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INTELLECTUAL REGULATION OF VEHICLE FLOWS IN MEGAPOLIS

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The research is a technology that implements the optimal route for each vehicle in a large city [1]. As the criterion of the optimality the time travel vehicle on the pointed route is selected. Let's call this criterion as t-optimal one.

The transport network of any city is presented as a weighted oriented graph. The laying of t-optimal route in such graph is based on: 1). fixing vehicles that cross each intersection; 2). control of all traffic lines between intersections and as a result, the optimal route is selected; 3) use of A*-algorithm. By plotting the optimal route in the graph, we can technically perform the procedure for regulating vehicle flows due to the dynamic interaction in real time between the traffic management center (TMC) and each vehicle that has set its position. The TMC transmits to each driver the voice commands concerning the route to the destination declared by each driver as with ordinal GPS navigation. The peculiarity consists in the fact that the program puts the t-optimal route, but not geometrically optimal (g-optimal) one as modern GPS navigation does. In view of g-optimal routes traffic jams in cities take place. In the case of applying the criterion of t-optimality, there is an opportunity not only to improve the travel through individual intersection, but also to organize optimal routes for all vehicles in the metropolis, taking into account the traffic situation at each particular time moment.

The ultimate goal of this study is to synchronize traffic flows, optimally use of the transport arteries throughout the city, prevent traffic jams, as well as convoy of each vehicle to its destination, so that the time spent on the trip was minimal.

Today traffic jams are the main headache of the metropolises around the world. This problem is far from new. Here is what the famous French writer Emile Zola wrote about this in his novel "The parish": "On the way to home, among the congestion of carriages that returned on the shore of a lake, moving was possible only step by step. Finally, the carriage got into such congestion that even must stop". The talk in the novel is about the middle of the 19th century. Ever since the problem of traffic jams has become extremely acute. How to avoid or minimize the impact of such negative phenomenon? How to get the route of each vehicle to the final destination so that the trip took the least time? (let's call such route as t-optimal one).

The technology offered in this study allows effectively solve the pointed problem and in some measure gives answers on the questions asked. The presented study aims to construct an algorithm for the t-optimal route for each vehicle in metropolis. In general, the traffic flow control procedure is carried out by dynamic interaction between the traffic management center (TMC) and each vehicle whose driver uses a GPS navigator. In a certain way, the proposed technology is similar to the well-known GPS navigation system. However, presented technology creates exactly the t-optimal routes. On the contrary, modern GPS-navigation makes geometrically optimal routes (let's call them g-optimal). Exactly g-optimality causes urban traffic jams. In contrast to modern GPS navigation, the proposed technology focuses not only on laying t-optimal routes, but also extremely dynamic, working with renewable every 5 second data. The integrated effect of intelligent regulation of individual intersections and the optimal travel of the vehicles on the selected routes leads to a new quality – the synchronization of traffic flows, and as a consequence, to the disappearance of the traffic jams. The ultimate goal of this study is the algorithm that allows synchronizing the flows of the vehicles, optimally using all city transport routes and accompanying each vehicle to the final destination of the route in the shortest possible time. With this approach traffic jams in cities will not occur in general!

The object of research is the transport networks of the large cities. The subject of the research is a traffic on these networks. The main goal of the work [2] is to build t-optimal routes for all city vehicles. Methods of research: 1) the graph theory; 2) Java-programming technologies; 3) A*-algorithm.

The laying of the optimal route for vehicles in any city can be divided into two stages. In the first stage, the traffic is regulated through a separate intersection (fig. 1). At this stage, vehicle registration is carried out using piezoelectric sensors (for example, Roadtrax BL type [1]), which mounted in the road-bed of the travel part of the road perpendicular to the longitudinal axis immediately behind the stop line [1–2]. The devices react on the pressure caused by the vehicle wheels. The measurement computing complex (MCC) registers the electrical signals caused by a compression of the piezoelectric sensors. The spectrum of the signals received from each intersection is proportional to the number of the vehicles that crossed named crossroad in different directions. It is important that not only individual intersections are controlled, but also the lanes between neighboring ones. Control is carried out by means of input and output sensors. The input sensors register the vehicles that enter the lane of the road from all possible directions of the intersection A, and the leaving ones – departing from the specified line of the road – a, b or c (Fig. 1).

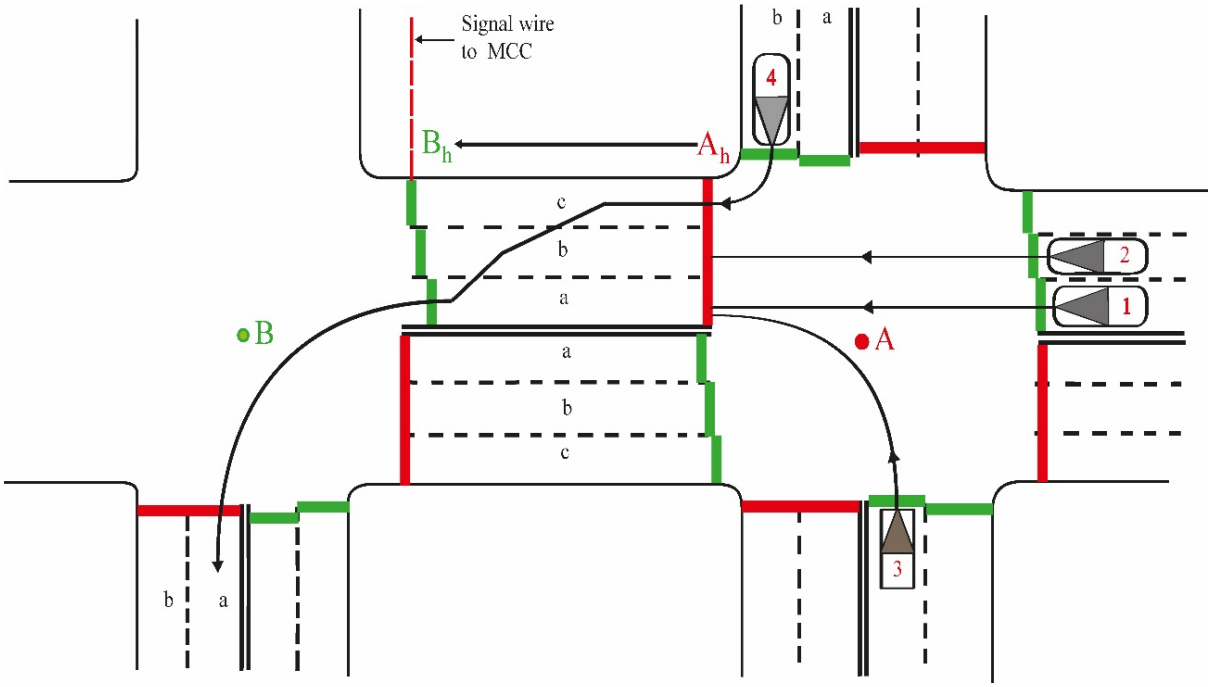

Fig. 1. Two adjacent cross-shaped intersections – A and B – and vehicles that enter the lane between these intersections are shown. The red stripes are input sensors. Output sensors are represented as three adjacent green stripes. The vehicle route of a number 4 is shown

Referencies

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