

BIG DATA SYSTEMS

PROJECT 1: BIG MOBILITY & IOT DATA ANALYTICS

NADA JOVANOVIĆ 1618

ZADATAK

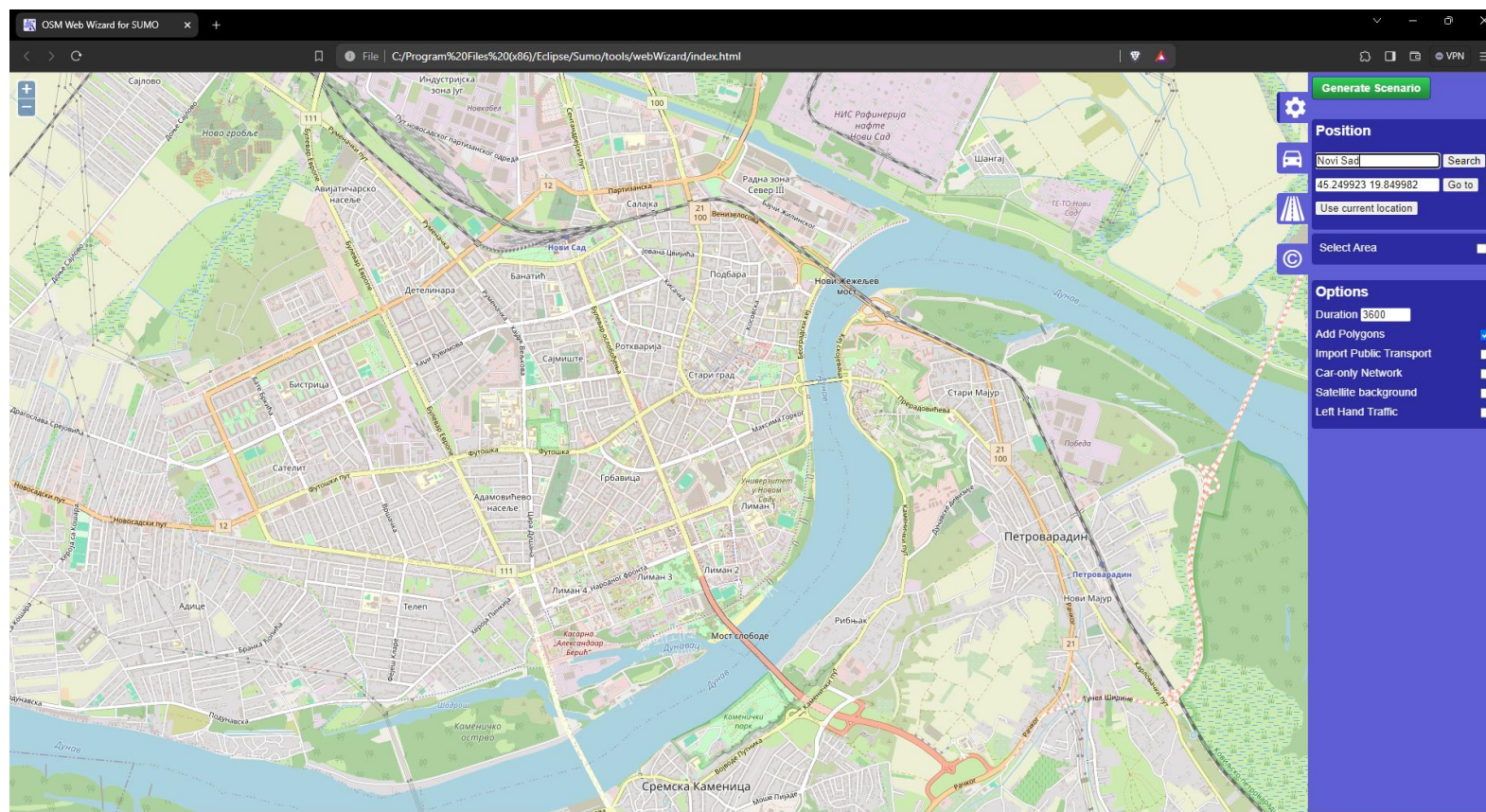
- Korišćenjem **SUMO** simulatora <https://sumo.dlr.de> kreirati jedan ili više velikih skupova podataka (~1GB) koji se odnose na kretanje vozila u IoT sistemima pametnih gradova i pametnog saobraćaja/transporta, u određenom gradu u Evropi ili svetu. Dobijene podatke u XML formatu prebaciti u .csv (xml2csv.py) i postaviti podatke na **HDFS**
- Razviti aplikaciju korišćenjem **Apache Spark** framework-a i Python (Scala, Java) API za batch obradu i analizu ovih podataka koja uključuje sledeće funkcionalnosti:
 1. Odrediti broj vozila i njihove karakteristike koja su prolazila u blizini značajnih mesta u gradu u određenom vremenskom periodu. Mesto (geo koordinate mesta), veličina „blizina“, granice vremenskog perioda i eventualni filter (npr. tip vozila) se zadaju kao argumenti aplikacije.
 2. Naći minimalne, maksimalne, srednje vrednosti, standardne devijaciju i ostale statističke parametre zagađenja (CO₂, CO, HC, NO_x, PM_x, noise) ili potrošnje goriva (fuel, electricity) po ulicama (edge/lanes) u određenim vremenskim periodima.

Korišćene tehnologije



GENERISANJE PODATAKA

GENERISANJE MREŽE – OSM WEB WIZARD









































GENERISANJE OUTPUT-A

- Za generisanje output-a korišćene su sledeće komande:
 - `sumo -c osm.sumocfg --fcd-output fdc.xml --fcd-output.geo`
 - `sumo -c osm.sumocfg --emission-output emissions.xml`
- A zatim:
 - `python tools/xml/xml2csv.py "D:\novisad\emissions.xml"`
 - `python tools/xml/xml2csv.py "D:\novisad\ fdc.xml"`

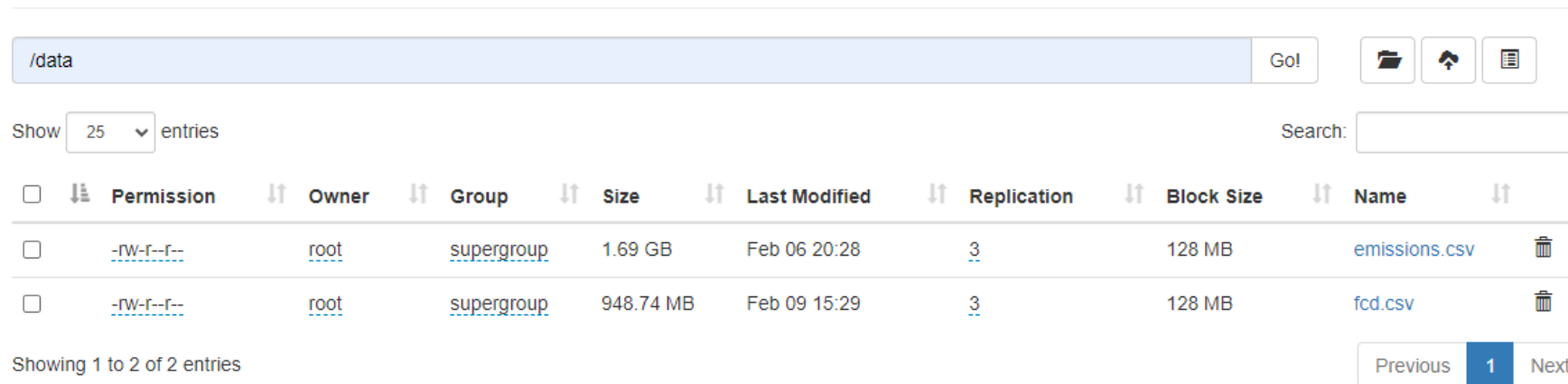
DOCKER COMPOSE

- Kroz docker se pokreću Hadoop kontejneri, kao i Spark



| | | | | | | |
|--------------------------|---|--|---------------|---|----------------|---|
| <input type="checkbox"/> | ▼  projekat1 | | Running (8/8) | 210.97% | 12 seconds ago |    |
| <input type="checkbox"/> |  datanode e84996e4c28a  | bde2020/hadoop-datanode:2.0.0-hadoop3.2.1-java8 | Running | 0.14% | 13 seconds ago |    |
| <input type="checkbox"/> |  historyserver 565b6b516a56  | bde2020/hadoop-historyserver:2.0.0-hadoop3.2.1-java8 | Running | 0.91% | 13 seconds ago |    |
| <input type="checkbox"/> |  namenode 22ff2c3918eb  | bde2020/hadoop-namenode:2.0.0-hadoop3.2.1-java8 | Running | 0.13% 9000:9000  Show all ports (2) | 13 seconds ago |    |
| <input type="checkbox"/> |  nodemanager c9b77b847c85  | bde2020/hadoop-nodemanager:2.0.0-hadoop3.2.1-java8 | Running | 0% | 13 seconds ago |    |
| <input type="checkbox"/> |  resourcemanager 96984817c10c  | bde2020/hadoop-resourcemanager:2.0.0-hadoop3.2.1-java8 | Running | 209.61% | 13 seconds ago |    |
| <input type="checkbox"/> |  spark-master 8b1c3f6b5cc1  | bde2020/spark-master:3.1.2-hadoop3.2 | Running | 0.06% 7077:7077  Show all ports (2) | 13 seconds ago |    |
| <input type="checkbox"/> |  spark-worker-1 29171aab2115  | bde2020/spark-worker:3.1.2-hadoop3.2 | Running | 0.06% 8071:8071  | 12 seconds ago |    |
| <input type="checkbox"/> |  spark-worker-2 e4b818e91940  | bde2020/spark-worker:3.1.2-hadoop3.2 | Running | 0.06% 8072:8071  | 13 seconds ago |    |

POSTAVLJANJE PODATAKA NA HDFS

- Prvo na namenode:
 - `docker cp emissions.csv namenode:/data`
- A zatim i na HDFS:
 - `docker exec -it namenode bash`
 - `root@22ff2c3918eb:/# hdfs dfs -mkdir /data`
 - `root@22ff2c3918eb:/# hdfs dfs -put /data/emission.csv /data`



The screenshot shows the HDFS web interface for the /data directory. At the top, there is a search bar with the text "/data" and a "Go!" button. Below the search bar, there are three icons: a folder, an upload arrow, and a document. The main content area displays a table of files. The table has columns for checkboxes, Permission, Owner, Group, Size, Last Modified, Replication, Block Size, Name, and a trash icon. Two files are listed: "emissions.csv" and "fcd.csv". The "emissions.csv" file is 1.69 GB, created on Feb 06 20:28, with 3 replications and a block size of 128 MB. The "fcd.csv" file is 948.74 MB, created on Feb 09 15:29, with 3 replications and a block size of 128 MB. At the bottom left, it says "Showing 1 to 2 of 2 entries". At the bottom right, there are navigation buttons: "Previous", "1" (highlighted), and "Next".

| <input type="checkbox"/> | Permission | Owner | Group | Size | Last Modified | Replication | Block Size | Name | |
|--------------------------|------------|-------|------------|-----------|---------------|-------------|------------|---------------|---|
| <input type="checkbox"/> | -rw-r--r-- | root | supergroup | 1.69 GB | Feb 06 20:28 | 3 | 128 MB | emissions.csv |  |
| <input type="checkbox"/> | -rw-r--r-- | root | supergroup | 948.74 MB | Feb 09 15:29 | 3 | 128 MB | fcd.csv |  |

Showing 1 to 2 of 2 entries

Previous 1 Next

APLIKACIJA

TASK 1

```
def find_vehicles(spark, latitude_point, longitude_point, proximity_size, time_start, time_end):
```

```
    start_time = time.time()
```

```
    data = spark.read.option("header", "true").option("delimiter", ",").csv('hdfs://namenode:9000/data/fcd.csv', inferSchema=True)
```

```
    data_filter = data.filter((col("timestep_time") >= lit(time_start)) & (col("timestep_time") <= lit(time_end)))
```

```
    df_with_distance = data_filter.withColumn(
```

```
        "distance",
```

```
        6371 * acos(
```

```
            sin(radians(lit(latitude_point))) * sin(radians(col("vehicle_x"))) +
```

```
            cos(radians(lit(latitude_point))) * cos(radians(col("vehicle_x"))) * cos(radians(col("vehicle_y")) - radians(lit(longitude_point)))
```

```
        )
```

```
    )
```

```
    df_filtered = df_with_distance.filter(col("distance") < proximity_size).dropDuplicates(["vehicle_id"])
```

```
    print(f"Broj jedinstvenih vozila u okoloni: {df_filtered.count()}")
```

```
    df_filtered.show()
```

```
    return time.time() - start_time
```

Za računanje udaljenosti između 2
tačke korišćena je Haversine formule

TASK 2

```
def air_fuel_task(spark, task, time_start, time_end):  
  
    start_time = time.time()  
  
    data = spark.read.option("header", "true").option("delimiter", ";").csv("hdfs://namenode:9000/data/emissions.csv", inferSchema=True)  
  
    data_filter = data.filter((col("timestep_time") >= time_start) & (col("timestep_time") <= time_end))  
  
    columns = []  
  
    if task == 'z':  
        # zagadjenje  
        columns = ["vehicle_CO", "vehicle_CO2", "vehicle_HC", "vehicle_NOx", "vehicle_PMX", "vehicle_noise"]  
    elif task == 'g':  
        # gorivo  
        columns = ["vehicle_electricity", "vehicle_fuel"]  
  
    for col_name in columns:  
        data_filter.groupBy("vehicle_lane") \  
            .agg(  
                count(col(col_name)).alias(f"count_{col_name}"), \  
                min(col(col_name)).alias(f"min_{col_name}"), \  
                max(col(col_name)).alias(f"max_{col_name}"), \  
                mean(col(col_name)).alias(f"mean_{col_name}"), \  
                avg(col(col_name)).alias(f"avg_{col_name}"), \  
                stddev(col(col_name)).alias(f"sddev_{col_name}") \  
            ) \  
            .show()  
  
    return time.time() - start_time
```

MAIN

```
if __name__ == "__main__":  
  
    ts = time.time()  
    args = sys.argv  
    print(args)  
  
    spark = SparkSession.builder.appName(args[1]).master(args[2]).getOrCreate()  
  
    t=0  
    if args[3] == '1':  
        print("task 1")  
        t = find_vehicles(spark,float(args[4]),float(args[5]),float(args[6]), float(args[7]), float(args[8]))  
  
    elif args[3] == '2':  
        print("task 2")  
        t = air_fuel_task(spark, args[4],float(args[5]),float(args[6]))  
  
    spark.stop()  
  
    print(f"Vreme izvršenja task{args[3]}: {t}")  
    print(f"Vreme izvršenja aplikacije: {time.time()-ts}")  
  
# not
```

Način izvršenja

Naziv aplikacije

POKRETANJE APLIKACIJE

DOCKERFILE

App >  Dockerfile

```
1 FROM bde2020/spark-python-template:3.1.2-hadoop3.2
2
3 ENV SPARK_APPLICATION_PYTHON_LOCATION app/main.py
4 ENV SPARK_APPLICATION_ARGS "AppKL spark://8b1c3f6b5cc1:7077 2 z 0 500"
```

KREIRANJE DOCKER IMAGE

```
D:\BigData\Projekat1>docker build --rm -t bde/spark-app .
[+] Building 9.9s (9/9) FINISHED                                docker:default
=> [internal] load build definition from Dockerfile            0.0s
=> => transferring dockerfile: 189B                             0.0s
=> [internal] load .dockerignore                               0.0s
=> => transferring context: 2B                                    0.0s
=> [internal] load metadata for docker.io/bde2020/spark-python-template:3.1.2-hadoop3.2 1.4s
=> [1/1] FROM docker.io/bde2020/spark-python-template:3.1.2-hadoop3.2@sha256:905fcb3cf7890faaa21789aefb2e330d921 0.0s
=> [internal] load build context                               0.6s
=> => transferring context: 873.56kB                             0.6s
=> CACHED [2/1] COPY requirements.txt /app/                    0.0s
=> CACHED [3/1] RUN cd /app      && pip3 install -r requirements.txt 0.0s
=> [4/1] COPY . /app                                           5.1s
=> exporting to image                                           2.7s
=> => exporting layers                                           2.7s
=> => writing image sha256:16ffb8d280b481b16b33ab39b48dd60b51e19486cdc808d8dea71607280faa68 0.0s
=> => naming to docker.io/bde/spark-app                        0.0s
```

What's Next?

View summary of image vulnerabilities and recommendations → [docker scout quickview](#)

POKRETANJE APLIKACIJE

Postavljanje argumenata

```
docker run --rm --net bde -e SPARK_APPLICATION_ARGS="AppKL spark://8b1c3f6b5cc1:7077 2 z 0 500" bde/spark-app
```

- Argumenti:

- 1) Ime aplikacije
- 2) Izvršenje na kalsteru/lokalno
- 3) Task
- 4) Parametri za task
 - Task1: lat, lon, prox, t_{start} , t_{end}
 - Task2: z/g, t_{start} , t_{end}

REZULTATI

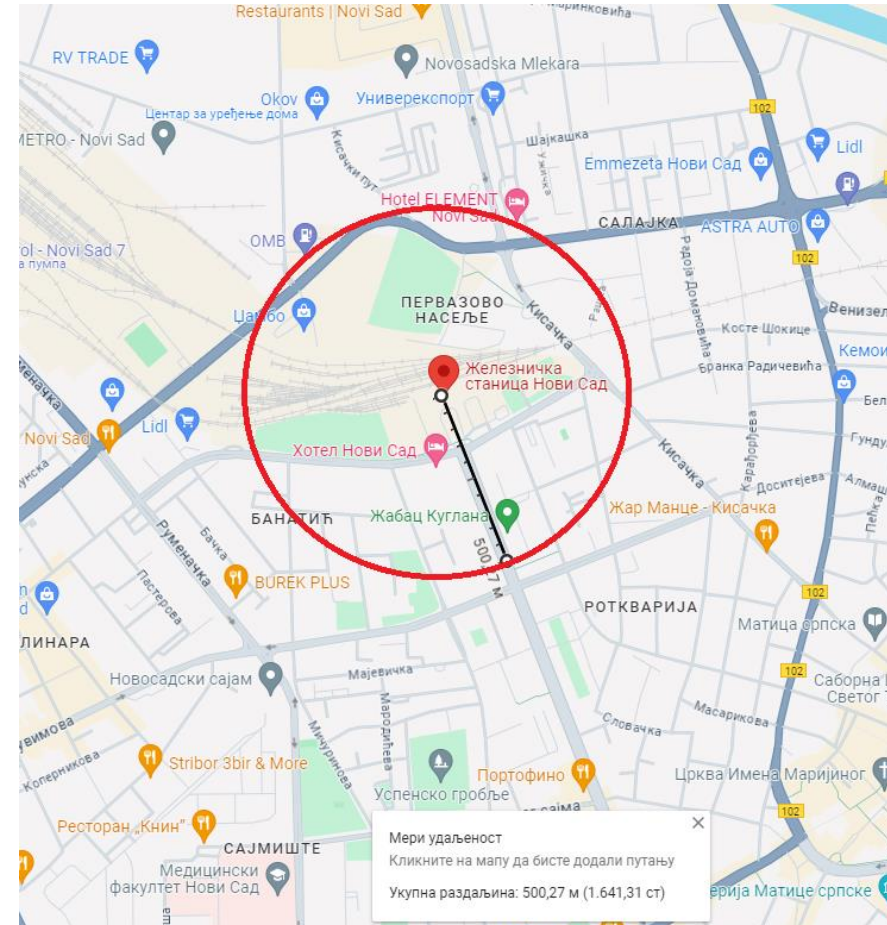
TASK 1 - KLASITER

Pronazi sva vozila koja su prošla pored Železničke stanice u Novom Sadu, radius 500m, u vremenskom intervalu 0-500.

Argumenti:

```
1 45.26559684070068 19.829572722354236 0.5 0 500"
```

```
24/02/19 10:07:00 INFO: Baza podataka: 1.00  
Broj jedinstvenih vozila u okolini: 91
```



TASK 1 - KLAUSTER

| timestep_time | vehicle_angle | vehicle_id | vehicle_lane | vehicle_pos | vehicle_slope | vehicle_speed | vehicle_type | vehicle_x | vehicle_y | distance |
|---------------|---------------|------------|----------------------|-------------|---------------|---------------|---------------|-----------|-----------|---------------------|
| 363.0 | 90.84 | veh421 | 8103927#3_1 | 201.26 | 0.0 | 14.54 | veh_passenger | 19.827866 | 45.269938 | 0.49215689105178684 |
| 20.0 | 255.75 | veh61 | 682003435#0_2 | 0.2 | 0.0 | 0.0 | veh_passenger | 19.82988 | 45.264049 | 0.16547263285845176 |
| 377.0 | 249.03 | veh845 | -272030397#0_0 | 125.78 | 0.0 | 14.46 | veh_passenger | 19.833473 | 45.26332 | 0.49478018631263904 |
| 80.0 | 265.09 | veh119 | 8080984#0_2 | 24.14 | 0.0 | 13.43 | veh_passenger | 19.832287 | 45.269373 | 0.49709980447422425 |
| 192.0 | 265.09 | veh157 | 8080984#0_2 | 27.0 | 0.0 | 10.89 | veh_passenger | 19.832251 | 45.269371 | 0.4945126180908946 |
| 287.0 | 265.09 | veh789 | 8080984#0_2 | 25.81 | 0.0 | 12.94 | veh_passenger | 19.832266 | 45.269372 | 0.4956022103814146 |
| 356.0 | 90.84 | veh504 | 8103927#3_1 | 193.35 | 0.0 | 15.29 | veh_passenger | 19.827764 | 45.269938 | 0.49664078900303393 |
| 132.0 | 245.75 | veh420 | 725388592#2_1 | 1.14 | 0.0 | 0.0 | veh_passenger | 19.830644 | 45.26427 | 0.18289942395816533 |
| 175.0 | 265.09 | veh274 | 8080984#0_2 | 27.37 | 0.0 | 14.47 | veh_passenger | 19.832246 | 45.26937 | 0.4940944407765635 |
| 102.0 | 165.96 | veh132 | 245159912#10_0 | 69.71 | 0.0 | 13.75 | veh_passenger | 19.831451 | 45.269914 | 0.4975384527108102 |
| 473.0 | 95.18 | veh1358 | 753847962#3_0 | 0.79 | 0.0 | 12.32 | veh_passenger | 19.825532 | 45.263746 | 0.4892441649475674 |
| 277.0 | 95.82 | veh834 | :cluster_38951754... | 18.32 | 0.0 | 12.13 | veh_passenger | 19.826259 | 45.262442 | 0.4946442247171551 |
| 240.0 | 250.7 | veh768 | 725388590_1 | 0.35 | 0.0 | 0.0 | veh_passenger | 19.83001 | 45.264103 | 0.1636483530530444 |
| 439.0 | 95.19 | veh1257 | :cluster_12296531... | 6.05 | 0.0 | 14.52 | veh_passenger | 19.82552 | 45.263746 | 0.49046987421318017 |
| 231.0 | 177.24 | veh544 | :60493683_0_1 | 3.2 | 0.0 | 14.19 | veh_passenger | 19.831491 | 45.269885 | 0.49668063896978043 |
| 465.0 | 265.1 | veh1305 | 8080984#0_3 | 19.84 | 0.0 | 13.18 | veh_passenger | 19.832346 | 45.269348 | 0.49905143867564056 |
| 174.0 | 240.23 | veh508 | 682003446#2_1 | 63.18 | 0.0 | 13.24 | veh_passenger | 19.834065 | 45.265658 | 0.4995594428068992 |
| 447.0 | 255.75 | veh1432 | 682003435#0_2 | 0.2 | 0.0 | 0.0 | veh_passenger | 19.82988 | 45.264049 | 0.16547263285845176 |
| 437.0 | 277.17 | veh1398 | 32617696#2-Added0... | 5.1 | 0.0 | 0.0 | veh_passenger | 19.827862 | 45.269997 | 0.4980265467240161 |
| 123.0 | 167.97 | veh394 | 725805933#0_1 | 5.1 | 0.0 | 0.0 | veh_passenger | 19.831492 | 45.269793 | 0.4880560791436194 |

only showing top 20 rows

Vreme izvrsenja task1: 34.340492486953735

Vreme izvrsenja aplikacije: 39.12476205825806

TASK 2 ZAGAĐENJE - KLASITER

| vehicle_lane | count_vehicle_CO | min_vehicle_CO | max_vehicle_CO | mean_vehicle_CO | avg_vehicle_CO | sddev_vehicle_CO |
|----------------------|------------------|----------------|----------------|--------------------|--------------------|--------------------|
| :cluster_29864227... | 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| -698946635#5_0 | 131 | 0.0 | 180.73 | 25.046183206106864 | 25.046183206106864 | 39.28809619010702 |
| :3069940788_7_0 | 6 | 79.15 | 139.06 | 104.20833333333336 | 104.20833333333336 | 22.049189932209902 |
| 725331468_1 | 182 | 0.0 | 246.05 | 30.996098901098907 | 30.996098901098907 | 51.61721928471445 |
| :2189608399_2_0 | 4 | 0.0 | 114.2 | 36.222500000000004 | 36.222500000000004 | 53.9605969666756 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 79.66 | 15.686153846153847 | 15.686153846153847 | 28.21252042931221 |
| :904119318_7_0 | 9 | 0.0 | 56.01 | 8.19 | 8.19 | 18.55831484806743 |
| 8676539#0_0 | 7 | 0.0 | 15.39 | 4.132857142857143 | 4.132857142857143 | 7.07837249251953 |
| :cluster_29842561... | 5 | 0.0 | 64.87 | 33.346000000000004 | 33.346000000000004 | 27.869238956239908 |
| :2285516135_3_1 | 27 | 0.0 | 147.99 | 57.09777777777777 | 57.09777777777777 | 57.75651087728508 |
| :3069940788_3_0 | 4 | 0.0 | 33.92 | 8.48 | 8.48 | 16.96 |
| -115158835#4_0 | 47 | 0.0 | 172.62 | 85.44297872340425 | 85.44297872340425 | 52.51318550425108 |
| -144715839#2_0 | 24 | 0.0 | 185.22 | 67.71666666666668 | 67.71666666666668 | 61.65380616387568 |
| :cluster_23207031... | 15 | 0.0 | 146.65 | 25.942 | 25.942 | 50.056827591962204 |
| 1239699006_0 | 27 | 0.0 | 164.79 | 96.05555555555559 | 96.05555555555559 | 46.75515219107148 |
| :cluster_11040490... | 4 | 0.0 | 40.45 | 16.325000000000003 | 16.325000000000003 | 18.707229440334913 |
| :cluster_10768597... | 4 | 0.0 | 151.8 | 84.305 | 84.305 | 70.75453413032977 |
| 360741092#3_0 | 11 | 0.0 | 68.8 | 17.59181818181818 | 17.59181818181818 | 26.238705310354707 |
| -105296041#5_0 | 19 | 0.0 | 163.61 | 22.09631578947368 | 22.09631578947368 | 44.65076709687282 |

only showing top 20 rows

TASK 2 ZAGAĐENJE - KLASITER

| vehicle_lane | count_vehicle_CO2 | min_vehicle_CO2 | max_vehicle_CO2 | mean_vehicle_CO2 | avg_vehicle_CO2 | sddev_vehicle_CO2 |
|----------------------|-------------------|-----------------|-----------------|--------------------|--------------------|--------------------|
| :cluster_29864227... | 4 | 0.0 | 2806.07 | 701.5175 | 701.5175 | 1403.035 |
| -698946635#5_0 | 131 | 0.0 | 11485.42 | 2581.643969465649 | 2581.643969465649 | 2260.7256624495526 |
| :3069940788_7_0 | 6 | 3809.68 | 6298.9 | 4865.625 | 4865.625 | 970.3249731868185 |
| 725331468_1 | 182 | 0.0 | 15558.08 | 3604.462857142859 | 3604.462857142859 | 3409.7407443437983 |
| :2189608399_2_0 | 4 | 0.0 | 6368.37 | 2502.1275 | 2502.1275 | 2729.2986331458246 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 6571.07 | 2258.1715384615386 | 2258.1715384615386 | 2300.350453513718 |
| :904119318_7_0 | 9 | 0.0 | 5250.21 | 1563.0966666666666 | 1563.0966666666666 | 1841.2238694276155 |
| 8676539#0_0 | 7 | 0.0 | 3265.61 | 1615.987142857143 | 1615.987142857143 | 1319.322516340796 |
| :cluster_29842561... | 5 | 0.0 | 4509.8 | 2759.556 | 2759.556 | 1894.7885528285208 |
| :2285516135_3_1 | 27 | 0.0 | 6523.96 | 2796.899259259259 | 2796.899259259259 | 2069.4101571535302 |
| :3069940788_3_0 | 4 | 0.0 | 3525.22 | 1870.9074999999998 | 1870.9074999999998 | 1448.5406816833508 |
| -115158835#4_0 | 47 | 0.0 | 10480.41 | 5698.172127659573 | 5698.172127659573 | 3016.885798898489 |
| -144715839#2_0 | 24 | 0.0 | 11583.42 | 3973.56375 | 3973.56375 | 3638.716127995903 |
| :cluster_23207031... | 15 | 0.0 | 9361.58 | 3370.6320000000005 | 3370.6320000000005 | 2757.01080542004 |
| 1239699006_0 | 27 | 0.0 | 10155.06 | 5396.727407407408 | 5396.727407407408 | 2907.2965648474506 |
| :cluster_11040490... | 4 | 0.0 | 4742.86 | 3037.3199999999997 | 3037.3199999999997 | 2190.9478888067297 |
| :cluster_10768597... | 4 | 0.0 | 7995.49 | 4631.875 | 4631.875 | 3659.7535918373883 |
| 360741092#3_0 | 11 | 0.0 | 5722.4 | 2039.7590909090907 | 2039.7590909090907 | 2253.2865564834606 |
| -105296041#5_0 | 19 | 0.0 | 9648.99 | 2426.8136842105264 | 2426.8136842105264 | 2744.059306959937 |

TASK 2 ZAGAĐENJE - KLASITER

24/02/09 16:57:51 INFO DAGScheduler: Job 4 finished: showString at NativeMethodAccessorImpl.java:0, took 4.104647 s

| vehicle_lane | count_vehicle_HC | min_vehicle_HC | max_vehicle_HC | mean_vehicle_HC | avg_vehicle_HC | sddev_vehicle_HC |
|----------------------|------------------|----------------|----------------|----------------------|----------------------|---------------------|
| :cluster_29864227... | 4 | 0.0 | 0.05 | 0.0125 | 0.0125 | 0.025 |
| -698946635#5_0 | 131 | 0.0 | 1.1 | 0.16946564885496176 | 0.16946564885496176 | 0.22643835288456718 |
| :3069940788_7_0 | 6 | 0.45 | 0.78 | 0.5883333333333334 | 0.5883333333333334 | 0.1215593133686871 |
| 725331468_1 | 182 | 0.0 | 1.5 | 0.2179670329670329 | 0.2179670329670329 | 0.3203826079576664 |
| :2189608399_2_0 | 4 | 0.0 | 0.67 | 0.21500000000000002 | 0.21500000000000002 | 0.316280466253187 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 0.52 | 0.11923076923076925 | 0.11923076923076925 | 0.181496627078923 |
| :904119318_7_0 | 9 | 0.0 | 0.38 | 0.06555555555555556 | 0.06555555555555556 | 0.12758439472669758 |
| 8676539#0_0 | 7 | 0.0 | 0.14 | 0.038571428571428576 | 0.038571428571428576 | 0.06593647736738024 |
| :cluster_29842561... | 5 | 0.0 | 0.4 | 0.21400000000000002 | 0.21400000000000002 | 0.1703819239238717 |
| :2285516135_3_1 | 27 | 0.0 | 0.78 | 0.3225925925925926 | 0.3225925925925926 | 0.3048781924813781 |
| :3069940788_3_0 | 4 | 0.0 | 0.24 | 0.065 | 0.065 | 0.11704699910719625 |
| -115158835#4_0 | 47 | 0.0 | 1.04 | 0.5242553191489361 | 0.5242553191489361 | 0.30992106064252434 |
| -144715839#2_0 | 24 | 0.0 | 1.12 | 0.4029166666666667 | 0.4029166666666667 | 0.3651501081052495 |
| :cluster_23207031... | 15 | 0.0 | 0.89 | 0.17866666666666667 | 0.17866666666666667 | 0.3008290132917622 |
| 1239699006_0 | 27 | 0.0 | 1.0 | 0.5655555555555556 | 0.5655555555555556 | 0.2794408336073658 |
| :cluster_11040490... | 4 | 0.0 | 0.3 | 0.1475 | 0.1475 | 0.13351029922818689 |
| :cluster_10768597... | 4 | 0.0 | 0.88 | 0.4925 | 0.4925 | 0.4080339038200952 |
| 360741092#3_0 | 11 | 0.0 | 0.45 | 0.12363636363636363 | 0.12363636363636363 | 0.17089603431751876 |
| -105296041#5_0 | 19 | 0.0 | 0.98 | 0.1505263157894737 | 0.1505263157894737 | 0.2684414623590221 |

only showing top 20 rows

TASK 2 ZAGAĐENJE - KLASITER

| vehicle_lane | count_vehicle_PmX | min_vehicle_PmX | max_vehicle_PmX | mean_vehicle_PmX | avg_vehicle_PmX | sddev_vehicle_PmX |
|----------------------|-------------------|-----------------|-----------------|----------------------|----------------------|----------------------|
| :cluster_29864227... | 4 | 0.0 | 0.02 | 0.005 | 0.005 | 0.01 |
| -698946635#5_0 | 131 | 0.0 | 0.25 | 0.03541984732824425 | 0.03541984732824425 | 0.04463974672496272 |
| :3069940788_7_0 | 6 | 0.06 | 0.13 | 0.09000000000000001 | 0.09000000000000001 | 0.026076809620810597 |
| 725331468_1 | 182 | 0.0 | 0.36 | 0.05747252747252743 | 0.05747252747252743 | 0.07627506788867447 |
| :2189608399_2_0 | 4 | 0.0 | 0.13 | 0.0375 | 0.0375 | 0.062383224240709675 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 0.12 | 0.028461538461538465 | 0.028461538461538465 | 0.041602514716892185 |
| :904119318_7_0 | 9 | 0.0 | 0.09 | 0.015555555555555553 | 0.015555555555555553 | 0.03004626062886658 |
| 8676539#0_0 | 7 | 0.0 | 0.04 | 0.01 | 0.01 | 0.017320508075688773 |
| :cluster_29842561... | 5 | 0.0 | 0.07 | 0.036 | 0.036 | 0.03361547262794322 |
| :2285516135_3_1 | 27 | 0.0 | 0.13 | 0.04666666666666667 | 0.04666666666666667 | 0.04402796314232057 |
| :3069940788_3_0 | 4 | 0.0 | 0.05 | 0.015000000000000001 | 0.015000000000000001 | 0.02380476142847617 |
| -115158835#4_0 | 47 | 0.0 | 0.23 | 0.10936170212765957 | 0.10936170212765957 | 0.0674506020638727 |
| -144715839#2_0 | 24 | 0.0 | 0.25 | 0.0775 | 0.0775 | 0.07605775837280279 |
| :cluster_23207031... | 15 | 0.0 | 0.2 | 0.04733333333333334 | 0.04733333333333334 | 0.06507870692659846 |
| 1239699006_0 | 27 | 0.0 | 0.22 | 0.10444444444444445 | 0.10444444444444445 | 0.0647678299379545 |
| :cluster_11040490... | 4 | 0.0 | 0.07 | 0.0425 | 0.0425 | 0.03403429642777023 |
| :cluster_10768597... | 4 | 0.0 | 0.17 | 0.0925 | 0.0925 | 0.08098353742170895 |
| 360741092#3_0 | 11 | 0.0 | 0.1 | 0.02727272727272727 | 0.02727272727272727 | 0.03690282078402926 |
| -105296041#5_0 | 19 | 0.0 | 0.21 | 0.034736842105263156 | 0.034736842105263156 | 0.05824931292419122 |

only showing top 20 rows

TASK 2 ZAGAĐENJE - KLASITER

24/02/09 18:37:58 INFO DAGScheduler: Job 5 finished: showString at NativeMethodAccessorImpl.java:0, took 4.983079 s

| vehicle_lane | count_vehicle_NOx | min_vehicle_NOx | max_vehicle_NOx | mean_vehicle_NOx | avg_vehicle_NOx | sddev_vehicle_NOx |
|----------------------|-------------------|-----------------|-----------------|--------------------|--------------------|---------------------|
| :cluster_29864227... | 4 | 0.0 | 0.9 | 0.225 | 0.225 | 0.45 |
| -698946635#5_0 | 131 | 0.0 | 5.01 | 0.9637404580152675 | 0.9637404580152675 | 0.9453622308429738 |
| :3069940788_7_0 | 6 | 1.56 | 2.75 | 2.0633333333333335 | 2.0633333333333335 | 0.45802474460084214 |
| 725331468_1 | 182 | 0.0 | 6.82 | 1.3685714285714285 | 1.3685714285714285 | 1.4770581269331906 |
| :2189608399_2_0 | 4 | 0.0 | 2.72 | 0.9525000000000001 | 0.9525000000000001 | 1.216480579376424 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 2.69 | 0.8246153846153846 | 0.8246153846153846 | 0.9274841902032203 |
| :904119318_7_0 | 9 | 0.0 | 2.09 | 0.5277777777777778 | 0.5277777777777778 | 0.7131405502735378 |
| 8676539#0_0 | 7 | 0.0 | 1.15 | 0.4857142857142857 | 0.4857142857142857 | 0.4740554518498563 |
| :cluster_29842561... | 5 | 0.0 | 1.82 | 1.05 | 1.05 | 0.7777531742140305 |
| :2285516135_3_1 | 27 | 0.0 | 2.81 | 1.1303703703703705 | 1.1303703703703705 | 0.8999037618694461 |
| :3069940788_3_0 | 4 | 0.0 | 1.32 | 0.6074999999999999 | 0.6074999999999999 | 0.5435301279598032 |
| -115158835#4_0 | 47 | 0.0 | 4.59 | 2.3870212765957453 | 2.3870212765957453 | 1.3313133673730468 |
| -144715839#2_0 | 24 | 0.0 | 5.07 | 1.6854166666666668 | 1.6854166666666668 | 1.57246684949274 |
| :cluster_23207031... | 15 | 0.0 | 4.05 | 1.2093333333333334 | 1.2093333333333334 | 1.2556072330986008 |
| 1239699006_0 | 27 | 0.0 | 4.43 | 2.29037037037037 | 2.29037037037037 | 1.2780046992855743 |
| :cluster_11040490... | 4 | 0.0 | 1.83 | 1.105 | 1.105 | 0.8280297901243249 |
| :cluster_10768597... | 4 | 0.0 | 3.5 | 1.9775 | 1.9775 | 1.615392109262227 |
| 360741092#3_0 | 11 | 0.0 | 2.32 | 0.7554545454545454 | 0.7554545454545454 | 0.8979461413287952 |
| -105296041#5_0 | 19 | 0.0 | 4.22 | 0.9021052631578947 | 0.9021052631578947 | 1.1744766160453886 |

only showing top 20 rows

TASK 2 ZAGAĐENJE - KLASITER

| vehicle_lane | count_vehicle_noise | min_vehicle_noise | max_vehicle_noise | mean_vehicle_noise | avg_vehicle_noise | sddev_vehicle_noise |
|----------------------|---------------------|-------------------|-------------------|--------------------|--------------------|---------------------|
| :cluster_29864227... | 4 | 60.9 | 65.51 | 62.8475 | 62.8475 | 1.9478428239123087 |
| -698946635#5_0 | 131 | 55.94 | 73.1 | 64.1590076335878 | 64.1590076335878 | 2.506703276282591 |
| :3069940788_7_0 | 6 | 63.28 | 69.11 | 65.59833333333333 | 65.59833333333333 | 2.16893906476569 |
| 725331468_1 | 182 | 61.63 | 75.74 | 66.69857142857146 | 66.69857142857146 | 2.6114744978423237 |
| :2189608399_2_0 | 4 | 59.86 | 67.8 | 62.897499999999994 | 62.897499999999994 | 3.4981554663374603 |
| :9611216349_3_0 | 1 | 60.92 | 60.92 | 60.92 | 60.92 | null |
| :cluster_16058699... | 13 | 61.83 | 68.03 | 64.49538461538461 | 64.49538461538461 | 1.900546480114843 |
| :904119318_7_0 | 9 | 61.17 | 66.66 | 63.224444444444444 | 63.224444444444444 | 1.8113883564210558 |
| 8676539#0_0 | 7 | 54.29 | 64.99 | 62.300000000000001 | 62.300000000000001 | 3.785573492440298 |
| :cluster_29842561... | 5 | 59.64 | 65.03 | 62.878 | 62.878 | 2.316456345368934 |
| :2285516135_3_1 | 27 | 54.91 | 68.31 | 63.39888888888888 | 63.39888888888888 | 3.0670950091041838 |
| :3069940788_3_0 | 4 | 61.87 | 64.26 | 63.3775 | 63.3775 | 1.1363501514351388 |
| -115158835#4_0 | 47 | 55.98 | 72.65 | 67.11595744680851 | 67.11595744680851 | 3.396612544986336 |
| -144715839#2_0 | 24 | 37.48 | 73.35 | 61.625833333333331 | 61.625833333333331 | 9.138786864913683 |
| :cluster_23207031... | 15 | 63.1 | 71.07 | 66.52333333333333 | 66.52333333333333 | 2.226697319435436 |
| 1239699006_0 | 27 | 56.4 | 72.16 | 66.2651851851852 | 66.2651851851852 | 4.170098108392438 |
| :cluster_11040490... | 4 | 63.38 | 68.01 | 65.75999999999999 | 65.75999999999999 | 1.9821368940279254 |
| :cluster_10768597... | 4 | 59.2 | 70.93 | 65.63 | 65.63 | 5.431261363624477 |
| 360741092#3_0 | 11 | 61.44 | 66.98 | 63.94727272727275 | 63.94727272727275 | 1.8068264493807442 |
| -105296041#5_0 | 19 | 61.74 | 72.04 | 64.62421052631579 | 64.62421052631579 | 2.5631259469411645 |

only showing top 20 rows

Vreme izvršenja task2: 53.93255257606506
Vreme izvršenja aplikacije: 56.81790542602539

TASK 2 GORIVO - KLAUSTER

| vehicle_lane | count_vehicle_fuel | min_vehicle_fuel | max_vehicle_fuel | mean_vehicle_fuel | avg_vehicle_fuel | sddev_vehicle_fuel |
|----------------------|--------------------|------------------|------------------|--------------------|--------------------|--------------------|
| :cluster_29864227... | 4 | 0.0 | 895.02 | 223.755 | 223.755 | 447.51 |
| -698946635#5_0 | 131 | 0.0 | 3663.27 | 823.4293893129767 | 823.4293893129767 | 721.06274816013 |
| :3069940788_7_0 | 6 | 1215.13 | 2009.06 | 1551.9199999999998 | 1551.9199999999998 | 309.4826538596307 |
| 725331468_1 | 182 | 0.0 | 4962.23 | 1149.6528021978024 | 1149.6528021978024 | 1087.5345370596874 |
| :2189608399_2_0 | 4 | 0.0 | 2031.21 | 798.0725 | 798.0725 | 870.5136172542047 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 2095.85 | 720.2553846153846 | 720.2553846153846 | 733.7019833308273 |
| :904119318_7_0 | 9 | 0.0 | 1674.57 | 498.56111111111113 | 498.56111111111113 | 587.26580488405 |
| 8676539#0_0 | 7 | 0.0 | 1041.59 | 515.4342857142857 | 515.4342857142857 | 420.8063516574317 |
| :cluster_29842561... | 5 | 0.0 | 1438.42 | 880.18 | 880.18 | 604.3500651526399 |
| :2285516135_3_1 | 27 | 0.0 | 2080.84 | 892.094074074074 | 892.094074074074 | 660.0485203625286 |
| :3069940788_3_0 | 4 | 0.0 | 1124.39 | 596.7425000000001 | 596.7425000000001 | 462.02093057746504 |
| -115158835#4_0 | 47 | 0.0 | 3342.73 | 1817.4440425531914 | 1817.4440425531914 | 962.234011867265 |
| -144715839#2_0 | 24 | 0.0 | 3694.53 | 1267.3795833333336 | 1267.3795833333336 | 1160.5718303022538 |
| :cluster_23207031... | 15 | 0.0 | 2985.88 | 1075.0753333333332 | 1075.0753333333332 | 879.3466471101199 |
| 1239699006_0 | 27 | 0.0 | 3238.96 | 1721.3022222222223 | 1721.3022222222223 | 927.2787487022831 |
| :cluster_11040490... | 4 | 0.0 | 1512.75 | 968.7649999999999 | 968.7649999999999 | 698.809521996755 |
| :cluster_10768597... | 4 | 0.0 | 2550.18 | 1477.3525 | 1477.3525 | 1167.2865937542217 |
| 360741092#3_0 | 11 | 0.0 | 1825.17 | 650.59 | 650.59 | 718.691543375877 |
| -105296041#5_0 | 19 | 0.0 | 3077.55 | 774.0436842105262 | 774.0436842105262 | 875.2201632491649 |

only showing top 20 rows

Vreme izvršenja task2: 37.21283721923828

Vreme izvršenja aplikacije: 40.39761304855347

SPARK MASTER



Spark Master at spark://8b1c3f6b5cc1:7077

URL: spark://8b1c3f6b5cc1:7077

Alive Workers: 2

Cores in use: 12 Total, 0 Used

Memory in use: 13.5 GiB Total, 0.0 B Used

Resources in use:

Applications: 0 Running, 6 Completed

Drivers: 0 Running, 0 Completed

Status: ALIVE

Task 1
Task 2 gorivo
Task 2 zagađenje

Workers (2)

| Worker Id | Address | State | Cores | Memory | Resources |
|--|------------------|-------|------------|----------------------|-----------|
| worker-20240213160027-172.19.0.8-44785 | 172.19.0.8:44785 | ALIVE | 6 (0 Used) | 6.7 GiB (0.0 B Used) | |
| worker-20240213160027-172.19.0.9-46237 | 172.19.0.9:46237 | ALIVE | 6 (0 Used) | 6.7 GiB (0.0 B Used) | |

Running Applications (0)

| Application ID | Name | Cores | Memory per Executor | Resources Per Executor | Submitted Time | User | State | Duration |
|----------------|------|-------|---------------------|------------------------|----------------|------|-------|----------|
|----------------|------|-------|---------------------|------------------------|----------------|------|-------|----------|

Completed Applications (6)

| Application ID | Name | Cores | Memory per Executor | Resources Per Executor | Submitted Time | User | State | Duration |
|-------------------------|------------------|-------|---------------------|------------------------|---------------------|------|----------|----------|
| app-20240213165630-0005 | AppKL-BrojVozila | 12 | 1024.0 MiB | | 2024/02/13 16:56:30 | root | FINISHED | 37 s |
| app-20240213164701-0003 | AppKL-Gorivo | 12 | 1024.0 MiB | | 2024/02/13 16:47:01 | root | FINISHED | 39 s |
| app-20240213164224-0002 | AppKL-Zagadjenje | 12 | 1024.0 MiB | | 2024/02/13 16:42:24 | root | FINISHED | 56 s |

TASK 1 - LOKALNO

| timestep_time | vehicle_angle | vehicle_id | vehicle_lane | vehicle_pos | vehicle_slope | vehicle_speed | vehicle_type | vehicle_x | vehicle_y | distance |
|---------------|---------------|------------|----------------------|-------------|---------------|---------------|---------------|-----------|-----------|---------------------|
| 363.0 | 90.84 | veh421 | 8103927#3_1 | 201.26 | 0.0 | 14.54 | veh_passenger | 19.827866 | 45.269938 | 0.49215689105178684 |
| 20.0 | 255.75 | veh61 | 682003435#0_2 | 0.2 | 0.0 | 0.0 | veh_passenger | 19.82988 | 45.264049 | 0.16547263285845176 |
| 377.0 | 249.03 | veh845 | -272030397#0_0 | 125.78 | 0.0 | 14.46 | veh_passenger | 19.833473 | 45.26332 | 0.49478018631263904 |
| 80.0 | 265.09 | veh119 | 8080984#0_2 | 24.14 | 0.0 | 13.43 | veh_passenger | 19.832287 | 45.269373 | 0.49709980447422425 |
| 192.0 | 265.09 | veh157 | 8080984#0_2 | 27.0 | 0.0 | 10.89 | veh_passenger | 19.832251 | 45.269371 | 0.4945126180908946 |
| 287.0 | 265.09 | veh789 | 8080984#0_2 | 25.81 | 0.0 | 12.94 | veh_passenger | 19.832266 | 45.269372 | 0.4956022103814146 |
| 356.0 | 90.84 | veh504 | 8103927#3_1 | 193.35 | 0.0 | 15.29 | veh_passenger | 19.827764 | 45.269938 | 0.49664078900303393 |
| 132.0 | 245.75 | veh420 | 725388592#2_1 | 1.14 | 0.0 | 0.0 | veh_passenger | 19.830644 | 45.26427 | 0.18289942395816533 |
| 175.0 | 265.09 | veh274 | 8080984#0_2 | 27.37 | 0.0 | 14.47 | veh_passenger | 19.832246 | 45.26937 | 0.4940944407765635 |
| 102.0 | 165.96 | veh132 | 245159912#10_0 | 69.71 | 0.0 | 13.75 | veh_passenger | 19.831451 | 45.269914 | 0.4975384527108102 |
| 473.0 | 95.18 | veh1358 | 753847962#3_0 | 0.79 | 0.0 | 12.32 | veh_passenger | 19.825532 | 45.263746 | 0.4892441649475674 |
| 277.0 | 95.82 | veh834 | :cluster_38951754... | 18.32 | 0.0 | 12.13 | veh_passenger | 19.826259 | 45.262442 | 0.4946442247171551 |
| 240.0 | 250.7 | veh768 | 725388590_1 | 0.35 | 0.0 | 0.0 | veh_passenger | 19.83001 | 45.264103 | 0.1636483530530444 |
| 439.0 | 95.19 | veh1257 | :cluster_12296531... | 6.05 | 0.0 | 14.52 | veh_passenger | 19.82552 | 45.263746 | 0.49046987421318017 |
| 231.0 | 177.24 | veh544 | :60493683_0_1 | 3.2 | 0.0 | 14.19 | veh_passenger | 19.831491 | 45.269885 | 0.49668063896978043 |
| 465.0 | 265.1 | veh1305 | 8080984#0_3 | 19.84 | 0.0 | 13.18 | veh_passenger | 19.832346 | 45.269348 | 0.49905143867564056 |
| 174.0 | 240.23 | veh508 | 682003446#2_1 | 63.18 | 0.0 | 13.24 | veh_passenger | 19.834065 | 45.265658 | 0.4995594428068992 |
| 447.0 | 255.75 | veh1432 | 682003435#0_2 | 0.2 | 0.0 | 0.0 | veh_passenger | 19.82988 | 45.264049 | 0.16547263285845176 |
| 437.0 | 277.17 | veh1398 | 32617696#2-Added0... | 5.1 | 0.0 | 0.0 | veh_passenger | 19.827862 | 45.269997 | 0.4980265467240161 |
| 123.0 | 167.97 | veh394 | 725805933#0_1 | 5.1 | 0.0 | 0.0 | veh_passenger | 19.831492 | 45.269793 | 0.4880560791436194 |

only showing top 20 rows

```
24/02/13 17:06:36 INFO SparkUI: Stopped Spark web UI at http://6630f0543b04:4040
24/02/13 17:06:36 INFO MapOutputTrackerMasterEndpoint: MapOutputTrackerMasterEndpoint stopped!
24/02/13 17:06:36 INFO MemoryStore: MemoryStore cleared
24/02/13 17:06:36 INFO BlockManager: BlockManager stopped
24/02/13 17:06:36 INFO BlockManagerMaster: BlockManagerMaster stopped
24/02/13 17:06:36 INFO OutputCommitCoordinator$OutputCommitCoordinatorEndpoint: OutputCommitCoordinator stopped!
24/02/13 17:06:36 INFO SparkContext: Successfully stopped SparkContext
```

Vreme izvršenja task1: 39.00479316711426

Vreme izvršenja aplikacije: 41.482304096221924

TASK 2 ZAGAĐENJE - LOKALNO

| vehicle_lane | count_vehicle_noise | min_vehicle_noise | max_vehicle_noise | mean_vehicle_noise | avg_vehicle_noise | sddev_vehicle_noise |
|----------------------|---------------------|-------------------|-------------------|--------------------|--------------------|---------------------|
| :cluster_29864227... | 4 | 60.9 | 65.51 | 62.8475 | 62.8475 | 1.9478428239123087 |
| -698946635#5_0 | 131 | 55.94 | 73.1 | 64.1590076335878 | 64.1590076335878 | 2.506703276282591 |
| :3069940788_7_0 | 6 | 63.28 | 69.11 | 65.59833333333333 | 65.59833333333333 | 2.16893906476569 |
| 725331468_1 | 182 | 61.63 | 75.74 | 66.69857142857146 | 66.69857142857146 | 2.6114744978423237 |
| :2189608399_2_0 | 4 | 59.86 | 67.8 | 62.897499999999994 | 62.897499999999994 | 3.4981554663374603 |
| :9611216349_3_0 | 1 | 60.92 | 60.92 | 60.92 | 60.92 | null |
| :cluster_16058699... | 13 | 61.83 | 68.03 | 64.49538461538461 | 64.49538461538461 | 1.900546480114843 |
| :904119318_7_0 | 9 | 61.17 | 66.66 | 63.224444444444444 | 63.224444444444444 | 1.8113883564210558 |
| 8676539#0_0 | 7 | 54.29 | 64.99 | 62.300000000000001 | 62.300000000000001 | 3.785573492440298 |
| :cluster_29842561... | 5 | 59.64 | 65.03 | 62.878 | 62.878 | 2.316456345368934 |
| :2285516135_3_1 | 27 | 54.91 | 68.31 | 63.398888888888888 | 63.398888888888888 | 3.0670950091041838 |
| :3069940788_3_0 | 4 | 61.87 | 64.26 | 63.3775 | 63.3775 | 1.1363501514351388 |
| -115158835#4_0 | 47 | 55.98 | 72.65 | 67.11595744680851 | 67.11595744680851 | 3.396612544986336 |
| -144715839#2_0 | 24 | 37.48 | 73.35 | 61.625833333333331 | 61.625833333333331 | 9.138786864913683 |
| :cluster_23207031... | 15 | 63.1 | 71.07 | 66.52333333333333 | 66.52333333333333 | 2.226697319435436 |
| 1239699006_0 | 27 | 56.4 | 72.16 | 66.2651851851852 | 66.2651851851852 | 4.170098108392438 |
| :cluster_11040490... | 4 | 63.38 | 68.01 | 65.75999999999999 | 65.75999999999999 | 1.9821368940279254 |
| :cluster_10768597... | 4 | 59.2 | 70.93 | 65.63 | 65.63 | 5.431261363624477 |
| 360741092#3_0 | 11 | 61.44 | 66.98 | 63.94727272727275 | 63.94727272727275 | 1.8068264493807442 |
| -105296041#5_0 | 19 | 61.74 | 72.04 | 64.62421052631579 | 64.62421052631579 | 2.5631259469411645 |

only showing top 20 rows

```
24/02/13 17:10:58 INFO SparkUI: Stopped Spark web UI at http://0b73f0743d1a:4040
24/02/13 17:10:58 INFO MapOutputTrackerMasterEndpoint: MapOutputTrackerMasterEndpoint stopped!
24/02/13 17:10:58 INFO MemoryStore: MemoryStore cleared
24/02/13 17:10:58 INFO BlockManager: BlockManager stopped
24/02/13 17:10:58 INFO BlockManagerMaster: BlockManagerMaster stopped
24/02/13 17:10:58 INFO OutputCommitCoordinator$OutputCommitCoordinatorEndpoint: OutputCommitCoordinator stopped!
24/02/13 17:10:58 INFO SparkContext: Successfully stopped SparkContext
```

```
Vreme izvršenja task2: 93.25876593589783
Vreme izvršenja aplikacije: 96.06872987747192
```


TASK 2 GORIVO - LOKALNO

| vehicle_lane | count_vehicle_fuel | min_vehicle_fuel | max_vehicle_fuel | mean_vehicle_fuel | avg_vehicle_fuel | sddev_vehicle_fuel |
|----------------------|--------------------|------------------|------------------|--------------------|--------------------|--------------------|
| :cluster_29864227... | 4 | 0.0 | 895.02 | 223.755 | 223.755 | 447.51 |
| -698946635#5_0 | 131 | 0.0 | 3663.27 | 823.4293893129767 | 823.4293893129767 | 721.06274816013 |
| :3069940788_7_0 | 6 | 1215.13 | 2009.06 | 1551.9199999999998 | 1551.9199999999998 | 309.4826538596307 |
| 725331468_1 | 182 | 0.0 | 4962.23 | 1149.6528021978024 | 1149.6528021978024 | 1087.5345370596874 |
| :2189608399_2_0 | 4 | 0.0 | 2031.21 | 798.0725 | 798.0725 | 870.5136172542047 |
| :9611216349_3_0 | 1 | 0.0 | 0.0 | 0.0 | 0.0 | null |
| :cluster_16058699... | 13 | 0.0 | 2095.85 | 720.2553846153846 | 720.2553846153846 | 733.7019833308273 |
| :904119318_7_0 | 9 | 0.0 | 1674.57 | 498.5611111111111 | 498.5611111111111 | 587.26580488405 |
| 8676539#0_0 | 7 | 0.0 | 1041.59 | 515.4342857142857 | 515.4342857142857 | 420.8063516574317 |
| :cluster_29842561... | 5 | 0.0 | 1438.42 | 880.18 | 880.18 | 604.3500651526399 |
| :2285516135_3_1 | 27 | 0.0 | 2080.84 | 892.094074074074 | 892.094074074074 | 660.0485203625286 |
| :3069940788_3_0 | 4 | 0.0 | 1124.39 | 596.7425000000001 | 596.7425000000001 | 462.02093057746504 |
| -115158835#4_0 | 47 | 0.0 | 3342.73 | 1817.4440425531914 | 1817.4440425531914 | 962.234011867265 |
| -144715839#2_0 | 24 | 0.0 | 3694.53 | 1267.3795833333336 | 1267.3795833333336 | 1160.5718303022538 |
| :cluster_23207031... | 15 | 0.0 | 2985.88 | 1075.0753333333332 | 1075.0753333333332 | 879.3466471101199 |
| 1239699006_0 | 27 | 0.0 | 3238.96 | 1721.3022222222223 | 1721.3022222222223 | 927.2787487022831 |
| :cluster_11040490... | 4 | 0.0 | 1512.75 | 968.7649999999999 | 968.7649999999999 | 698.809521996755 |
| :cluster_10768597... | 4 | 0.0 | 2550.18 | 1477.3525 | 1477.3525 | 1167.2865937542217 |
| 360741092#3_0 | 11 | 0.0 | 1825.17 | 650.59 | 650.59 | 718.691543375877 |
| -105296041#5_0 | 19 | 0.0 | 3077.55 | 774.0436842105262 | 774.0436842105262 | 875.2201632491649 |

only showing top 20 rows

```
24/02/13 17:09:04 INFO SparkUI: Stopped Spark web UI at http://090ebda82399:4040
24/02/13 17:09:04 INFO MapOutputTrackerMasterEndpoint: MapOutputTrackerMasterEndpoint stopped!
24/02/13 17:09:04 INFO MemoryStore: MemoryStore cleared
24/02/13 17:09:04 INFO BlockManager: BlockManager stopped
24/02/13 17:09:04 INFO BlockManagerMaster: BlockManagerMaster stopped
24/02/13 17:09:04 INFO OutputCommitCoordinator$OutputCommitCoordinatorEndpoint: OutputCommitCoordinator stopped!
24/02/13 17:09:04 INFO SparkContext: Successfully stopped SparkContext
Vreme izvršenja task2: 47.88893413543701
Vreme izvršenja aplikacije: 50.391751289367676
```

POREĐENJE REZULTATA

| | KLASTER | LOKALNO |
|------------------|---------|---------|
| Task 1 | 39,12s | 14,48s |
| Task 2 Zagađenje | 56,81s | 96,06s |
| Task 2 Gorivo | 40,39s | 50,39s |