APPLICATION OF INTELLECTUAL SEARCH METHODS FOR SOFTWARE DETERMINATION OF PUBLIC TRANSPORT ROUTES

Ibragimov Ulugbek Muradilloyevich

Associate professor in Asia international University

Abtract: This article highlights the importance of public transport route planning (PTP) technologies in improving the efficiency of modern urban transport. In conditions of increasing population density, the problems of proper planning and management of public transport traffic, in particular, inefficient route organization, remain a pressing issue. PTP allows for the formation of optimal routes by processing large amounts of data - information from GPS trackers, video surveillance systems, payment devices and mobile applications. As part of the research, a minimal data structure was created on the example of the city of Bukhara, which is expected to serve in the future to determine the most optimal routes for tourists using BigData technologies and the A* search algorithm. Data confidentiality and infrastructure constraints are also considered as important factors.

Keywords: Public transport, Programmatic route planning, BigData, Artificial intelligence, A* algorithm, Passenger flow, Data analysis, Transport logistics.

Today, public transport plays a vital role in the daily movement of millions of people around the world. However, one of the main problems in cities is the inefficient use of public transport due to poor route planning and management. However, thanks to new technologies such as software-based public transport routing, we can make significant improvements in this area. This article will examine what software-based public transport routing is, its capabilities and potential to improve efficiency and passenger comfort.

The definition of public transport routing software is as follows: Public transport routing software (PTS) is a set of technologies and methods that allow for the optimization of public transport routes and traffic. It is based on the use of information about road infrastructure, passenger demand and other factors in order to effectively plan and manage traffic.

One of the key aspects of public transport route planning is the use of big data and analytics. Traffic data processing, passenger flow analysis, and route planning require the collection and analysis of large amounts of information. Such data can be obtained from various sources, including GPS trackers, video cameras, payment systems, and passenger applications. Modern data processing technologies, such as artificial intelligence and machine learning, contribute to the realization of the potential of public transport route planning [1,4].

Although public transport route planning has great potential, there are also some limitations and challenges that need to be considered. Some of them include data privacy issues, difficulties in interacting with other road users, infrastructure upgrades, and staff training requirements.

We set ourselves the goal of conducting our research in the small but tourist-rich city of Bukhara. First of all, we need to structure the necessary data and apply methods and appropriate algorithms to process them in the future. We only consider buses in public transport.

We can use a data management system that supports large volumes of data, such as mongoDB, as a minimum. We plan to expand this scheme in the future by adding trams, trolleybuses, metro, and other types of public transport[3,5].

1109

After collecting enough data according to this scheme, we can process the data using the method of minimizing the overall cost of the solution and use the intelligent search method to programmatically generate the most optimal solutions for tourists (Figure 1). The most popular type of first-best-fit search is called A* search (pronounced "A with an asterisk"). It includes g (n) - the cost of the achievements of this link (which includes short distance, less time, etc.) to get there faster and h (n) - the cost of getting from this link to the destination.

$$f(n) = g(n) + h(n) \qquad\qquad (1)$$
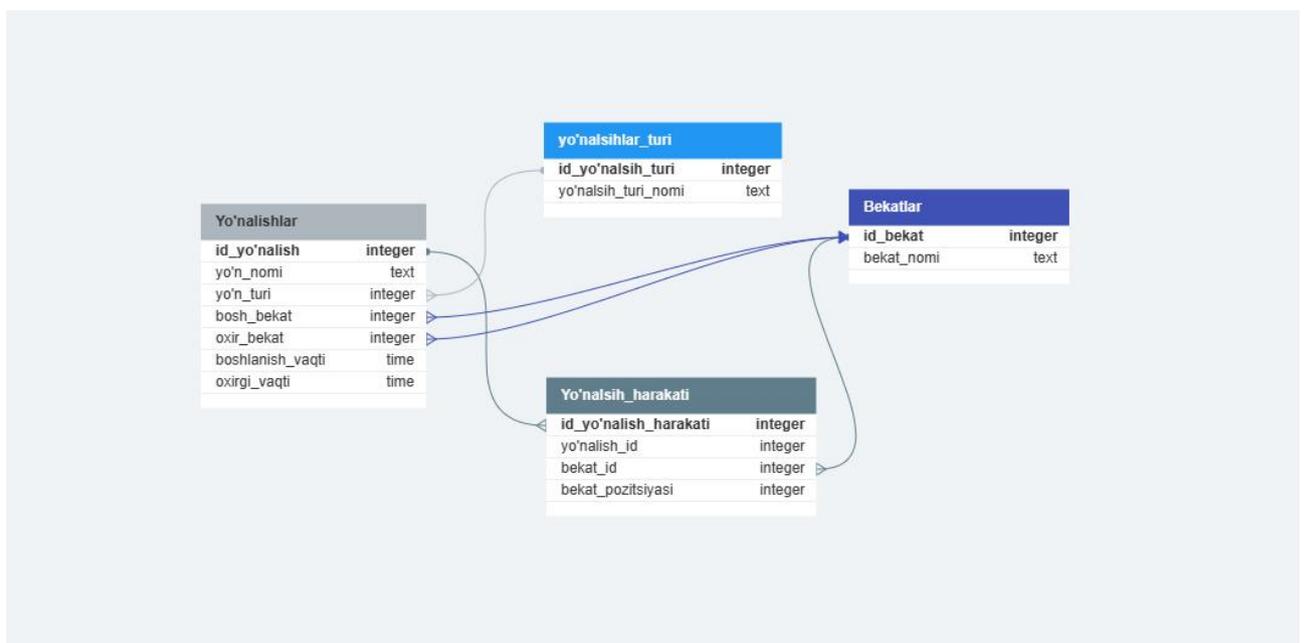
Our scheme currently looks like this minimally:

Figure 1. Minimal scheme of intelligent data processing on the example of public transport.

Since the function g(n) allows us to determine the costs from the initial node to node n, and the function h(n) allows us to determine the minimum costs from node n to the goal, the following formula is acceptable:

f(n) = the cost of the least-cost path through n nodes.

Thus, when trying to determine the solution with the lowest cost, it would probably be appropriate to first examine the node with the lowest value of g(n) + h(n). It turns out that this strategy is not only rational, but also has other advantages: if the heuristic function h(n) satisfies some conditions, the A* search is both complete and optimal[7].

When the A* method is used in conjunction with the Tree-Search algorithm, the analysis of the optimality of the A* search is not complicated. In this case, A* search is optimal if h(n) is an admissible heuristic function, i.e., h(n) never overestimates the cost of reaching the goal. Admissible heuristic functions are essentially optimization functions, since the solution to the problem returns smaller values   of the costs compared to the actual values   of the costs.

1110

Since g(n) is the exact cost of reaching the nth link, it follows directly that the function f(n) never overestimates the actual cost of reaching the solution via the nth link[2,6].

Programmatic public transport routing is a technological breakthrough that has allowed to significantly increase the efficiency and convenience of public transport. This not only reduces travel times and improves predictability, but also allows to optimize the use of vehicles in order to transport passengers more efficiently and reduce traffic congestion. However, successful implementation of software-based route planning requires careful consideration of the limitations, challenges, and the integral importance of data and analytics. In the future, as technology and road infrastructure develop, we can expect even greater advances in public transport route planning, making cities more accessible for all their residents.

References:

1.   R.A.Gulyaev, U.M.Ibragimov, X.B. Ismoyilov, Avtomatlashtirish elementlari – qishloq xo'jaligi sanoatini raqamlashtirishda yordamchilar sifatida. "Science and Education" Scientific Journal / Impact Factor 3.848. March 2023 / Volume 4 Issue 3. pp 282-287.
2.   Rassel S., Norvig P. Sun`iy intellekt: zamonaviy yondashuv, 2-nashr.: ingliz tilidan tarjima. – M. : "Vilyams" nashriyot uyi, 2006. – 1408 b.
3.   Intellektual tizimlar va texnologiyalar: Oliy kasbiy ta`lim muassasalari talabalari uchun darslik / B. Ya. Sovetov, V. V. Tsexanovskiy, V. D. Chertovskoy. – M. : "Akademiya" nashriyot uyi, 2013. — 320 b.
4.   Ibragimov, U. (2025). Application of the harrington method in the food industry. Journal of Applied Science and Social Science, 1(3), 544–549.
5.   Ibragimov Ulugbek Muradilloyevich. Integrating prometheus monitoring into the comparative framework of virtual machines and docker containers. Journal of applied science and social science. Volume 15 Issue 09, September 2025. P. 665-677.
6.   Ibragimov Ulugbek Muradilloyevich. Rainbow table threat and defense mechanisms. Journal of applied science and social science. Volume 15 Issue 10, October 2025. P. 280-287.
7.   Ibragimov Ulugbek Muradilloyevich. Analysis of linear, binary and interpolation search algorithms. Journal ofmultidisciplinary sciences and innovations. Volume 04 Issue 10, November 2025. P. 425-428.