

Leveraging gamification for V2X charging apps: Lessons learned from a long-term field test

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Abstract

The present study investigates the impact of gamification elements on the motivation for Vehicle-to-Grid (V2G) charging in a long-term context. 20 pilot users tested V2G and Vehicle-to-Home (V2H) charging for 15 months using a continuously updated smart charging app, with 14 of them exploring an in-app point system (PS) for V2G. Evaluation of the PS and an advanced version (APS) showed no significant effect on motivational potential. As stated by the participants, this could be due to the lack of a specific purpose of the points. To enhance the value of points, it is recommended to combine them with other gamification elements or financial incentives.

Introduction and Motivation

To address the challenges posed by energy shortages (e.g. high energy demand caused by an increased use of electric vehicles) and energy insecurity (including fluctuations in energy production of renewable energy resources), it is crucial to employ intelligent strategies and technologies to optimize the use of available energy resources. V2X charging enables electric vehicles to function as mobile energy storage, facilitating the feed-in of electricity to the public grid (V2G) or the home grid (V2H). In addition to the charging infrastructure, V2X charging requires the participation of the end user and therefore largely depends on user acceptance and motivation, in particular for long term usage. Gamification represents a promising approach to increase motivation for green energy behaviors (Günther et al., 2020; Kramer et al., 2023) such as V2X charging (Kämpfe et al., 2022; Kellerer et al., 2023). To provide design recommendations for the implementation of gamification in V2X charging apps, this study investigates the impact of gamification elements on the motivation of V2X experienced users for V2G charging in a long-term context.

Applied Method

In a German pilot project, 20 pilot users tested V2G and V2H charging at home for 15 months using a continuously updated smart charging app. An initial point system (PS) for

V2G charging was implemented in the app. In an online survey, 14 pilot users who experienced the PS in the V2G charging use case under real-life conditions, were asked to evaluate the implemented PS. Furthermore, all pilot users, including those experiencing the V2H use case, were asked to evaluate a not-yet-implemented, advanced version of this point system (APS) presented in the survey. The evaluations included perceptions of pragmatic and hedonic quality, understandability and satisfaction. Finally, users were asked to indicate the potential of the APS to motivate V2G charging and were invited to provide further open feedback.

The sample ($N = 20$) consisted of $n = 1$ female and $n = 19$ male participants with an average age of 46 years ($SD = 11.55$, $min = 30$, $max = 74$). 15 of the 20 participants owned a higher education degree (university or university of applied sciences). The assignment to the use cases (V2G or V2H) was determined by technical conditions.

Results

On all evaluation scales, both the PS and the APS achieved mean scores above the mean of the scales, although not to a particularly high degree ($M_{min} = 4.47$, $M_{max} = 5.19$). The APS's potential to motivate was rated as moderate ($M = 3.95$, $SD = 2.12$) by the respondents.

No statistically significant mean differences were found between the PS and APS evaluations, nor in the ratings of the APS's motivational potential between participants who had experienced the PS and those who had not, $U = 35.50$, $Z = -.312$, $p = .755$. Furthermore, a regression analysis revealed no significant effect of the APS evaluation on its motivational potential, $F(5, 13) = .780$, $p = .581$.

Five of eight participants who provided additional free-text feedback addressed the missing purposes of points, including the need for tangible consequences (2), the desire for point-based comparisons on an individual or societal level (2), and the preference for a monetary value associated with points (1).

Conclusions

We conclude that implementing a point system to motivate V2G charging is an incomplete gamification solution. For a more effective strategy, the points need to serve a specific purpose. To enhance the value of points, we recommend incorporating gamification elements that stimulate competition (e.g., rankings) and progression (e.g., progress bars, history) or provide financial incentives (e.g., rewards, marketing initiatives, and donations).

References

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