



18 | BOMBUSCAR: GAMIFICATION DESIGN OF A CARPOOLING-BASED FREIGHT TRANSPORT

Francesco Carrino¹, Quentin Vaucher², Richard Pasquier¹, Vincent Bourquin¹, Omar Abou Khaled¹, Elena Mugellini¹, Stéphane Gobron²

¹: Haute école d'ingénierie et d'architecture de Fribourg, HES-SO, Fribourg, Switzerland

²: Haute Ecole Arc Ingénierie, HES-SO, Neuchâtel, Switzerland

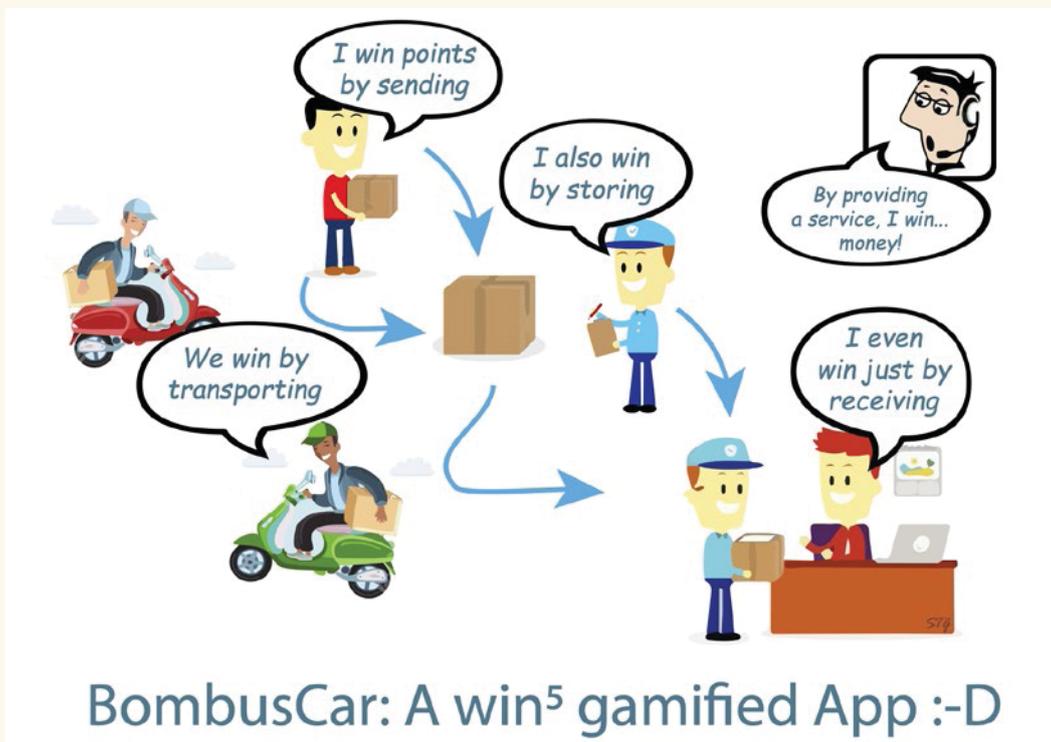
Contact: francesco.carrino@hefr.ch

ABSTRACT

The environmental and societal cost of traditional logistics, based on the "Hub and spoke" model, is increasingly unfavorable. Digitization allows new approaches that have proved effective in people transportation (e.g., Uber, BlaBlaCar). This project proposes the creation of a smart distribution network for the goods transport by exploiting existing transport capabilities. We present the gamification design of the user interface (UI) to foster users' motivation and trust to the platform.

KEYWORDS

Carpooling, gamification, dynamic flow simulation.





CONTEXT

Currently, the transport of parcels is mainly based on the “Hub and spoke” model: the nodes of the network consist of a single central point (the hub) to which all the transport lines (the spokes) converge. In practice, several hubs are connected to each other to cover the entire concerned territory. This model has been used with varying success degrees in several areas (e.g., computer networks, aeronautics, etc.). However, this model comes with a few important drawbacks: it generates a concentration of traffic near the hubs; the hubs represent network failure “single-points”; last but not least, a parcel sent from one city to another separated by a few kilometers will pass through a route of a hundred kilometers to reach the closest hub and come back (currently, throughout Switzerland, there are only three hubs). This issue is even more dramatic if both cities belong to adjacent regions referring to different hubs.

While the Hub and spoke model has a high cost-effectiveness optimization thanks to a limited number of high-performance centers, in terms of sustainable mobility, the package does not follow the shortest path (and therefore energetically optimal).

Our project, called BombusCar, is a work in progress that proposes the creation of an intelligent, flexible and secure distribution network for the parcels transportation by exploiting existing transport capabilities. The main idea is to adapt the carpooling concept to the transportation of goods.

TARGETED ISSUES

From the users’ point of view, our platform takes the form of a mobile application. The user can register as sender, carrier, or collector (for temporary storage). The sender (an individual or a reselling company) specifies the characteristics of the parcels to be sent (origin, destination, volume, etc.). The carrier indicates its route and transport capabilities. The collector gives his storage availability.

To bring the package to the destination, the system will choose the “optimal” combination of sender/transporter(s)/collector(s). Optimal in terms of cost, time and environmental impact. A digital shipment tracking until the package delivery will prevent possible abuse and give assurances that the goods will arrive at their destination.

One of the key factors for the viability of such a project is the long-term participation of people as carriers and collectors, to transport and temporary stock the goods, respectively. The “green appeal” of the project and extrinsic motivations (such as pecuniary rewards for the service provided as carrier or collector) can only partially face this challenge. For this reason, the user interface should be adapted to foster users’ motivation, platform fidelity and trust.

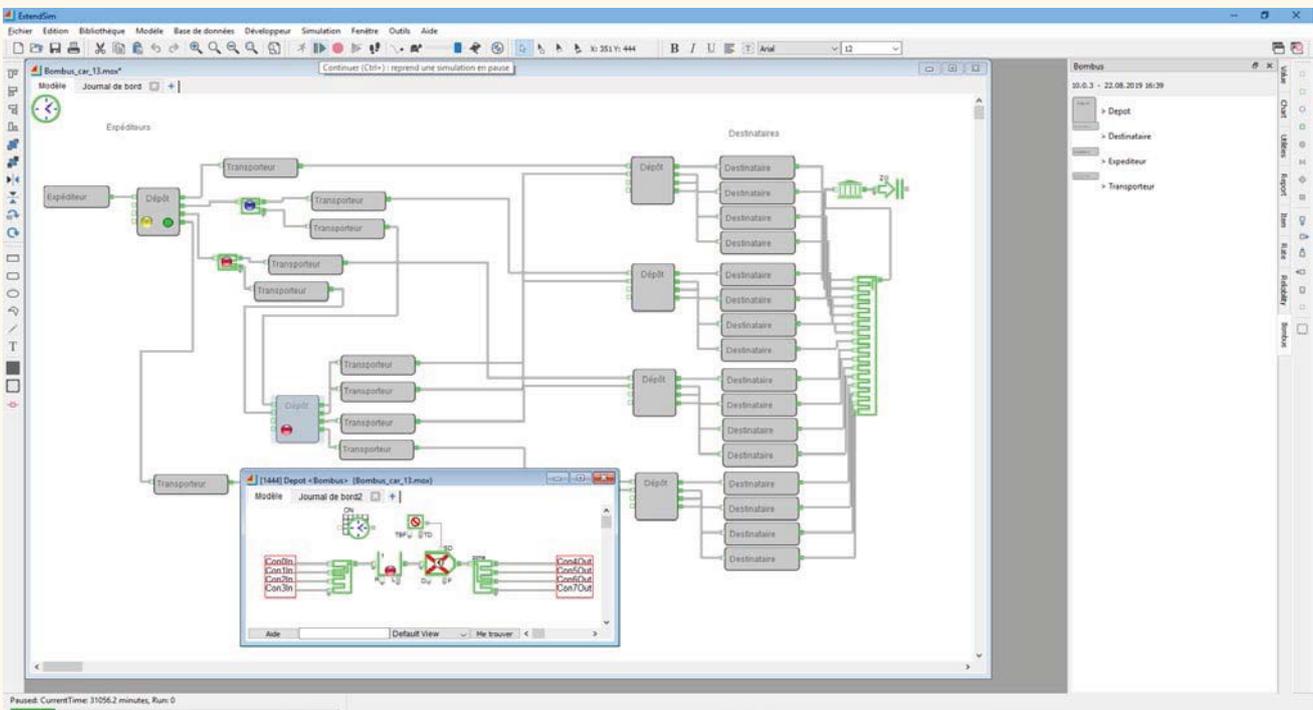
An intelligent, flexible and secure distribution network for the parcels transportation



PROPOSED SOLUTION

Gamification-specific elements have been successfully used in the past as a support for behavior change techniques, for example to encourage people to maintain a healthy lifestyle in adolescents [1] or in seniors [2].

In this project, we use gamification to empower the users and foster their fidelity to the platform. In particular, a gamified approach has been designed to encourage carriers to modify their route when needed (itinerary, departure time, etc.), to meet the network needs and optimize ecological costs. The gamification design takes into account all the actors in the platform (see image above). In addition, in order to predict needs and adapt rewards, we developed a network simulator replicating our network specificities, e.g., carriers’ and collectors’ location, availability and other constraints such as max capacity, payload, etc.



In this paper, we present the simulator we developed to analyze the network dynamics and we introduce the gamification design implemented in our platform.

RELEVANT INNOVATION

The field of logistics is currently undergoing major changes. In the goods distribution many solutions consider at the use of drones or autonomous vehicles [3-5]. All these projects require the creation of new infrastructures or the use of systems which are not yet fully usable in everyday life. Furthermore, none of these projects presents a sustainable vision similar to the carpooling we offer. Some examples of freight-oriented carpooling are Cocolis, Kartoffeltaxi, Roadie, Piggybee, Bring4You. However, many of them are simple web platforms that facilitate the encounter between carriers and senders and, at the best of our knowledge, none of them use advanced gamification approaches to motivate and involve their users.

Undeniably, the less people take part in the system, the lower the quality of service (QoS) that such a platform can provide. Another key specificity of the network is its dynamicity. The ever-changing state of the system leads to continuously evolving needs which will require large amounts of data to train the models able to predict the system's future states.

Our goal is to use gamification as data-based leverage, guiding the users towards actions fulfilling the current needs. To do so, gamification has to act symmetrically with the platform, resulting in dynamically generated "game events" that depend on the current system state.

PROJECT OUTCOMES & RESULTS

We implemented a dynamic flow simulation to test the limits and key points of the parcel transport system. The modelling aims to highlight the different parameters that influence the performance of the overall transport solution. This information is used to feed the gamification system.

The dynamic simulation model reproduces the behavior of the various interacting entities (senders, carriers, collectors and receivers). By recreating a routing grid passing through intermediate points representing the stages of the journey, the model reproduces the network behavior (see image above). This allowed highlighting the importance of different parameters to guarantee the whole system performance, such as the need for many users to couple carriers' schedules with the opening collectors' hours and the importance of carrier's capacity in terms of volume and/or payload.



These aspects should be considered for the UI design. Thus, the gamification is designed around three objectives:

- › Firstly, ensuring the system's equilibrium through daily objectives generated as a function of the system state;
- › Secondly, increasing end-user's fidelity through long-term objectives;
- › Finally, developing QoS hand in hand with the community through:
 - + Ranking (experience system based on a logarithmic levelling formula);
 - + Badges (such as "Eco-friendly", "On Time", etc.);
 - + Titles (awarded to highly specialized users, e.g., able to reliably transport precious objects, perishable goods, etc.).

CONCLUSION

BombusCar is a work in progress that aims at creating an intelligent, flexible and secure distribution network for the transport of parcels based on carpooling. In this paper, we presented (i) the design of the gamified interface for a mobile application that encourages users to answer the needs of the platform and (ii) the conception of a dynamic simulation model to predict these needs. The simulator will be used to analyze different scenarios and, thus, adapt the rewards strategy.

PERSPECTIVES & NEEDS

This project fits into two visions. In the short-term, the system can be integrated into the current transportation network made up of private vehicles (cars, bicycles, etc.) and logistics operators. In a longer-term vision, it will be able to follow technological development and integrate into a network made up of autonomous cars and other innovative transport systems (Hyperloop, Magway, etc.). This while keeping the same requirements in terms of performance, environmental impact and safety.

ACKNOWLEDGEMENTS

This work was supported by the HES-SO "P2" funding system, grant entitled "BombusCar" (2019-2020). The authors would also like to thank the QoQa company for the insight provided and their partnership in the future practical application in the field.

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