Abstract Bachelor-Thesis

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Topic: Application of Floating Phone Data in Intermodal Transport

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In the present bachelor-thesis intermodal applications of Floating Phone Data (FPD) will be gathered, analysed and evaluated.

To introduce the topic and to show and outline FPD from other possibilities of capturing the traffic situation and determining positioning data a diagram was created. This shows that now for the first time it is possible to determine routes of an array of road users.

For determining these routes FPD uses the permanent communication between mobile telephones and their base station. At first a distinction is drawn between a mobile phone that is in stand-by mode and a model with an outgoing call. The mobile network consists of multiple radio cells which are summarized to 'location areas'. If the phone is on stand-by mode the changeover to another location area can be determined while moving. If the user receives or is making a phone call, even the change to a new radio cell can be registered, which is called handover. The determining of the position can be captured more precisely by measuring the Timing-Advance-Value, comparing it with signal-strength-maps and using different algorithms and filters. Today an accuracy up to 100 m is already possible.

With the help of FPD it is possible to determine traffic data in a longitudinal section not only on motorways but also on state and federal roads without using any new technology. Because 60% of vehicle users are equipped with mobile phones, data can be collected in great quantities. One of the disadvantages of FPD is the current accuracy of the positioning data which is much less precise than GPS positioning. Especially in narrow road networks or times of low traffic the system exhibits its weakness. While collecting and evaluating the positioning data, it also has to be ensured that the limits of data protection are observed.

Also by means of anonymised data identification of customers is possible by recognizing constant movement patterns. Therefore a careful data handling is highly important. Gathering individual data is only permitted with the agreement of the customer. For determining the customers position a written permission is required which can be cancelled at any time. The acquired data has to be transported safe and used only for the committed purpose.

In 2003 the "Bundesministerium für Wirtschaft und Technologie" (BMWi) started the government-subsidised project named "Verkehrsmanagement 2012". Participants using FPD were the research project "Datenoptimierung für integrierte Telematik" (Do-iT) of the university in Stuttgart and the projects TrafficOnline und Ring&Ride of the university in Braunschweig.

The project Do-iT deals with determining the position and routes of active traffic users of the motorised private transport. Using this data, route choices could be monitored, Origin-Destination Matrices generated and the traffic determined. A field test took place on the route from Stuttgart to Walldorf and

in the city network of Karlsruhe. The result was a standard deviation of 300 – 400 m of positioning and a 61% correct detection of short-distance public transport users, a compliance rate of 29% after trouble reports, a 97% correct daily forecast of traffic and a detection rate of traffic disruption of 25%.

In contrast to Do-iT TrafficOnline only determined the road situation regarding forming and dissolving of traffic jams as well as the accuracy of the gathered data. The result was a strong correlation of FPD and the reference data on high frequented roads with a high to medium average speed. The data showed a high variation especially during morning and night times as well as in the inner city area.

The E-Ticketing-System Ring&Ride deals with the pricing of routes covered in the short-distance public transport using FPD. Furthermore the customer satisfaction was analysed by accomplishing a field test. The prices were determined correct in 94% of short-distance and in 96% of long-distance traffic. In terms of satisfaction and acceptance the project received a good to very good rating. In spite of the discomfort concerning the positioning the customers had a big faith in the compliance of the data protection. 50% would use Ring&Ride again and 20% stated that they would use the public transport more often.

Further foreign projects using FPD for acquiring the road situation were ITIS Holdings, the system Mobile Traffic Services of the company Logica CMG and the French project Sinergit. They all showed a good consistence to the reference data on roads and at times of high traffic volume and a weakness in the inner city road network.

In the following, the opportunity using FPD for further applications was analysed. The key topic was using FPD positioning for monitoring the route choice in public transport. The target was to improve the quality of traffic information in public transport with the help of individual customer data. Also the headway, transfer time, interchange points and vehicle sizes should be adjusted using the gathered data. Further potential applications can access these data.

Connecting FPD with navigation devices combines the advantages of the motorised private and the short-distance public transport. Involving all means of transport, it should be possible to find the fastest route observing every traffic disruption and providing it for the customer. Another opportunity is finding customers with identical routes for supporting car sharing.

Another possible application is to supply customer-friendly data by using applications for mobile phones. For automatic provision of user-defined alternative routes in case of disruption, individual customer data shall be gathered and saved. As before customers with identical routes can be brought together and cheaper group tickets can be used. To use this application a smartphone is required.

Nowadays the prevalence rate of smartphones is about 35%. That is why customers who do not own this kind of phone should be considered. The idea was to install information points at high frequented interchange points of public transport. The aim was to gather and save the routes of the customer by using personal accounts. In case of any disruptions in the public traffic alternative connections can be provided.

All these potential applications should increase the attractiveness of the public transport by improving its quality and lead to higher usage.

To figure out the advantages and disadvantages and to show further need for research the projects and applications were evaluated. For this purpose the method of a value benefit analysis was chosen. After establishing a goal system the aims and criteria were weighted. Afterwards the systems were rated from "very good" (++) to "very bad"(- -). The overall objectives of the goal system were "effectiveness/quality", "profitability", "environmental compatibility/sustainability", "acceptance" and "safety". The basis of this evaluation was the dissertation "Analyse und Evaluation von Nahverkehrsplänen und die Aufstellung von Kriterien zur Bewertung von Standards im ÖPNV " about

evaluating standards in the public transport from the university in Kassel from 2005 and the DIN EN 13816.

The result was that FPD is suitable for collecting a broad and large amount of data. But because of the wide scatterings and the inaccuracy depending on traffic volume and road network it is impossible to use FPD as the only data source. The fusion with other traffic data is still necessary for guaranteeing the reliability of the provided information. Furthermore using individual, personal data can decline the data protection and the trust of the customer.

That is why it has to be considered if it would prove beneficial to use the advantages of collecting a broad data basis and determining individual routes solely in exceptional cases. Furthermore a need for research consists in increasing the accuracy of the data. Therefore it should be evaluated to what extent the quality of the data can be improved by using further algorithms and filters. Better positioning results using mobile phones can also be expected because of the launching of the UMTS network. Caused by the increasing dissemination of smartphones with attached GPS and WLAN it should be reviewed to what extent the accuracy of the positioning data could be improved by using this technique considering technical feasibility.

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