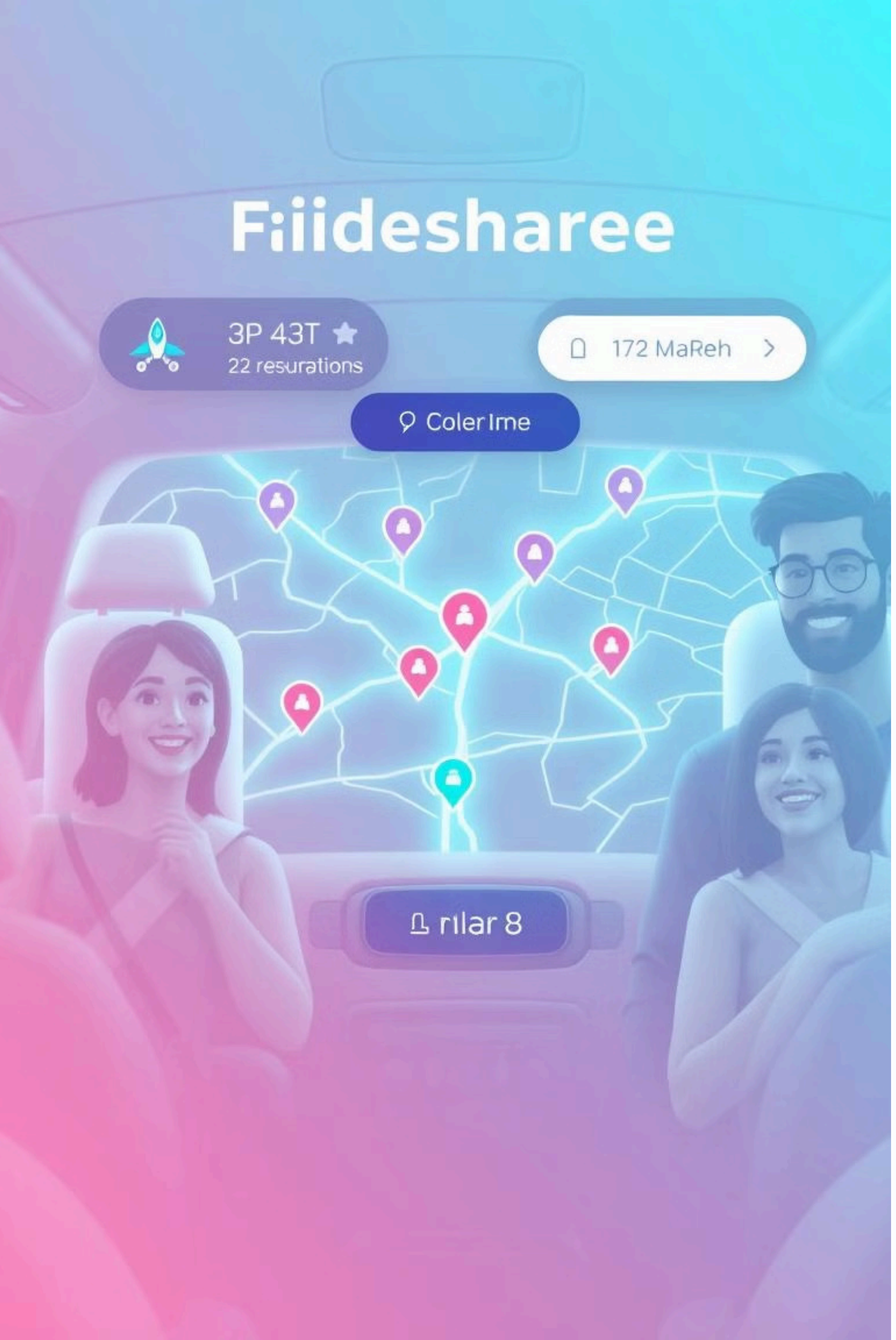
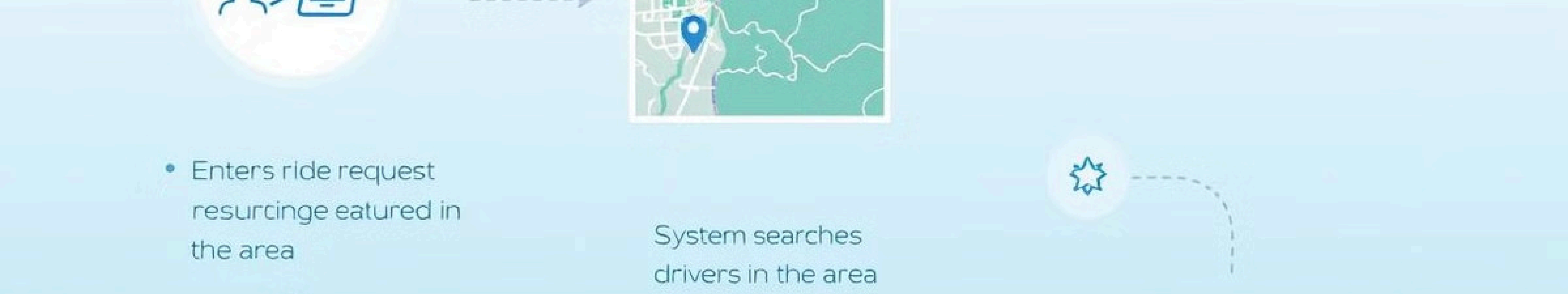


Ride-Sharing Matching System

This presentation explores an efficient ride-sharing matching system.

It leverages Trie, Heap, and Queue data structures for scalability and fairness.

We address the challenges of matching passengers and drivers based on location and idle time of drivers for fairness.


Enters ride request resurcinge eatured in the area
System searches drivers in the area

Ride-Matching Algorithm

Request Ride

Passenger requests a ride, adding location to Trie and request to Queue.

Find Nearest Drivers

Find drivers using the Trie based on passenger location.

Prioritize Drivers

Extract drivers from Heap based on idle time priority.

Assign Driver

Assign the most suitable driver and remove them from the Heap.

Trie for Location Storage

Trie Data Structure

The Trie stores geocoordinates(latitude/longitude) by converting then into GeoHash .

Enables efficient location-based search. Each level represents a digit/alphabets of GeoHash

Advantages

- Fast prefix-based search
- Efficient storage of hierarchical data
- Scalable for large datasets

Heap for Driver Prioritization

Min-Heap

A Heap prioritizes drivers based on idle time.

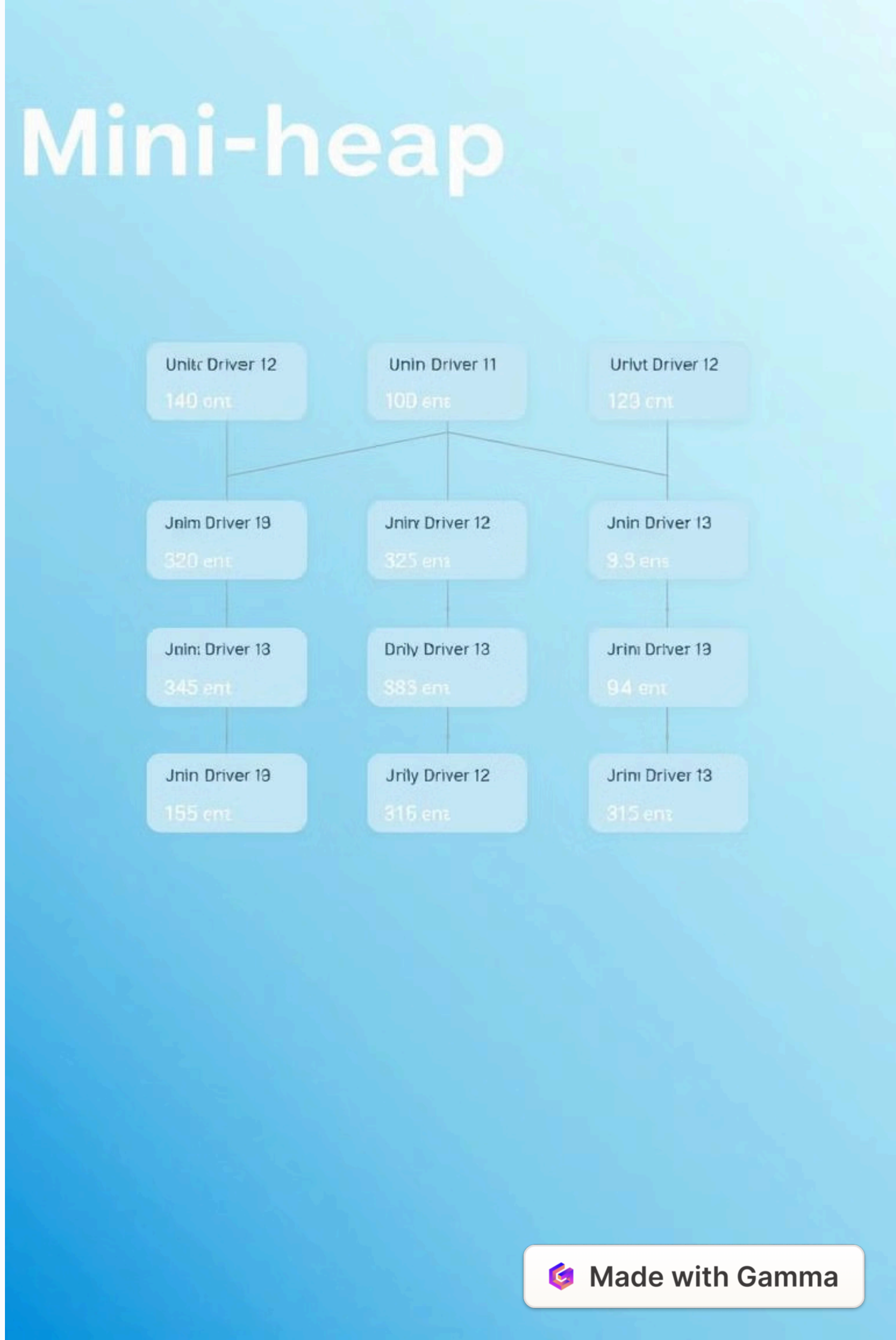
Drivers with the longest idle time get higher priority.

Idle Time as Key

Drivers are inserted into the heap with idle time as the key.

Fairness

Ensures fairness by matching the longest waiting driver.



Queue for Unmatched Requests

Queue Data Structure

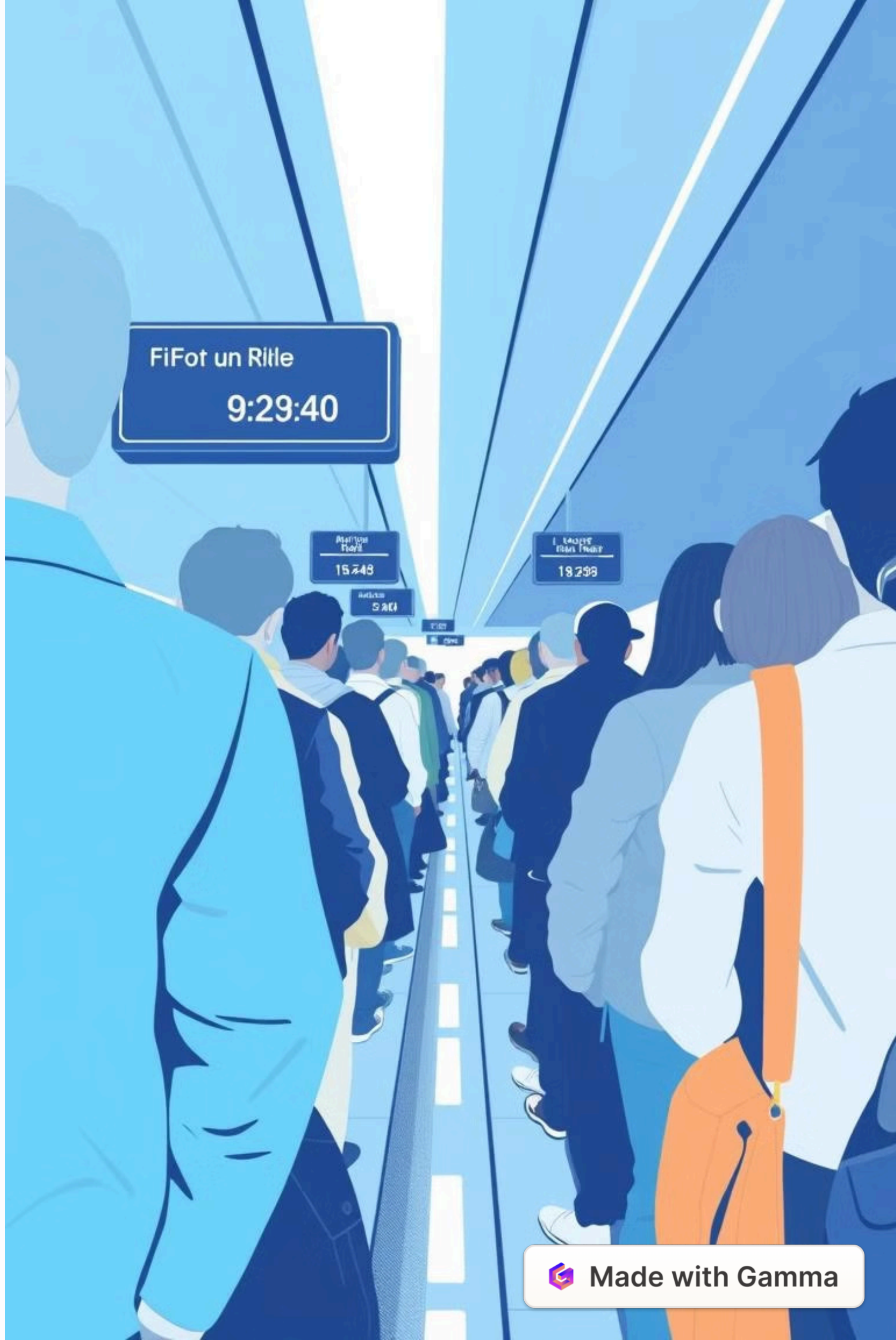
A queue stores unmatched passenger requests.

FIFO

Requests are processed in First-In, First-Out order.

Expiration

Requests expire after a certain time to prevent indefinite waiting.



Current Industry Challanges

1
Latency Issues

High-Volume matching in dense areas causes delays

2
Fairness Problem

Drivers in high-demand areas get more rides

3
Request Timeout Handling

Poor handling of unmatched requests

Main Functionalities

Driver Management

Add new drivers to the system with their location.

Passenger Management

Handle requests and match with the nearest drivers.

Efficient Matching

Ensure the best matches using location and idle time.

Performance Analysis

O(log n)

Time Complexity

Efficient matching algorithm.

O(n)

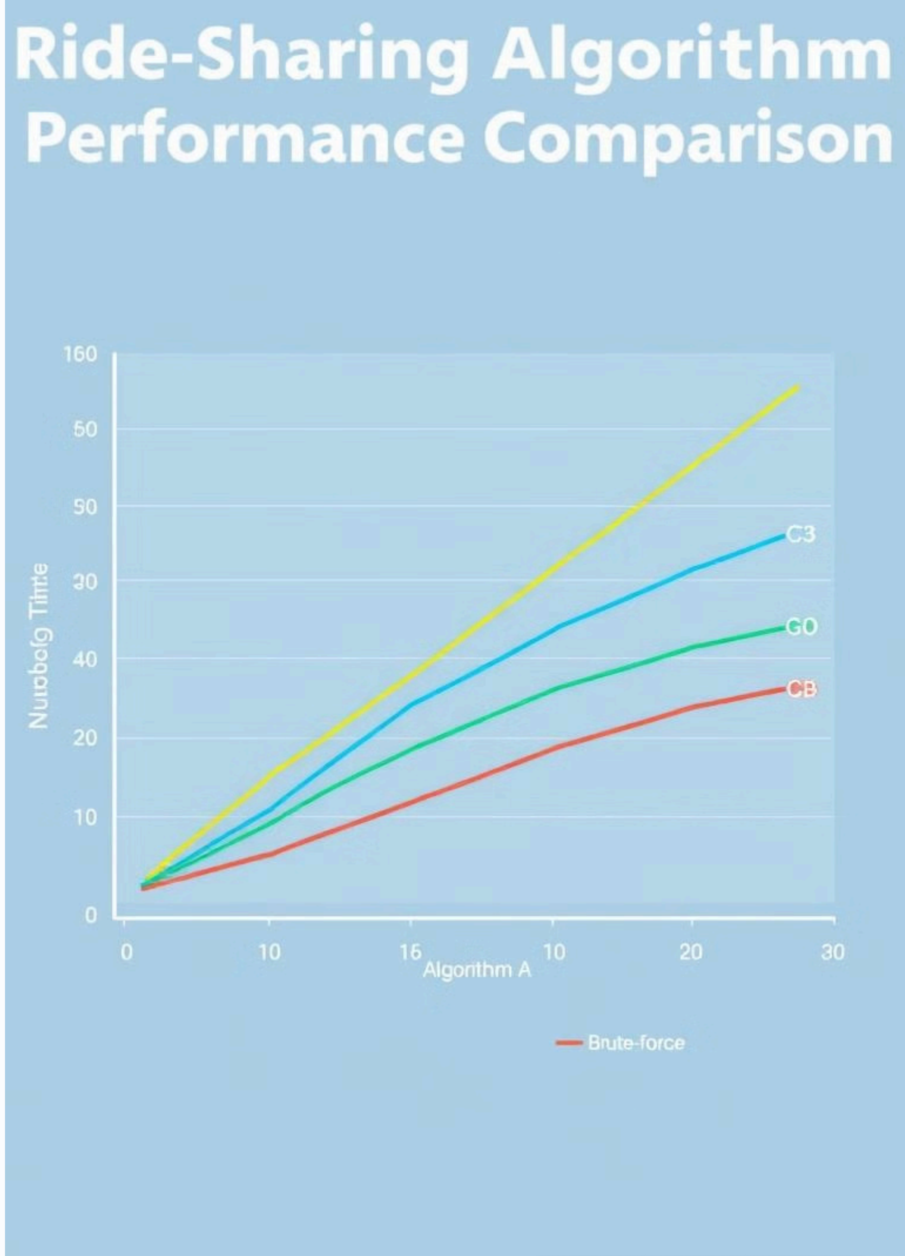
Space Complexity

Data structures (Trie, Heap, Queue).

Faster

Comparison

Better than brute-force search.



Conclusion and Future Work

Dynamic Pricing

Implement pricing based on demand.

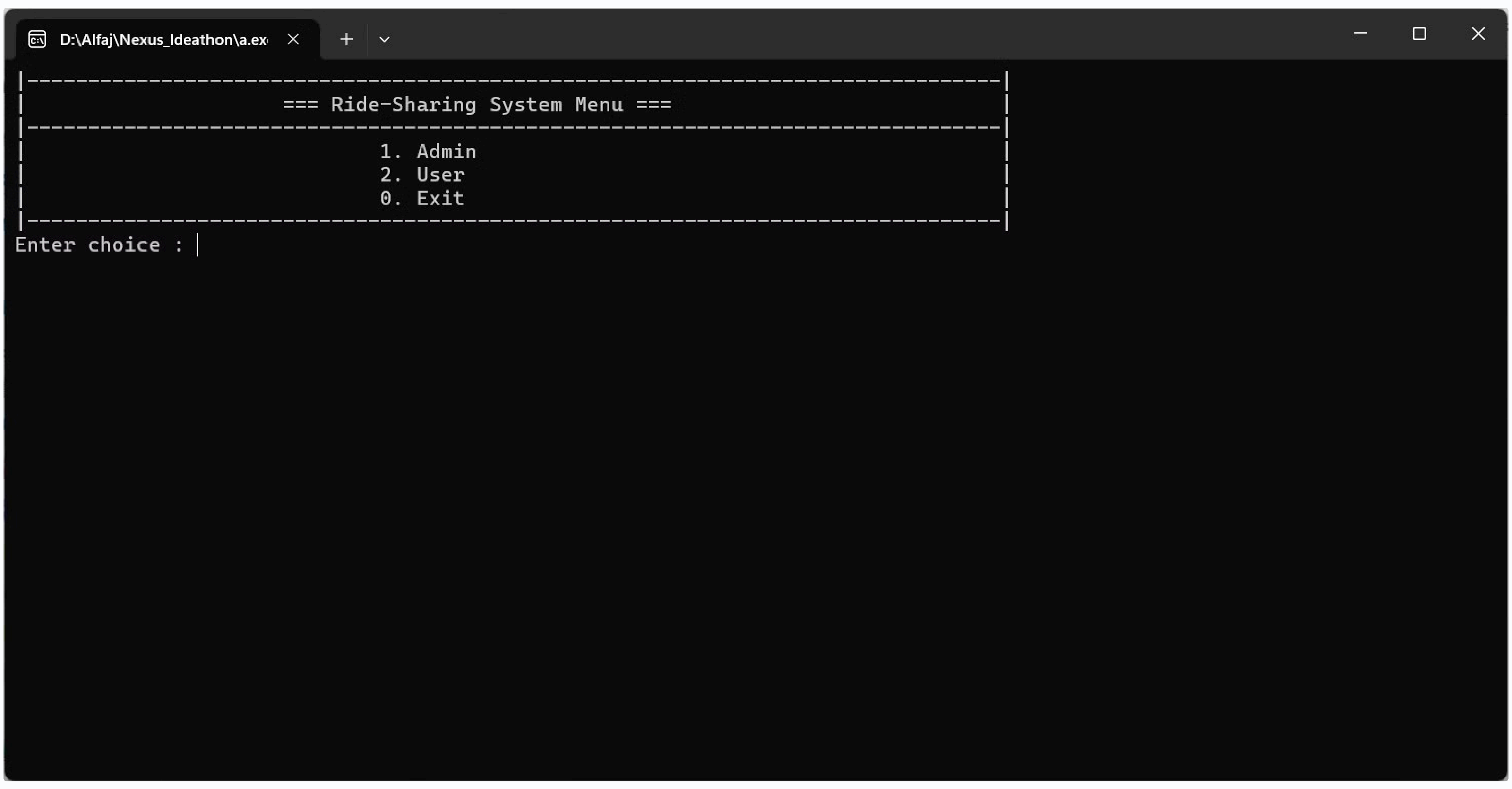
Traffic Data

Integrate real-time traffic updates.

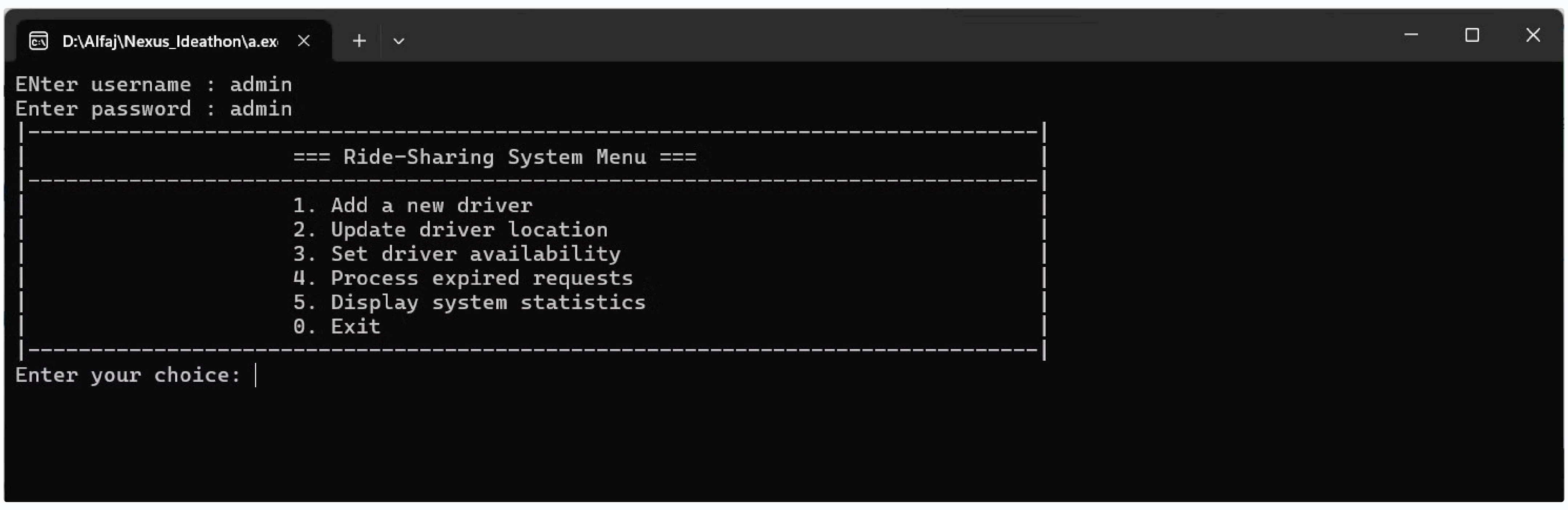
Further Optimization

Improve the matching algorithm.

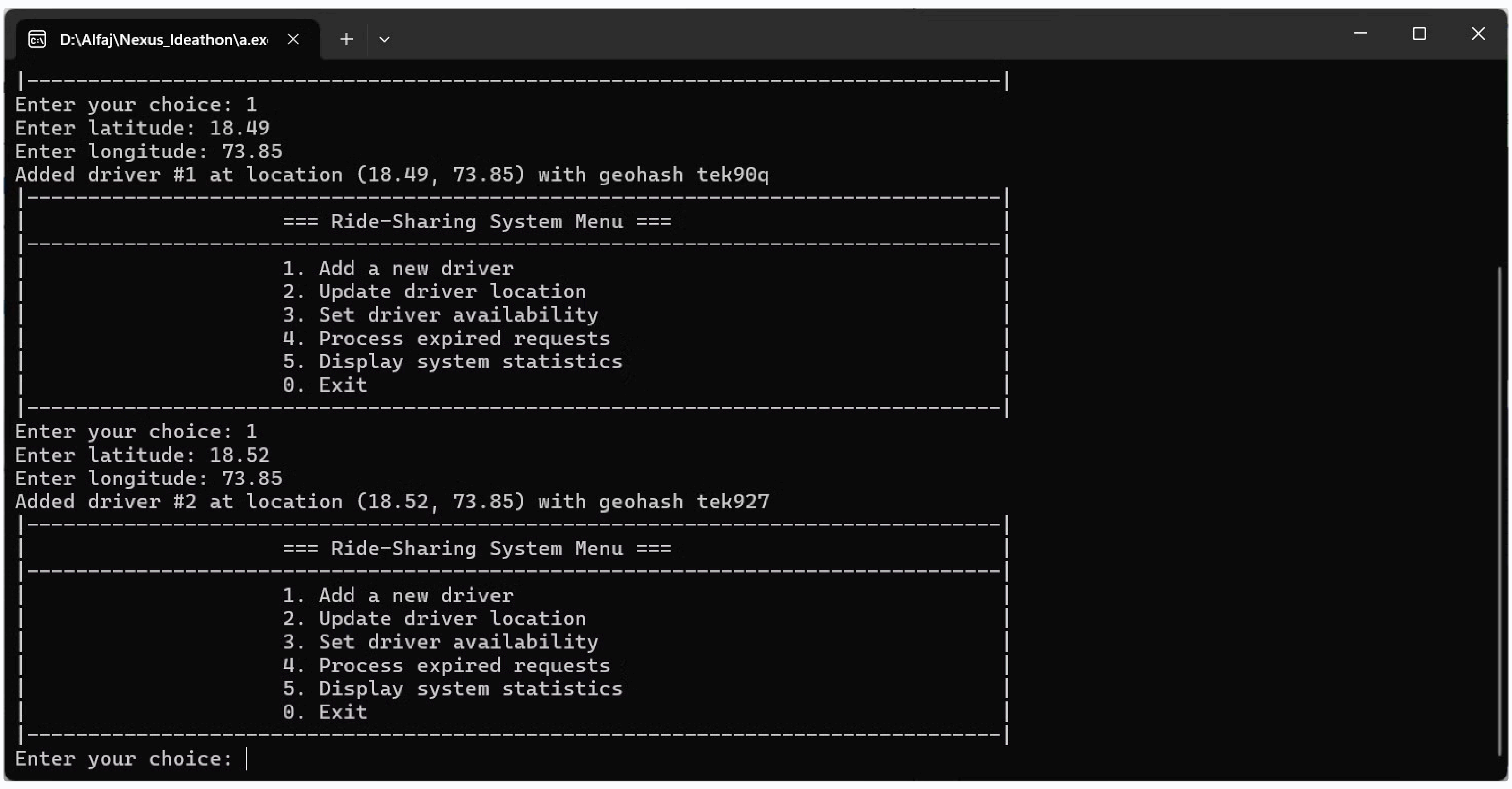
Output



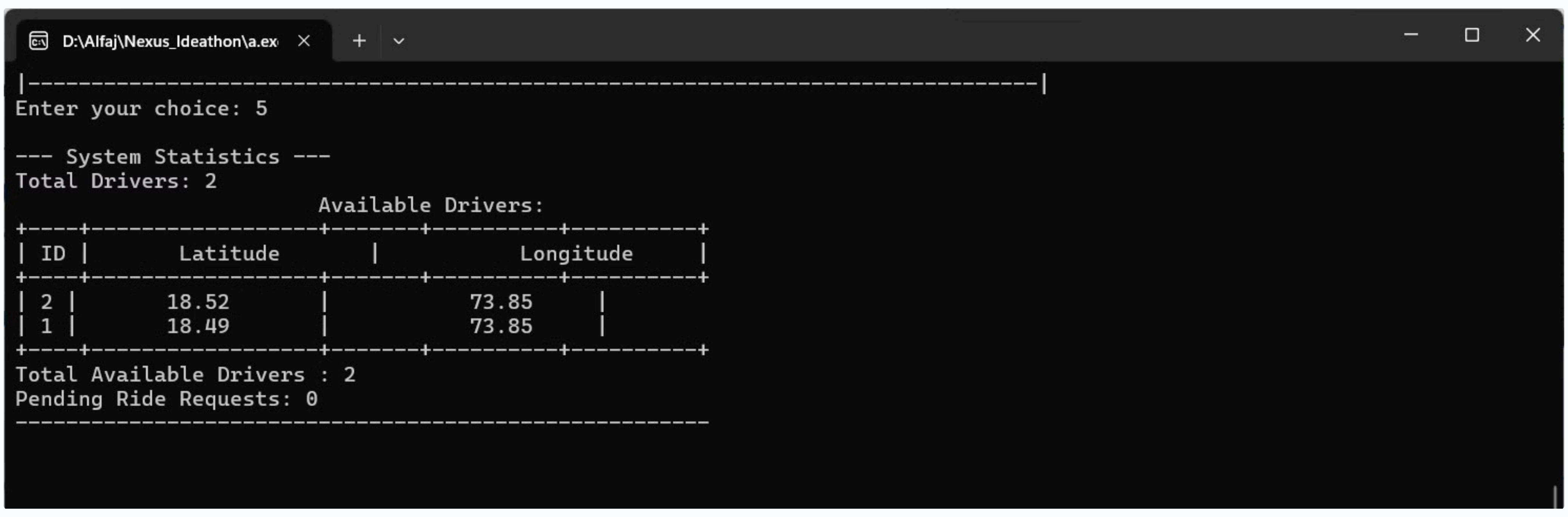
```
|--------------------------------------------------------------------------------|
|                      === Ride-Sharing System Menu ===                          |
|--------------------------------------------------------------------------------|
|                              1. Admin                                          |
|                              2. User                                           |
|                              0. Exit                                           |
|--------------------------------------------------------------------------------|
Enter choice : 
```



```
ENter username : admin
Enter password : admin
|--------------------------------------------------------------------------------|
|                      === Ride-Sharing System Menu ===                          |
|--------------------------------------------------------------------------------|
|                      1. Add a new driver                                       |
|                      2. Update driver location                                 |
|                      3. Set driver availability                                |
|                      4. Process expired requests                               |
|                      5. Display system statistics                              |
|                      0. Exit                                                   |
|--------------------------------------------------------------------------------|
Enter your choice: 
```

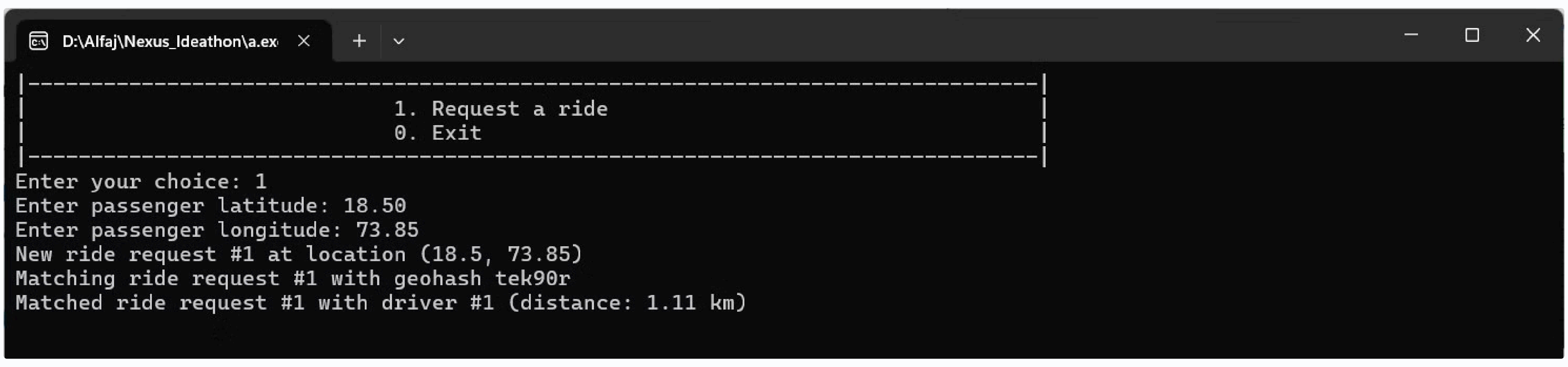


```
|--------------------------------------------------------------------------------|
Enter your choice: 1
Enter latitude: 18.49
Enter longitude: 73.85
Added driver #1 at location (18.49, 73.85) with geohash tek90q
|--------------------------------------------------------------------------------|
|                      === Ride-Sharing System Menu ===                          |
|--------------------------------------------------------------------------------|
|                      1. Add a new driver                                       |
|                      2. Update driver location                                 |
|                      3. Set driver availability                                |
|                      4. Process expired requests                               |
|                      5. Display system statistics                              |
|                      0. Exit                                                   |
|--------------------------------------------------------------------------------|
Enter your choice: 1
Enter latitude: 18.52
Enter longitude: 73.85
Added driver #2 at location (18.52, 73.85) with geohash tek927
|--------------------------------------------------------------------------------|
|                      === Ride-Sharing System Menu ===                          |
|--------------------------------------------------------------------------------|
|                      1. Add a new driver                                       |
|                      2. Update driver location                                 |
|                      3. Set driver availability                                |
|                      4. Process expired requests                               |
|                      5. Display system statistics                              |
|                      0. Exit                                                   |
|--------------------------------------------------------------------------------|
Enter your choice: 
```

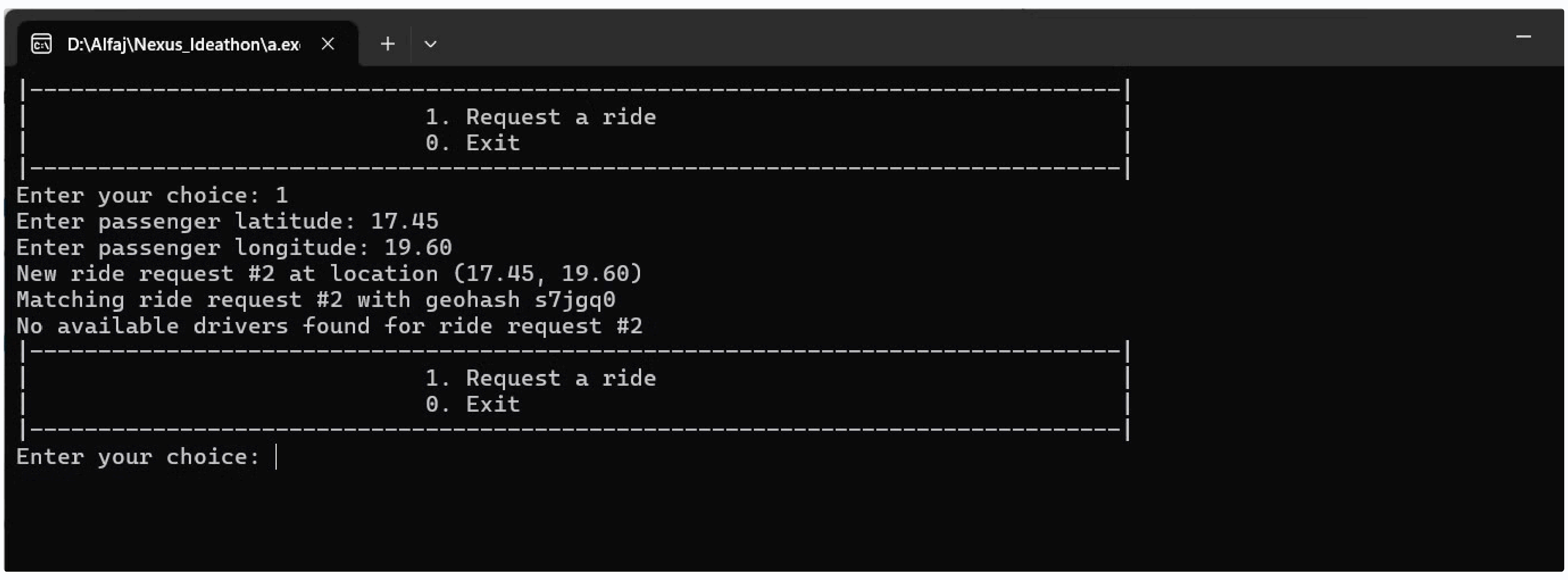


```
|--------------------------------------------------------------------------------|
Enter your choice: 5

--- System Statistics ---
Total Drivers: 2
                        Available Drivers:
+----+------------------+-------+----------+----------+
| ID |       Latitude        |          Longitude      |
+----+------------------+-------+----------+----------+
| 2 |       18.52       |          73.85      |
| 1 |       18.49       |          73.85      |
+----+------------------+-------+----------+----------+
Total Available Drivers : 2
Pending Ride Requests: 0
-------------------------------------------------------
```



```
|--------------------------------------------------------------------------------|
|                              1. Request a ride                                 |
|                              0. Exit                                           |
|--------------------------------------------------------------------------------|
Enter your choice: 1
Enter passenger latitude: 18.50
Enter passenger longitude: 73.85
New ride request #1 at location (18.5, 73.85)
Matching ride request #1 with geohash tek90r
Matched ride request #1 with driver #1 (distance: 1.11 km)
```



```
|--------------------------------------------------------------------------------|
|                              1. Request a ride                                 |
|                              0. Exit                                           |
|--------------------------------------------------------------------------------|
Enter your choice: 1
Enter passenger latitude: 17.45
Enter passenger longitude: 19.60
New ride request #2 at location (17.45, 19.60)
Matching ride request #2 with geohash s7jgq0
No available drivers found for ride request #2
|--------------------------------------------------------------------------------|
|                              1. Request a ride                                 |
|                              0. Exit                                           |
|--------------------------------------------------------------------------------|
Enter your choice: 
```