Name: Dhruv Bheda   **SAPID:** 60004200102

DIV: B/B1

ADBMS
Exp9

Aim: Processing of Spatial and Temporal data

Theory:

* Spatial Database

→ A spatial database is a database that deals with information associated with geographical locations such as cities, towns etc.

→ A spatial database is optimized to store & query data representing objects

→ These are the objects which are defined in a geometric space

→ Spatial db offers spatial data types (SDTs) in it's data model & query language.

→ It supports spatial data type in it's implementation, providing atleast spatial indexing & efficient algorithm for spatial join

→ Spatial Data is majorly of 3 Types:-
- Vector Data — Data represented as discrete pts, lines & polygon
- Raster Data - Data represented as matrix of square cells
- Image Data - Data typically in form of images

Conclusion :-
Thus, we studied & implemented spatial & temporal data.

Queries:

Temporal:

```
mysql> select * from 2022_july where start_time < "04:00:00";
+------------+------------+----------+----------------------+------------+------------------------------+
| start_date | start_time | distance | mode                 | confidence | Places                       |
+------------+------------+----------+----------------------+------------+------------------------------+
| 02-07-2022 |            |    18716 | IN_PASSENGER_VEHICLE | MEDIUM     |                              |
| 06-07-2022 | 03:23:42   |     1669 | MOTORCYCLING         | LOW        |                              |
| 06-07-2022 | 03:35:46   |    11483 | IN_TRAIN             | LOW        |                              |
| 06-07-2022 | 03:58:13   |     1069 | MOTORCYCLING         | MEDIUM     |                              |
| 08-07-2022 | 03:11:39   |      461 | MOTORCYCLING         | LOW        |                              |
| 08-07-2022 | 03:26:15   |     1099 | IN_PASSENGER_VEHICLE | LOW        |                              |
| 08-07-2022 | 03:42:42   |     7548 | IN_TRAIN             | MEDIUM     | Anhad Misal                  |
| 11-07-2022 | 03:48:22   |     1609 | IN_BUS               | MEDIUM     | Kandivali Bus Station (W)    |
| 13-07-2022 | 03:19:59   |      905 | WALKING              | LOW        |                              |
| 13-07-2022 | 03:48:02   |     1896 | IN_BUS               | LOW        | Kandivali Railway Station (W)|
| 14-07-2022 | 03:54:54   |     8949 | IN_BUS               | HIGH       |                              |
| 15-07-2022 | 03:48:49   |     8500 | IN_PASSENGER_VEHICLE | LOW        |                              |
| 16-07-2022 | 03:44:35   |     9838 | IN_BUS               | MEDIUM     | Laxmi Industrial Colony      |
| 18-07-2022 | 03:51:31   |     1292 | IN_BUS               | LOW        |                              |
| 18-07-2022 | 03:57:47   |     9400 | IN_BUS               | LOW        | Anhad Misal                  |
| 19-07-2022 | 03:54:30   |    10085 | IN_BUS               | MEDIUM     | Lotus Business Park          |
| 20-07-2022 | 03:32:29   |     1721 | IN_BUS               | MEDIUM     | Bajaj Municipal School       |
| 20-07-2022 | 03:47:40   |     9487 | IN_TRAIN             | MEDIUM     | Andheri Police Station       |
| 21-07-2022 | 03:46:02   |     8698 | UNKNOWN_ACTIVITY_TYPE| LOW        | Sun-n-Sand Hotel             |
| 23-07-2022 | 03:45:05   |    11590 | IN_PASSENGER_VEHICLE | LOW        |                              |
| 25-07-2022 | 03:34:52   |    10629 | IN_BUS               | MEDIUM     | Doolally Taproom - Andheri   |
| 26-07-2022 | 03:52:48   |    10072 | IN_BUS               | MEDIUM     | Doolally Taproom - Andheri   |
| 27-07-2022 | 03:48:55   |     9483 | IN_BUS               | LOW        | Doolally Taproom - Andheri   |
| 28-07-2022 | 03:29:48   |     9599 | IN_BUS               | MEDIUM     | RikÄ? - Terrace Bar & Grill  |
| 29-07-2022 | 03:31:35   |     1948 | MOTORCYCLING         | LOW        | Kandivali Bus Station (W)    |
| 29-07-2022 | 03:47:34   |     9579 | IN_TRAIN             | MEDIUM     |                              |
+------------+------------+----------+----------------------+------------+------------------------------+
26 rows in set (0.00 sec)
```

Spatial:

```
mysql> select * from 2022_july where distance>10000;
+------------+------------+----------+----------------------+------------+------------------------------+
| start_date | start_time | distance | mode                 | confidence | Places                       |
+------------+------------+----------+----------------------+------------+------------------------------+
| 02-07-2022 |            |    18716 | IN_PASSENGER_VEHICLE | MEDIUM     |                              |
| 06-07-2022 | 03:35:46   |    11483 | IN_TRAIN             | LOW        |                              |
| 13-07-2022 | 13:44:17   |    11855 | IN_TRAIN             | LOW        | Kandivali Station (W)        |
| 19-07-2022 | 03:54:30   |    10085 | IN_BUS               | MEDIUM     | Lotus Business Park          |
| 21-07-2022 | 18:59:35   |    41236 | UNKNOWN_ACTIVITY_TYPE| LOW        | Jay's Dosa & Paratha Center  |
| 23-07-2022 | 03:45:05   |    11590 | IN_PASSENGER_VEHICLE | LOW        |                              |
| 24-07-2022 | 06:56:09   |    10674 | MOTORCYCLING         | LOW        | Axis Bank ATM                |
| 25-07-2022 | 03:34:52   |    10629 | IN_BUS               | MEDIUM     | Doolally Taproom - Andheri   |
| 26-07-2022 | 03:52:48   |    10072 | IN_BUS               | MEDIUM     | Doolally Taproom - Andheri   |
+------------+------------+----------+----------------------+------------+------------------------------+
9 rows in set (0.03 sec)
```

```
mysql> select * from 2022_july where Places="Doolally Taproom - Andheri";
+------------+------------+----------+--------+------------+----------------------------+
| start_date | start_time | distance | mode   | confidence | Places                     |
+------------+------------+----------+--------+------------+----------------------------+
| 25-07-2022 | 03:34:52   |    10629 | IN_BUS | MEDIUM     | Doolally Taproom - Andheri |
| 26-07-2022 | 03:52:48   |    10072 | IN_BUS | MEDIUM     | Doolally Taproom - Andheri |
| 27-07-2022 | 03:48:55   |     9483 | IN_BUS | LOW        | Doolally Taproom - Andheri |
+------------+------------+----------+--------+------------+----------------------------+
3 rows in set (0.00 sec)
```

Data:

```
mysql> select * from 2022_july;
+------------+------------+----------+----------------------+------------+-------------------------------------------------+
| start_date | start_time | distance | mode                 | confidence | Places                                          |
+------------+------------+----------+----------------------+------------+-------------------------------------------------+
| 02-07-2022 |            |    18716 | IN_PASSENGER_VEHICLE | MEDIUM     |                                                 |
| 06-07-2022 | 03:23:42   |     1669 | MOTORCYCLING         | LOW        |                                                 |
| 06-07-2022 | 03:35:46   |    11483 | IN_TRAIN             | LOW        |                                                 |
| 06-07-2022 | 03:58:13   |     1069 | MOTORCYCLING         | MEDIUM     |                                                 |
| 08-07-2022 | 03:11:39   |      461 | MOTORCYCLING         | LOW        |                                                 |
| 08-07-2022 | 03:26:15   |     1099 | IN_PASSENGER_VEHICLE | LOW        |                                                 |
| 08-07-2022 | 03:42:42   |     7548 | IN_TRAIN             | MEDIUM     | Anhad Misal                                     |
| 11-07-2022 | 03:48:22   |     1609 | IN_BUS               | MEDIUM     | Kandivali Bus Station (W)                       |
| 11-07-2022 | 04:11:17   |     9363 | IN_TRAIN             | MEDIUM     | Agarkar Chowk                                   |
| 11-07-2022 | 04:39:15   |     2125 | IN_SUBWAY            | LOW        | SAMMOHI BY MOKSHA & HIRAL                        |
| 11-07-2022 | 04:48:18   |      896 | IN_PASSENGER_VEHICLE | LOW        | Trumpet Sky Lounge                              |
| 11-07-2022 | 12:22:26   |     2972 | IN_PASSENGER_VEHICLE | LOW        | McDonald's                                      |
| 11-07-2022 | 12:48:32   |     9467 | IN_TRAIN             | MEDIUM     | Kandivali Bus Depot                             |
| 11-07-2022 | 13:10:00   |     2203 | IN_PASSENGER_VEHICLE | LOW        | State Bank of India                             |
| 13-07-2022 | 03:19:59   |      905 | WALKING              | LOW        |                                                 |
| 13-07-2022 | 03:48:02   |     1896 | IN_BUS               | LOW        | Kandivali Railway Station (W)                   |
| 13-07-2022 | 04:04:12   |     9348 | IN_TRAIN             | MEDIUM     | Agarkar Chowk / Pinky Cinema                    |
| 13-07-2022 | 04:33:49   |     3270 | IN_PASSENGER_VEHICLE | LOW        | Lotus Business Park                             |
| 13-07-2022 | 13:06:26   |     5297 | IN_BUS               | LOW        | Villa Decor - Premium Bed, Bath & Mattresses Store |
| 13-07-2022 | 13:44:17   |    11855 | IN_TRAIN             | LOW        | Kandivali Station (W)                           |
| 13-07-2022 | 14:15:27   |     1969 | IN_PASSENGER_VEHICLE | MEDIUM     | State Bank of India                             |
| 14-07-2022 | 03:54:54   |     8949 | IN_BUS               | HIGH       |                                                 |
| 14-07-2022 | 04:39:02   |      578 | WALKING              | MEDIUM     | UK Realty                                       |
| 14-07-2022 | 14:12:01   |     6005 | IN_BUS               | LOW        | Yoko Sizzlers                                   |
| 14-07-2022 | 14:58:50   |     4087 | UNKNOWN_ACTIVITY_TYPE | LOW       | Xth Central Mall                                |
| 15-07-2022 | 03:48:49   |     8500 | IN_PASSENGER_VEHICLE | LOW        |                                                 |
| 15-07-2022 | 04:41:11   |     9105 | IN_BUS               | LOW        | RikÄ? - Terrace Bar & Grill                     |
| 15-07-2022 | 14:15:09   |     5691 | IN_BUS               | MEDIUM     | D Mart                                          |
| 15-07-2022 | 15:08:26   |     4933 | IN_BUS               | MEDIUM     | La Pino'z Pizza Kandivali                       |
| 16-07-2022 | 03:44:35   |     9838 | IN_BUS               | MEDIUM     | Laxmi Industrial Colony                         |
| 16-07-2022 | 13:08:07   |     2965 | MOTORCYCLING         | LOW        | Andheri Station (W)                             |
| 16-07-2022 | 13:32:44   |     9292 | IN_TRAIN             | MEDIUM     | Kandivali West                                  |
| 16-07-2022 | 13:53:02   |     2074 | IN_PASSENGER_VEHICLE | LOW        | La Pino'z Pizza Kandivali                       |
| 17-07-2022 | 08:38:08   |      880 | MOTORCYCLING         | LOW        | Malad Industrial Estate                         |
| 17-07-2022 | 10:23:08   |     1492 | IN_PASSENGER_VEHICLE | LOW        | Aadhar Center                                   |
| 17-07-2022 | 10:57:46   |     1294 | MOTORCYCLING         | MEDIUM     | La Pino'z Pizza Kandivali                       |
| 17-07-2022 | 11:38:53   |     5829 | MOTORCYCLING         | LOW        | State Bank Of India ATM                         |
| 18-07-2022 | 03:51:31   |     1292 | IN_BUS               | LOW        |                                                 |
| 18-07-2022 | 03:57:47   |     9400 | IN_BUS               | LOW        | Anhad Misal                                     |
```

Conclusion:

We successfully implemented spatial and temporal queries to make the database more efficient for the user.