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VEHICLE PRE-BOOKING OPTIMIZATION

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***Abstract*: The automated allotment of pre-booked vehicle ride problem is a scheduling problem which is a major requirement in the industry. In this problem, a ride i has to be assigned to a vehicle j and starting time s_i such that total profit(P) made by all the rides is maximum. This cannot be particularly designed as a linear programming problem and no algorithms can give optimal solutions in a limited time. In this paper genetic algorithm with custom settings is used to determine the optimal solution to this problem. GA is a metaheuristic optimization technique based on Darwin's principle of the survival of the strongest. Using GA algorithm, the objective function based on multiple parameters is optimized and optimal solution was found. The result has shown that the implementation of GA on the penalty-based optimization problem gives a good result with a limited amount of time and iteration.**

KEY WORDS: Car-scheduling, Genetic algorithm, Optimization, Job-shop scheduling problem (JSSP), Manhattan Distance

I. INTRODUCTION

During past few years the pre booking of rides has been more frequent and its network has expanded itself from city to city. Millions of people commute by car every day for several purposes. Self-driving vehicles are an interesting development for transportation. They aim to make traveling by vehicle safer and more available while saving traveler' time. Therefore, the necessity of studying the effectiveness and result of this automated pre-booking of rides is existential.

Companies like Ola and Uber provides this kind of pre-booking service. But their company model is not so effective as they sometimes miss up on rides and try to allocate their regular cab drivers to pre-booking service. This sometimes create havoc for the customers.

In our model, we try to allocate the cab drivers beforehand at the beginning of the day. The model uses a few of available cars for any cab company and tries to allocate maximum number rides to optimize the car pre-booking system.

II. PROBLEM STATEMENT

The problem statement of our model is to assign all the pre-booked rides to vehicles at the beginning of the day, given a list of pre-booked rides in a simulated city and fleet of self-driving vehicles. This also optimizes the ride time allotment so that the customers get to their destination on time. For every ride that finishes before the requested time by the customer we award a bonus and for every ride that is late we add a penalty proportional to the excess time taken. We also usually charge the customers the ride-fare proportional to the distance covered in the ride.

III. PROBLEM DESCRIPTION

1. Map of the simulated city

A rectangular grid of streets is used to represent the city, with r horizontal streets (rows) and c vertical streets (columns). The integer coordinates of the horizontal and vertical street are used to index street intersections on a 0-based scale. For instance, the junction of the r-th horizontal and c-th vertical street is denoted as ($0 \leq r < R$, $0 \leq c < C$). While tackling our challenge, we used a 5x5 test grid.

2. Vehicle's description

There are M available automobiles. All of the cars are at the junction [0, 0] at the beginning. There is no restriction on the number of cars that can pass through an intersection.

3. Time and distance calculation

The minimum total number of blocks that a vehicle must travel through on the map to get from one intersection to the other is used to determine the distance between two intersections or places on the map. It is, the separation between intersection $[x_1, y_1]$ and intersection $[x_2, y_2]$ is equal to $|x_2 - x_1| + |y_2 - y_1|$. This is also called **Manhattan distance**.

The distance between two intersections or points divided by the vehicle's speed gives the travel time between them.

4. Rides

N rides have already been reserved in our model.
Each ride is distinguished by the following details:

- **Start intersection**: The car must be in this intersection before the ride can start.
- **Finish intersection**: At this intersection, the ride must come to a conclusion. Every finish junction differs from the beginning intersection.
- **Start time** - the earliest possible moment for the ride to begin. It may also begin at any subsequent moment.
- **Finish time** - the latest time by which the ride must be completed in order to receive points. The penalty and bonus are applied in accordance with