Application of Intelligent Transport System (ITS) in Passenger Boarding and Alighting Surveys

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Abstract

Bus passenger transportation essentially requires continuous planning, evaluation and upgrading to maintain its level of service. Necessary traffic data including passenger counts, bus stop locations and corresponding demand, speed, relevant functional and infrastructure information have to collect regularly by the authorities to conduct such studies. Though there exist various conventional approaches for data collection, most of them are regarded as less effective in the present context. Global Positioning System (GPS) based applications in intelligent transport systems have proven to be efficient and cost-effective in identifying and tracking the geolocation of connected elements. Hence, with the intention of narrowing the technological gap, a holistic system that embodies both hardware components and software applications were developed for real-time data acquisition with remote access.

This multidisciplinary engineering solution collects data mainly from two sources. Firstly, a mobile application was developed to facilitate the collection of trip-specific data. For every journey, at the departure, the surveyor can create a new trip in the app and input the origin, destination, date, surveyor's position (front door, back door or middle door) and characteristics of the vehicle. Then a recurring sequence of features appears on the screen to record the GPS locations of bus stops, boarding and alighting counts at every bus stop, passenger demographics and the characteristics of each bus stop. All the data are transmitted to a server in real-time for storage and remote retrieval purposes. The surveyors are provided with unique login identities to improve the credibility of the survey. Every journey is labelled with a system-generated identifier which can be changed if necessary, to facilitate conducting surveys by placing two surveyors at the front and back doors of the same bus. On such occasions, retrieval of data can be carried out corresponding to the journey ID.

Secondly, a handheld portable electronic device which is capable of locating its position at regular intervals was developed with single-board computers (e.g.: Raspberry Pi), GPS receivers, data communication module and rechargeable power sources. An interactive display similar to a mobile phone is available in this device. The surveyor can input the details about each journey before the departure. When the journey begins, the automatically recognized real-time GPS coordinates and travelling speed are displayed to the user. A single-click feature to log waypoints with an accuracy of 2.5m was also provided. This serves as a facility to locate

bus stops, bottlenecks, intersections, or any other parameter as expected in the survey. These data are also sent to the same server and can be visualized through the front-end user interface. This approach can be directly utilized in assisting annual fare reviews incorporating both the cost component and income component eliminating past barriers. The data helps in developing driving cycles and thus fuel consumption and other cost parameters can be identified involved in bus services. The boarding and alighting surveys reflect the income components via the collected data. Thus, the calculation for fare review revisions become relevant and reliable with a good rationale and justifiable outcome helping three stakeholders (related authorities, passengers and bus owners/employees). This can be a fair play fare platform to all involved entities. The quality and level of service of public transit can be improved using this technological introduction including route requirements, increasing or decreasing supply as per the demand, improving and altering timetables (scheduling services) and restructuring bus stop locations and level of service of bus stops/terminals with available data based on demand and usage.

The results that can be tabulated in terms of data via the ITS incorporated approach can be utilized for analysis with effective outcomes. It is very important to attain the quality of data along with a considerable quantity. This approach helps in establishing healthy quality data over the conventional methodology in Passenger Boarding and Alighting Surveys. The outcomes from analysis of the available data can be utilized with a higher acceptance in inclusion for required transportation applications. The data security and storage phases provide high effectiveness in comparison to conventional technology redundant approaches. A digital platform can facilitate easy quick data retrieval without having to waste considerable time and effort. In a sustainable perspective, the inclusion of technology into the surveys and its process helps in the reduction of waste and usage of resources increasing environmentally prominent actions in terms of the survey process and outcomes. This technique is deemed the way forward of surveys in transportation engineering since it has a low margin for error unless it is a technical malfunction. With the use of highly reliable and state of the art technology, better levels of precision and accuracy can increase the validity of decision making in the industry. This approach which is initially implied to be applied in public bus transport services can be extended to other public transit forms such as railways with minor parametric changes and can be developed further into a passenger transport analytics platform.

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