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Integral management of public transport

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Abstract

The presented system for integral management of regional public transport is based on a Geoinformation System (GIS) and includes tools for data management and display. The tools operate on a dataset that contains all the data necessary for management of public transport on rail and road. The data structure is entity-based and is methodically defined and published as a reference. All the user editable data is managed on GIS base layers (maps, orthophotographs) and publicly available GIS overlays (road, rail and waterway network, and auxiliary layers such as topography and buildings). The specific public transport data includes geographical data about station points, obtained from field measurements, user defined data about public transport itinerary segments between station points, and user editable data about public transport itineraries. Once the set of itineraries is defined, the system provides its users to create individual journeys on these. The journeys are the base for collecting the economic data, usable for the transport operators in preparing tender applications and for the managing authorities in preparing concession calls. The system incorporates all the support tools, which include a station point cataloguing form, a map editor with line section and station point management tools, itinerary creation tools with connection search abilities, and interface to GPS receivers for field work. Due to its modular structure, the system is expandable with additional data and functionality according to user needs. One such possible expansion is an interface for data collection from in-vehicle terminals. Currently, the system is targeted to regional public transport in Slovenia, but can be adapted to other regions.

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1. Introduction

An efficient system for management of public passenger transport (PPT) requires that the management authority can at any time access and analyse the data required to make decisions. This can only be accomplished if all the required data is stored centrally in electronic form. To provide efficient decision making it is also essential that the data, which is bound to geographical location, can be visualised and edited on a map.

As of writing this paper the integration of PPT in Slovenia is in process, reaching the final stages. The proposed PPT model is intermodal and includes rail and bus transport at the national level, urban transport in some regions, and auxiliary transport means such as cableways and transport to local points of interest. In the recent past there has been a lively development of PPT management solutions in Slovenia (Tibaut et al., 2012, Gregorc et al. 2012) and abroad (a literature review by Ibarra-Rojas et al., 2015). Some of those solutions have proven useful and are in use by the authorities at the national or regional level, or by individual PPT operators. On the other hand, the PPT operators have developed their own systems for PPT management at the level of their companies or consortia. These systems usually include everything from fleet management tools and real time vehicle tracking to journey planning applications for end users, but are largely incompatible among themselves and limited to local or regional geographic areas.

The aim of the work presented in this paper was to develop a system that would complement all those solutions by utilising and unifying the existing data and by adding the functionalities that would ultimately enable the newly established PPT Management authority to prepare PPT concession tenders and analyse the economic effects with minimal required human intervention (Korinšek et al. 2011, Blaž et al., 2008).

The way that leads to such a system consists of several tasks that have to be completed before releasing the system to the users. The most essential of those tasks include the following steps:

- Review of historic data and practices,
- Acquisition of historic data and their conversion into suitable format for server storage,
- Review of the required data and formats,
- Acquisition of the required data from their providers and conversion into suitable formats,
- Creation of database and facilities for data storage,
- Development of a client application for data access and management,
- Testing, deployment and user training.

The development process is a recursive one and is described in the following sections of this paper. The end result is a system that is used on the national public transport management level and complements other tools used by the Transport Directorate and by PPT operators (Tibaut et al., 2012).

2. Methodology

2.1. Entity definitions

In order to be able to manage the routes of the PPT vehicles, the infrastructure used in the PPT management model must consist of the following entities:

- **Station points** are the physical locations on the public road network where vehicles operating in PPT stop in order to accept or discharge passengers.
- **Stations** represent the areas on the public road network that contain one or more station points. Examples of these are bus termini (with a single station point), pairs of bus stops with the same name across the street (two station points) or larger passenger terminals with several bus- and train station points.
- **Road sections** are segments of public road between landmarks (mostly intersections or administrative boundaries).

By using these entities the routes of the PPT vehicles can be constructed by defining and combining the following entities:

- **Itinerary segments** are unidirectional parts of the road sections, each between two station points.
- **Itineraries** are sequences of adjacent itinerary segments representing possible routes on which PPT vehicles operate.
- **PPT lines** are similar variations of itineraries with different sets of intermediate station points.

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