Improving Public Transit Applications by Utilizing Location Data

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***Abstract*—The variety of public transit providers in Germany provide a variety of applications that provide information and services. However, many of those applications are targeted at occasional, long distance travelers, rather than commuters and other passengers that often travel similar routes. This paper proposes the implementation of a set of location-based features, which are target at users that travel the same routes frequently.**

I. Introduction

One of the major challenges for the upcoming years is bringing more people from individual transit options to public ones. A big factor in wether people are willing to use public transit options is the convenience of usage. Therefore accurate and reliable information systems are required to keep passengers updated on delays, changes and arrival times. The variety of mobile applications (see examples [1, 2]) available from different public transit offer many different features, but often target users on occasional, long distance trips, rather than commuters [1]. The research proposed in this paper aims to implement and evaluate a set of features that are more targeted at those, by using the current location of the user.

II. Nearby Departures Detection

Existing public transit applications have the ability to provide the user with real time departure information of the station they are at. This information is either shown for upcoming departures in trips, that have been planned using the application, or for specific station, which requires manually selecting the required station. In the earlier case, only the departure of the planned train is shown, in the later case, all upcoming departures of the station are shown.
In contrast to occasional, long trip travelers, commuters and other users of long-time tickets often have a confident knowledge about the options they need to take and therefore will not enter the trip in the application. Nevertheless they may be interested in the departure times when waiting at a platform, especially when delays and disruptions are expected. Often this information is available from information systems on site, but these might be broken, do not provide real time information or are not present at all. The proposed solution is to automatically show departures of nearby platforms, when the user is using the application, based on the current location of the user. This eliminates the need to manually enter the station or platform and reduces the amount of information shown to the relevant ones.

[1]For the sake of readability, all passengers frequently using similar routes will be referred to as "commuters".

III. Onboard Train Detection

Similar to providing departure information stations and trips, existing public transit applications have the ability to provide the user with real time information about the train that they are on, the central aspect being the upcoming stops with the according estimated arrival time. The information which train the user is on is inferred from a previous planning of the trip within the app or from a trip-specific ticket that was added to the app.
Just like with departure information, this information is not as easily accessible to commuters, who usually do not plan the trip in the application or use trip specific tickets. Instead, they will need to manually enter the departure point from which they already left and set a planned departure time in the past. Alternatively an upcoming station needs to be entered from memory. This is especially cumbersome if it needs the be repeated on a daily basis. The proposed solution is to automatically detect the train the user is traveling on by combining the current location and direction of travel with the scheduled timetable, as well as current delay data. This way, the user can be presented with information about the train they are currently on, without requiring additionally inputting information.

IV. Learning User Behavior

Most commuters will take the same routes on regular basis. Additionally, even when non commuting users will often get on or off at similar stations, regardless of the day and time. By learning those important trips and stops, the previously described features may be enhanced and extended. When it is detected, that the user has boarded a train, the exit station may be inferred or at least suggested from the last trip. This also applies to follow up trains and the final destination of the trip. Learning a regular trip of the user allows to inform the

user about upcoming blockings and impairments on the trip as well. This information can be provided in advance, so that the user can plan an alternative route or choose a different mode of transportation.

V. Implementation

In an ongoing group project, a software system called "Oeffis" was created, which consists of a NestJS and PostgreSQL backend and a frontend build from Ionic and React [3]. The application is primarily targeting users of the newly introduced "Deutschland-Ticket" [4] and at the moment focused on the region serviced by the *VRR* (Verkehrsverbund Rhein Ruhr). Even though the features described in this paper would conceptually fit into the app, they will be implemented separately as a headless module to avoid conflicts in planning and development. The features may be included into the "Oeffis" application at a later point of time.

VI. Milestones

To allow for a better planning and control of progress, the following milestones have been set.

A. 20th October 2023

A specification has been created that describes the features to be implemented, fitting acceptance criteria and general constraints to be respected. Based on this specification the implemented features can be evaluated later.

B. 27th October 2023

Research on existing approaches of implementing the proposed features and architectures respecting the introduced constraints has been completed. The research results are documented and evaluated.

C. 24th November 2023

Implementation of platform aware, real time departure information has been completed. The feature is tested and available using an externally exposed API.

D. 15th December 2023

Implementation of real time information about the train the user is currently on has been completed. The feature is tested and available using an externally exposed API.

E. 19th January 2024

Implementation of user behavior learning has been completed. The feature is tested and available using an externally exposed API.

F. 23rd February 2024

The final report, including the evaluation of the implemented features based on the specification, has been completed and submitted. An inclusion of the features into the Oeffis app has been evaluated and documented accordingly. References have been re-checked and updated if necessary, extend of usage of assistive AI has been documented.

References

[1] Deutsche Bahn AG. "Der DB Navigator." (2023), [Online]. Available: https://www.bahn.de/service/mobile/db-navigator (visited on 09/27/2023).

[2] Verkehrsverbund Rhein-Ruhr AöR. "VRR App." (2023), [Online]. Available: https://www.vrr.de/de/fahrplan-mobilitaet/vrr-app/ (visited on 09/27/2023).

[3] Oeffis Team. "Oeffis Project on GitHub." (2023), [Online]. Available: https://github.com/Oeffis/Oeffis (visited on 09/27/2023).

[4] Transdev Vertrieb GmbH. "Deutschland-Ticket." (2023), [Online]. Available: https://deutschlandticket.de (visited on 09/27/2023).