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Hackathons for innovation: case Living Lab Bus and passenger game Bussig in Junction 2017

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Abstract: This paper presents a case study of using an open innovation platform and hackathons to advance service innovation. IoT-enabled buses were used as the context for a mobility track challenge at the Junction 2017 hackathon held in Espoo, Finland. We describe the challenge and the context, offered assets and support and the judging criteria. Moreover, we present the challenge winner as an example of a shared game for passengers. It shows how hackathons can provide fresh ideas to improve public transport passenger experience and, thus, potentially contribute towards a mode shift. The paper provides lessons learned on aspects to consider when setting up hackathon challenges, including different roles of technical support, mentors and judges as well as setting criteria and objectives.

Keywords: public transport, hackathon, infotainment

1. Introduction

Hackathons are sprint-like events of typically one or two days (e.g. over a weekend) where computer programmers and people of other types of expertise (e.g. service and concept design) form teams that try to come up with innovative solutions for given challenges [1]. They provide a way for companies to find fresh ideas and new talents to solve different challenges. For participants, hackathons provide an opportunity to network and apply their skills.

This paper presents a practical case study of how open innovation platforms and hackathons can foster innovation in a public transport context. Namely, we present the experiences of using a fleet of test platform buses running in normal operation (the Living Lab Bus platform) as the context for a challenge posed in the mobility track of the Junction hackathon (24.-26. Nov 2017, Espoo, Finland). The paper provides a concrete example and lessons learned on setting up hackathon challenges as well as an example of an innovative entertainment service aimed at making public transport more attractive through engaging passenger services. We describe the challenge and the context, offered assets and support and the judging criteria as well as the winner.

The goal of the Living Lab bus project (LLB, <http://livinglabbus.fi/>), which was used as the context for the hackathon challenge in question, is to facilitate development of services in cooperation with companies, research organizations, public authorities and passengers. The research activities aim to identify challenges and possible solutions for establishing open development environments (i.e., living labs). Moreover, the project aims to provide guidelines for implementation of service platforms and test environments based on the research and testing with real public transportation services. The project and its development environment aim to fulfill needs and requirements of various stakeholders (i.e., companies, passengers, service developers and public authorities) in three focus areas: 1) seamless multimodal travel chains, 2) travel experience, and 3) technological solutions.

2. Setting up a hackathon challenge to encourage innovation: case Living Lab Bus

This section describes context and challenge used as one mobility topic in the 2017 Junction hackathon. First, we provide a brief overview of the Living Lab Bus innovation environment and the Junction hackathon. Then, we describe the presented challenge and its objective and judging criteria.

Living Lab Bus innovation platform

Living Lab Bus (Figure 1) is an ongoing R&D project (until 7/2019) in which a fleet of innovative electric buses running in normal public transport operations in the Helsinki Region is used as an open test platform for developing, testing and demonstrating new solutions in a real context and with real users [2]. The project serves as an open platform welcoming interested service developers (e.g. using data from vehicle CAN bus or sensors), service providers (e.g. presenting passenger services and collecting user feedback) and technology providers (e.g. installing and testing new sensors).

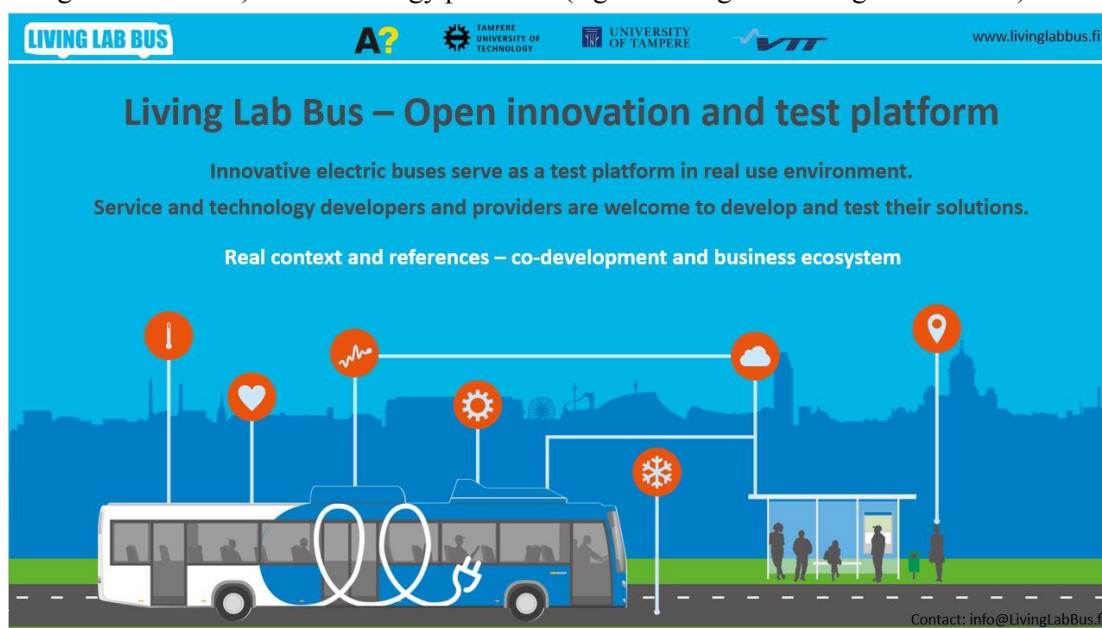


Figure 1 - Living Lab Bus research project and open platform (www.LivingLabBus.fi).

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The project is a collaboration between and co-funded by VTT Technical Research Centre of Finland Ltd (coordinator), Aalto University, Tampere University of Technology and University of Tampere, City of Helsinki, Helsinki Regional Transport Authority, City of Tampere, Ajeco Ltd., EEE Innovations Ltd., Foreca Ltd., PayiQ Inc., Linkker Ltd. and the Finnish Funding Agency for Innovation Tekes.

Junction hackathon, 24.-26. Nov 2017, Espoo, Finland

Junction (www.hackjunction.com) is a student-run hackathon organized the weekend before the Slush event. In 2017, it attracted nearly 1500 participants from more than 100 countries, competing in a number of tracks for different sectors (such as entertainment, legal tech, space, artificial intelligence, intelligent buildings, fintech, mobility etc.), each consisting of multiple challenges set by companies, public stakeholders and research organizations.

Aalto University was partnering with Junction 2017. After internal competition, Aalto University selected the 'Brilliant Bus Display' as their challenge for the mobility track using the Living Lab Bus as the context and assets (further described in the next section). The challenges in the mobility track are summarized in Table 1.

Table 1 - Junction 2017 mobility track challenges [4]

Title and organizer	Brief description	Criteria
“Intelligent air travel” Finnair	Provide intelligent and personalized travel recommendations or revolutionize the use of operational flight data in airlines.	Creativity, feasibility, clever use of data and the intelligence of the algorithm.
“Future of mobility in cities” Waltti, Föli, Nysse	Making the mobility services at the same time more fun, accessible and integrated with 21st-century lifestyle.	Fresh ideas achieving high quality and new type of customer experience.
“Brilliant bus display” Aalto University	Create useful and/or interactive entertaining content for bus displays based on real-time information provided by the bus system.	Utilization of real-time data, innovativeness and impact.
“Making transportation easy” Kyyti	New services using the Kyyti API.	Working software demonstrating the use of Kyyti services, Mobility service concept for a new customer use case.
“Revolutionizing the rural transport” FTA, MINTC, Trafi	Solve the global demand for intelligent mobility solutions for rural areas that are becoming less and less populated.	Successful testing and use of the comparison interfaces to be offered, observations about compatibility, and the type of services that could be built through the existing interfaces (NAP and OTE).

The Living Lab Bus challenge: Brilliant Bus Display

One of the **main intentions behind the challenge** was to foster innovation of new kinds of solutions that could improve the appeal and attractiveness of public transport e.g. by making it easier to use, more comfortable or providing new infotainment solutions. One of the ways of improving passenger experience during travel is to make the time spent in a bus more productive or pleasant - that is, reducing the perceived travel time [4].

The challenge motivation was described and defined with the following paragraph:

“Public transportation is a growing and transforming multi-billion euro business, influenced and disrupted currently by forces like digitalization, urbanization and environmentalism. In order to stay competitive and evolve, public transportation has to improve its ability to meet the varying needs and aspirations of the passengers. In Brilliant Bus Display -challenge we are looking for innovative public screen services/applications that will improve the travel experience of the bus passengers. We offer a unique set of bus-related data to be utilized in the created services, and a possibility to showcase your work among leading industry stakeholders in ITS World Congress in Copenhagen in September 2018.”

As the resources and context for the challenge, the Living Lab Bus project offered access to extensive real-time data from a fleet of buses operated by the Helsinki Region Transport (HSL) in Helsinki and Espoo. The data had three main sources:

1. Onboard positioning and 3D sensors (uBlox NEO-M8L)
2. TinyNode sensor hubs placed in 3 points in the bus (temperature, humidity, air pressure, battery level), and
3. Vehicle CAN bus data

The data was available via LLB REST API and was updated once per second (1 Hz). For displaying services, the buses have a 21.5”, non-interactive Full HD display located at the front of the bus, behind the driver. Services are displayed through a browser, from a specified URL and with desired intervals. For the development, we recommended HTML5 and related technologies.

The LLB REST API was accessible through a portal which required registration but was free of charge. The contestants were allowed to use also other publicly available APIs and content in their work. The portal link was provided to all interested people on Friday. In addition to API access, the developer portal included recommended design guidelines and facilitated mobile device application development and testing in a bus context. The portal has been accessible for developers also after the hackathon.

The main **evaluation criteria** were:

1. Utilization of the LLB REST API data
2. Innovativeness, and
3. Potential positive impacts on the travel experience of the passengers.

As **the prize**, the winning team received a 2000 € travel scholarship to the ITS World Congress 2018, where the LLB offers the team a possibility to demonstrate and present their service to an international audience. The jury withheld the right to present also other prizes, and to award only teams that provided complete services meeting the evaluation criteria.

The challenge was promoted with flyers presented in Figure 2.

The flyer is titled "BRILLIANT BUS DISPLAY" and is for the "LIVING LAB BUS" challenge. It features a blue background with a white bus and a bus stop illustration at the bottom. The text is centered and includes a list of six steps for participation. Below the steps are two columns: "CRITERIA" and "PRIZES". The criteria list includes API data utilization, innovativeness, and passenger impact. The prizes section mentions a 2000 € scholarship and a chance to present at the ITS World Congress. A disclaimer at the bottom states that the jury reserves the right to award other prizes to teams meeting the criteria. The footer contains logos for various partners including Aalto University, TTY, Tampereen Yliopisto, VTT, AJECO, FORECA, PayiQ, Linkkar, Tekes, and ...you?.

LIVING LAB BUS

BRILLIANT BUS DISPLAY

We are looking for innovative public screen services and applications that will improve the travel experience of the bus passengers (and preferably use our data)

How to participate:

- 1 Go to <https://llb.sis.uta.fi/portal>
- 2 Sign up
- 3 Check the API Documentation and other resources of your choice
- 4 Get your LLB REST API Key
- 5 Develop a brilliant public bus display web app – with our data and/or other public data. The app can be informative, entertaining, inspiring or something else
- 6 Provide us the URL of your app or service

CRITERIA

The main evaluation criteria are:

- Utilization of the LLB REST API data
- Innovativeness and feasibility
- Potential positive impacts on the travel experience of the passengers

PRIZES

The winning team will receive a 2000 € travel scholarship to ITS World Congress in Copenhagen in September 2018, where the LLB offers the team a possibility to demonstrate their service to an international audience.

The jury withholds the right to present also other prizes, and to award only teams who have provided complete services that meet the evaluation criteria.

Partners: Aalto-yhteiskunta, TTY, TAMPEREEN YLIOPISTO, VTT, AJECO, FORECA, PayiQ, Linkkar, Tekes, ...you?

Figure 2 - Flyer for the Living Lab Bus challenge "Brilliant Bus Display".

3. The Winning Team Bussig - a gamification service reducing boredom during public transport trips – “Make public transport fun again”

Public transport is a great thing. It gives us affordable opportunities, both in terms of cost and time, to go from point A to point B. This can be done with the help of different vehicles and approaches such as trains, trams, buses, ferries and airplanes to some extent. However, public transport is most used in large cities where buses and trams are dominant and with many inhabitants that need to go from their point A to their chosen point B. How come, then, so many people still choose to not go by the public transport? Is it the lack of complete freedom regarding destinations and time of departures and arrivals? Is it the fear of some connections not reaching in time? Or could it be that it simply is not fun and entertaining enough to ride the public bus?

Bussig is a project about making public transport fun again by offering interactive entertainment while riding the public bus. Other transportation means like ferries and airplanes often have entertainment systems onboard, let it be slot machines or movies, as these transportation routes are often long and strenuous. To have an entertainment system like these onboard a city bus would simply neither work out nor make sense as the average travel time is very short in comparison. Watching 10 minutes of a two-hour movie would not attract too many new customers. We thought about an interactive entertainment system that is both simple and time-effective enough to be used and enjoyed while riding the bus. Even if just for a stop or two this would make a difference. That is when the idea of offering mini-games to play against others on the bus was born.

Bussig offers a way for passengers to entertain themselves as well as others riding the same bus. The service consists of two parts: a mobile application with multiple mini-games and a leaderboard displayed on the bus.

One of our stated goals was to make passengers interact more with each other. We have made a few decisions to make sure that users feel like they interact with others on the same bus. Every bus has its own leaderboard, and whenever a user plays a game they will be matched to the nearest bus. This makes sure that the leaderboards on each bus feel more interesting, since the person with more points than you might be sitting next to you.

We also implemented a time-based system where every user will play the same mini-game at the same time. A central server sends out the next game a couple of seconds in advance in order to account for network delays, and also sends the game's start time. All clients will then start the game at the same time, providing for more possible interaction in the time between games. This also helps groups of people to compare their scores locally without the leaderboard.

One difficulty with implementing the described system is that we heavily rely on that the client clocks

are reliable. Real world testing, however, has shown us that this is not the case in the slightest and many clocks could be several minutes off. We have seen some examples on syncing clocks based on ping times to a time server and this approach could help to ensure that users are synced up.

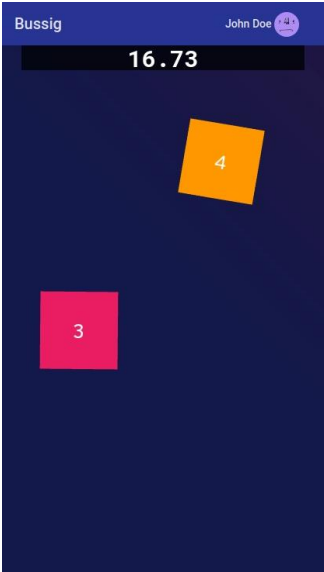


Figure 3 - One of the mini-games where the player should tap each appearing square as fast as possible to collect points. For each successful tap, a new square will appear until the time is over.

The mini-games and user client are optimised for use with smartphones as this would be the most commonly used device with a running web browser in this context. The client is built as a Progressive Web Application and will load in mere seconds on modern devices. Progressive Web Applications are an improvement over native applications for our use case since the onboarding experience is very important. If a potential user sees the display in the bus we want them to be able to join the session and start playing the games as soon as possible. Downloading an app, installing it and finally starting it simply introduces too much friction which might discourage potential users from using the service.

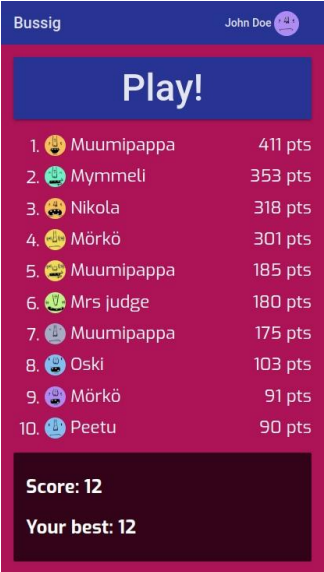


Figure 4 - The view where a user will wait until a new game starts, is able to start and play it and sees the leaderboard of all players scores as well as their own score for the last game.

The leaderboard displayed on the bus is also built with web technologies, since that is the easiest thing to deploy to the bus, only requiring a browser and an URL in order to get running, which was also requested as part of the challenge criteria. It makes updates very easy so that new features and bug fixes can be rolled out continuously. The display also features a QR code and a URL to the web application for an easy and effective way to join the session and games.

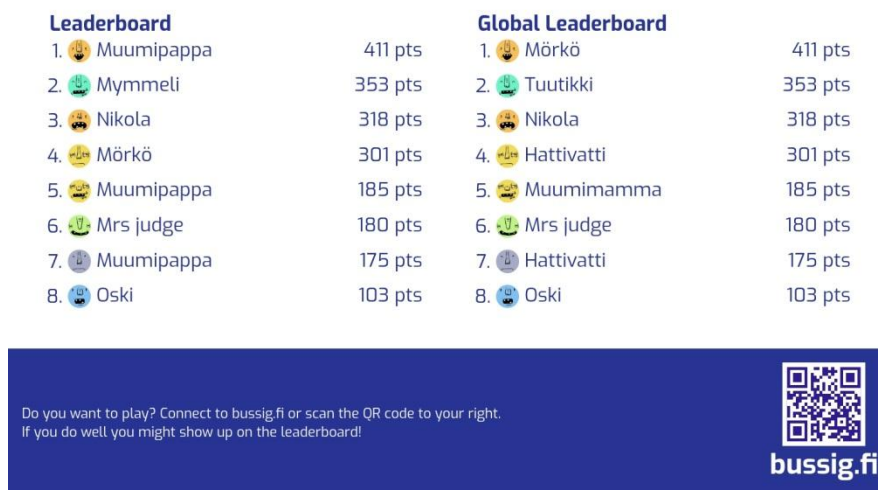


Figure 5 - The leaderboard display onboard the bus with a QR code and URL.

Every bus leaderboard is also currently responsible to keep track of the next and current games for all users on that bus, but we would like to move that responsibility to a central server in the future. This central server would also be responsible for the geo-coordinate calculation for matching users to buses to make sure they are playing with and against people on the same bus.

We use the information from each bus in order to find out which bus a user is currently on. We do this by matching geolocation from GPS coordinates over time. Simply put, if a user is near a moving bus moving the same direction, they are very likely to be on that bus.

Knowing which bus each user is on opens up for some interesting possibilities. For example, we could show the next stop or if there are any delays right in the users' phone. This also gives us an interactive medium which is a very stark difference from the usual static information displayed in buses.

By offering a service consisting of mini-games to play against other commuters onboard the same bus, with the bus itself being a part of the experience, we believe that we could make travel by bus, and therefore public transport as well, fun again.

4. Lessons learned and recommendations for hackathons

From a practical standpoint, doing a hackathon requires first of all the context (e.g. data and APIs for the participants to utilize) and the support and guidance for them. It is important to provide not only technical expertise but also mentoring on the context and the topic at hand in order to guide the participants in the right way. Technical support can be done both in person as well as through online services (e.g. chat or video conferencing) whereas mentoring can be much more effective when done face-to-face as it allows for more natural and conversational way of discussing the ideas (compared to asking specific questions).

In our case, one of the challenges was related to live context and content. Although the public transport operator was contacted the previous day to confirm the operating hours of the buses, the risk of using real systems and data in a live event did come true as the operations had a gap with the buses staying in place (i.e. not providing live data for the participants to use). This highlights the value of backup systems, e.g. by supplementing live data with test data that developers can use for testing. In addition to providing assurance of availability, sample data (e.g. recorded data feeds) can also make it easier to test and simulate changes in services.

In addition to technical and mentoring support, the judges need to be appointed. For them, it is important to define clear enough criteria to base the rulings on. For example, whether to require certain tools or resources to be used or how much emphasis to put on e.g. practicality, maturity of the solution, feasible business idea or pure innovativeness. The criteria needs to be clear for both the judges themselves and the participants, and the mentors should be wary of this when instructing and guiding the participants.

From the participants' side, understanding the goal and purpose behind the challenge is important. For this, active discussion with the mentors is crucial in order to understand what is considered relevant and what is not worth spending time on. One of the main challenges for mentors is to balance themselves between 1) providing a too open challenge and being vague about what is expected, and 2) guiding people too much towards a specific idea. Especially if the objective is to find new ideas, providing too detailed examples or what might be appropriate may limit the thought process of the participants - whereas too vague descriptions may result in seemingly out-of-scope solutions.

It is recommended that, if possible, those presenting and organizing challenges in the same hackathon track would see if they can coordinate and collaborate with one another. This includes on the one hand avoiding too direct competition or overlap between challenges but also on the other hand combining offered resources and tools to further encourage addressing the challenge(s) and finding innovative combinations. In our case, the mobility track turned out to have another challenge looking for fresh ideas to make the public transport customer experience better and more fun. As the Junction format

allowed the participating teams to submit their solutions to multiple challenges, many took advantage of it and tried even if the solution was not well aligned. While participation in many challenges was a positive thing, the criteria and focus of the challenges could have been better designed together to accommodate it, resulting in more focused (or more extensively beneficial) solutions.

The key aspects to consider when setting up a hackathon challenge are summarized in Table 2.

Table 2 - Key aspects to consider when setting up a hackathon challenge

<i>Aspect</i>	Description
<i>Support</i>	Technical and mentoring (face-to-face as well as online)
<i>Resources</i>	In addition to live content, test data for simulation where applicable
<i>Criteria</i>	Criteria should be clear for judges, participants and mentors
<i>Dialogue</i>	Active mentor-team discussions help guide the work and avoid “the ordinary”
<i>Challenge coordination</i>	Collaboration between challenges; avoid overlap, attract participants and result in greater results (either better focus or broader benefits)

5. Discussion and conclusions

The Junction 2017 provided valuable new service concepts and ideas. Participation to the hackathon increased awareness of the Living Lab Bus platform and attracted talented students and developers to utilize it. As a result from this case, the LLB project obtained several useful lessons for future utilization of hackathons in innovation activities. This paper presented a shared passenger game application for improving public transport appeal that was developed in a hackathon. It serves as an example of a solution that can make the bus journey feel less tiresome, and thereby improving its attractiveness, and potentially serving as a slight nudge towards behavioural choices and a modal shift towards public transport. In addition, the paper presented lessons learned for aspects to consider when setting up hackathons in order to maximise the benefits.

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