Fleet management system

Ver 1.0.

1. The main objectives of the system:
   1.1. provision of centralized vehicle real-time control and management:
      1.1.1. visual representation on geographically positioned map (within the scope of the open source);
      1.1.2. visual representation on horizontally expanded route line direction maps;
      1.1.3. visual representation in the current status data table;
      1.1.4. data storage in the central archive;
      1.1.5. integrated reporting and analysis system.
   1.2. provision of automated vehicle motion control according to the plan/schedule.
   1.3. provision of both automated and operator-controlled motion macro adjustment of vehicle (deviations from the plan/schedule).
   1.4. provision of the traffic forecasts and their availability for the use in other resources (display board, application).
2. Vehicle movement control and management in geographically positioned map view (mode) – displays vehicle location, routes, stops, destinations, depots and other information for vehicle traffic provision, control, and management:
   2.1. open source maps (for example, "Openstreetmap" format) are used as a basis for the map user interface;
   2.2. the interface provides user functions for more convenient use of the map – the ability to zoom in, zoom out, move;
   2.3. at least 3 (three) types of displaying modes on the map:
      2.3.1. automatic mode when the map scale is automatically selected for displaying all selected vehicles in the map view;
      2.3.2. free mode when the map view uses a user-selected scale and location that does not change depending on the location of the selected vehicle;
      2.3.3. tracking mode when the smallest scale is turned on in the map view and the pre-selected vehicle is tracked by centering it.
   2.4. vehicle is displayed on the map as an icon, for ensuring the visual notion on the direction of movement, accompanied by minimal metadata - identifier (onboard number), type of vehicle, driving status, route. Applied colors – providing operational information about the status of vehicles. Possible coloring: yellow – delayed, red - delayed lot/problem, green – on time, blue – without assignment, purple – vehicle is in the park / depot, gray – off-line, black – malformation, white – deviation off the route.
   2.5. use of the icons for operational management – a pop-up menu with the most important activities for operational vehicle control and data viewing:
      2.5.1. function for displaying the most important data received recently: type, identifier (onboard number), date and time, route number, order, route direction, route status, delay or advance in minutes and seconds, current stop, next stop, driver identification (work number), speed, send event, assignment mode, alcotest result (if any), number of passengers in the cabin of vehicle, equipment diagnostic information, macro adjustment data, estimated time of arrival at destination;

2.5.2. function for displaying the vehicle number within the area of 100m from the selected vehicle;

2.5.3. function for displaying service information for operative access to the selected vehicle service report on a specific day;

2.5.4. function for viewing the historical data in order to access the historical data table of the selected vehicle according to pre-selected menu of the required time range. The historical data table contains data on the type of vehicle, onboard number, date and time, route number, order, direction of travel, route status, delay and advance in minutes and seconds, current stop, next stop, driver's work number, driving speed, send event, type of assignment, number of passengers in the cabin of vehicle, equipment diagnostic information, macro adjustment data, estimated time of arrival at the destination. Filter selection possibility due to any parameters with "and/or/no" logic principles. Ability to edit the layout of the data table, move columns, turn on/off their display, sort the table by any of the parameters. Data can be exported (formatted file). Layout data saving when the last version of the layout is saved;

2.6. the possibility of sending messages to the vehicle driver that will be displayed on the on-board computer and can be initiated like predefined or also as a free text. The route of the defined assignment is selected from the list;

2.7. the assignment possibility when the assignment for selected vehicle can be sent or "removed", or the driver can be taken off the route. There are two ways of sending the assignment, ordinary and extraordinary. In case of extraordinary assignment, the driver of the vehicle does not have the opportunity to change the submitted assignment himself. The route and order of the assignment must be selected and sent from the list.

2.8. the ability to request for an alcohol test on the selected vehicle when the request or unlock or cancel of the test is initiated.

3. The map view shows the location of route lines and stops:

3.1. possibility to select the routes and stops by parameters: route number, route direction, the stops of selected direction, where selection is made due to "and/or/no" logic principles. The layout made by the user is saved and displayed at the next connection to the system;

3.2. possibility to select metadata displaying for the stop designation: unique identifier, name, geographical coordinates, crossing stops of the route, numbers of crossing vehicles with a list of planned route schedule and the list of completed route schedule and forecasted schedule. Data export option;

3.3. possibility to select a metadata representation for the route designation: route number, direction, planned schedule of direction with route layers. Data export option.

4. Control of the vehicle execution intervals on routes by visual displaying on horizontally expanded route direction maps based on online traffic data providing that:

4.1. the location of vehicle is visualized in the direction of the selected route as an icon in the display area with horizontal lines and the location of stops. Route displaying generated automatically from the route list database. The longest direction of the route must be displayed in the width of the whole area, the others in proportion to their length comparing to the longest one. Stops must include the name, and proportions of mutual distances between the lines are maintained. The icon of vehicle shows the onboard number and the interval to the previous vehicle in minutes and seconds. The icons of vehicle support the route coloring. Metadata viewing and activities for operational control are provided in a

similar way as described in paragraph 2 in relation to vehicles and stops icons, to route lines;

4.2. line view provides configurable line areas according to displaying parameters: route number, route direction, names of displayed stops, option to select the routes from the work assignation list. Configuration layouts are saved and displayed when the system is reopened.

5. Execution control of vehicles on routes based on the received online traffic (movement) data and displaying in a data table providing:

   5.1. the possibility to follow-up the last received data information of the vehicle in form of table, by combining its on-screen display due to "and/or" principle. The last event table must contain: the type of vehicle, onboard number, date and time, route number and order, driving direction on the route, vehicle route status, delay or advance in minutes and seconds, code of the current stop, the name of current stop, code of the next stop, the name of the next stop, driver identifier, driving speed, send event, type of assignment, result of the last alcohol test performed, number of passengers in the cabin of vehicle, estimated time of arrival at destination, type of assignment;

   5.2. possibility of selection in the last received data table by filtering any of the parameters due to "and/or/no" logic principles. Option for editing the layout of a data table, move columns, turn them on/off, sort the table by any of the parameters available in the table, and the work assignation list. Data export option;

   5.3. possibility to select the transcript of the table view records when metadata review and operational management has been provided for the corresponding vehicle, similar to the activity described in paragraph 2.

6. Possibility to distribute jobs and their volume among users (dispatchers) must be provided for the vehicle management level. Then the user defines his vehicle monitoring group from the common list - by onboard numbers, type of vehicle, parks/depots, routes, by creating his own unique work distribution list that is used for data selection criteria and upon receiving or sending messages. The selection is made from predefined lists, in which the user should see the unrelated vehicles, as well as routes and assignments that are not related to any other user.

7. Centralized sending, receiving of messages and alarm management applicable to vehicle:

   7.1. possible only with vehicles included in the work distribution list;

   7.2. sending to the driver of the vehicle is possible by selecting the vehicle on the map or in the latest data table via a pop-up menu;

   7.3. a special interface has been developed for receiving of messages from the vehicle driver, as well as for handling of alarm signals, in which the user is informed about: the time of sending the message, onboard number, the driver, the route and order, the content of the message or alarm, the status of the message. Possibility to accept or reject the message, recorded in the report status, should be provided;

   7.4. the following types of messages are included: phone call request, vehicle damaged, driver has not arrived for replacement, driver request, emergency medical assistance required, police required, passengers remained at the stop, diversion from the route, vehicle overcrowded, traffic jam, firefighters needed.

   7.5. the following types of alarms are included: driver alarm button, alcotest treatments. Cases of received alarms are highlighted visually and audibly.

8. Macro-regulation functions for prevention of causes of the mismatches between extraordinary and random routes shall include at least the following macro-commands:

8.1. additional allocation of route delay time, when extra time is added to the scheduled route time outside the list, optionally apply to all vehicles on the route or to certain route direction of vehicle;

8.2. additional allocation of delay time for vehicles, when additional time is added outside the list to any vehicle selected from the list;

8.3. linear distribution of vehicles on the route in order to ensure the planned rearrangement of trips by obtaining the maximum regular frequency of vehicles on the route, considering the number of vehicles actually used;

8.4. regulation based on the time of trip in order to cancel the linear distribution of vehicles on the route and to proceed with a periodic calculation between actual and planned time of the trip;

8.5. the activation of macro-commands and the modes thereof shall be registered in a special application archive table. One or all of them can be turned off.

9. Provided analysis of received vehicle data in specially created report forms, providing the following options:

9.1. clear and fast selection of report;

9.2. the result of report is a data table that can be exported – in a structured file in xml, pdf and csv;

9.3. selection by filters in report data tables according to any of the parameters due to "and/or/no" logic principles;

9.4. editing the layout of the data table by moving its columns, turning on/off their representations, sorting the table by any of the parameters;

9.5. at least the following standard reports are included:

9.5.1. all historical data;

9.5.2. regularity of vehicle routs and handling of stops as per the list;

9.5.3. user activity log;

9.5.4. service capacity – the number of planned and completed trips per route;

9.5.5. execution of trips (orders) - comparison between planned and completed trips;

9.5.6. accuracy of stops – data on the accuracy of arriving/departing from the stop;

9.5.7. analysis of route directions - information regarding the accuracy of route direction execution;

9.5.8. vehicle assignments – information about vehicle assignment data on the route;

9.5.9. actual time of the trip - information regarding the time passed en-route: number of trips and total number of daily hours spent by each vehicle on every specified route (trip);

9.5.10. trip analysis - indicates the execution of each trip by recording the number of deviation minutes in relation to the scheduled time of arrival at each stop of particular trip;

9.5.11. passenger counting results – actually boarded/disembarked/located in the cabin of each vehicle at each stop on the route;

9.5.12. work of vehicles - information about kilometers travelled, for each vehicle on the route, outside it;

9.5.13. accounting of the vehicle driver working time on the route;

9.5.14. recording of time of the vehicle driver check-in/check-out at vehicle equipment;

9.5.15. messaging report between the vehicle and the system;

9.5.16. diagnostic messages for vehicle equipment;

9.5.17. alco testing reports on alcohol tests made in the vehicle by the driver and staff.

10. Provision of administrative functions of system users at least in 3 (three) levels: administrator, operator and viewer:

    10.1. the administrator accesses all functional rights, including the user administration with password change, adding new users, granting and suspending user access rights;

    10.2. the operator accesses all functional capabilities, except for administration;

    10.3. the viewer is prevented from operating the vehicle control, messaging, macro adjustment. Viewers can be divided into groups with different roles, where the list of roles and associated functionality is editable.

11. Provision of collaboration and data exchange in automated modes with open format SIRI, GTFS feeds and GTFS real-time.

12. Provision of automated backup of movement information for the use on a mobile smart device by ensuring the information on the estimated arrival time at stops online in html mode and in mobile application performance in both Android and IOs environments. This includes the ability to select the required vehicle, route, direction and stop, thus passing to the forecast page displaying the type of vehicle, as an icon, route numbers, names of directions and the nearest arrival forecasts expressed in minutes with an accuracy of 1 minute.

13. Provided automated backup of traffic information for the use at information displays located at stops or in their area, providing information online on the execution of current transport timetables: route number, the icon of the vehicle, the name of route direction, estimated/planned time of arrival in minutes, date and time. If the amount of information to be displayed exceeds the placement capabilities, it is represented on multiple pages in a sequential and cyclical manner. Only the nearest x trips for each direction of the route with an accuracy of 1 minute are displayed.