

This project can be done in groups of one or two.

The Internet of Things (IoT) involves the growing trend of having multiple small devices that all collect small amounts of information. Each IoT device uses a small processor. Most of these devices do not even have an operating system on them.

Arrow corporate hires many people to integrate IoT devices which help control power for companies. The buildings are scattered with small IoT devices. The devices monitor heat, light, and water usage, people presence, ventilation, sunlight, and cooling needs. By combining information from many sources, they form a larger picture which tells more of a story than any individual device can. They are now promising to save money for customers, as a blanket statement. This level of IoT is beyond having a computer in your toaster, it is called Industrial IoT, or IIoT for short.

Part A:

You are provided with a set of GPS data tracks in which Dr. Kinsman drove. Given the GPS data please achieve the following goals:

1. Write a program to read in the GPS data.
2. Given that GPS file, compute how long it took the car to drive from the start of the GPS location, to the final location.
3. There will be extra GPS information at the start or end of the file.
4. The GPS file might start (or stop) while the car is in motion, in which case you should report this, and not report any time.
5. Find a way to clean the data by filtering out and ignoring any redundant or erroneous data.

For example:

- a. If the vehicle is parked, you do not need multiple data points at that same location.
- b. If the vehicle is traveling in a straight line going down-hill, you can ignore some points on the line.
- c. If the vehicle is traveling in a straight line going up-hill, you can ignore some points on the line.
- d. The Arduino sometimes burps and writes two GPS sentences to the same line of the data file.
You need to detect and ignore these anomalies. Otherwise it looks like the car jumps to the other side of the planet.
- e. The Arduino sometimes loses its mind, and starts recording GPS values that jump all over the place.
This especially happens if it loses connection to the antenna. You will need to ignore meaningless junk.
- f. At some point the antenna broke, and the GPS device became less accurate.
- g. When the vehicle first starts up, the GPS device is not moving. Do not worry about the data points when the vehicle has not started moving yet.
- h. When the vehicle parks, the GPS device stops moving. Do not worry about these non-moving data points at the end of a drive.
- i. The “heading” or “direction” information on the GPS is only valid if the car is moving. If the car stops at a stop sign or a traffic light, the “direction” is meaningless. So, you can only use this information if the speed of the vehicle is above some minimum speed.
- j. You need to convert the GPS sentences. You cannot rely on the comments in the code.

There is a maximum limit to the number of points you can include in any path, so you might need to split one GPS track into multiple paths after 10,000 or 20,000 points. (I don’t know what the limit is.)

(continued)

6. Resources:

There are lots of web pages about “Python Pynima GPS Visualization”. Search the internet for examples. They are out there.

<https://towardsdatascience.com/simple-gps-data-visualization-using-python-and-open-street-maps-50f992e9b676>

<https://thatmaceguy.github.io/python/gps-data-analysis-intro/>

<https://ozzmaker.com/using-python-with-a-gps-receiver-on-a-raspberry-pi/>

<https://blog.jetbrains.com/pycharm/2022/09/visualizing-geospatial-data-in-python/>

<https://stackoverflow.com/questions/62645722/track-gps-data-for-a-certain-time-with-python>

https://www.youtube.com/watch?v=bDOoT4nu_oE

7. At some point, you will be asked to analyze a few files and report the trip durations of them. They will be drawn from the files now up on MyCourses.

8. PART A Write-up:

- a. How did you solve the problem of redundant information at the start or stop of the file?
- b. Did you bother to make a KML file out of your GPS?

9. **Turn into the dropbox, ONE OF YOU should submit:**

- a. Your write-up, as above. Name it PROJ_A_<names in filename>.pdf
- b. Your part A code, in a *.zip file.