PUBLIC TRANSPORTATION OPTIMIZATION

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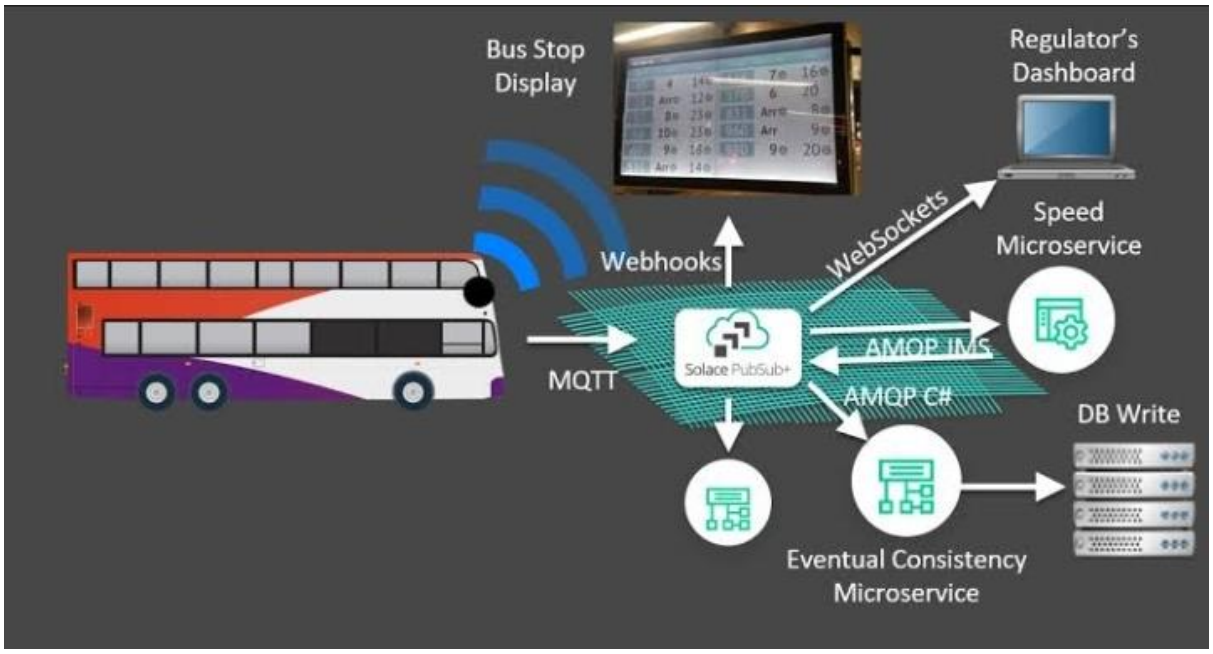
ABSTRACT:

With the rapid development of logistics industry, optimization of road transport has become a constraint that must be overcome in the development of related industries. In the IoT era, classic car routing solutions could not meet many different needs. +e relevant research findings are endless but not suitable to reduce costs in logistics and distribution processes and meet the needs of customers. If the paper researches on vehicle path optimization using IoT technology and intelligent algorithms. Firstly, the traditional GA is optimized, and its coding mode, fitness function, selection, crossover, and mutation operators are studied.

- e crossover probability was set to 0.6, and the mutation probability was set to 0.1; then, according to the improved GA, a vehicle route optimization model was created. Finally, simulations were conducted to optimize vehicle routes for some distribution centers and 15 customer sites, and the model's validity was tested.
- Experimental data show that the improved genetic algorithm begins to converge in 100 generations with a running time of 37.265 s. We calculate the time sensitivity of the customer. An algorithmic model is then used to determine distribution plans based on product demand and time sensitivity. In addition, we compare distribution costs and customer satisfaction of algorithmic and randomized plans.
- e distribution cost and customer satisfaction of the algorithmic and random patterns were 498.09 yuan and 573.13 yuan and 140.45 and 131.35, respectively. +is shows that the vehicle routing optimization model using IoT technology and an improved GA can reduce distribution costs and increase customer satisfaction.

INTRODUCTION:

- IoT is an important carrier for collecting, transmitting, processing, and applying information. Related technologies such as big data, cloud computing, sensors, and so on are widely used in various fields, especially the logistics industry .
- The continuous improvement of the urban system makes the establishment of a good urban distribution system, a problem that must be solved to increase the development of the urban economic system.
- If the optimization of the transportation path of the distribution vehicle is a vital link in the urban logistics distribution system, which connects the production line, warehouses, and consumers
- Optimization of vehicle routes has always been a key issue in logistics . Discussed by local and international researchers, Braekers conducted a categorization review of the literature on vehicle routing issues published between 2009 and June 2015, 277 existing coverages were classified, and the development trend of VRP literatures was analyzed Yao et al. Proposed the box-to-collection station heterogeneous vehicle routing problem and used particle swarm optimization



Customer Satisfaction and Distribution Costs:

a. Customer satisfaction of each customer and each route is investigated, and the distribution plan and the random distribution plan under the improved GA model are used to compare the customer satisfaction of the two.
b. The highest score of each customer satisfaction is 10 points, a total of 150 points. Specific scores are as follows. As shown in Table 4, there is a big difference in customer satisfaction between the distribution scheme under the GA model and the random distribution scheme.
c. Under the GA model, customer satisfaction can reach a maximum of 10 points and a minimum of 8.9 points. Under the random distribution scheme, the highest customer satisfaction score is 9.5 points and the lowest is only 8 points. To further analyze the customer satisfaction of different vehicles under different scenarios, we compare the customer satisfaction of the customer points that each vehicle passes.
d. Under the two scenarios, the total satisfaction of vehicle 1, vehicle 2, and vehicle 3 is compared as follows. As shown in Figure 4, no matter which car, the satisfaction of the delivery plan under the improved GA model is higher than that of the random delivery plan.
e. Especially for vehicle 2, the satisfaction scores of the two are 47.8 and 43 points, respectively, a difference of 4.8 points. After comparing the overall satisfaction of the vehicle, the satisfaction of each customer is compared.
f. comparison results are as follows. As shown in Figure 5, although from the overall satisfaction point of view, the distribution scheme under the improved GA model is better, from the perspective of individual customers, not all individual customer satisfaction levels of the random scheme are lower

g. in the random scheme is 9.5 points, which is higher than that of the algorithm scheme by 0.5 points.than those of the algorithm scheme.
h. Customer 15's satisfaction with the random scheme is 9.2 points, which is 1 point higher than that of the algorithm scheme.whether it is fuel consumption cost or penalty cost, the distribution scheme under the improved GA model is almost lower than the random scheme. +e biggest difference is the penalty cost of vehicle 3.
i. The difference between the two schemes is 16.07 yuan. +en, we analyze the composition and proportion of the distribution cost of the improved GA, and in the total distribution cost of 498.09 yuan, fixed costs accounted for the largest proportion, totaling 72%, followed by the fuel consumption cost, totaling 20%, and the penalty cost is the least, accounting for only 8%. Among the three vehicles, vehicle 3 is the one with the most distribution cost, totaling 171.78 yuan, accounting for 35% of the total cost.

CONCLUSIONS:

The application of IoT technology in optimizing vehicle routing can improve the reliability of the distribution process, as well as real-time tracking and monitoring of the distribution process. It can also provide key data summarized by the route optimization model, such as the state of the goods, the flatness of the route, and the time of traffic jam.

Based on the improved GA and the classic vehicle path optimization problem, the GA vehicle path optimization model established has better optimization ability and shorter Table 5: Comparison of vehicle distribution costs.

Vehicle (GA) Fixed cost Fuel consumption cost Penalty cost Total 1 120 33.65 11.92 165.57 2 120 25.43 15.31 16.74 3 120 38.62 13.16 171.78 Total 360 97.7 40.39 498.09 Vehicle (R) Fixed cost Fuel consumption cost Penalty cost Total 1 120 48.74 25.24 193.98 2 120 34.01 30.69 184.7 3 120 45.22 29.23 194.45 Total 360 127.97 85.16 573.13 33.65 25.43 38.62 11.92 15.31 13.16 48.74 34.01

45.22 25.24 30.69 29.23 1F 2F 3F 1P 2P 3P GA Distribution costs of different vehicles. 24% 24% 24% 7% 5% 8% 2% 3% 3% 8% 1F 2F 3F 1FC 2FC 3FC 1P 2P 3P Distribution cost composition proportion under the algorithm scheme.

Mathematical Problems in Engineering 9 running time. By comparing distribution costs and customer satisfaction, the data show that the algorithm model established in this paper can improve customer satisfaction and save distribution costs.

Before, in the optimization process, it is assumed that each vehicle travels at the same speed. However, in reality, there may be unexpected phenomenon of traffic congestion, which affects the delivery time and cost to a large extent. Due to limited time and knowledge, this study did not consider this situation, in the following research work, we will focus on the limitations of this study and make the research results closer to reality