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# Automated Fare Collection System

Automated Fare Collection System provides automatic fare collection on the lines, access control to stations, control and analysis of passenger flow as well as controls the tariff policies.

Bar-coded tickets, smart tokens, contactless payment cards of MIFARE<sup>®</sup> standard and bank cards are used as payment media in the system. Barcoded tickets and smart tokens are used as means of one-time fare payment. Contactless payment cards of MIFARE<sup>®</sup> standard and bank cards are used as means of repeated fare payment.

MIFARE® cards can also be used as season tickets of different purposes.



**Each subsystem consists of soft and hardware** and provides performing the functions of sub-system. Each subsystem consists of automatized working places, which allow controlling system operation and receiving required data. Center of the system is a processing center (central server node). Set of server equipment with correspondent software, which provides system's operation, is installed in the processing center.







### Advantages of the AFC system implementation:

- increase in fare collection revenue;
- analysis of the passengers flow records to manage the traffic route efficiency;
- possibility of flexible policy implementation (according to the distance, zone, etc.);
- implementation of different loyalty systems;
- preventing the fraud both from passengers as well as from transport company's staff;
- reducing the costs for collecting the fare;
- developing of the extended report system for on-line monitoring of the financial flows;
- increasing of public transport appeal for passengers;
- improving of environment due to the reducing of private transport usage.







## AFC system is intended to perform the following functions:

- to release contactless cards of different functional capabilities and purposes;
- to release of payment smart-tokens for one-time fare payment;
- to validate payment media according to the established rules;
- to collect statistic information about vending and payment media usage;
- to accept and transmit controlling signals to the station equipment;
- to control working efficiency of station and server equipment.



## Vehicle Operation Management System

Implementation of the system allows to systematize and regulate the procedure of releasing the vehicles to the route, keep precise records of every driver's work and every vehicles operation as well as to provide quick and effective communication between the drivers and traffic control operators.

The main element of the system is GPS traffic control display that is intended to inform the chief traffic control operator about the current situation in the whole control zone of the vehicle dispatching system.





### All the main elements of the system are displayed on the central display:

- schematic illustration of the vehicles that are on the routes;
- schematic illustration of the map with the stops;
- schematic illustration of the routes;
- symbolic representation of the **operation mode**.

### Advantages of the system implementation:

- improving the **quality of the service** by means of providing the traffic regularity; lowering the intensity of transport crowding; reducing the intervals on the routes during the rush hours; improving the safety of passenger transportation;
- increasing the information awareness of the population about the public transport operation;
- providing the effective centralized control and management of transportation in general;
- increasing the quality control of public transport services;
- providing the centralized **monitoring of route passing time and speed**.



# Intersection Control System



Intersection Control System provides automatic traffic lights control at the intersections to provide privileges in traffic for vehicles while crossing the intersections.

Intersection control system is a complicated multilevel system.



**The first level** consists of executive devices and traffic flow sensors: traffic lights, information panels, microwave radars, surveillance cameras with analytic functions support.

**The second level** is performed by road controllers. Controllers allow to control trafficlights and information panels, collect information about traffic volume and intersection crowding, analyze and process the received information and according to this data to unload the intersections, to connect with traffic control center via any available communication channel, to record the history of its actions with opportunity to get this information

while considering the disputable situations.

**The third level** of the system is intended for transmitting the data from road controllers to the traffic control center and if necessary, for receiving the control commands by devices of the first level.

**The fourth level** of the system is performed by the central server node, central traffic control center, automated working places that provide the information to other systems and allows to control the equipment of certain intersections and the whole system in general.

Implementation of the Intersection control system will allow to solve the following problems:

- improving the **traffic control**;
- lowing the level of motor vehicle emission from cars standing in traffic jams;
- reduction the travel time and total reduction of fuel consumption;
- vehicles priority control along the road over the other participants of the traffic;
- maximum assistance in keeping the vehicle timetable;
- prevention of traffic jams and reducing the time of traffic jam elimination at the complicated and crowded intersections;
- providing the **information for municipal services** about the highway crowding, providing the possibilities of changing the traffic situation for solving the emergency situations (providing the priority for special purpose vehicles, etc).



# CCTV

To control public transport traffic and to provide safety movement on the lines we offer to implement the following **subsystems of the Closed Circuit TV (CCTV) system**:

- automatic video-detection subsystem of moving vehicles;
- automatic video-detection subsystem of vehicles passing on red;
- sectional speed measuring subsystem.
- Automatic video-detection subsystem of moving vehicles provides the following functions:
- vehicle license plate recognition;
- searching for stolen vehicles;
- checking traffic of lanes reserved for busses and trams;
- electronic toll system supervision;
- modular solution enabling additional functions.
   Automatic video-detection subsystem of vehicles passing on red provides the following functions:
- video-detection of a traffic junction light state;
- license plate recognition;
- photographic documentation and traffic offence archiving;
- option of reconstructing the traffic accident from the video-recording;
- connection to traffic junction light not necessary.
   Sectional speed measuring subsystem provides the following functions:
- recognition of license plates;
- measuring of an arbitrarily long section;
- high reliability and accuracy;
- automatic data processing;
- easy processing of violations.



## **Passenger Information System**

PIS is an effective tool which provides passengers with necessary information connected with bus timetable, train arrival and departure time, current time and date, different help information.

### Main tasks solved by the proposed PIS are:

- visual informing of the passengers about the bus routes at the station;
- visual informing of the passengers about the time intervals of bus arrivals and departures at the stations;
- visual informing of the passengers about the bus timetable at the station;
- providing the information about the current date and time;
- providing the passengers with the help information of different kinds (for example, information about the fare, routes, etc.);
- displaying the information of emergency operations services (for example, displaying the information of the firefighting system);
- providing the related systems such as <u>Public Address System</u>, <u>SCADA</u>, ATS, <u>AFC</u> and emergency operation services with the PIS resources.









The advantages of PIS implementation are:

- **increasing of the passenger flow** by means of informing the passengers about the timetable and intervals of train movement in the on-line mode, in its turn, it allows to improve the efficiency of the passenger service;
- prompt response for the emergency situations in train movement (failures, accidents, etc.), automatic correction of the traffic timetable and informing the passengers about these changes;
- creation of the PIS joint **monitoring center**, that allows to control centrally the display information on the passenger information displays (PID Passenger Information Display) and perform its operation monitoring in on-line mode.



**Multi Services Network** 



MSN is a Multi-Service Redundant Gigabit Ethernet Network which is intended for providing **well-organized telecommunication infrastructure** that covers all strategic objects such as OCC, stations, depots, service-and-office buildings and any other places connected with public transport. MSN also provides reliable communication channels between the strategically important places and the rolling stock or mobile operating staff.

MSN provides reliable data transmission between all the nodes and systems.



The network topology for Multi-Service Redundant Gigabit Ethernet Network to link Main Sites nodes will be a «dual ring topology»:

- each of the nodes of the network will be connected to two other nodes in the network, with two connections to each of these nodes, and with the first and last node being connected to each other with two connections, forming a double ring;
- dual ring network topology allows to transmit all necessary data volumes in case of fiber optic line break or one of the system nodes failures. All
  the MSN equipment has the required level of backing-up not to lose the transmitted data.
  MSN monitoring and control is carried out from OCC, where automated working place of the network duty administrator is equipped.

## Advantages of MSN implementation are:

- reliable base for data transmission between the systems;
- single MSN operation monitoring center located in OCC;
- single logging center of the MSN events;
- providing other systems with MSN resources (Signaling, SCADA, Building Management System, etc.);
- connection of the **new network segments** to the MSN network on the new public transport lines without essential costs for creation of the network control center for each public transport line.