OPTIMAL CHARGING STATION SUGGESTION

IT832: Blockchain Technologies and Applications- Decentralization and Smart Contracts Assignment I

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Most optimal algorithms base their recommendations on distance, cost, or a combination of the two. However, there are additional factors that can be taken into account in addition to these factors in order to improve the suggestions even further. These factors include traffic, the presence of fast charging stations, deviance from the path, the track record of the stations in the past, etc.

To provide users with greater options, we have tried to take into account a few additional aspects other than price and distance. We try to optimise the solution using:

- Energy Gain to Energy Spent ratio:

  Charging stations have a limited energy capacity. It is possible that it has a low energy supply at any given time, and it may even be reduced by the time the vehicle arrives. Reaching the station will also require some energy from the vehicle. This amount is regarded as the energy spent. And The amount of energy a charging vehicle will gain when it arrives at the station is known as the energy gain. We advise using a station where the user receives three times as much energy as he spends.

- Current direction of user:

  It is possible that the user is currently going towards north, but the closest or most affordable station is in the south. In this scenario, the user will expend twice as much energy to get to the station and once more to continue travelling. We tend to favour the stations that are near the direction the user is travelling or which provides a huge charging amount.

- Previous Visits of the User:

  If a user charges their vehicle from a specific station for longer than a specific amount of time, they receive discounts. And this is applied to all the future charging.

- User feedback data:

The experiences of users and their levels of satisfaction with the services offered by the stations are reflected in user feedback. We advise utilising the stations with the best ratings.

An ideal station should have an economical charging price, low travel cost, high energy gain and high user feedback. Utilising these relations, we associate a factor to each of the stations and rank them accordingly.

Factor of a Station i is calculated as follows:

$$F_i = 100 * \frac{uf_i * eg_i}{c_i * d_i}$$

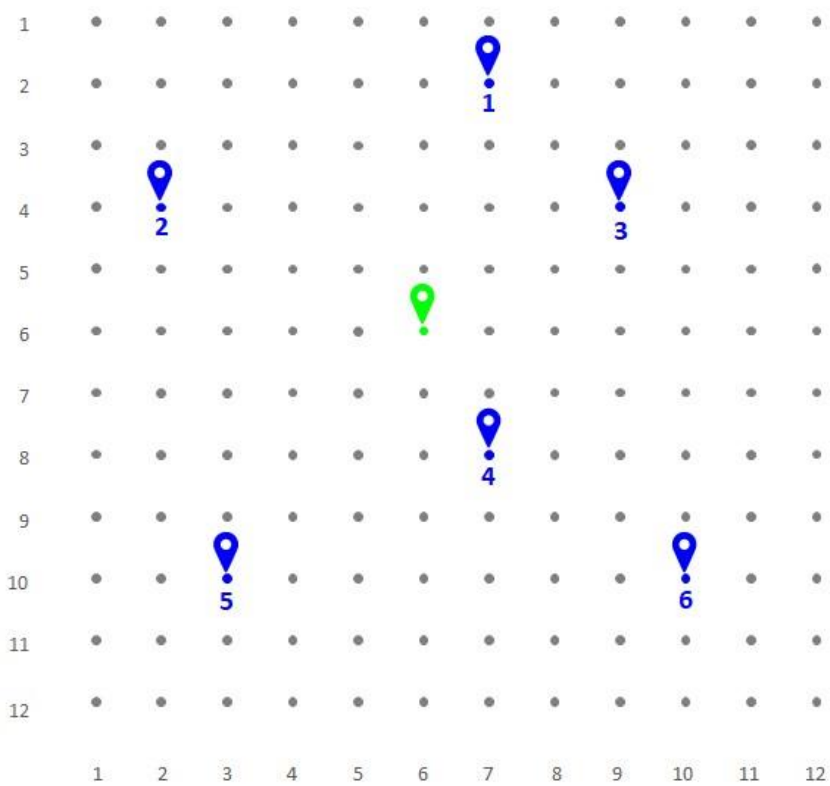
uf = user rating

eg = energy gain

c = cost

d = distance

The map is viewed as a grid or block city system, and the distance between city blocks is taken into account. Take the following map as an example to better understand how it functions.



- # Vehicle:
- Latitude- 6
- Longitude- 6
- Battery Percentage- 7
- Mileage- 1
- Direction- N

Range = Battery Percentage * Mileage = 7*1 = 6

- # Stations:

Station ID	Latitude	Longitude	Price	Visits	Charge Remaining	Rating	Distance	Paying Price	Charge At Arrival	Score	Direction
0	2	7	15	6	50	8	3	12	48	1067	NE
1	4	2	13	4	40	6	6	13	36	277	NW
2	4	9	10	7	30	7	5	8	27	473	NE
3	8	7	15	6	40	8	3	12	38	844	SE
4	10	3	13	7	30	6	7	10	25	214	SW
5	10	10	10	4	35	7	8	8	29	317	SE

From range of vehicle and distances of station we conclude that station 5 is unreachable and is dropped. Up to this point all the steps are same in nearest, most affordable and our approach.

After this we also drop station on the basis of direction, and energy gain to energy spent ration and then calculate the factor for each station and sort the accordingly.

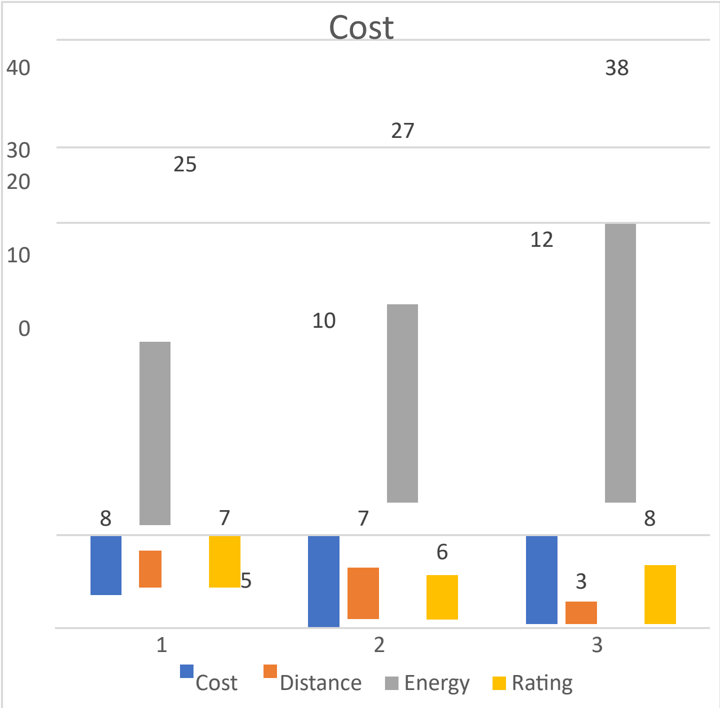


Fig 1. Top 3 stations suggested by affordability.

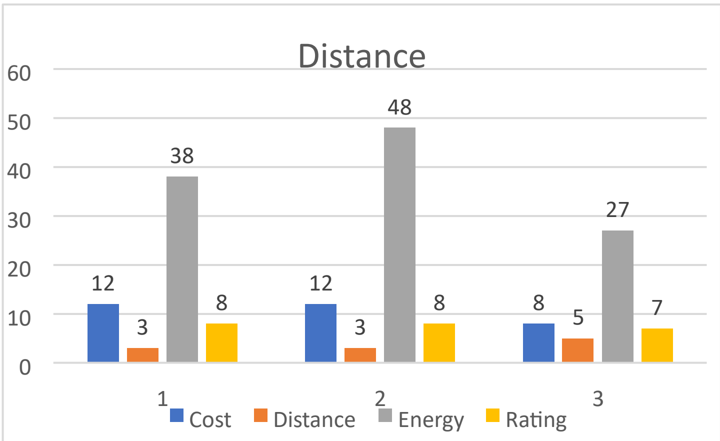


Fig 2. Top 3 stations suggested by distance.

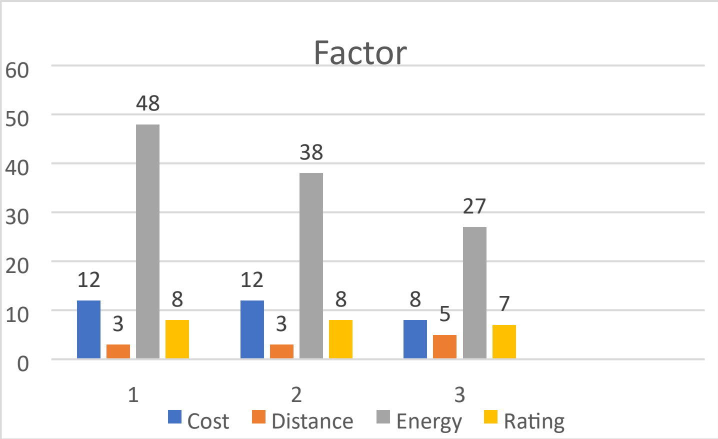


Fig 3. Top 3 stations suggested by factor.

Figures 1 and 2 show that they only attempt to minimise cost and distance, respectively, whereas the recommendations made by our approach (figure 3) maximise energy and rating while simultaneously minimising cost and distance.

Output Screenshots:

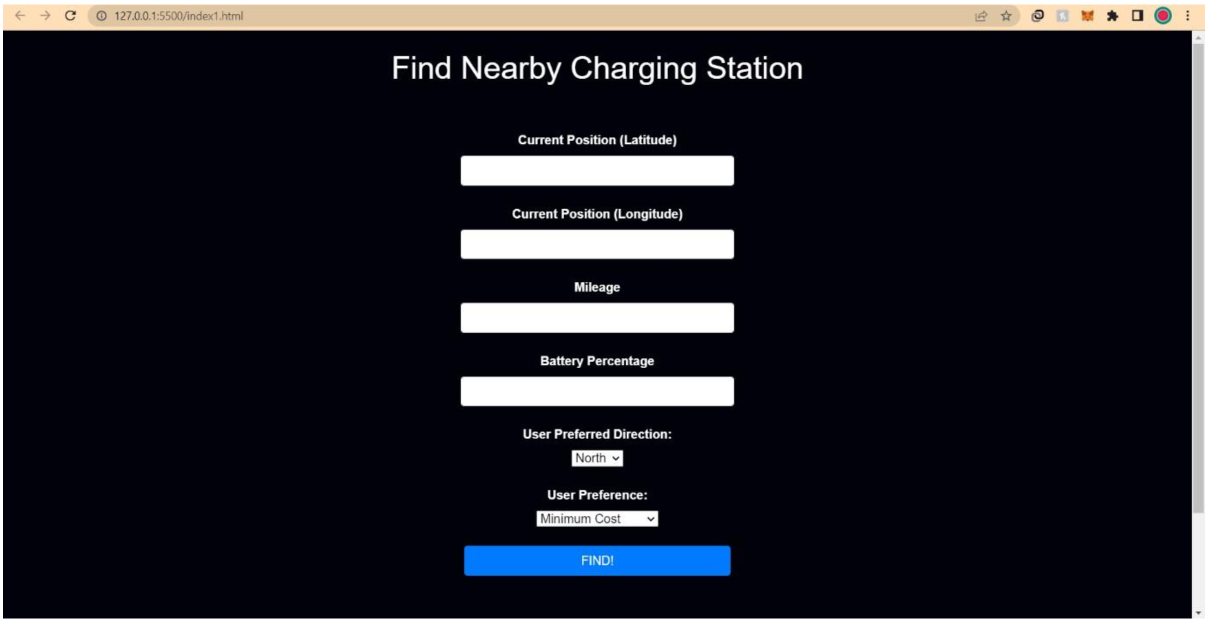


Fig. 4 Frontend

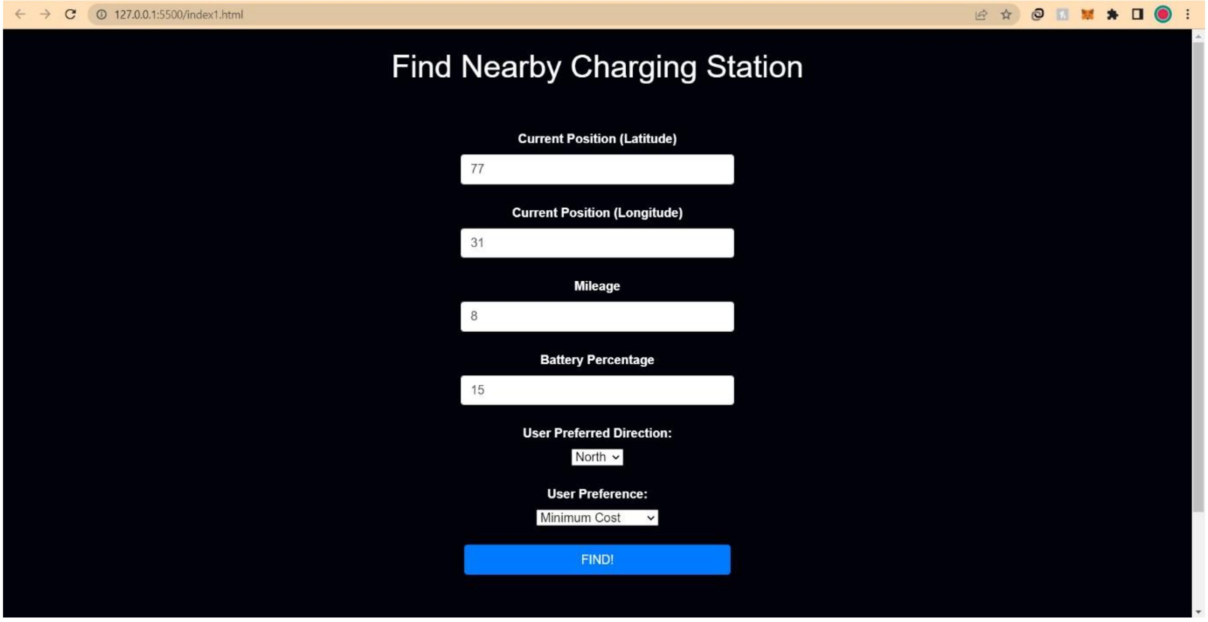


Fig. 5 User Vehicle Inputs

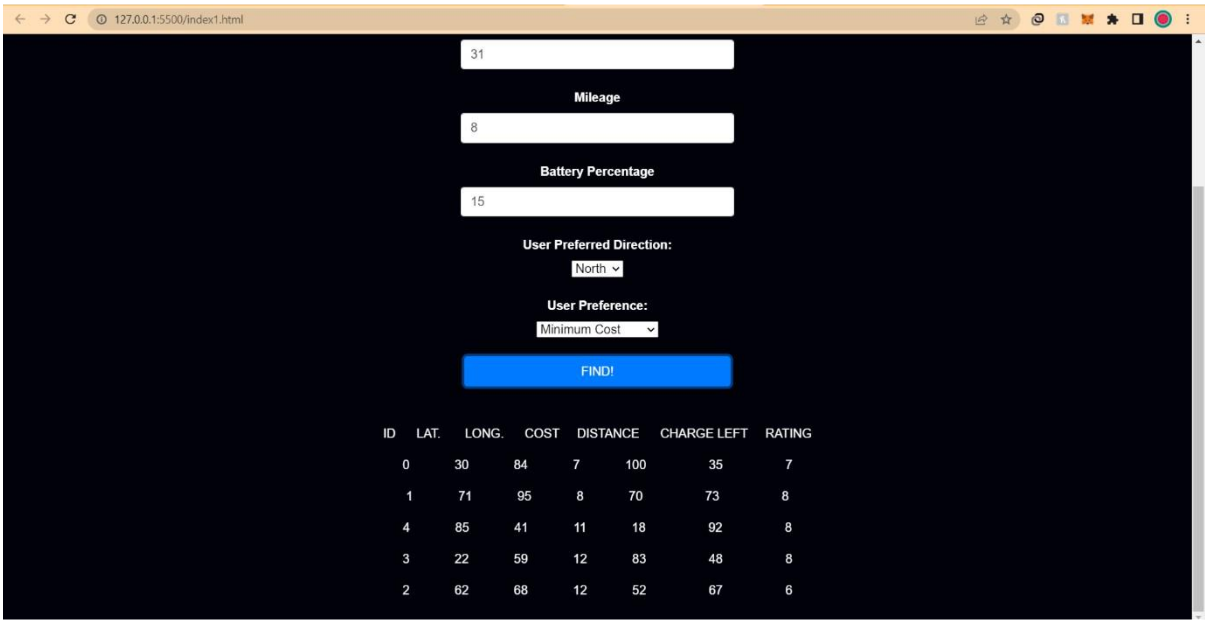


Fig. 7 Cost based suggestions

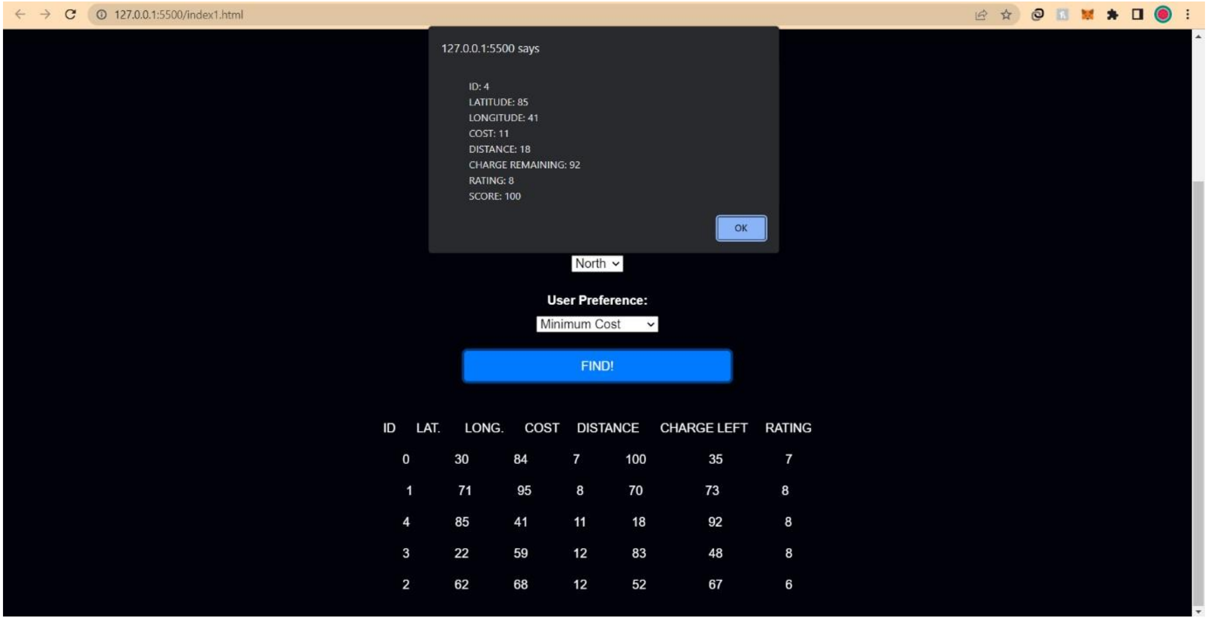


Fig. 8 Factor based suggestion