### **Product information**

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## **MOBILE-APC**

Next Generation's Automatic Passenger Counting

Providing an attractive service while efficiently utilizing resources efficiently is key to an effective public transport provider. To balance the service offering with the actual demand is the number one reason to document ridership aside the needs of public funding or revenue distribution. But accurate passenger counts provide even more, especially if further operational data is considered for analyzing the fleet's performance. This results in a solid basis for any optimization processes or management decisions.



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# Most precise counts. Enhanced positioning. Sophisticated evaluation.

The growing societal need for mobility and flexibility creates new challenges for public transportation. For being able to compete with the convenience of individual transportation an attractive service is crucial. Adequate planning and scheduling requires the efficient collection of ridership data and raises many questions:

- How many passengers are boarding and/or alighting the vehicle at a particular station?
- Which routes are particularly crowded and what are the peak ridership times?
- How do I extend, eliminate or relocate my resources to fit the actual demand and save costs?
- How can I visualize my passenger streams?

To find the exact answers to these questions, transportation companies must count their passengers and carefully evaluate the data. This analyzing process can help identify inefficiencies and results in a number of benefits for passengers and transport providers alike:

- More robust time tables
- Better balance between service frequency and demand
- Optimized capacity planning of vehicles
- Provides the data basis for revenue distribution
- Fraud detection by comparison with data collected at check-in terminals
- Statistical data reporting for government subsidies
- Enhanced safety measures
- Guiding of passengers or service enhancements when information is transmitted in real-time.

The costs and efforts for manual passenger counting are extremely high, the sampling plans are often not representative, the results are inaccurate, and a meaningful evaluation is not supported.

#### **INIT** provides:

- Automatic and continuous recording of passenger boarding and alighting counts, both in offline operation as well as in real time
- Classification of height profiles to distinguish adults and children for precise revenue distribution
- No driver log-on or interaction is needed
- Automatic processing, balancing and analyzing of the recorded data
- Customized evaluation reports from various data sources
- Clear presentation of data for management

#### Counting

For solid counting, INIT uses the most accurate sensor currently available on the market - the IRMA 6 sensor. For IRMA 6, the proven time-of-flight technology has been further developed. Light pulses are sent out in quick succession using the invisible IR range. These pulses are reflected by objects and detected by the sensor. The distance to the object is then calculated by taking the period of time between transmission and reception of the light pulse. In this manner, the system generates a three dimensional image of the door space, so that individual persons may be detected even in tightly packed crowds. A new feature is the detection and evaluation of the size of people and objects, i.e. the sensor can distinguish between strollers, wheelchairs, bicycles etc. Unlike conventional sensors, the IRMA 6 sensor does not need the door contact signal anymore, which has often been a source of malfunction in the past. The sensor is maintenance free and can be subtly installed even in areas of limited access.

## Processing the Data and Enhancing Data Quality

The passenger counts which are detected by the sensors are transmitted via an Ethernet interface to the on-board computer. The on-board computer, e.g. COPILOTpc, combines the raw count data with accurate location information collected by the vehicle subsystems like odometer, door contact and GPS coordinates. With the help of this data and highly developed INIT algorithms, the counts are assigned to the stop positions either in the on-board computer software or later in the background system.

#### Multi-stage enhanced location information

The raw GPS data is collected by the GPS receiver integrated in the on-board computer, COPILOTpc. In order to produce accurate direction and distance measurements, the onboard computer utilizes a hardware interface with the odometer signal and the gyroscope (electronic compass). Assisted by a mathematical filter algorithm, the driving directions and distances are used to correct the raw GPS data. Using street vector mapping these signals are then matched with nominal route information such as trips, blocks, sequence of stop positions and network data distances.



Graphical displays present at a glance where buses and trains are most crowded.

This patented multi-stage enhanced GPS positioning is the key to why INIT's calculated location is more precise than any other. It is capable of determining the location information to a few feet. This presents a huge advantage as well for operations control and real-time passenger information and makes the INIT APC system more reliable than any other.

If no schedule data is available during data recording, the process of linking the data with the timetable takes place in the background system on the basis of the GPS coordinates and routes travelled.

#### Transfer of data

The passenger count data is transmitted from the on-board computer to the background system via the depot Wi-Fi or the mobile radio system. In both cases, no driver interaction is necessary. In addition, passenger count data can be transmitted in real time to MOBILEguide, the system for managing occupancy rates and guiding passengers. From there, occupancy rates are available via open interfaces for INIT systems and external data sytems.

#### Matching the data

In MOBILEstatistics, the passenger count data is assigned to schedule data. If the logical localization has already been performed by the on-board computer, it is checked for accuracy. Implausible locations and driver actions are discarded without loss of passenger data. Data gaps that are less conspicuous during operation are closed with the help of recorded GPS coordinates and their comparison with the schedule data.

The raw data is first assigned to the blocks and trips with the help of sophisticated pattern recognition algorithms. Then the vehicle stop events are allocated to the scheduled stop positions in the currently valid timetable. Passages at stops are detected using cyclically recorded vehicle positions (e.g. every 5 seconds).

#### **Statistical Evaluation**

MOBILEstatistics presents the passenger-related evaluations in a clear way using tables and diagrams, as well as geographical displays and dashboards. Management reports can be generated easily.

Which routes are the most used ones? Which stops are especially frequented? Where do service and demand not match? The realistic representation, along with the evaluation of long periods of time serve as a solid basis for profitability reviews, performance records or an optimized planning of schedules and assignment of vehicle resources. Thus, operational processes can be optimized.

As an browser-based application MOBILEstatistics can be run on any PC or mobile device. Of course, the data obtained can also be exported and processed further with standard software (e.g. MS Excel®, Crystal reports or as an HTML or PDF file).

#### Enhancements

#### **Passenger projection**

If only a part of the fleet is equipped with APC sensors, this module extrapolates the passenger counts of the entire fleet. This is an important piece of information that is needed e.g. to gain public funding.

#### Analysis of full operational data

Beyond passenger counts, MOBILEstatistics is a powerful tool that can evaluate all data collected in ITCS operations. Hence, the whole service trip, including schedule adherence, can be recorded and evaluated. The recorded, detailed information like driving times, planned and unplanned stop times, schedule adherence, etc. is used, among other analyses, for documentation and optimization of operations and scheduling. Key performance indicators visualized in dashboards – allow even ad hoc – insights into the actual performance of the fleet.



#### MOBILEguide: Information on occupancy rates

In recent years, passenger counts have proved to be useful in another way: informing passengers about the expected occupancy rate in buses and trains.

MOBILEguide enables an advanced prediction of occupancy rates based on historical and real-time data or even artificial intelligence and it is the only system that also takes into account the number of passengers alighting at each stop. This is why MOBILEguide exceeds the reliability of conventional systems. The information on occupancy levels is provided via passenger information channels such as apps or displays.

In addition, MOBILEguide helps to improve the distribution of passengers in rail systems. The occupancy level can be specified for each car and displayed via LEDs in different colours on the platform, for example. This allows passengers on the platform to board the less crowded car sections.

Being added to the passenger information, information on occupancy rates enables passengers to flexibly adjust their travel plans, to use a less busy train or bus connection and therefore benefit from increased convenience. At the same time, a more even distribution of passengers also ensures shorter boarding and alighting times, improved punctuality, and consequently greater efficiency.

## **MOBILE-APC** at a glance

#### On-board

#### The IRMA 6 sensor

- 76,800 pixel sensor with time-of-flight technology
- Low installation effort
- Highest accuracy
- Ethernet and Power over Ethernet (PoE) interfaces
- No door contact required
- Detection and evaluation of the size of people and objects (Object Analyzer)



#### Background

#### MOBILEstatistics

- Overall view of fleet management and vehicle data
- Tables, diagrams and dashboards including performance indicators
- Map display
- Export to MS Office, etc.
- Web based application
- Business Intelligence Data



If you would like to know more about MOBILE-APC, please contact us at sales@initse.com. We look forward to hearing from you.

More than 1,100 transport providers worldwide rely on our integrated solutions to support them with their daily tasks

- Planning & Dispatching
- *Ticketing & Fare Management*
- Operations Control & Real-Time Passenger Information
- Analyzing & Optimizing

Moreover, transport companies can also master all requirements of electromobility and set up a single sign-on mobility platform using our integrated solutions. A robust package of operational services completes the INIT offer.

INIT is the worldwide leading supplier of integrated planning, dispatching, telematics and ticketing systems for buses and trains. For more than 35 years, INIT has been assisting transport companies in making public transport more attractive. faster and more efficient.



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