MATLAB Hackathon

Fitness tracker

As a first step, data were collected from a cell phone on which the MATLAB Mobile application was installed and were transferred to a computer to be uploaded to MATLAB r2022b.The data collected are related to the position obtained by GPS according to latitude and longitude and to the accelerometers; after that once imported, they were extracted to be saved to variables within the workspace.

Acceleration

19418x3 timetable

	Timestamp	1 X	2 Y	3 Z
1	06-Sep-2018 13:27:32....	1.8902	5.1196	6.7059
2	06-Sep-2018 13:27:32....	0.5494	4.8946	7.0004
3	06-Sep-2018 13:27:33....	-0.5663	4.6576	7.7426
4	06-Sep-2018 13:27:33....	-0.7435	4.4971	9.1767
5	06-Sep-2018 13:27:33....	-0.1904	4.7533	9.7346
6	06-Sep-2018 13:27:33....	-0.0970	5.0215	9.4377
7	06-Sep-2018 13:27:33....	0.2549	4.7821	9.5909
8	06-Sep-2018 13:27:33....	0.3076	4.8323	9.6508
9	06-Sep-2018 13:27:33....	-0.0013	4.8539	9.7250
10	06-Sep-2018 13:27:33....	-0.2119	4.6624	10.3260
11	06-Sep-2018 13:27:33....	0.1209	4.1667	10.4792
12	06-Sep-2018 13:27:33....	-0.3915	3.0750	12.1527
13	06-Sep-2018 13:27:33....	-1.3875	1.8061	15.2939

Acceleration | Position

217x6 timetable

	Timestamp	1 latitude	2 longitude	3 altitude	4 speed	5 course	6 hacc
1	06-Sep-2018 13:28:48....	42.2999	-71.3490	0	0	0	72.9000
2	06-Sep-2018 13:30:25....	42.2986	-71.3496	27	2.2900	2.6000	53.0950
3	06-Sep-2018 13:30:26....	42.2987	-71.3496	41	4.3300	8.9000	60.6800
4	06-Sep-2018 13:30:27....	42.2987	-71.3498	73	1.4700	15.8000	77.3670
5	06-Sep-2018 13:30:28....	42.2988	-71.3499	52	2.4800	236.9000	68.2650
6	06-Sep-2018 13:30:29....	42.2987	-71.3498	31	3.2700	216.2000	39.4420
7	06-Sep-2018 13:30:30....	42.2988	-71.3496	42	1.1900	293.6000	30.3400
8	06-Sep-2018 13:30:31....	42.2990	-71.3498	99	2.0400	292.9000	28.8230
9	06-Sep-2018 13:30:32....	42.2989	-71.3499	83	2.3900	319.1000	33.3740
10	06-Sep-2018 13:30:33....	42.2989	-71.3499	88	2.2700	318.7000	30.3400
11	06-Sep-2018 13:30:34....	42.2989	-71.3498	80	1.7500	324.3000	31.8570
12	06-Sep-2018 13:30:35....	42.2990	-71.3497	59	2.6200	357.1000	40.9590
13	06-Sep-2018 13:30:36....	42.2990	-71.3497	51	1.7900	4	62.1970

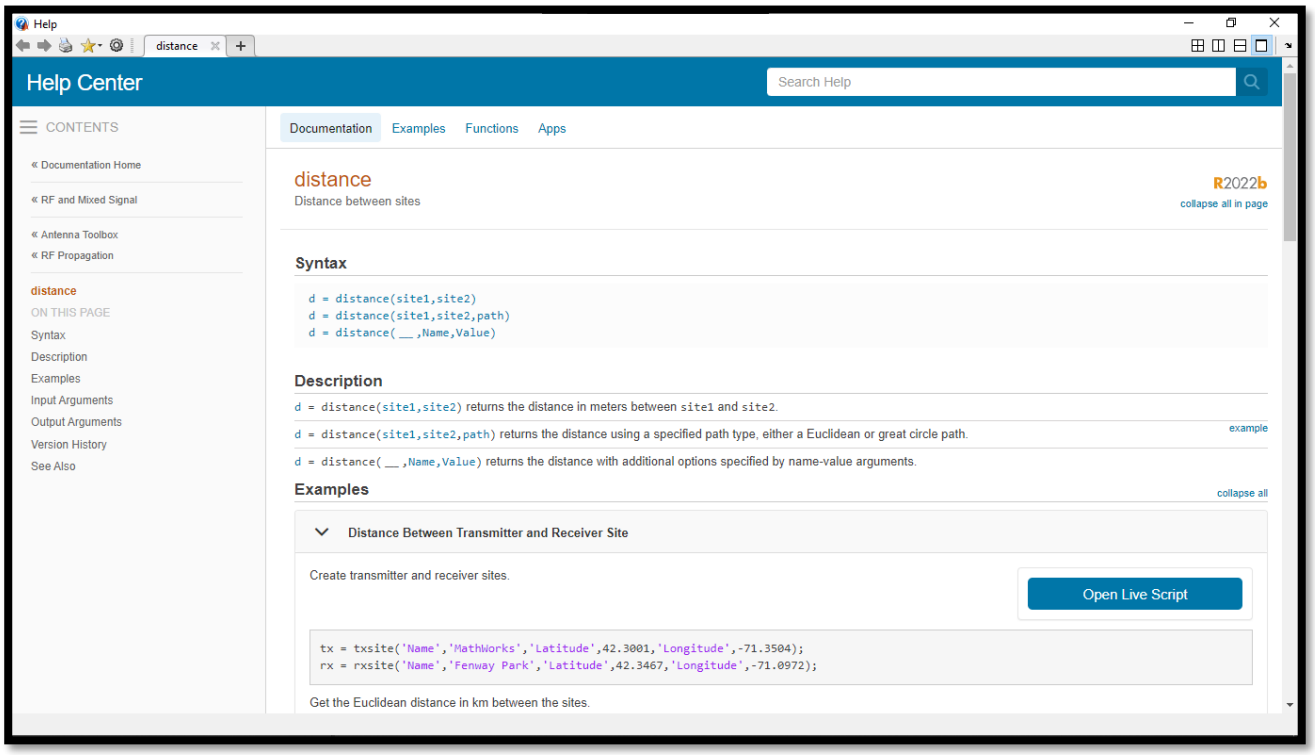
This is the code that performs the above:

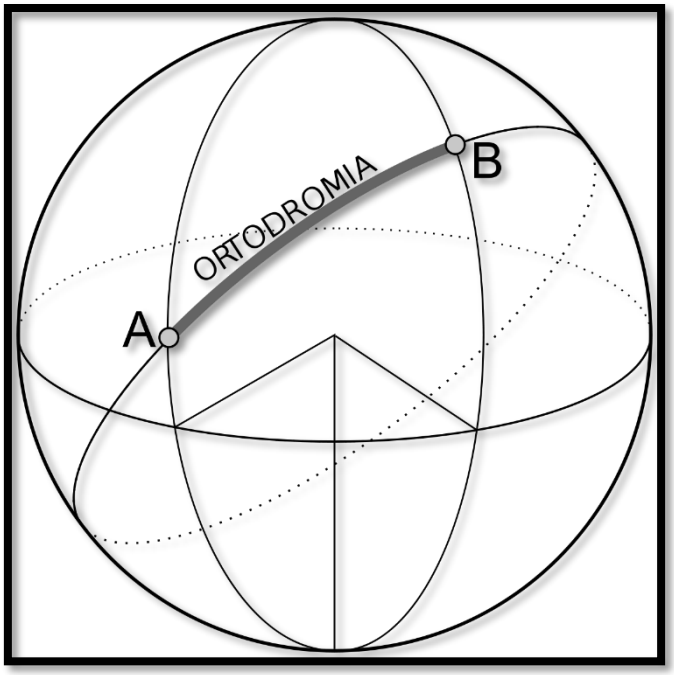
```
load('SensorLog#3.mat');
LAT = Position.latitude;
LON = Position.longitude;
TIMEposition=Position.Timestamp;
Xacc = Acceleration.X;
Yacc = Acceleration.Y;
Zacc = Acceleration.Z;
TIMEacc=Acceleration.Timestamp;
```

Next, standard data for an average person were decided, specifically his weight and the distance traveled by taking a single step; furthermore the variable for total distance traveled was generated:

```
%% VARIABLES
step = 0.6; %m
totaldis = 0;
weight = 80;
```

To obtain the value of distance traveled, a Orthodromy formula was used to report the change in angles given by GPS coordinates in distance through the function *d = distance(site1,site2)* and this was done for the entire length of the position vector (divided into latitude and longitude).





The code for this process is given here:

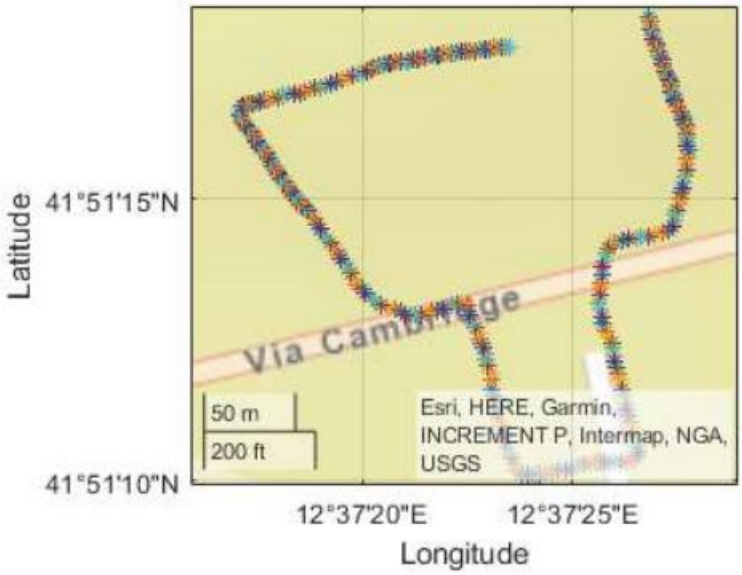
```
for i = 1:(length(LAT)-1)        % Loop through every data sample
 LAT1 = LAT(i);                  % Latitude of the iLth sample
 LON1 = LON(i);                  % Longitude of the iOth sample
 LAT2 = LAT(i+1);                % Latitude of the (i+1)Ath sample
 LON2 = LON(i+1);                % Latitude of the (i+1)Lth sample
 tx = txsite('Name','MathWorks','Latitude',LAT1,'Longitude',LON1);
 rx = rxsite('Name','Fenway Park','Latitude',LAT2,'Longitude',LON2);

 DIFF = distance(tx,rx,'greatcircle');
 dis = DIFF;
 totaldis = totaldis + dis;
end
totaldis
```

```
totaldis = 787.5137
```

The path traveled by the user and its code is shown here:

```
for i = 1:(length(LAT)-1)        % Loop for live plot
   geoplot(LAT(i),LON(i),'-*')
   geobasemap streets            % Rappresentation based on geographic grid
   pause(0.1);
   hold on;
end
```



Finally, the values for kilocalories burned during the run and the total number of steps taken were calculated; the code for this part is shown here:

```
steps = round(totaldis/step)            % Steps taken
```

```
steps = 1313
```

```
kcal = round(steps * 0.0005 * weight)    % Burned calories
```

```
kcal = 53
```

Furthermore, through the vector of positions and the corresponding time vector, we calculated the average speed held by the person; the code is shown here:

```
i = 0;
av_speed = 0;
inst_speed = Position(TIMEposition,"speed" );
inst_speed = table2array(inst_speed);
for i = 1:+1:271
    av_speed = av_speed + inst_speed(i);
end
av_speed = (270 / av_speed) * (1000/60) % Average speed in min/Km
```