Penerapan Metode Simulated Annealing untuk Masalah Last-Mile Delivery Problem dalam Bentuk Sistem Crowdsourced Two Echelon Vehicle Routing dan Truk Trailer Routing = Application of Simulated Annealing for Last-Mile Delivery Problems in the form Crowdsourced Two Echelon Vehicle Routing and Truck Trailer Routing Systems

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Abstrak

Crowdsourced delivery merupakan suatu upaya dalam mengatasi masalah peningkatan kebutuhan jasa pengiriman barang akibat dari tren berbelanja online pada masyarakat yang meningkat secara signifikan. Crowdsourced delivery didefinisikan sebagai proses pengiriman barang yang melibatkan individu dengan latar belakang profesi bukan sebagai kurir untuk memenuhi kebutuhan last mile delivery. Diibaratkan kurir tersebut merupakan pekerja lepas (freelance) dari perusahaan pengiriman logistik. Last-mile delivery merupakan tahap akhir dari proses distribusi pengiriman barang dimana barang akhirnya sampai kepada pelanggan. Pada skripsi ini dilakukan perencanaan last-mile delivery dengan menggunakan integrasi crowdsourcing parsial, dimana permasalahan tersebut membutuhkan titik singgah sementara dalam proses pengiriman barang. Crowdsourcing parsial merupakan gabungan permasalahan two-echelon vehicle routing problem (2-EVRP) dan truck trailer routing problem (TTRP). Two-echelon vehicle routing problem adalah pencarian rute vehicle routing problem dengan dua tingkat jaringan distribusi. Tingkat jaringan distribusi pertama berupa rute perjalanan truk dan tingkat jaringan distribusi kedua berupa perjalanan kurir crowdsourced. Truck trailer routing problem merupakan variasi tambahan permasalahan 2-EVRP agar pelanggan dapat dilayani menggunakan truk dan juga kurir crowdsourced, jika hanya 2-EVRP saja maka pelanggan hanya dapat dilayani oleh crowd-worker. Pada permasalahan ini digunakan metode simulated annealing untuk mencari pendekatan terhadap solusi optimal rute pengiriman barang. Proses simulated annealing bekerja dengan mencari suatu posisi pada suatu temperatur tertentu untuk mereduksi rute yang tidak diperlukan dan memperbaiki solusi agar menjadi optimal. Dalam skripsi ini digunakan data sebanyak 63 titik koordinat lokasi, di mana terdiri dari 1 depot, 12 titik transfer, dan 50 pelanggan. Hasil terbaik dari beberapa kasus yang dijalankan yaitu untuk kasus 19 pelanggan dilayani truk dan 31 dilayani oleh crowd-worker, dapat menghemat biaya perjalanan sebesar 25,9748%.

.....Crowdsourced delivery is an effort to overcome the problem of increasing the need for goods delivery services due to the trend of online shopping in the community, which has increased significantly. Crowdsourced delivery is defined as the process of delivering goods that involve individuals with professional backgrounds not as couriers, to fulfill last-mile delivery needs. The courier is likened to a freelancer from a logistics delivery company. Last-mile delivery is the final stage of the distribution process where the goods finally arrive at the customer. In this thesis, last-mile delivery planning is carried out using partial crowdsourcing integration, where the problem requires a temporary stopover point in the process of delivering goods. Partial crowdsourcing combines the two-echelon vehicle routing problem (2-EVRP) and the truck trailer routing problem (TTRP). The two-echelon vehicle routing problem is a route-finding vehicle routing problem with two levels of distribution network. The first distribution network level is a truck route, and the second distribution network level is a crowdsourced courier. The truck trailer routing

problem is an additional variation of the 2-EVRP problem to serve customers using crowdsourced trucks and couriers. If it is only 2-EVRP, then customers can only be served by crowd-workers. In this problem, the simulated annealing method is used to find an approach to the optimal solution of the shipping route. The simulated annealing process works by finding a position at a specific temperature to reduce unnecessary routes and improve the solution to become optimal. In this thesis, the data used are 63 coordinate location points, consisting of 1 depot, 12 transfer points, and 50 customers. The best results from several cases that were carried out were for cases where 19 customers were served by trucks and 31 were served by crowd-workers. It could save travel costs by 25.9748%.