Problem Statement

Routing Optimization System

Problem

Consider that we have an environment having a set of Riders $\boldsymbol{R} = \{\boldsymbol{R_1}, \boldsymbol{R_2}, \boldsymbol{R_3}, \ldots, \boldsymbol{R_N}\}$ and some Restaurants $\boldsymbol{P} = \{\boldsymbol{P_1}, \boldsymbol{P_2}, \boldsymbol{P_3}, \ldots, \boldsymbol{P_M}\}$, also known as Pickup locations in our context, and some Orders $\boldsymbol{O} = \{\boldsymbol{O_1}, \boldsymbol{O_2}, \boldsymbol{O_3}, \ldots, \boldsymbol{O_K}\}$, which are being received continuously, one after the other, at the hub. The hub is the central point where all orders are received and the hub has to decide which rider should be assigned what order, such that the overall time to complete all the jobs is minimized. Each order has an impact of $\boldsymbol{t_l}$ minutes on the overall time of a particular rider $\boldsymbol{R_n}$, and an impact of $\boldsymbol{t_g}$ minutes on the overall completion time of all the jobs.

When an Order $\boldsymbol{O_n}$ arrives at the hub for a pickup location $\boldsymbol{P_k}$, the hub filters out the riders that are near to the pickup location $\boldsymbol{P_k}$ and for each rider $\boldsymbol{r_i}$, a fitness value $\boldsymbol{f}$ and the total time $\boldsymbol{rt_i}$, that the rider will take to complete its job after the assignment of the current order, is calculated to find the best possible rider. This process is dynamic i.e. if another order $\boldsymbol{O_{n+x}}$ arrives for the same pickup location, while the earlier one(s) were being processed, the fitness value and the total time to complete the all the jobs, with respect to the new order will also be calculated for all the filtered riders. On the basis of the fitness value of all the riders, the hub will decide which rider is to be assigned what order.

Assumptions

Following are some assumptions for the project.

- The total number of riders is less than the number of orders.
- A rider cannot have more than 5 orders at a time. As for some real businesses, a rider is sent out for deliveries with a maximum of five orders.