FieldRobotEvent

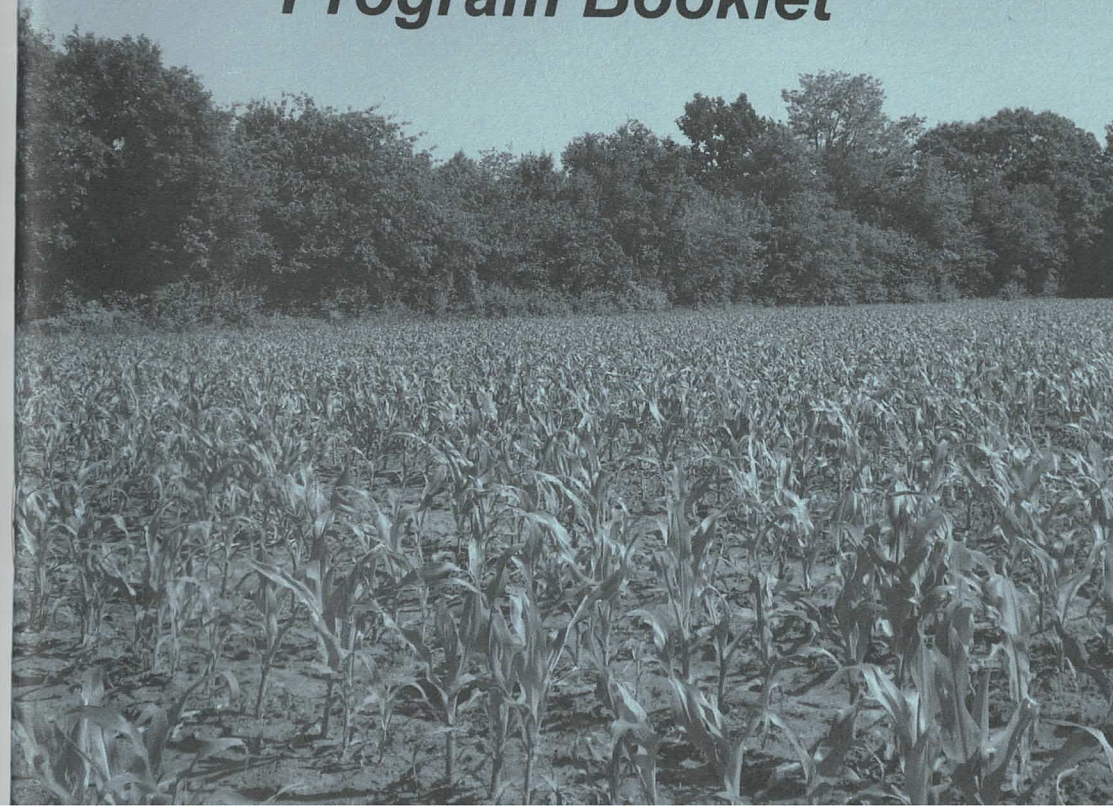
PrototypeContest.Workshops.Party

June 12-14, 2008
Osnabrück, Germany
www.fieldrobotevent.de

Fachhochschule Osnabrück
University of Applied Sciences

Germany
Land of Ideas
Selected Landmark 2008

Program Booklet



Contest Information

Jury members:

Dr. Jochen Hemming
Wageningen University and Research Center, The Netherlands

Dr. Rasmus Nyholm Jørgensen
University of Southern Denmark, Odense, Denmark

Dr. Johannes Marquering
B. Strautmann & Söhne GmbH & Co. KG, Bad Laer, Germany

Prof. Dr. Joachim Müller
Universität Hohenheim, Stuttgart, Germany

Prof. Dr. Thomas Rath
Leibniz Universität Hannover, Germany

Tasks – Overview

Navigation
Navigating in between curved rows of maize, including headland turning.

Robust Navigation
Following a predefined pattern in a maize field with missing plants, the headland is limited to 1.5 m (or 2 times the length of the robot).

Weed Control
Detection of artificial weed (simulated by golf balls), weed control action.

Freestyle
Show your own ideas taking into account your robot's speciality! The relevance for agricultural practice will be taken into account by the evaluation of the committee.

Challenge Task
Navigation under extreme conditions in a maize field: hilly or wet ground, curved rows, weed, missing plants; counting of maize plants. Each discipline will have awards for the 3 best teams. Summing up the results for the navigation, robust navigation and weed control the winners of the Field Robot Event will be determined, thereby taking into account the costs of the robots.

Tasks (Details) and Criteria

The status and the future of the Field Robot Event has been brought in the discussion by Eldert van Henten in Wageningen during the FRE 2007. The most important aspects have been the overall (yearly) technical progress and student education. These aspects are found to be partly conflicting: New students are learning to build robots, thus the challenge of the tasks shouldn't be too high. On the other hand, the overall progress in technology and the increasing public perception should lead to more challenging tasks and applications. This is also an aspect for professional teams from companies. Within this context, the importance of the costs of the robots is also a point of conflict .

As a consequence we have tried to take into account these aspects to define the tasks for the FRE 2008:

Task 1: Navigation
Task 2: Advanced Navigation
Task 3: "Weed" Control
Freestyle
Challenge Task

Tasks 1,2 and 3 are very similar as compared to the FRE 2007. This is important for student participation and continuity of the competition. Each competition will have an award for 3 teams (great idea from last year !), the competitions 1+2+3 will have 3 overall winners of the competition (the winner is called "the winner of the FRE 2008"). The logic within the 3 competitions is very clear (thus the names have been slightly changed): a kind of standard navigation ("navigation"), more complex robust navigation ("advanced navigation") and an application ("weed control").

A lot of good ideas have been implemented in the freestyle sessions during the last years. Moreover, the application point of view has already been very strong. Thus we thought not to change it, don't put any further restrictions on it. We would like to take out the freestyle competition for the evaluation of the overall winners. It should be a separate award, it is completely left to the jury what aspects to evaluate. The competition will have 3 winners.

In order to include more challenging tasks (without suppressing the majority of teams) the "challenge task" is introduced. It includes the navigation and plant counting in a maize field with curved rows, some weed, some slopes (uphill, downhill; up to 10 % slope / 10 cm on 1 m) and some wet regions. The navigation and the counting of maize plants will be evaluated.

Task 1: Navigation

The robot should cover as much distance as possible in 3 minutes time while navigating between curved rows of a maize field, making a head-land turn and returning in the adjacent row. See figure 1 for illustration. If mother nature is willing to support this task, there won't be plants missing in the rows. This task is all about speed, accuracy and robustness of navigation and smoothness of operation.

Figure 1. Robust navigation in a maize field with curved rows.

Assessment:

1. The distance travelled in 3 minutes is measured. If end of field is reached within 3 minutes, the time counts. Distance and time are observed by officials.
2. Touching the robot results in a penalty of 5m (per touch); number of touches are counted by officials.
3. Distances and time result in a ranking of teams; points are based on ranking number; the following sequence is used: 25-20-15-12-10-9-8-7-6-5-5-5-5-…
4. Smoothness of operation is judged by a jury.
5. Each member of the jury gives a score between 1 and 5; between 5 and 25 points can be earned.
6. Not participating in a task is 0 points.

Task 2: Advanced Navigation

The robot should cover as much distance as possible in 3 minutes time while navigating between straight rows of maize plants. The robot should be able to follow a certain pre-defined pattern over the field. See figure 2. At various places in the maize field, plants will be missing in either one or both rows over a length of maximally 1 m. A head-land of only 1.5 m will be available for turning.

Coding of the pattern of the path through the maize field is done as follows. S means Start, L means left-hand turn, R means right-hand turn, F means Finish, the number before the L or R represents the path that has to be entered after the turn. So, 2L means: enter the second path after a left-hand turn. 3R means: enter the third path after a right hand turn. The path shown in figure is coded as follows: S, 3L, 2R, 1L, 1R, 3R, 2L, 1R, F.

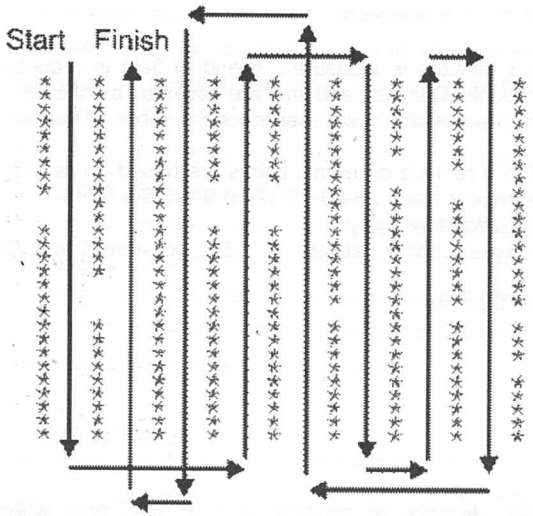


Figure 2. : Advanced navigation along a complex pattern in a maize field with straight rows with plants missing

The code of the path is made available to the competitors 1 hour before the start of the competition without having the opportunity to test it in the maize rows.

Assessment:

1. The distance travelled in 3 minutes is measured. If end of field is reached within 3 minutes, the time counts. Distance and time are observed by officials.
2. Touching the robot results in a penalty of 5m (per touch); Number of touches are counted by officials.
3. Crossing the headland boundary of 1.5 m (or 2 times the length of the robot) results in a penalty of 5m per crossing. Number of crossings are counted by officials
4. Distances and time result in a ranking of teams; points are based on ranking number; the following sequence is used: 25-20-15-12-10-9-8-7-6-5-5-5-5-…
5. Smoothness of operation is judged by a jury.
6. Each member of the jury gives a score between 1 and 5; in total between 5 and 25 points can be earned.
7. Not participating in a task is 0 points.

Task 3: 'Weed' Control

The robot should cover as much distance within 3 minutes time while navigating between straight rows of maize plants. In the maize field randomly distributed artificial weeds yellow golf balls have to be detected. Detection of a 'weed' should be demonstrated by producing a clear signal such as a flash-light or a sound.

Additionally, a 'weed-killing' operation should be performed on the 'weed'.

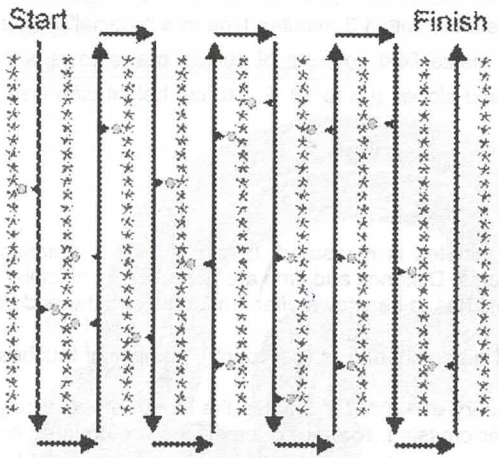


Figure 3. 'Weed'-control in a maize field

Assessment:

1. The number of correctly detected golf balls and consecutive action is counted.
2. Weed killing action should affect golf ball; else it will not count.
3. Continuous spraying is not allowed.
4. Touching the robot results in a penalty of 1 detected golf ball (per touch); Number of touches are counted by officials.
5. Correct counted golf balls result in a ranking of teams; points are based on ranking number; the following sequence is used: 25-20-15-12-10-9-8-7-6-5-5-5-5-…
6. Smoothness of operation and quality of the weed killing action are judged by a jury.
7. Each member of the jury gives a score between 1 and 5; in total between 5 and 25 points can be earned.
8. Not participating in a task is 0 points.

Freestyle

Robots are invited to perform a free-style operation. Fun is important in this task but agricultural relevance is emphasized. One team member has to inform the public about the idea.

Assessment:

1. Assessed by jury.
2. Ranking will be made by the jury after the performance of all teams.

3. Points are based on ranking number; the following sequence is used: 50-40-30-24-20-18-16-14-12-10-10-10-10-...

Challenge Task

The robot should cover as much distance within 3 minutes time in a "special" maize field and count maize plants. The maize field consists of curved maize rows with missing plants, weed, wet regions and slopes (up to 10 % - 10 cm height difference on a length of 1 m).

Assessment:

1. The distance travelled in 3 minutes is measured. If end of field is reached within 3 minutes, the time counts. Distance and time are observed by officials.
2. The number of detected plants has to be shown after 3 minutes or if the end of field is reached.
3. Touching the robot results in a penalty of 5 m (per touch); number of touches are counted by officials.
4. Crossing the headland boundary of 1.5 m (or 2 times the length of the robot) results in a penalty of 5m per crossing. Number of crossings are counted by officials
5. Distances and time result in a ranking of teams; points are based on ranking number; the following sequence is used: 25-20-15-12-10-9-8-7-6-5-5-5-5-...
6. Number of plants result in a ranking of teams; points are based on ranking number; the following sequence is used: 25-20-15-12-10-9-8-7-6-5-5-5-5-...
7. Smoothness of operation is judged by a jury.
8. Each member of the jury gives a score between 1 and 5; in total between 5 and 25 points can

Presentation during Workshop on Saturday

There will be a fair with stands and posters for all robots in a tent (10.00). The robot can stand next to the stand. It is a forum for exchanging ideas and experiences.
In the following "Scientifc Workshop" (11.00) there will be 3 parts:

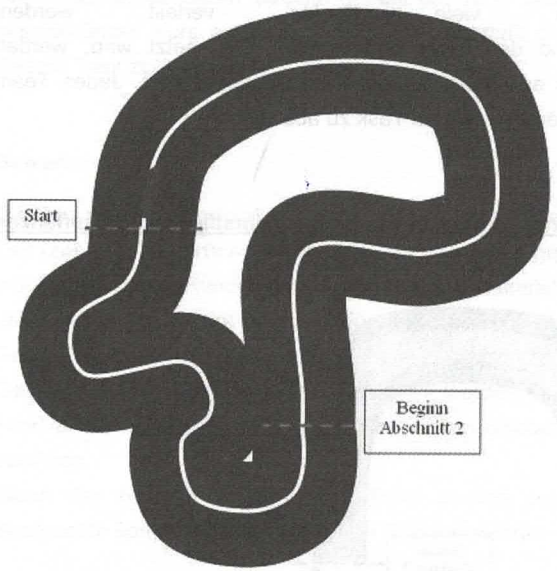
1) Presentation of robots (competitors FRE 2008)
Teams FRE (3 minutes per team; 10 minutes for the 3 best teams FRE 2008)
2) Research Activities: Autonomous Field Robots (Spotlights)
Speakers from different institutions can briefly present their research projects in the field of autonomous field robots (probable speakers are Jørgensen, Müller, Hemming, van Henten, Grimsel, Lang, Ruckelshausen, ...).
3)- Future of the Field Robot Event (Discussion)

Submitting a paper
Submitting a paper before 30 June 2008 about the construction of the robot.

Field Robot Junior

Nachfolgend werden die einzelnen Tasks des Field Robot Event Junior Wettbewerbs beschrieben.

Task 1: Entlangfahren einer Linie



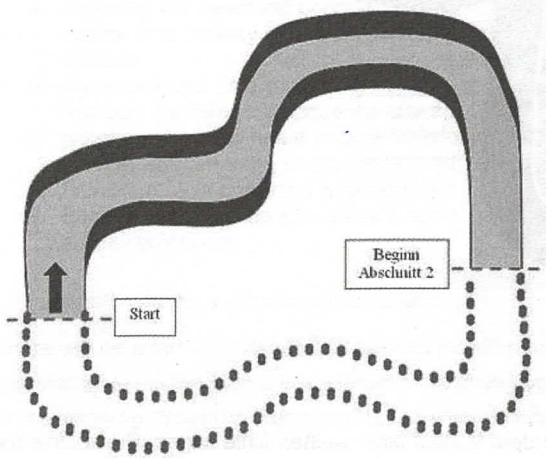
Parcours: Task 1

Beschreibung:
Im TASK 1 muss der Roboter dem Verlauf einer weißen Linie folgen. Diese Linie hat eine Breite von ca. 1-2 cm. Die kleinste zu durchfahrende Kurve innerhalb dieser Strecke hat einen minimalen Kurvenradius von nicht unter 10cm. Der umgebende Boden ist in einem Bereich von mindestens 15 cm jeweils links und rechts der Linie schwarz eingefärbt. Die Strecke ist im ersten Abschnitt (etwa 2/3 der gesamten Strecke) völlig eben und ohne jegliche Steigung. Im zweiten Abschnitt sind leichte Unebenheiten eingebaut, deren Steigung maximal 1cm Höhe auf 20cm Strecke beträgt. Die Gesamtlänge der Strecke beträgt ca. 10 m und ist als in sich geschlossener Kurs aufgebaut.

Bewertung:

Die Punktevergabe erfolgt nach gefahrener Strecke, die innerhalb einer festgelegten Zeit (z.B. 2 min) zurückgelegt wurde. Aufgrund des geschlossenen Parcours ist es möglich, mehrere Runden innerhalb dieses Zeitfensters zu fahren. Die Bewertung der Teilstrecken erfolgt so, dass für den ersten leichteren Abschnitt (ca. 2/3 der Gesamtstrecke) und für den zweiten schwereren Abschnitt (ca. 1/3 der Gesamtstrecke) gleich viele Punkte verteilt werden.
Wenn der Roboter während der Fahrt berührt oder umgesetzt wird, werden Strafpunkte von den bereits erreichten Streckenpunkten abgezogen. Jedes Team erhält die Möglichkeit, zwei Läufe in diesem Task zu absolvieren.

Task 2: Entlangfahren einer durch Banden und künstlichen Maispflanzen seitlich begrenzten Strecke



Parcours: Task 2

Beschreibung:

Im TASK 2 muss der Roboter dem Verlauf einer seitlich begrenzten Strecke folgen, die eben und ohne jegliche Steigung ist. Im ersten Abschnitt besteht die seitliche Begrenzung aus Banden, die eine Höhe von mindestens 25 cm und einen Abstand von etwa 75 cm zueinander haben. Der zweite Streckenabschnitt wird seitlich durch

künstliche Maispflanzen begrenzt. Diese Maispflanzen haben eine Höhe von ca. 35cm und sind in einem Versatz von etwa 10cm zueinander angeordnet (eine Musterzeichnung der künstlichen Maispflanzen ist ***demnächst*** im Downloadbereich auf www.fieldrobotevent.de verfügbar). Die Reihenbreite beträgt ebenfalls 75cm. Im hinteren Streckenabschnitt können vereinzelt Pflanzen auf der linken oder rechten Seite fehlen.
Die Gesamtlänge dieser Strecke beträgt ca. 15 m und ist wie in Task1 als in sich geschlossener Kurs aufgebaut. Jedes Team erhält die Möglichkeit, zwei Läufe in diesem Task zu absolvieren.

Bewertung:

Die Punktevergabe erfolgt nach gefahrener Strecke, die innerhalb einer festgelegten Zeit (z.B. 2 min) zurückgelegt wurde. Aufgrund des geschlossenen Parcours ist es möglich, mehrere Runden innerhalb dieses Zeitfensters zu fahren. Die Bewertung der Teilstrecken erfolgt so, dass für den ersten leichteren Abschnitt (ca. 2/3 der Gesamtstrecke) und für den zweiten schwereren Abschnitt (ca. 1/3 der Gesamtstrecke) gleich viele Punkte verteilt werden. Der Roboter darf während der Fahrt sowohl die Banden als auch im zweiten Streckenabschnitt die Maispflanzen berühren.
Wenn der Roboter während der Fahrt berührt oder umgesetzt wird, werden Strafpunkte von den bereits erreichten Streckenpunkten abgezogen.

Freestyle

Im Freestyle-Wettbewerb könnt Ihr die besonderen Fähigkeiten Eures Roboters demonstrieren – ganz egal ob es um Landtechnik oder um andere Bereiche geht. Hauptsache die Demonstration ist originell und kreativ. Ihr habt außerdem die Möglichkeit, den Zuschauern vor bzw. während der Vorführung kurz ein paar Erläuterungen zu geben. Bei Bedarf kann Eure Vorführung auch auf einem echten Maisfeld vorgenommen werden.

Bewertung:

Die Bewertung wird von einer Jury vorgenommen, die alle Teilnehmer begutachtet.

Platzierung:

Es werden bei jedem einzelnen Task die besten drei Teams platziert. Der Gesamtsieger des Field Robot Event Junior wird aus den Platzierungen von Task 1 und Task 2 errechnet. Zusätzlich wird ein Preis für das beste Roboter-Design durch die Jury vergeben.

Teams

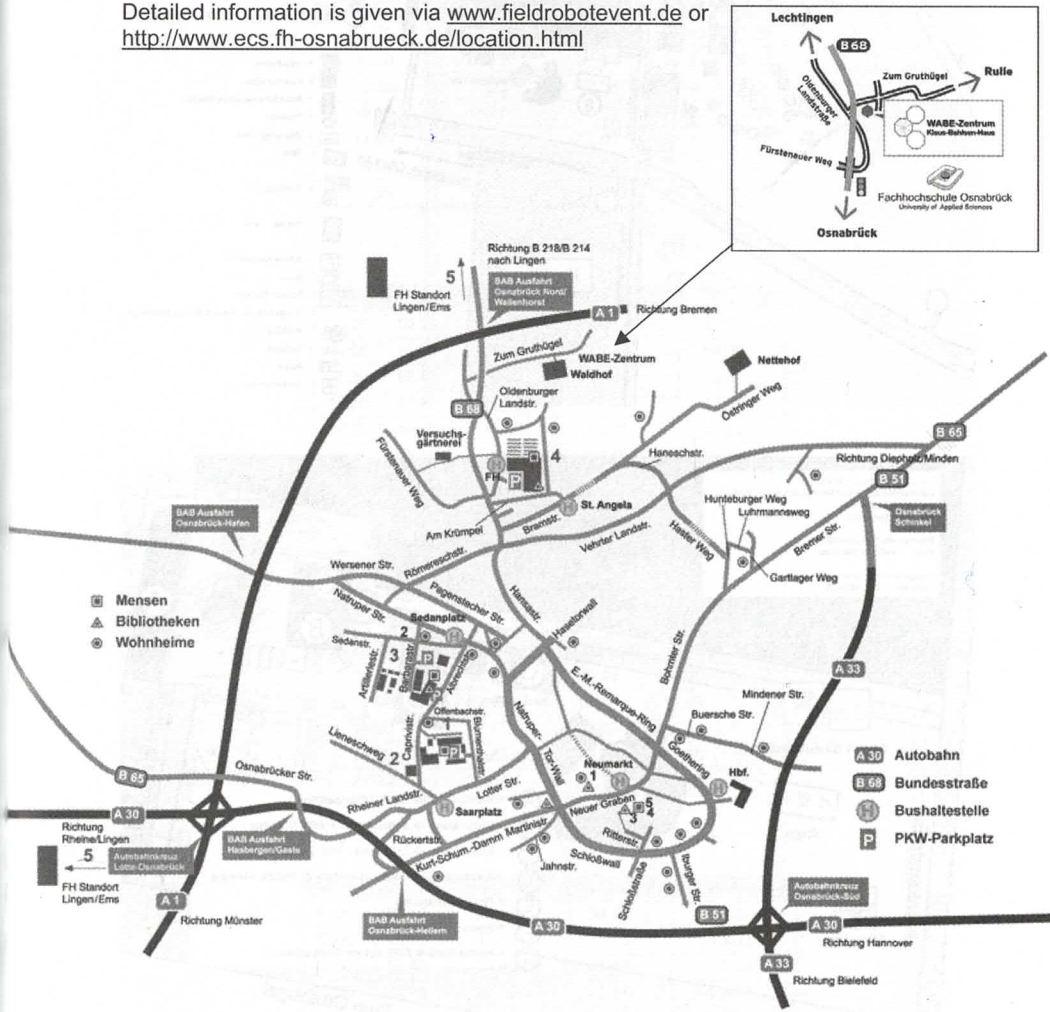
Teams	Schule	Ansprechpartner
3	BBS Brinkstraße Osnabrück	Herr L. Kaja
2	Georgsmarienhütte GmbH	Herr P. Leimbrink
1	Gymnasium Carolinum Osnabrück	Herr J. Vornhülz
3	Gymnasium in der Wüste	Herr H. Hogrebe
1	Freie Waldorfschule Evinghausen	Herr M. Posch
8	Goethe-Gymnasium Hamburg	Herr O. Wagner
16	Ratsgymnasium Osnabrück	Frau K. Cullmann
1	Ratsgymnasium (Informatik AG)	Herr M. Block
6	Kopernikus-Gymnasium Rheine	Herr G. Broelemann
1	Haupt- und Realschule Salzbergen	Herr F. Engeln
1	Wageningen	Herr Ragnar Groot Koerkamp
1	Grund- und Hauptschule Wellingholzhausen	Herr A. Unland
1	Hauptschule Westerkappel	Herr H. Bünemann

Maps

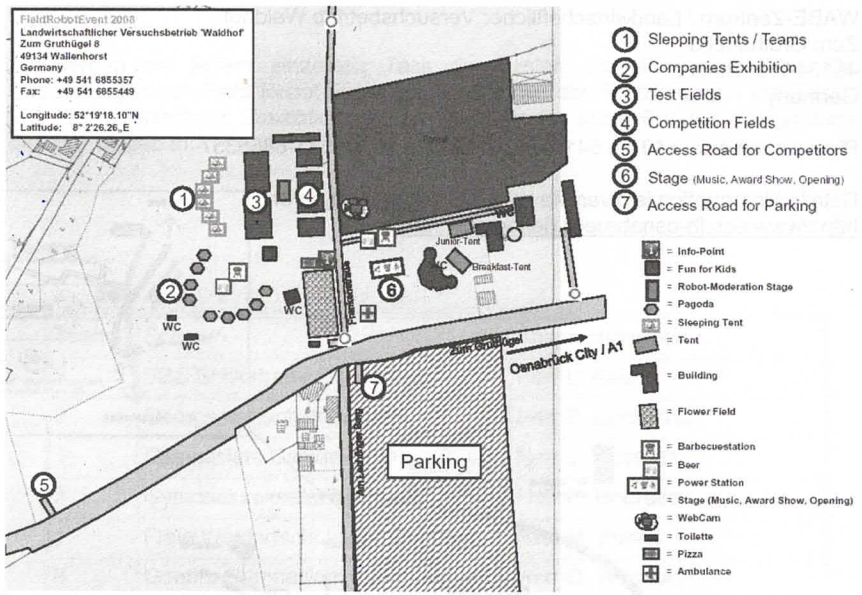
WABE-Zentrum / Landwirtschaftlicher Versuchsbetrieb Waldhof
Zum Gruthügel 8
49134 Wallenhorst
Germany

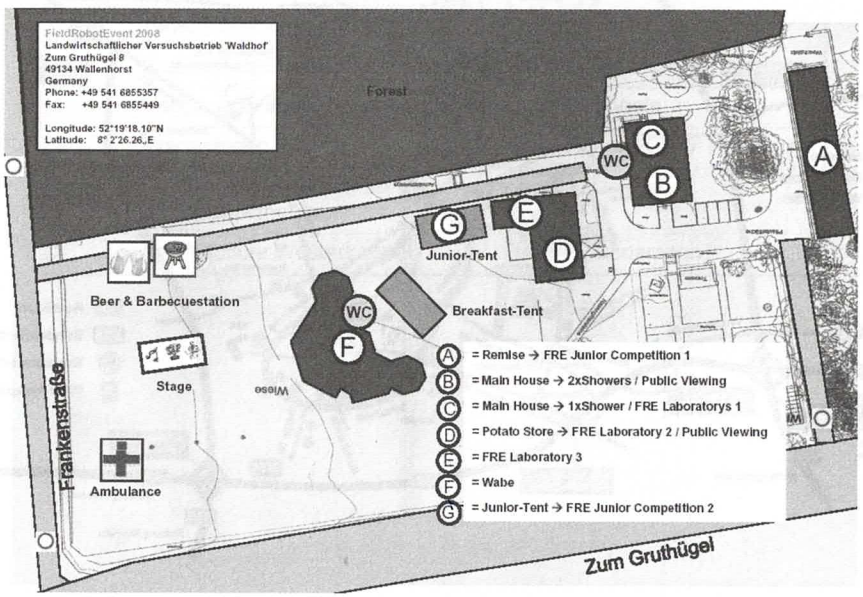
Phone numbers: +49 (0) 541 – 6855718 or +49 (0) 541-6855357

Detailed information is given via www.fieldrobotevent.de or http://www.ecs.fh-osnabrueck.de/location.html



Plans of buildings:





Shuttle Service Osnabrück City – Waldhof/WABE

(sponsored by Stadtwerke Osnabrück; June 12 and 13)

Thurday 12.06.2008

Departure Hauptbahnhof:

Hbf. Bussteig 2	Neumarkt A 1	Dom/Theater	Hasetor	Waldhof
07:30	07.35	07.38	07.40	07.50
09:30	09.35	09.38	09.40	09.50
13:30	13.35	13.38	13.40	13.50
16:00	16.05	16.08	16.10	16.20
17:00	17.05	17.08	17.10	17.20
19:00	19.05	19.08	19.10	19.20
21:30	21.35	21.38	21.10	21.20

Departure Waldhof:

Waldhof	Hasetor	Dom/Theater	Neumarkt (B)	Hbf. Bussteig 2
10:00	10.10	10.12	10.15	10.20
14:00	14.10	14.12	14.15	14.20
16:30	16.40	16.42	16.45	16.50
17:30	17.40	17.42	17.45	17.50
19:30	19.40	19.42	19.45	19.50
22:00	22.10	22.12	22.15	22.20

Friday 13.06.2008

Departure Hauptbahnhof:

Hbf. Bussteig 2	Neumarkt A 1	Dom/Theater	Hasetor	Waldhof
08:30	08.35	08.38	08.40	08.50
12:30	12.35	12.38	12.40	12.50
17:00	17.05	17.08	17.10	17.20
19:30	19.35	19.38	19.40	19.50
21:30	21.35	21.38	21.40	21.50

Departure Waldhof:

Waldhof	Hasetor	Dom/Theater	Neumarkt (B)	Hbf. Bussteig 2
09:00	09.10	09.12	09.15	09.20
13:00	13.10	13.12	13.15	13.20
17:30	17.40	17.42	17.45	17.50
20:00	20.10	20.12	20.15	20.20
22:00	22.10	22.12	22.15	22.20