CASSETTE ROBOTIZED URBAN TRANSPORT SYSTEM OF MASS CONVEYING PASSENGER BASED ON THE UNMANNED ELECTRIC CARS

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Short project description. We suggest automated public urban transport system capable of operating in the streets with heavy traffic uninterrupted by other vehicles and of transporting a number of passengers comparable to the subway. The system operates without any control by man and it is a fundamentally new form of public transport based on the electric mobile autonomous electric cars (unmanned). Technical and economic characteristics provided by this transportation system, are not available at the currently used vehicles of urban passenger transportation, such as bus, trolleybus, tram and metro. All the unmanned electric vehicles are linked to a control circuit. The system is adaptive to passenger traffic that is works on a service request for transportation with a minimum response time to a request (passenger's waiting time). It combines the features of personal (short waiting transport time and non-stop or with a minimum number of stops, travel of passenger from point of origin to destination) and public transport (high capacity).

The system comprises. Cassette robotized urban transport system of mass conveying passenger transportation system includes separate narrow path (rail or monorail) which borders upon the sidewalk and is fenced from it to the right and fenced from the roadway to the left; stopping points of embarkation and disembarkation of passengers, equipped with turnstiles; unmanned autonomous electric cars with a capacity of 50 passengers (Figure 1).

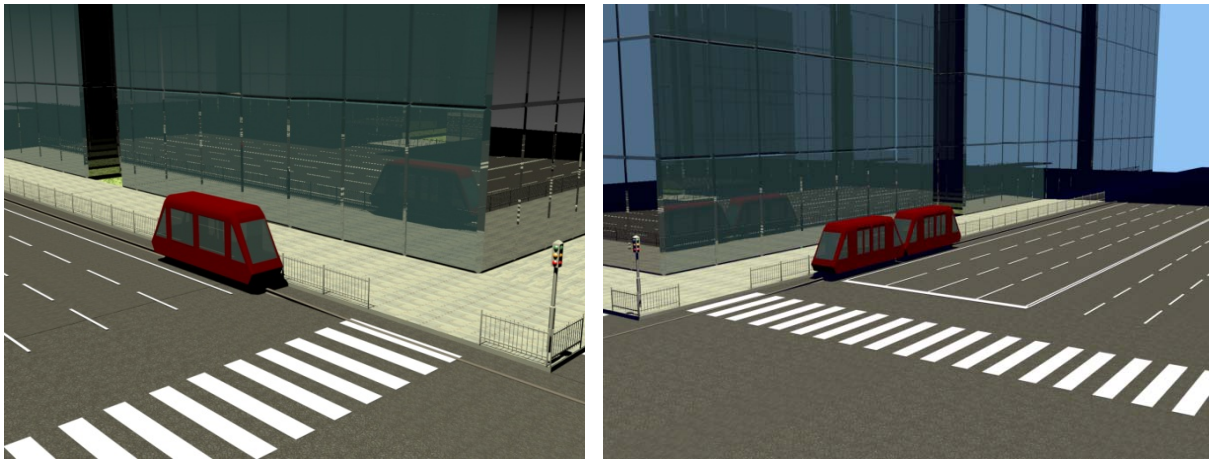

Fig. 1 – Autotrain from one or two electric vehicles at an intersection

Electric cars are based in the assembly points 1 and 2 located in the final destinations (Figure 2). The recharging of the electric cars is performed there and from there they move forward to the route.

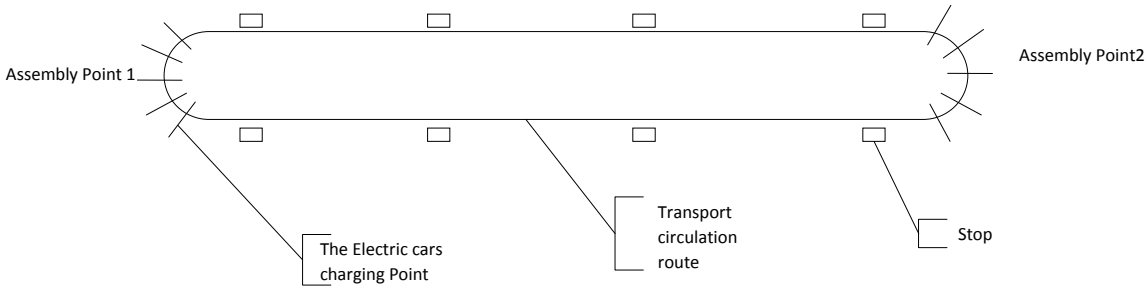

Fig. 2 – Basing structure and the transport circulation route

The system operates. Cassette robotized urban transport system of mass conveying passenger transportation system in its initial state is in "sleep" mode and is activated at the time the passengers come to the station (stop). Passing through the turnstile the passengers pay the travel fee and at the same time indicate their destination station. This information is submitted to the system server, where the mobility plan for this stop is formed. Based on the data from all stops the mobility plan M of the trips of passengers is built up:

$$M = \begin{pmatrix} 0 & m_{1,2} & m_{1,3} & \cdots & \cdots & m_{1,j} & \cdots & m_{1,k} \\ 0 & 0 & m_{2,3} & \cdots & \cdots & m_{2,j} & \cdots & m_{2,k} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ 0 & \cdots & 0 & m_{i,i+1} & \cdots & m_{i,j} & \cdots & m_{i,k} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ 0 & \cdots & \cdots & \cdots & \cdots & \cdots & 0 & m_{k-1,k} \\ 0 & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & 0 \end{pmatrix} \quad (1)$$

Where: k – number of stops, mi,j – number of passengers, who get in at the I stop in order to get to the j stop (i, j =1,…,k). All the elements on the main diagonal of the matrix M and under its main diagonal are equal to zero (because the passenger can neither light down on the same bus stop where he got in the car nor go "backwards"). Thus, all the passengers, who are at the stations are differentiated in accordance with their final trip points. The server processes the mobility plan using special software and sends to the route the number of electric cars necessary to cover the passenger traffic at the current time. And the electric car riven up to the i-th stop has an electronic label (on the trunk display) indicating the destination station (2 stations). Thus, passenger travel is ensured with a minimal number of stops (in this case just one).

This is called cassette transport because the electric cars are collected in virtual cassettes from one and up to six electric cars that form a road train. It uses the well-known autocaravaning principle founded by the European Commission in September 2009 in the project Safe Road Trains for the Environment (SARTRE), which allows several machines moving on the road in an organized column. Column moves in

synchronism with traffic light signals it obtains from the system server. As a result, a non-stop auto train movement is organized.

The title indicates conveyor transport mode, which means that the motion process of the cassettes (auto trains) is continuous with a minimum interval of 20 seconds in between. This also is the minimum sufficient time for passengers loading. For this purpose, the electric cars are narrow (their width is one meter) and with many doors. Conveyor movement method enables maximizing the use of precious road space and evenly distributing the load on the roadway and provides passenger transport timeout from 20 seconds to one minute at any time of day. Of particular note is that this is the only kind of urban public transport ready to serve 24 hours a day.