ETH
Eidgenössische Technische Hochschule Zürich
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Smart Energy HS 2017

Project 1: Development of a personal energy and carbon footprint mobility app

Start:	September 28, 2017
End:	November 7, 2017

Objectives

The aim of this first project is to be confronted with a typical situation that requires system design and development skills from the computing area to address a question related to smart energy and sustainability. Concretely, course participants are requested to develop a personal energy and carbon footprint mobility calculator as an Android application.

The application has to continuously run in the background during the day and infer the means of travel (tram, car, bicycle, or on foot) from the user's context. It should subsequently derive the energy used and the carbon emitted that can be attributed to the user for her or his mobility needs on a daily basis. Daily records should be stored, and weekly and monthly aggregations presented.

Deliverables

The project will be completed in teams of three course participants. Teams are formed within the first week of the course. As around 75% of attendees are computer science students, we ask teams to be formed in such way that each one encompasses at least one computer science student. By Friday, 29 September, the teams must be formed; one of the team members submits the names of the three members via email to Vlad Coroamă (vcoroama@ethz.ch), cc'ing the others on the team.

The project has three deliverables, required by 11:59 p.m., 7 November 2017:

1. **sourcecode**: The final project must be submitted via email (as entire Android project, with build files removed, zipped) to Vlad Coroamă (vcoroama@ethz.ch). The code should be well structured and documented.

2. **report**: A short report that summarizes the project should be submitted along with it. The text, including supporting graphs and screenshots, should highlight important aspects of the app, e.g., its architecture, encountered challenges, and deployed solutions. It should also present the main elements of the developed graphical user interface (GUI). The text should be relatively short: 3-4 pages without the figures; as long as necessary with the figures included.

3. **presentation**: A day later, during the lecture on November 8th, each team will have 10 minutes to present their app to the entire course. The presentation should focus on similar aspects as the report. Screenshots of the app should also be included. A short emulator-based demo or a video showing the app at work can also be part of the presentation, but are not required.

Suggested work packages

To approach the project, we suggest defining work packages, and progress iteratively. A possible such approach is shown below; it is not binding, nor will the intermediate results be tested in any way:

- WP1 (by week 3, October 4), **hello world**: develop a first, hello-world-type of app that does not only report 'hello world', but 'hello world, i am at the following coordinates and currently travelling with the following speed'.

- WP2 (by week 4, October 11), **simple means of transport differentiation**: from the user's speed (and possibly position), infer whether the user is moving on foot versus any other means. User polling is used to differ between further classes of transport means (bicycle, tram, car, etc).
- WP3 (by week 6, October 25), **personal energy and carbon footprint**: from the daily distance and the means of transport determined in the previous WP, infer the personal mobility energy and carbon footprint. Display it at the end of the day, and on user request.
- WP4 (by week 8, November 7), **more advanced means of transport differentiation**: from the user's location and speed, in conjunction with maps and further features, *automatically* infer the means of transport used.

Organizational aspects

As this assignment will last for several weeks, we kindly ask course participants to decide early-on whether they want to continue attending the course. Giving up the course in the middle of the project will bring a disadvantage to your team (one we will be able to handle by reducing the requirements for that team, but this will imply effort on our side and a less satisfying final result for the rest of your team).

The project is meant to simulate a real-life work assignment, in which your team receives the task of developing such an application for a customer. We thus do not specify too many details; in particular we do not recommend sources of energy and carbon intensities for different means of transport. Some basic requirements engineering, finding data sources, and the graphical user interface (GUI) are explicit parts of the assignment.

For the assignment you can use your own Android smartphone(s), if available; no rooting is required. If needed, we can provide one smartphone per team for the duration of the project.

Grading and minimum requirements

Two projects will accompany the course; the mobility footprint app is the first one. The final grade for the course will be composed to 75% of the oral examination and to 25% of the two projects taken together.

For grading this project, all three deliverables will be taken into account. A general and non-binding orientation on grade requirements for the app itself is listed below:

- **4.0**: a simple automatic classification (walking versus everything else) was developed, complemented by user polling for more detailed classification. A simple GUI presents at the end of the day and on request the user's daily energy and carbon footprints.
- **6.0**: a smart classification was developed, which automatically distinguishes among several means of transport. The classification, while not 100%, distinguishes relatively reliably between cars, trams, and bicycles. An appealing GUI shows, besides the daily footprints, also weekly or monthly aggregates.
- **bonus points**: bonus points can improve the grade for this project by 0.25-0.5, if not all requirements for a 6.0 have been reached. For bonus points, the team needs to impress the audience with innovative, out-of-the-box ideas, during the presentation on November 8. As an example of such feature, the user could be congratulated when undertaking a similar ride to one of the previous days but with a less energy- and carbon-intensive means of transport.