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MACHINE LEARNİNG

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Subject: Should we use routing protocols for routing inter-city buses? Why or why not?

ROUTING INTER-CITY BUSES

Today, people use buses for intercity transportation and this system is accelerating and developing day by day. People want buses to be safer and reach their destination as soon as possible. Routing protocols will greatly benefit buses in intercity transportation. In this research, we will see detailed information about these protocols and why we should use them.

Vehicle routing problems (VRP) is a generic name referring to optimization problems in the transportation, distribution and logistics industry. Route planning techniques is one of the main tasks of VRP which aims to find an optimal route from a starting point to a destination on a road map (Nha, Djahel and Murphy, 2012). Routing methods are primarily used in computer science. Originally routing refers to a set of elements for route scheduling and transmission of data packets on the internet (minimum two physical networks connected with each other via a router), from the transmitting station to the receiving station (Kuczyński and Stęgierski, 2011).

Routing protocols used to communicate different networks use two different methods, static and dynamic. Distance Vector Protocols. In these protocols, routes are determined based on distance and direction vectors. Distance, according to the number of hops (stop) passed; the direction is determined by the next hob or output interface. Distance Vector Protocols use the Bellman-Ford algorithm to determine the best route. Although the Bellman-Ford algorithm allows to keep the information of the accessible networks in the database; No one router has a map of the entire topology, since it has as much information as the neighboring router sends. In these protocols, the router periodically sends the entire routing table to its neighbors, even if only a part of the record in the table changes. This causes significant traffic on large networks. Also, the update is slow because packets are modified while they are being sent. Distance vector protocols do not overload the router's processor, as they use simple algorithms to choose the best path; but sometimes they may not choose the right path. These protocols; It is preferred in simple networks that do not require a special hierarchical order, in some private networks such as hub-and-spoke (the structure where the router in the center serves the others), and in cases where the convergence (all routers in the topology learn all networks) time is not important. Link State Protocol routers working with these protocols can map the topology of the entire network, thanks to the information they have learned from other routers. In other words, they have the knowledge of all the paths between two points. Thus, they collect all subnets in a tree and make the best decision about which path to take with the Shortest Path First algorithm. In addition, once the topology is in place, instead of periodic updates, only small packets are updated when there is a change, which prevents traffic. Since the packets are transferred to the neighboring router without any changes on it, the speed problem encountered in distance vector protocols is not present in these protocols. However, since they use complex and multi-parameter algorithms, they require a more powerful processor and ram compared to distance vector protocols. Although this was seen as an economic disadvantage in the past, nowadays it has ceased to be a significant disadvantage as processor and ram prices have decreased. Line State Protocol is preferred in large hierarchical networks and where short convergence time is important.

As a result of our research, let's examine a system used in city bus transportation. An example of the deployment of the routing method for the city of Opole in the first stage;

The bus line in the routing method would be used as a route, the intermediate points would be bus stops along the route of the bus route along which the route would run. At the time of the blocked route running through the bus line, the routing algorithm would calculate the most-advantageous alternative route for transport to the destination of the bus (package). The second method of using the method of routing in public transport would be information about the current traffic volume and in the case of a greater intensity of vehicles, the bus would be sent an optimal route for him including the main intermediate stops to the destination. The only problem of adaptation of such a method in the city would be its dynamically changing route adapted to current conditions on the road, although it could be assumed that such a change of route would take place only in case of a delay of 15 minutes. This problem may be less in intercity transportation because there are not many roads and route alternatives. routing protocols should be in a hierarchy and routing should be done in that order. The demand for modern optimization methods used during the planning of routes in transportation is becoming ever greater. Increasing problems resulting from the development of cities effectively hamper the work of entities involved in planning routes in cities. Component factors taken into account when constructing optimization tasks are time of travel, travel cost, customer satisfaction, limitation of the route. After the analysis of routing methods, one can observe the ease of implementing this solution in planning interurban routes. This solution gives a variety of advantages resulting from its universality, including self-improvement, manual changes of routes and assumptions, estimation of future travel conditions, uncertain default knowledge, prescriptive decision processes, any type and amount of information. Taking into account the conducted analysis, research has been started on the implementation of routing methods, including the DLRP protocol in planning routes of public transport vehicles in the city of Opole. The implementation of telematics systems in cities brings tangible benefits to the functioning and development of urban agglomerations (Masłowski, Kulińska, 2017) The proposed routing methods after implementation will be designed to shorten the time of public transport, improving traffic in the city. Thanks to advanced algorithms, they can include multiple routing kernels. The most advantageous factor in the implementation of routing methods is the fact that it will be possible to dynamically manage bus crossings taking into account the actual traffic.

To sum up, if routing protocols are used in intercity transportation, it can increase safety and customer satisfaction in intercity transportation by estimating and guiding about safety, weather conditions, natural disasters, and road conditions while routing the route.

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