ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Electronics Laboratory
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GROUP PROJECT

for

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ParaShare: Sharing climb rates to find thermal spots in paragliding

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Introduction

Paragliding is flying without an engine. Just by using thermal lift, pilots can rise up in the sky making it possible to stay up in the air for hours. A challenge, especially inexperienced paragliders have to face, is to find spots with optimal thermal characteristic. Once a pilot finds a spot with good thermal characteristics, he begins to fly in a circle, trying to center the circle on the strongest part of the thermal (the core), where the air is rising the fastest. Most pilots use a 'vario-altimeter', which indicates climb rate with beeps and/or a visual display, to help 'core-in' on a thermal. Since good termals are very local it can be hard to find then and once found, often, several pilots simultaneously core-in at the same spot.

In this Group thesis, the aim is to develop a mobile system which supports paragliders in finding good termals. The system will automatically detect spots with good termals by analyzing the flight behavior of other paragliders. Locations where multiple paragliders have a large climb rate could indicate a spot with good thermal characteristics and hence could be recommended to other pilots within reach.

Hence, a collaborative sensing approach should be followed. In particular, the location together with the climb rate (obtained through built-in GPS or an external Vario) of other paragliders should be use to derive a recommendation to other pilots. The system should be implemented using the CoenoSense platform. Figure 2 shows an illustration of the architecture. A sample user interface could look like in Figure **??**.

Task List

- Interview experienced paragliders as for what applications on a smartphone could be useful, include questions on visualization and HCI
- Compare the built-in GPS-based altitude estimation and its derivation to a professional variometer's accuracy
- Perform literature research on approaches for collaborative sensing and real-time reasoning suitable for 'optimal thermal spotting' and recommendation. Select one approach considering your requirements and extend it to work with your specifications.
- implement your selected algorithm into the existing CoenoSense framework
- Develop a mobile application to visualize the aggregated climbrate information and the 'optimal thermal spot' recommendation.
- Design and conduct a real-world experiment to evaluate your system.

Optional

- Select an appropriate variometer (with Bluetooth interface) and extend the existing CoenoSense client application to log the variometer's data and stream it to the CoenoSense server.

Work packages and Procedure

- **Familiarization**: Familiarize yourself with the topic by means of the supplied documents and papers as well as of other sources you find on IEEExplore[1], Google Scholar[2], etc. Familiarize yourself with the Android interface and the CoenoSense Platform.
- **Organization and work plan**: Organize your work by assigning tasks to the individual members. Minimize overhead. After one week of familiarization create an as detailed as possible work plan with important milestones. Check your progress on a continuous basis. Unexpected problems can necessitate adaptations of the time schedule which should be documented.
- **Expert Interview**: Contact experienced and novice paragliders and arrange an interview. Questions of interest could include type of applications and features that could be useful on a smartphone. Include questions on usability and visualization.
- **Variometer vs. GPS**: Compare the performance and accuracy of the external variometer to change of altitude estimated from the mobile phones built in GPS device.
- **Sharing climbrates**: Perform literature research on approaches for collaborative sensing and real-time reasoning suitable for 'optimal thermal spotting' and recommendation. Select one approach considering your requirements and extend it to work with your specifications. Discuss your approach with the supervisors and implement it into the CoenoSense platform.

[1] `http://www.ieeexplore.ieee.org/`
[2] `http://scholar.google.com/`

- **Visualization**: Develop an appropriate visualization of the shared climb rate data according to the findings in the interviews with paragliders and develop a mobile application by implementing it.
- **Experiment**: Evaluate your algorithms in a final experiment including up to 10 paragliders. Thoroughly define the experiment setup preliminary.
- **Variometer interface**: If time permits, choose a variometer equipped with a bluetooth interface. Enable data transfer from the variometer to the Anroid smartphone/Coeno Sense to log and transfer information on the climb rate to the server.
- **Documentation**: Concisely and thoroughly document your work with a written report, a presentation and a short summary of your results in form of a webpage. The reports for the weekly meetings with your supervisor mentioned in the next section should ease this task.
  The documentation is a very important part of the thesis and is marked as well. It's recommendable to continuously document the individual steps and results already during the work. A LaTeX-template for the report can be found under
  `www2.ife.ee.ethz.ch/repository/sada/templates.html`

Realization of the Semester Thesis

General

- **Evaluation**: The progress of the work shall be checked on a continuous basis. Unexpected problems can necessitate adaptations of the time schedule which should be documented as well.
- **Workplace**: 4(?) workplaces with PC in ETZ G63 and all necessary software are available.
- **Short talk**: Present your project at the beginning of your thesis with a short presentation (*Date: xx.10.2010*, *Duration: 5 minutes*, `www2.ife.ee.ethz.ch/sada/`)
- **Final talk**: Present the developed results at the end of your thesis in the Institutskolloquium. (*Date: 17.01.2011*, *Duration: 15 minutes + 5 minutes questions*, `www2.ife.ee.ethz.ch/sada/`)
- **Meetings**: Discuss your procedure with your supervisor in a weekly meeting based on a short written report.

Hand-over

- **Report**: Hand in three signed copies of your report by January 14, 2011. The present description should be included at the beginning of your report.
- **Webpage**: The most important results should be summarized in the form of a webpage to be published on `wearable.ethz.ch`.

- **Cleanup**: Copy all important local data to your Unix account. Clean up your Unix account so that just the relevant data remains there. A possibly following thesis should be able to continue at this point. Burn a CD/DVD of this data and hand it over to your supervisor.

Additional information

- Wegleitung für Semester- und Diplomarbeiten am Institut für Elektronik, ETH, nei 8/05 (`www2.ife.ee.ethz.ch/repository/sada/SADA_Anleitung.pdf`).

11. 10., 2010

Prof. G. Tröster

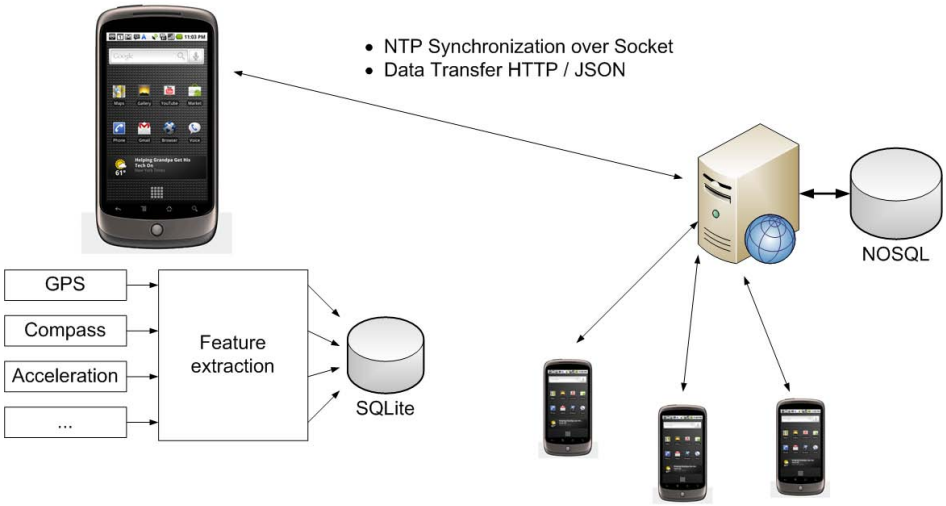

Figure 1: Architecture of the CoenoSense Platform

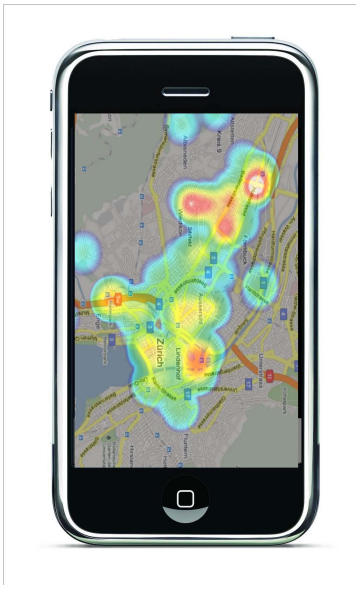

Figure 2: Possible visualization of spots with good termals using heat maps

References