**Simulation Testbed Overview**

The simulation aims to analyze the supply and demand levels over one day, focusing on the movement of vehicles (represented by anonymous vehicle identification numbers, or anon\_vin) across different zones.

Input

* **Supply and Demand Level From Historical Record**
* **Interzonal Time Data**: Utilizes GTA06 data to understand and simulate the travel time between zones.

Data Structure:

Trip Request:

|  |  |
| --- | --- |
| Field Name | Description |
| request\_ID | Unique identifier for each trip request made by passengers from TASHA |
| anon\_vin | Anonymized vehicle identification number (VIN) |
| start\_zone | zone where the passenger begins their journey. |
| end\_zone | zone where the passenger ends their journey. |
| driver\_zone | zone where the driver accept the request |
| Deadhead Distance | The distance from when the driver accepts the trip request to when they pick up the passenger |
| trip distance | Total distance traveled during the trip (in kilometers). |
| fare | Total amount charged to the passenger for the trip. |
| event\_type | Type of event related to the trip (e.g., complete, cancellation). |
| request\_datetime | Date and time when the passenger made the trip request. |
| driver\_acceptance\_datetime | Date and time when the driver accepted the trip request. |
| passenger\_pickup\_datetime | Date and time when the driver picked up the passenger. |
| passenger\_drop\_datetime | Date and time when the passenger was dropped off at the destination. |

P1 Data:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| anon\_vin | start\_zone | end\_zone | distance | event\_type | idle\_start\_datetime | idle\_end\_datetime |
| 3522 | 193 | 193 | N/A | P1 Event | ######## | ######## |
| 4616 | 101 | 101 | N/A | P1 Event | ######## | ######## |

Simulation Process

The process includes simulating events based on the generated supply and demand levels and using interzonal time data to realistically model travel times between zones.

Output of the Simulation

* **P1 Period**: Events are logged with the following details:
  + **anon\_vin**: Anonymous vehicle identification number.
  + **start\_zone** and **end\_zone**: The zones from and to which the vehicle travels.
  + **distance**: The distance covered during the trip.
  + **event\_type**: The type of event (e.g., P1 Event, Complete trip).
  + **start\_datetime** and **end\_datetime**: The start and end timestamps of the event.

**P1 Period**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| anon\_vin | start\_zone | end\_zone | distance | event\_type | idle\_start\_datetime | idle\_end\_datetime |
| 9853 | 533 | 544 | N/A | P1 Event | ######## | ######## |
| 36403 | 376 | 373 | N/A | P1 Event | ######## | ######## |
| 44678 | 74 | 75 | N/A | P1 Event | ######## | ######## |
| 27132 | 416 | 407 | N/A | P1 Event | ######## | ######## |
| 18443 | 195 | 227 | N/A | P1 Event | ######## | ######## |
| 76045 | 37 | 38 | N/A | P1 Event | ######## | ######## |
| 65267 | 219 | 219 | N/A | P1 Event | ######## | ######## |
| 7332 | 146 | 129 | N/A | P1 Event | ######## | ######## |
| 47764 | 240 | 239 | N/A | P1 Event | ######## | ######## |
| 7478 | 117 | 106 | N/A | P1 Event | ######## | ######## |

* **For Servicing the Trips**: The completion of trips is logged with additional details:
  + **requestdatetime**: The timestamp when the trip was requested.
  + **passengerpickupdatetime** and **passengerdropdatetime**: The timestamps when the passenger was picked up and dropped off, respectively.
  + **Additional Trip Details:** anon\_vin, start\_zone, end\_zone, event\_type request\_datetime, driver\_acceptance\_datetime, passenger\_pickup\_datetime, passenger\_drop\_datetime

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| request\_ID | anon\_vin | start\_zone | end\_zone | event\_type | request\_datetime | driver\_acceptance\_datetime | passenger\_pickup\_datetime | passenger\_drop\_datetime |
| 453c4be7a8a4116371686d6a6ed0eabf0b3ac34e92185f26361313d7 | 17462 | 546 | 547 | Complete trip | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:02 |
| 8c7b13d366d5cfdeffedf6a0bdc763d5e6af1202a33ac3020a8f0d60 | 11823 | 400 | 400 | Complete trip | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:03 |
| 1176120ae0a9609054c8c336cf6cc6dca0a4b948aafe4177d278d246 | 78959 | 253 | 1 | Complete trip | 2020-01-01 23:59 | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:03 |
| 5e0d78d062cac200075df922 | 17672 | 313 | 306 | Complete trip | 2020-01-01 23:59 | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:04 |
| 3def9444a6ae37fdcc435314e6ad5e9226068bf17b54aba2004faf08 | 30124 | 268 | 24 | Complete trip | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:04 |
| 5e0d79078f8c0d0007462740 | 9853 | 544 | 532 | Complete trip | 2020-01-02 0:00 | 2020-01-02 0:00 | 2020-01-02 0:02 | 2020-01-02 0:04 |

**Metrics:**

The simulation aims to provide insights into the following metrics for the ride-hailing system given the specific supply level and demand level:

* **Distribution of Utilization Rate**: Understanding how the utilization rates of vehicles are distributed across the system.
* **Average Rate of Return**: Calculating the average rate at which vehicles return to service after completing trips.
* **Average Utilization Rate**: Measuring the average extent to which vehicles are utilized over the simulation period.
* **Average Number of Orders**: Determining the average number of trip orders serviced by vehicles.
* **Average Idling Time**: Calculating the average time vehicles spend idle, without servicing any trips.
* **Average Profit Per Unit**: Estimating the average profit generated by each vehicle per unit of measure (e.g., per trip, per day).
* **Average Service Time**: Calculating the average time taken to service a trip, from request to drop-off.