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GoEco!

Extracting Eco-Feedback from Movement Trajectories

GoEco! is one of several smartphone applications that perform automatic mobility tracking. In contrast to many others, it uses the tracked movement data to compute possible behavioral improvements of its users, and provides this assessment as eco-feedback in various forms. These include booklets detailing user journeys and possible alternatives in detail, an in-app feedback screen which summarizes the information given in the booklets, as well as gamification elements that use the computed improvements as a base to compute progress towards goals and challenges, award trophies and allow people to compete against each other. This poster discusses the various steps involved in producing comprehensive yet easy to communicate eco-feedback from the raw movement data, and introduces estimations of potential CO_2 savings and preliminary findings from providing the users of *GoEco!* with this eco-feedback.

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Introduction

In automatic mobility tracking apps [1], users frequently see a very condensed summary of their mobility (e.g., total CO_2 emissions) or all the individual routes they travel, and do not get a complete yet simple understanding of their mobility patterns. Getting the right eco-feedback [2], and making users aware of their mobility patterns and the consequences they entail, is acknowledged as a necessary — though not sufficient — condition towards more sustainable mobility [1].

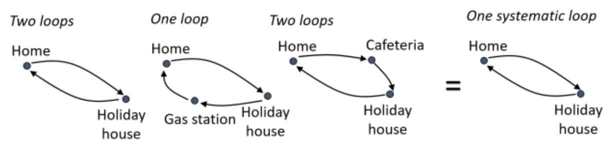
Eco-feedback can be improved by taking into account peculiarities of individual mobility. In our approach, we first identify users' individual *mobility features* and *patterns* and then compute *ecological travel alternatives*.

We deployed this approach in the Swiss-based *GoEco!* project, which uses a gamified smartphone app to influence the mobility behavior of 213 volunteer users over the course of 4.5 months. This poster is based on the work presented in [3].

Mobility Features and Patterns

Mobility features are aggregated indicators summarizing user's mobility data as a whole, such as the weekly distribution of transport modes, the average distance traveled, or the CO_2 produced.

Mobility patterns instead describe systematically traveled routes. They are of particular interest, as a behavioral change in these situations would be repeated over time and thus has a large potential to reduce energy consumption.



To compute them, we aggregate routes into loops starting and ending at the user's home location. Out of all the loops identified for a given user, we consider those that appear at least 3 times in 6 weeks as systematic.

Ecological Alternatives

For each systematic loop, we assess other travel options that visit the same sequence of points of interest and reduce the overall ecological impact (at least 5% less CO_2 produced, to account for tracking inaccuracies), yet still respect the peculiarities of daily mobility:

- users only have a limited number of transport modes available, and these have to end up at the same place where they were originally taken from;
- the overall travel duration should not increase excessively.

The computed travel options form a graph of mobility choices from which we choose the one producing the least CO_2 as a possible alternative for all the loops that correspond to this systematic loop.

Figure 1 shows an exemplary alternative for a walk/tram route, which consists of taking the bike instead. This leads to a reduction in CO_2 production of 0.1 kg every time the user chooses the alternative.

Communication of Eco-Feedback

As *GoEco!* is installed on every participant's phone, the app itself is the primary means to provide eco-feedback. Figure 2 shows the weekly summary for a sample user.

Due to the complexity of communicating patterns, loops, and possible alternatives, the in-app feedback screen focuses on mobility features and their changes over the weeks. Nonetheless, the systematic mobility is used as a base for the gamified elements, in particular goal-setting, whose most ambitious suggestions correspond to using the most ecological alternative for every loop.

For users with a high interest in their own mobility, the eco-feedback booklet provides maps (as in Figure 1) and detailed records of the chosen routes and detected loops, their best alternatives, and the potential savings from a mobility behavior change. These booklets are sent to users by e-mail.

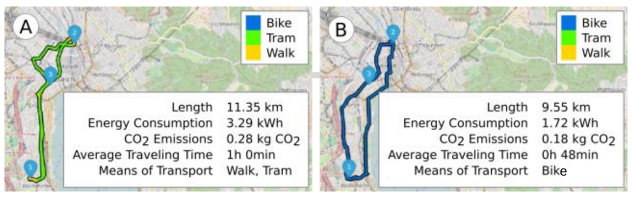


Figure 1 A systematic loop (A) and the ecological alternative we computed (B).

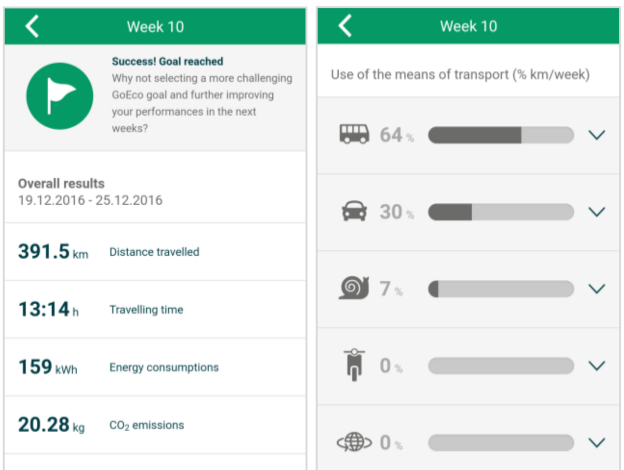
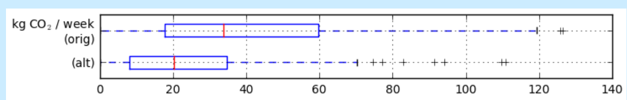


Figure 2 In-app eco-feedback visualization.

Expected Impact

We identified an average of 3.98 systematic loops per user, each one repeated 4.86 times during a 6-week period. Looking at the potential CO_2 savings of the whole *GoEco!* participants sample (computed using the method described on this poster), we see a possible reduction from approx. 35 kg CO_2 / week per user to around 20 kg CO_2 / week per user (median).



While it might be unrealistic to reach these numbers (as mobility is still highly individual and depending on many contextual factors that were not considered in the computation of eco-feedback), preliminary analyses show that people with a high potential for change (covering most distances by car, e.g., in the Southern part of Switzerland) significantly change their behavior after receiving the eco-feedback presented on this poster.

References

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[3] Bucher, D. et al.: Demo Abstract: Extracting Eco-Feedback Information from Automatic Activity Tracking to Promote Energy-Efficient Individual Mobility Behavior. In: Computer Science - Research and Development (6th D-A-CH+ Energy Informatics Conference). (2017)

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