Number of trips detected by old and new algorithm

IMEI	By Old Algorithm	By New Algorithm
0587	17	20
0603	0	0
0636	0	0
6057	0	0
0665	8	0
0669	21	16
1210	27	19
1473	79	51
2910	9	0
3014	0	0
3215	104	102
3410	28	17
3469	49	49
4381	7	7
5223	0	0
5432	0	0
6089	124	90
6097	54	52
6473	33	33
6904	0	0
6994	0	0

7303	20	19
7459	6	6
7517	4	1
7710	26	18
8508	0	0
8664	0	0
8870	4	2
9050	0	0
9407	0	0
9519	17	1

Conclusion: For most of the bikes, the number of trips detected using old and new algorithm are close. After comparing these trips, I think the new algorithm is reliable and is more accurate. However, the difference of trips are still big for some bikes. (e.g. 0665, 2910, 7517, 9519). I looked into each bikes readings, some problems are found.

Problem1: DischargeCurr does not change (or there is one spike, which is not longer enough to be identified as a trip)

Possible cause:

1. sensor is not working for some bike
2. old algorithm detected the movement but it is not a trip.

bike 0665

```
mysql> select Stamp, dischargecurr from  imei0665 where Stamp between "2015-11-23 16:56:14" and "2015-11-23 17:03:14";
+-------------------------+--------------+
| Stamp                   | dischargecurr |
+-------------------------+--------------+
| 2015-11-23 16:56:14.269 |          498 |
| 2015-11-23 16:57:12.707 |          498 |
| 2015-11-23 16:57:13.203 |          499 |
| 2015-11-23 16:57:13.700 |          498 |
| 2015-11-23 16:57:14.202 |          498 |
| 2015-11-23 16:58:12.768 |          498 |
| 2015-11-23 16:58:13.269 |          498 |
| 2015-11-23 16:58:13.773 |          498 |
| 2015-11-23 16:58:14.275 |          498 |
| 2015-11-23 16:59:13.202 |          497 |
| 2015-11-23 16:59:13.702 |          498 |
| 2015-11-23 16:59:14.204 |          498 |
| 2015-11-23 17:00:12.833 |          498 |
| 2015-11-23 17:00:13.335 |          498 |
| 2015-11-23 17:00:13.835 |          498 |
| 2015-11-23 17:00:14.335 |          499 |
| 2015-11-23 17:01:12.722 |          499 |
| 2015-11-23 17:01:13.208 |          498 |
| 2015-11-23 17:01:13.708 |          499 |
| 2015-11-23 17:01:14.210 |          498 |
| 2015-11-23 17:02:12.714 |          499 |
| 2015-11-23 17:02:13.224 |          498 |
| 2015-11-23 17:02:13.722 |          498 |
| 2015-11-23 17:02:14.222 |          498 |
| 2015-11-23 17:03:12.687 |          499 |
| 2015-11-23 17:03:13.188 |          499 |
| 2015-11-23 17:03:13.689 |          498 |
+-------------------------+--------------+
27 rows in set (0.00 sec)
```

bike 8870

```
+----+---------------------+---------------------+----------+----------+------------+
| id | start_time          | end_time            | distance | comments | isAccurate |
+----+---------------------+---------------------+----------+----------+------------+
| 87 | 2015-11-17 08:07:06 | 2015-11-17 08:22:32 |     NULL | NULL     |       NULL |
| 88 | 2015-11-17 16:50:48 | 2015-11-17 17:14:48 |  1.15340 | NULL     |       NULL |
| 89 | 2016-01-31 15:13:22 | 2016-01-31 15:18:23 |     NULL | NULL     |       NULL |
| 90 | 2016-02-03 11:29:25 | 2016-02-03 11:40:25 |     NULL | NULL     |       NULL |
+----+---------------------+---------------------+----------+----------+------------+
4 rows in set (0.00 sec)

ERROR:
No query specified

mysql> select * from trip_curr8870;
+---------------------+---------------------+----------+
| start_time          | end_time            | duration |
+---------------------+---------------------+----------+
| 2015-11-17 08:10:04 | 2015-11-17 08:17:04 |      420 |
| 2016-02-03 11:29:24 | 2016-02-03 11:35:26 |      362 |
+---------------------+---------------------+----------+
2 rows in set (0.00 sec)

mysql> select Stamp, dischargecurr from imei8870 where Stamp between "2015-11-17 16:50:48" and "2015-11-17 17:14:48";
+-------------------------+--------------+
| Stamp                   | dischargecurr |
+-------------------------+--------------+
| 2015-11-17 16:50:48.227 |          499 |
| 2015-11-17 16:50:48.728 |          501 |
| 2015-11-17 16:50:49.228 |          499 |
| 2015-11-17 16:51:47.713 |          497 |
| 2015-11-17 16:51:48.214 |          498 |
| 2015-11-17 16:51:48.714 |          498 |
| 2015-11-17 16:51:49.214 |          498 |
| 2015-11-17 16:52:47.653 |          499 |
| 2015-11-17 16:52:48.154 |          499 |
| 2015-11-17 16:52:48.659 |          499 |
| 2015-11-17 16:52:49.159 |          499 |
| 2015-11-17 16:53:47.667 |          501 |
| 2015-11-17 16:53:48.172 |          501 |
| 2015-11-17 16:53:48.673 |          501 |
| 2015-11-17 16:53:49.175 |          501 |
| 2015-11-17 16:54:47.649 |            0 |
| 2015-11-17 16:54:48.137 |          501 |
| 2015-11-17 16:54:48.637 |          500 |
| 2015-11-17 16:54:49.137 |          501 |
| 2015-11-17 16:55:47.883 |          501 |
| 2015-11-17 16:55:48.383 |          501 |
| 2015-11-17 16:55:48.883 |          501 |
| 2015-11-17 16:56:47.948 |          499 |
```

bike 9519

```
mysql> select Stamp, dischargecurr from imei9519 where Stamp between "2015-11-07 08:48:14" and "2015-11-07 08:58:14";
+-------------------------+---------------+
| Stamp                   | dischargecurr |
+-------------------------+---------------+
| 2015-11-07 08:48:14.237 |           502 |
| 2015-11-07 08:48:14.739 |           501 |
| 2015-11-07 08:49:13.235 |           501 |
| 2015-11-07 08:49:13.751 |           502 |
| 2015-11-07 08:49:14.252 |           501 |
| 2015-11-07 08:49:14.752 |           501 |
| 2015-11-07 08:50:13.237 |           499 |
| 2015-11-07 08:50:13.736 |           499 |
| 2015-11-07 08:50:14.244 |           505 |
| 2015-11-07 08:50:14.744 |           503 |
| 2015-11-07 08:51:13.431 |           594 |
| 2015-11-07 08:51:13.933 |           594 |
| 2015-11-07 08:51:14.433 |           579 |
| 2015-11-07 08:52:13.492 |           520 |
| 2015-11-07 08:52:13.992 |           520 |
| 2015-11-07 08:52:14.493 |           522 |
| 2015-11-07 08:53:13.495 |           505 |
| 2015-11-07 08:53:13.996 |           505 |
| 2015-11-07 08:53:14.496 |           505 |
| 2015-11-07 08:54:13.250 |           504 |
| 2015-11-07 08:54:13.748 |           505 |
| 2015-11-07 08:54:14.249 |           505 |
| 2015-11-07 08:54:14.749 |           504 |
| 2015-11-07 08:55:13.461 |           731 |
| 2015-11-07 08:55:13.972 |           695 |
| 2015-11-07 08:55:14.474 |           695 |
| 2015-11-07 08:56:13.493 |           500 |
| 2015-11-07 08:56:14.005 |           500 |
| 2015-11-07 08:56:14.506 |           499 |
| 2015-11-07 08:57:13.382 |           499 |
| 2015-11-07 08:57:13.882 |           499 |
| 2015-11-07 08:57:14.391 |           499 |
| 2015-11-07 08:58:13.412 |           499 |
| 2015-11-07 08:58:13.912 |           499 |
+-------------------------+---------------+
```

Problem2: DischargeCurr is 0

Possible cause:

1. sensor is not working
2. bike is out of battery

bike 2910

```
mysql> select Stamp, dischargecurr from imei2910 where Stamp between "2015-11-04 07:40:47" and "2015-11-04 07:57:36";
+-------------------------+--------------+
| Stamp                   | dischargecurr |
+-------------------------+--------------+
| 2015-11-04 07:40:47.433 |            0 |
| 2015-11-04 07:40:47.932 |            0 |
| 2015-11-04 07:41:46.933 |            0 |
| 2015-11-04 07:41:47.429 |            0 |
| 2015-11-04 07:41:47.930 |            0 |
| 2015-11-04 07:42:46.952 |            0 |
| 2015-11-04 07:42:47.451 |            0 |
| 2015-11-04 07:42:47.952 |            0 |
| 2015-11-04 07:43:46.893 |            0 |
| 2015-11-04 07:43:47.394 |            0 |
| 2015-11-04 07:43:47.895 |            0 |
| 2015-11-04 07:43:48.398 |            0 |
| 2015-11-04 07:44:46.767 |            0 |
| 2015-11-04 07:44:47.294 |            0 |
| 2015-11-04 07:44:47.809 |            0 |
| 2015-11-04 07:44:48.309 |            0 |
| 2015-11-04 07:45:46.758 |            0 |
| 2015-11-04 07:45:47.260 |            0 |
| 2015-11-04 07:45:47.761 |            0 |
| 2015-11-04 07:45:48.262 |            0 |
| 2015-11-04 07:46:46.872 |            0 |
| 2015-11-04 07:46:47.370 |            0 |
| 2015-11-04 07:46:47.871 |            0 |
| 2015-11-04 07:46:48.371 |            0 |
| 2015-11-04 07:47:47.216 |            0 |
| 2015-11-04 07:47:47.710 |            0 |
| 2015-11-04 07:47:48.211 |            0 |
| 2015-11-04 07:48:46.866 |            0 |
| 2015-11-04 07:48:47.366 |            0 |
| 2015-11-04 07:48:47.871 |            0 |
| 2015-11-04 07:48:48.382 |            0 |
| 2015-11-04 07:49:46.901 |            0 |
| 2015-11-04 07:49:47.400 |            0 |
```

bike 9519

```
mysql> select Stamp, dischargecurr from imei9519 where Stamp between "2015-11-29 09:07:46" and "2015-11-29 09:21:25";
+-------------------------+--------------+
| Stamp                   | dischargecurr |
+-------------------------+--------------+
| 2015-11-29 09:07:46.032 |            0 |
| 2015-11-29 09:07:46.531 |            0 |
| 2015-11-29 09:08:45.589 |            0 |
| 2015-11-29 09:08:46.102 |            0 |
| 2015-11-29 09:08:46.603 |            0 |
| 2015-11-29 09:09:45.380 |            0 |
| 2015-11-29 09:09:45.880 |            0 |
| 2015-11-29 09:09:46.380 |            0 |
| 2015-11-29 09:09:46.881 |            0 |
| 2015-11-29 09:10:45.545 |            0 |
| 2015-11-29 09:10:46.049 |            0 |
| 2015-11-29 09:10:46.548 |            0 |
| 2015-11-29 09:11:45.536 |            0 |
| 2015-11-29 09:11:46.042 |            0 |
| 2015-11-29 09:11:46.541 |            0 |
| 2015-11-29 09:12:45.422 |            0 |
| 2015-11-29 09:12:45.924 |            0 |
| 2015-11-29 09:12:46.425 |            0 |
| 2015-11-29 09:12:46.925 |            0 |
| 2015-11-29 09:13:45.547 |            0 |
| 2015-11-29 09:13:46.048 |            0 |
| 2015-11-29 09:13:46.552 |            0 |
| 2015-11-29 09:14:45.480 |            0 |
| 2015-11-29 09:14:45.980 |            0 |
| 2015-11-29 09:14:46.485 |            0 |
| 2015-11-29 09:14:46.990 |            0 |
| 2015-11-29 09:15:45.524 |            0 |
| 2015-11-29 09:15:46.028 |            0 |
| 2015-11-29 09:15:46.528 |            0 |
| 2015-11-29 09:16:45.654 |            0 |
| 2015-11-29 09:16:46.144 |            0 |
| 2015-11-29 09:16:46.644 |            0 |
| 2015-11-29 09:17:45.450 |            0 |
| 2015-11-29 09:17:45.950 |            0 |
| 2015-11-29 09:17:46.456 |            0 |
| 2015-11-29 09:17:46.956 |            0 |
| 2015-11-29 09:18:45.393 |            0 |
| 2015-11-29 09:18:45.900 |            0 |
| 2015-11-29 09:18:46.396 |            0 |
| 2015-11-29 09:18:46.896 |            0 |
| 2015-11-29 09:19:38.159 |            0 |
| 2015-11-29 09:19:38.649 |            0 |
```

Problem3: Duplicate trips in old trip data

bike 7517

```
mysql> select * from trip7517 where start_time > "2015-11-00";
+-----+---------------------+---------------------+----------+----------+------------+
| id  | start_time          | end_time            | distance | comments | isAccurate |
+-----+---------------------+---------------------+----------+----------+------------+
| 112 | 2015-11-21 17:12:46 | 2015-11-21 17:35:23 |     NULL | NULL     |       NULL |
| 113 | 2015-12-02 09:56:34 | 2015-12-02 11:03:05 |     NULL | NULL     |       NULL |
| 118 | 2015-11-21 17:12:46 | 2015-11-21 17:35:23 |     NULL | NULL     |       NULL |
| 119 | 2015-12-02 09:56:34 | 2015-12-02 11:03:05 |     NULL | NULL     |       NULL |
+-----+---------------------+---------------------+----------+----------+------------+
```

Scripts and tables

trip_curr**** MYSQL Tables

These tables contains trips start_time, end_time and duration for each bicks after run TripDetection.py

---

Algorithm/TripDetection.py

file location: sensordc@blizzard:~/scripts/TripDetcTest/Algorithm/TripDetection.py

How to use: python3 TripDetection.py

usage run the scripty will create table trip*curr**** that contains start*time end_time and duration of trips identified by the new trip detection algorithm.

Analysis/reading.py

file location: sensordc@blizzard:~/scripts/TripDetcTest/Analysis/reading.py

usage: fetch data from imei and trip to compare the relationship between dischargecurr and GPS readings and trip detection.

Analysis/analysis.py

file location: sensordc@blizzard:~/scripts/TripDetcTest/Analysis/analysis.py

running environment: python3 with pandas and matlabplot installed (they are not installed in blizzard)

input: a csv file

output: a chart of discargecurr and trip, range of time that GPS reading is not zero and the range of time that is identified as trip by old algorithm.

Algorithm/reading.py

file location: sensordc@blizzard:~/scripts/TripDetcTest/Algorithm/reading.py

usage fetch data from imei****trip**** and dischargeCurr to compare the relationship between the trip identified by new algorithm and old algorithm

---

Missing GPS Location

File Location: sensordc@blizzard:~/scripts/missing_gps

Files: getGPS.py, index.html, missing.js, script

How to use

1. Run script

   > ./script

   Shows all missing trips from 2015 May to today

   > ./script YYYYMM

   Shows all missing trips from the month given to today

   > ./script YYYYMM YYYYMM

   Shows all missing trips bewtween the two given month

2. Copy the directory to local

   > scp sensordc@blizzard.cs.uwaterloo.ca:~/scripts/missing_gps/* .

3. Open **index.html** using a browser

Trip Summary

File Location: sensordc@blizzard:~/scripts/missing*trip*summary_map

Files: getGPS.py, index.html, script, trip.js

How to use

1. Run script

   > ./script

   Shows all missing trips from 2015 May to today

   > ./script YYYYMM

Shows all missing trips from the month given to today

```
./script YYYYMM YYYYMM
```

Shows all missing trips bewtween the two given month

2. Copy the directory to local

```
scp sensordc@blizzard.cs.uwaterloo.ca:~/scripts/missing*trip*summary_map/* .
```

3. Open **index.html** using a browser

How it works

getGPS.py reads from trip table and raw GPS datas. Collects all valid and any missing trip segments. In order to make the data retrieved to be small, I make readings in 2 minutes to be one trip segments. The green lines on the map shows all valid trip segments and the black lines is the missing trip segments

---

Visual Status Command

Directory Location : sensordc@blizzard:~/scripts/visual_status

Files: script, scripty.py, main.js, data.js, visual_status.html

How to use

1. Run script

```
./script
```

2. Copy the directory to local

```
scp sensordc@blizzard.cs.uwaterloo.ca: ~/scripts/visual_status/* .
```

3. Open **visual_status.html** using a browser

How it works

The python script **script.py** fetches the last seen status of each bikes from MySQL database. The LastSeen column is marked as red if the bike have not been used for more than 2 months, yellow if it is not been used for more than 1 month. Phone Battery column is marked red if it is lower than 95.

Per Bike Per Trip Database

Directory Location : sensordc@blizzard:~/scripts/quality_script

Files: generate_script.py atleastone_template.sql

MySQL Tables tripxxxx TDxxxx per_trip_each_minute_quality

How to use

1. If needed, update information for TDxxxx and tripxxxx tables.
2. Run script

   > python generate*script script*template.sql output_script.sql

   An sql script will be generated in output_script.sql
3. In mysql database First delete existing quality analysis (NOTE make a backup if needed!)

   > delete from per*trip*each*minute*quality;

   Then run the sql file generated in step #1

   > source /home/sensordc/quality*script/output*script.sql

   The generated analysis would be in table **per_trip_each_minute_quality** table

Outline of per_trip_each_minute_quality table

imei imei of bike

id trip id from TDxxxx tables

start_time start time of trip

end_time end time of trip

minute minute since start_time of trip

total_valid_reading total number of readng with valid GPS (i.e. nonzero) in current minute

total_reading total number of reading in current minute

Per Bike Per Trip Report

Directory Location : sensordc@blizzard:~/scripts/perbikepertrip_report

Files: bikes.js, main.js, pertrip.py, report.html, script

How to use

1. Run script

   > ./script

   Shows all trip report from 2015 May to today

   > ./script YYYYMM

   Shows all trip report from the month given to today

   > ./script YYYYMM YYYYMM

   Shows all trip report bewtween the two given month

2. Copy the directory to local

   > scp sensordc@blizzard.cs.uwaterloo.ca:~/scripts/perbikepertrip_report/* .

3. Open **report.html** using a browser

How it works

pertrip.py fetches trip report from **per_trip_each_minute_quality** in MySQL. The lengths of dot is proportional to the duration of each trip. Green dot means there is at least on valid gps reading in this minute, otherwise it is red.

Per Bike Trip Summary

Directory Location : sensordc@blizzard:~/scripts/perbikepertrip_summary

Files: bikes.js, main.js, report.html, script, trip_summary.py

How to use

1. Run script

   > ./script

   Shows all trip summary from 2015 May to today

   > ./script YYYYMM

   Shows all trip summary from the month given to today

   > ./script YYYYMM YYYYMM

   Shows all trip summary bewtween the two given month

2. Copy the directory to local

   > scp sensordc@blizzard.cs.uwaterloo.ca:~/scripts/perbikepertrip_summary/* .

3. Open **report.html** using a browser

How it works

trip_summary.py fetches trip report from **per_trip_each_minute_quality** in MySQL, and find out the percent of there is at least one good data in each minutes for every trip. If the percentage is lower than 0.5, it is marked as red.