Kinect
Control		
	Robot software description	http://rsewiki.elektro.dtu.dk/index.php/Main_Page
	Interface	Mobotware
On which tasks will you participate?	1 2 3 4 5	1, 2, and 3
Task 1	Short description of navigation algorithm	Laser scanner is used for localising where the robot moves in a row.
Task 2	How your robot detects blocked row (obstacles)?	Laser scanner detects the object between rows.

Task 3	How do you recognize weed (maize, oil seed rape)?	In progress. Plan is to use the camera in connection with laser scanner.
	How do you recognize damaged plants?	In progress. Same as above.
	Which device do you use for signalization?	Speaker and LED's at each side of the robot.
Task 4	Please describe shortly the presentation of free style task	
Sponsors		

12. FreFrobo

Team & Robot name		FreFrobo
	Team members	Troels Jørgensen Daniel Lindekilde Ravn
	Team captain	Klaus Kryhlmand
	E_mail	klkry09@student.sdu.dk
Team background:	Institution	Southern University of Denmark
	Department	
	Contact address	
	Street/ No.	Niels Bohrs Alle 1
	Zip code	5230
	City	Odense M
	Country	Denmark
Homepage		
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	Approx 50x40x30

	Weight (kg)	20kg
	Model/make	
	Number of wheels	4
	Drivetrainn conception	
	Turning	Skid
	Battery time:	20 minutes
	Is alternative battery set available?	yes
	Rain resistance	no
Used sensors:	Camera	Maybe
	Sonar	No
	Laser	Yes
	Compass	Not used
	GPS	No
	Gyroscope	Yes
	Odometry	Yes
	IR	No
	Sharp	No
	Other sensors:	
Control		
	Robot software description	FroboMind (http://www.fieldrobot.dk/pages/frobomind.php)
	Interface	ROS
On which tasks will you participate?	1 2 3 4 5	1,2 and maybe 5

Task 1	Short description of navigation algorithm	Arranging laser scans into boxes and move away from filled boxes
Task 2	How your robot detects blocked row (obstacles)?	Filled box in front of it
Task 3	How do you recognize weed (maize, oil seed rape)?	
	How do you recognize damaged plants?	
	Which device do you use for signalization?	
Task 4	Please describe shortly the presentation of free style task	
Sponsors		Mærsk Mckinney Møller Institute

13. Helios

Team & Robot name	Fredt	Helios
	Team members	Jan Roesler Matthias Kemmerling Danny Behnecke
	Team captain	Michaela Pußack
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Team background:	Institution	Technische Universität Braunschweig
	Department	Institute of Mobile Maschines and Commercial Vehicles
	Contact address	Field Robot Event Design Team Institute of Mobile Maschines and Commercial Vehicles
	Street/ No.	Langer Kamp 19a
	Zip code	38106
	City	Braunschweig
	Country	Germany
	Homepage	www.fredt.de
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	
	Weight (kg)	

	Model/make	Designed by team
	Number of wheels	4
	Drivetrainn conception	4 wheel drive with brushless DC-Motor
	Turning	4 wheel steering
	Battery time:	1,5 to 2 hours
	Is alternative battery set available?	yes
	Rain resistance	yes
Used sensors:	Camera	
	Sonar	
	Laser	SICK LMS 100
	Compass	
	GPS	
	Gyroscope	yes
	Odometry	yes
	IR	
	Sharp	
	Other sensors:	
Control		
	Robot software description	ROS-based
	Interface	W-LAN, LAN, CAN
On which tasks will you participate?	1 2 3 4 5	1, 2, 3, 4, 5
Task 1	Short description of navigation algorithm	Laser-based detection of single plants, calculation of

		regression curve
Task 2	How your robot detects blocked row (obstacles)?	Same algorithm
Task 3	How do you recognize weed (maize, oil seed rape)?	Noticing differences in plant height
	How do you recognize damaged plants?	Same principle
	Which device do you use for signalization?	Robot stops for a short moment
Task 4	Please describe shortly the presentation of free style task	Spontaneous presentation
Sponsors		

14. Idefix

Team & Robot name		Idefix
	Team members	David Lippner Ulrich Schmid Johannes Hruza Christoffer Raun Viktor Reischmann Long Hoang (spectator) Lukas Locher
	Team captain	Timo Widmaier
	E_mail	locher.l@t-online.de
Team background:	Institution	Schüler Forschungszentrum Südwürttemberg
	Department	
	Contact address	Schüler Forschungszentrum Südwürttemberg
	Street/ No.	Gutenbergstraße 18
	Zip code	88348
	City	Bad Saulgau
	Country	Germany
	Homepage	www.sfz-bw.de
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	50x80x35
	Weight (kg)	45
	Model/make	Idefix is a Do-it-yourself robot in cooperation with SFZ pupils and ZF trainees
	Number of wheels	4

	Drivetrainn conception	2 Maxon-Motors for front and rear axle
	Turning	2 Maxon Motors for front and rear steering
	Battery time:	15 minutes
	Is alternative battery set available?	yes
	Rain resistance	a little bit
Used sensors:	Camera	Possibly
	Sonar	No
	Laser	front and rear (Sick LMS100 and Sick Tim3xx)
	Compass	No
	GPS	No
	Gyroscope	Yes
	Odometry	Yes
	IR	No
	Sharp	No
	Other sensors:	Maybe Swissranger SR4000 for freestyle-task
Control		
	Robot software description	Player/Stage Middleware on Linux Car-PC with own Player-Drivers and Clients, small C-Programm on Atmega-Microcontroller for Gyroscope Data
	Interface	CAN-Bus (USB2CAN from Peak) Ethernet (LMS100, SR4000) UART2USB (Atmega)

		USB (Tim3xx) WLAN or Copper-Ethernet for remote programming and configuration
On which tasks will you participate?	1 2 3 4 5	We will try to participate on all tasks
Task 1	Short description of navigation algorithm	We are looking for the best match of a “Road-Profile” at different positions with the spots of preselected Lasersdata. The best match-position is the input for a proportional controller for the steering of the front axle
Task 2	How your robot detects blocked row (obstacles)?	Laser scanner, and maybe camera
Task 3	How do you recognize weed (maize, oil seed rape)?	we watch out for a good idea
	How do you recognize damaged plants?	we watch out for a good idea
	Which device do you use for signalization?	Servo with plastic pointer
Task 4	Please describe shortly the presentation of free style task	We are working on some simple ideas, at the moment we haven't made a final decision.
Sponsors		Wilhelm-Stemmer-Stiftung Badenwürttemberg-Stiftung Schülerforschungszentrum Südwürttemberg

15. KaMaRo 2010

Team & Robot name		KaMaRo 2010
	Team members	Tobias Loritz Nilan Marktanner Peter Merkert Ekkehart Schmidt Marcel Schnirring Stefanie Weißenbach Lennart Nachtigall Sven Hauer Matthias Luh Stephan Gocht Alexandru Albu Stefan Marinov Bernhard Baier Friedolin Gröger Christoph Straub Markus Montenegro Joachim Schönmehl Stefan Baur
	Team captain	Simon Merz
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Team background:	Institution	Karlsruher Institut für Technologie (KIT)
	Department	Lehrstuhl für mobile Arbeitsmaschinen (MOBIMA)
	Contact address	Kamaro Engineering e.V. c/o Lehrstuhl für mobile Arbeitsmaschinen (KIT)
	Street/ No.	Rintheimer Querallee 2
	Zip code	D-76131
	City	Karlsruhe

	Country	Germany
	Homepage	www.kamaro.kit.edu
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	420x750x450mm
	Weight (kg)	25
	Model/make	custom
	Number of wheels	4
	Drivetrain conception	Selfmade, all-wheel-drive, differential gears, electrically driven
	Turning	Selfmade, steering all wheels
	Battery time:	40min
	Is alternative battery set available?	yes
	Rain resistance	(yes with Umbrella ☺)
Used sensors:	Camera	yes
	Sonar	yes
	Laser	yes
	Compass	no
	GPS	no
	Gyroscope	no
	Odometry	no
	IR	yes

	Sharp	no
	Other sensors:	
Control		
	Robot software description	Self-written software using MRPT, especially for drivers, and SDL for the Gamepad and Keyboard interaction
	Interface	SSH, self-written commandlineinterface, Gamepad (Logitech)
On which tasks will you participate?	1 2 3 4 5	1, 2, 3, 4, 5
Task 1	Short description of navigation algorithm	In row: check average distance between plants and drive to the median between these values End row: set robot 90° to row entries and try to turn into the right one via counting the passed ones
Task 2	How your robot detects blocked row (obstacles)?	Drive as fast as it can and then detects that the average distance of the whole lidarsensor data are unexpected short (e.g. below a hard-coded value)
Task 3	How do you recognize weed (maize, oil seed rape)?	n/a
	How do you recognize damaged plants?	Search for average pixel color in a box
	Which device do you use for	LED for visualisation (and to show whether left or right) and a mini speaker for soundeffect

	signalization?	
Task 4	Please describe shortly the presentation of free style task	Idea in preparation ☺
Sponsors		Amewi, BKG, Conec, Dunkermotoren, Ganter Griff, Infineon, Nozag, Schaeffler, SICK, SLS, Schnorr, UHU

16. Ladybugbot

Team & Robot name	Uniovi Field Robots	Ladybugbot
	Team members	Germán Souto Fernández Elena Rodríguez Pombal Laura López García María Cabrero García Ignacio González Alonso Daniel Velasco Pérez Jesús Álvarez Rodríguez Jose Luis Ania Martínez Antonio Muñiz Vega
	Team captain	Antonio Muñiz Vega
	E_mail	info@uniovifieldrobots.com gsfagr@gmail.com
Team background:	Institution	Universidad de Oviedo
	Department	
	Contact address	
	Street/ No.	Jose Luis López Muñiz 4 4C
	Zip code	33009
	City	Oviedo, Asturias
	Country	Spain
	Homepage	www.uniovifieldrobots.com
Robot data		
	Robot hardware description	

Chassis	W x L x H (in cm)	44 x 57 x 35
	Weight (kg)	6 kg
	Model/make	Wild Thumper 6WD
	Number of wheels	6
	Drivetrain conception	
	Turning	
	Battery time:	
	Is alternative battery set available?	no
	Rain resistance	yes
Used sensors:	Camera	Logitech C920 – HD Pro Webcam
	Sonar	
	Laser	
	Compass	
	GPS	
	Gyroscope	
	Odometry	
	IR	2, Arduino Sharp IR Sensor
	Sharp	
	Other sensors:	4, HC-SR04 ULTRASONIC SENSOR MODULE ARDUINO
Control		

	Robot software description	Java, C++, OpenCV
	Interface	Eclipse and Visual C++
On which tasks will you participate?	1 2 3 4 5	1, 2, 3 y 4
Task 1	Short description of navigation algorithm	Algorithm reactive
Task 2	How your robot detects blocked row (obstacles)?	With sensor IR
Task 3	How do you recognize weed (maize, oil seed rape)?	With webcam images by form
	How do you recognize damaged plants?	With webcam images by color
	Which device do you use for signalization?	Leds. Luminic Signalization
Task 4	Please describe shortly the presentation of free style task	Biological control. When the robot detects an infected plant deposited a box of ladybug larvae on the ground.
Sponsors		BIOGAS FUEL CELL

17. Optomaize Prime Sun-Rover

Team & Robot name		Optomaize Prime Sun-Rover
	Team members	Kevin Bilges Marc-Alexandre Favier Daniel Kinski Fritz Matthäus Daniel Schmunkamp Marco Schulz Heiko Wilms Linus Witschen Andreas Linz Arno Ruckelshausen
	Team captain	Andreas Trabhardt
	E_mail	a.linz@hs-osnabrück.de
Team background:	Institution	Hochschule Osnabrück University of Applied Sciences
	Department	Fakultät Ingenieurwissenschaften und Informatik
	Contact address	Andreas Linz Hochschule Osnabrück
	Street/ No.	Albrechtstr. 30
	Zip code	
	City	Osnabrück
	Country	Germany
	Homepage	http://www.ecs.hs-osnabrueck.de/teamfieldrobot.html
Robot data		
	Robot hardware	

	description	
Chassis	W x L x H (in cm)	44 x 75 x 100
	Weight (kg)	~ 30
	Model/make	VolksBot
	Number of wheels	4
	Drivetrainn conception	4 wheel drivetrain with 2 Maxtron motors. 2 wheels connected over chains
	Turning	Like track vehicle
	Battery time:	~ 1 h
	Is alternative battery set available?	yes
	Rain resistance	yes
Used sensors:	Camera	LeanxCam
	Sonar	-
	Laser	LMS100, Tim310
	Compass	-
	GPS	-
	Gyroscope	-
	Odometry	Rotory Encoder of Drivetrain
	IR	-
	Sharp	-
	Other sensors:	Time of Light (ifm O3D201)
Control		
	Robot software description	ROS (Robot Operating System)
	Interface	
On which tasks will you participate?	1 2 3 4 5	1-5

Task 1	Short description of navigation algorithm	For the Navigation we describe a Matrix in front of the robot. This will fill with the free distance from the middle of robot to the plants on both sides of robot. Through the emphasis the robot stay in middle. The speed will regulate trough free space in front of the robot. The end of row will detect trough free space at both side of the robot. After row navigation the turning will done with odometry data.
Task 2	How your robot detects blocked row (obstacles)?	If in the filled matrix no space in front of robot we have a blockade and drive back.
Task 3	How do you recognize weed (maize, oil seed rape)?	At the moment we can't. We have no example plants or something else to define the differences to sunflowers. But we prepare us with volume measurement und colour detection of the plants.
	How do you recognize damaged plants?	Again we have no example plants und we try at testing to recalibrate our volume measurement and colour detection to detect damaged plants.
	Which device do you use for signalization?	For signalisation we use two LED lamps for visualisation and one horn for acoustic. The control will be done over a exsys Ethernet to digital IO or over the raspberry pi board with evaluation board.
Task 4	Please describe shortly the presentation of free style task	
Sponsors		AMAZONEN-Werke H. Dreyer GmbH & Co. KG, EXSYS Vertriebs GmbH, Parrot GmbH, SICK Vertriebs-GmbH, WERMA Signaltechnik GmbH + Co.KG

18. Phaethon

Team & Robot name		Phaethon
	Team members	Matthias Kölsch Timo Rothenpieler Fabian Weber Marc Andre Marburger Sven Höhn Thierry Zambou Wangyi Zhu Tim Shirley Maik Bastian Charly Tsannang Soffack
	Team captain	Lars Kuhnert Klaus Müller
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Team background:	Institution	Institute for Realtime Learning Systems
	Department	Department of Electrical Engineering and Computer Science
	Contact address	University of Siegen
	Street/ No.	Hölderlinstr. 3
	Zip code	57068
	City	Siegen
	Country	Germany
	Homepage	http://www.project-phaethon.de/index.html
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	40 x 57 x 38
	Weight (kg)	8 kg
	Model/make	Robotnik Summit + custom

		extensions
	Number of wheels	4
	Drivetrainn conception	4WD, motor on each axle
	Turning	Dual Ackermann-Steering
	Battery time:	approx. 2 h
	Is alternative battery set available?	no
	Rain resistance	IP 43
Used sensors:	Camera	2 x Logitech Pro 9000
	Sonar	4 x Devantech SRF8
	Laser	Hukuyo UTM-30 LX
	Compass	-
	GPS	-
	Gyroscope	Silicon Sensing CRG20
	Odometry	Wheelencoder (Renishaw RM22)
	IR	-
	Sharp	-
	Other sensors:	-
Control		
	Robot software description	Based on ROS
	Interface	USB, RJ-45, Wifi, serial port
On which tasks will you participate?	1 2 3 4 5	
Task 1	Short description of navigation algorithm	The robot looks via its laserscanner in a small rectangular area directly in front of it, whether there are any obstacles. Depending on the position and size it decides if and how to avoid it. If an obstacle has been detected, the algorithm calculates an obstacle-avoiding steering angle and

		executes it. The ultrasonic sensors mounted to the sides of the robot are used to support the laser range finder as redundant range sensor.
Task 2	How your robot detects blocked row (obstacles)?	If the navigation algorithm from Task 1 is not able to detect a free path, or if something is too close in front of the robot, it stops and assumes it has detected a blocked row if the obstacle is present for more than 5 seconds without moving.
Task 3	How do you recognize weed (maize, oil seed rape)?	We use two webcams mounted on either side of the robot in combination with a laser range finder. The range finder uses global k-means to localise individual plant stems. The relative position of the plants is then used to support several histogram-based algorithms which are combined to fulfill the task of removing the background and isolating individual plants within the image. The resulting color space is amplified to allow recognition of weed plants based on their specific hue range.
	How do you recognize damaged plants?	Damaged plants are recognized similarly to weed plants by looking for characteristic color changes of the plants.
	Which device do you use for signalization?	Loudspeaker, LED-stripes
Task 4	Please describe shortly the presentation of free style task	Not decided yet
Sponsors		Claas Stiftung, Lachmann & Rink GmbH

19. Robot TU Kaiserslautern

Team & Robot name		
	Team members	[1] Jochen Barthel [1] Long Phan [1] Moritz Ziegele [1] Stefan Mathis [1] Patrik Piecha [1] Sharad Bhadgaonkar [1] Cong Phu Dao [1] Sebastian Dauscher [1] Roland Werner [2] Viktor Leonhardt [2] Alexander Jung [2] Simon Baer [2] Markus Urschel [2] Tycho Groche [2] Volker Dänekas
	Team captain	[1] Kiarash Sabzewari [2] Simon Hook
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Team background:	Institution	[1] Institute of Mechatronics in Mechanical and Automotive Engineering [2] Robotics Research Lab
	Department	[1] Department of Mechanical and Process Engineering [2] Department of Computer Science
	Contact address	[1] TU Kaiserslautern - Institute of

		Mechatronics (MEC) [2] TU Kaiserslautern - Arbeitsgruppe Robotersysteme
	Street/ No.	[1] Gottlieb Daimler Strasse 42 [2] Postfach 3049
	Zip code	67663
	City	Kaiserslautern
	Country	Germany
	Homepage	[1] http://www.mv.uni-kl.de/mec/ [2] http://agrosy.informatik.uni-kl.de/
Robot data		
	Robot hardware description	
Chassis	W x L x H (in cm)	45 x 112 x 110
	Weight (kg)	25 kg
	Model/make	Non/TU Kaiserslautern
	Number of wheels	4
	Drivetrain conception	4WD-drive with central 2 kW EC-motor
	Turning	4-wheel steering; minimum turning radius: 0.85 m
	Battery time:	10 min
	Is alternative battery set available?	yes
	Rain resistance	no
Used sensors:	Camera	Webcam
	Sonar	n.a.
	Laser	2 x Hokuyo UBG-04LX-F01
	Compass	n.a.

	GPS	n.a.
	Gyroscope	Continental MEMS IMU
	Odometry	n.a.
	IR	n.a.
	Sharp	n.a.
	Other sensors:	n.a.
Control		
	Robot software description	dSPACE-RTOS + Linux
	Interface	MATLAB/Simulink, ControlDesk + SSH
On which tasks will you participate?	1 2 3 4 5	1, 2, 3
Task 1	Short description of navigation algorithm	[1] Reading Laser Scanner [1] Creating Obstacle Map [1] Detecting the Rows [1] Calculating Speed and Steering Angle
Task 2	How your robot detects blocked row (obstacles)?	[1] Looking for obstacles within the rows by analysing the laser scanner data
Task 3	How do you recognize weed (maize, oil seed rape)?	[2] Shape and size of the leaves
	How do you recognize damaged plants?	[2] Colour and shape of the leaves
	Which device do you use for signalization?	[1] Rotating light and Horn
Task 4	Please describe shortly the presentation of free style task	n.a.
Sponsors		John Deere, dSPACE

Results FieldRobotEvent 2013

Task 1 „Basic navigation“

1. Robot TU Kaiserslautern, TU Kaiserslautern, Kaiserslautern, Germany
2. Eduro Maxi, CULS Prague, Prague, Czech Republic
3. Flower Power, Technical University of Denmark, DTU, Kgs. Lyngby, Denmark

Task 2 „Advanced navigation”

1. Optomaize Prim, Hochschule Osnabrück University of Applied Sciences, Osnabrück, Germany
2. Flower Power, Technical University of Denmark DTU, Kgs. Lyngby, Denmark
3. Idefix, Schüler Forschungszentrum Südwürttemberg, Bad Saulgau, Germany

Task 3 „Professional”

1. Robot TU Kaiserslautern, TU Kaiserslautern, Kaiserslautern, Germany
2. Bullseye, Wageningen University, Wageningen, The Netherlands
3. Phaethon, Institute for Realtime Learning Systems, Siegen, Germany

Field Robot Event 2013 championship

1. Robot TU Kaiserslautern, TU Kaiserslautern, Kaiserslautern, Germany
2. Bullseye, Wageningen University, Wageningen, The Netherlands
3. Flower Power, Technical University of Denmark, DTU, Kgs. Lyngby, Denmark

Task 4 „Freestyle”

1. DoubleTrouble, Aalto University, University of Helsinki, Aalto, Finland
2. Bullseye, Wageningen University, Wageningen, The Netherlands
3. Optomaize Prim, Hochschule Osnabrück University of Applied Sciences, Osnabrück, Germany

Task 5 „Cooperation”

1. Bullseye, Wageningen University, Wageningen, The Netherlands
   KaMaRo, Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany
2. Robot TU Kaiserslautern, TU Kaiserslautern, Kaiserslautern, Germany
   Optomaize Prim, Hochschule Osnabrück University of Applied Sciences, Osnabrück, Germany
3. Eduro Maxi, CULS Prague, Prague, Czech Republic
   Idefix, Schüler Forschungszentrum Südwürttemberg, Bad Saulgau, Germany