# GPS Dilemma

UOIT IEC Group 1

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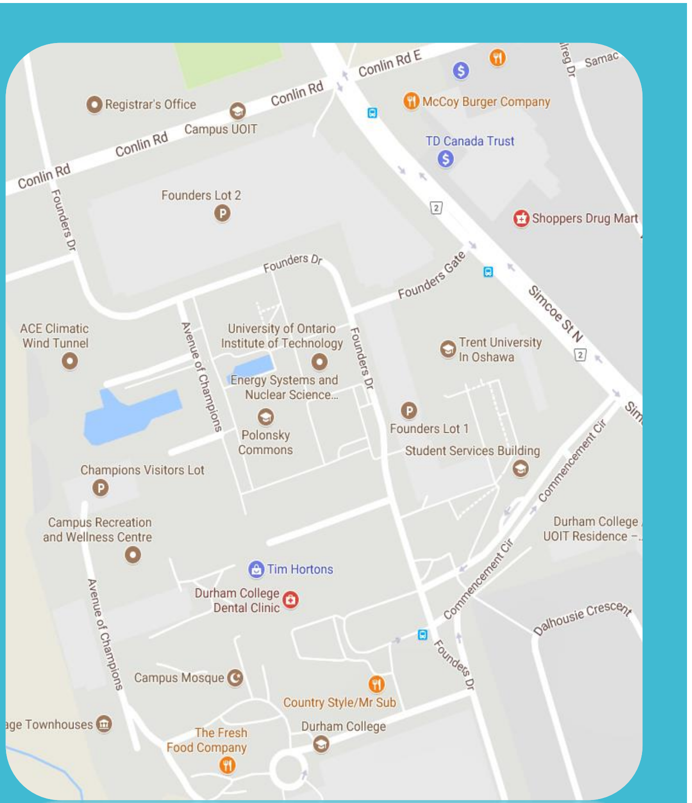


# problem_description

create an autopilot program for GPS navigation in 2D

# program function

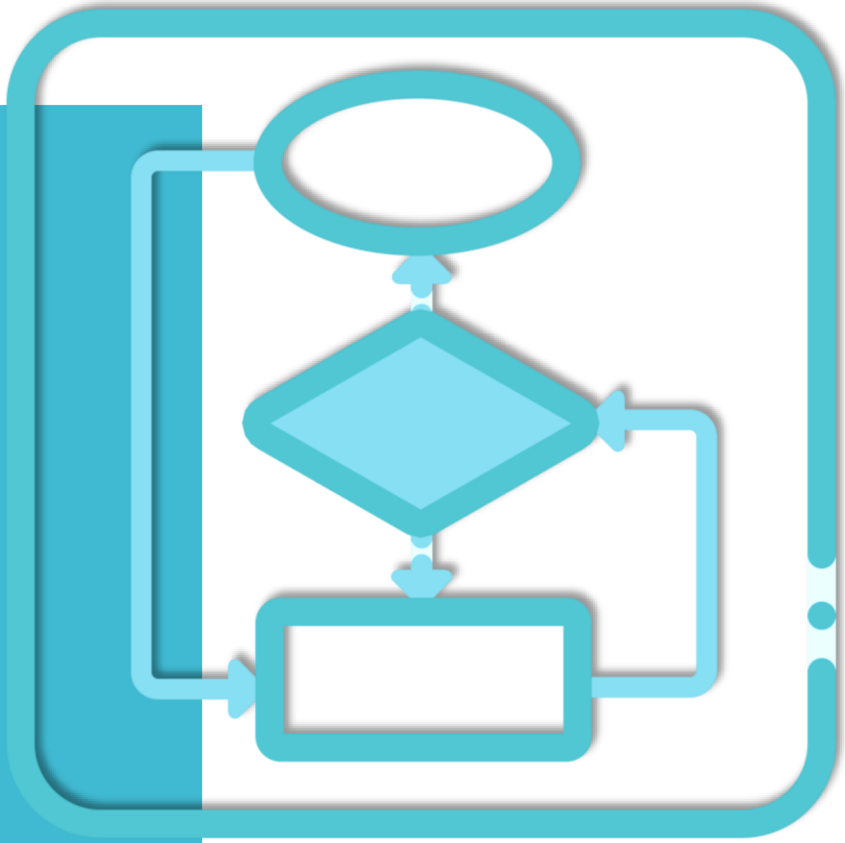
Input

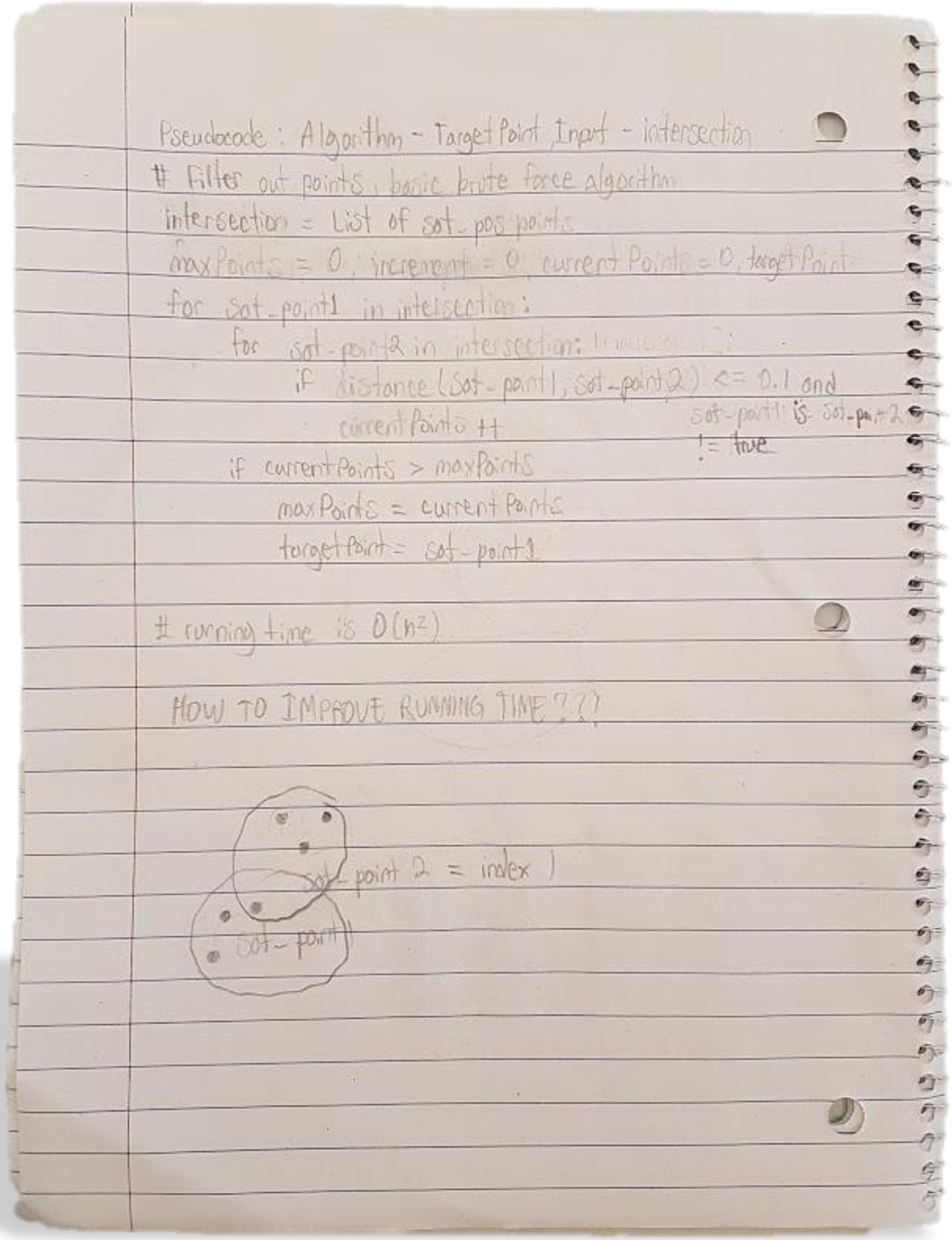
- time that signal is received by plane
- coordinates of destination point
- amount of signal sources available
- for each signal source:
  - heading of signal source
  - time signal source sends signal
  - satellite coordinates at initial time t = 0

Output

- compass heading from the receiving location to the destination, in degrees
- where many locations are consistent with the signals -> inconclusive
- no possible locations consistent with the signal -> inconsistent”.

# algorithm





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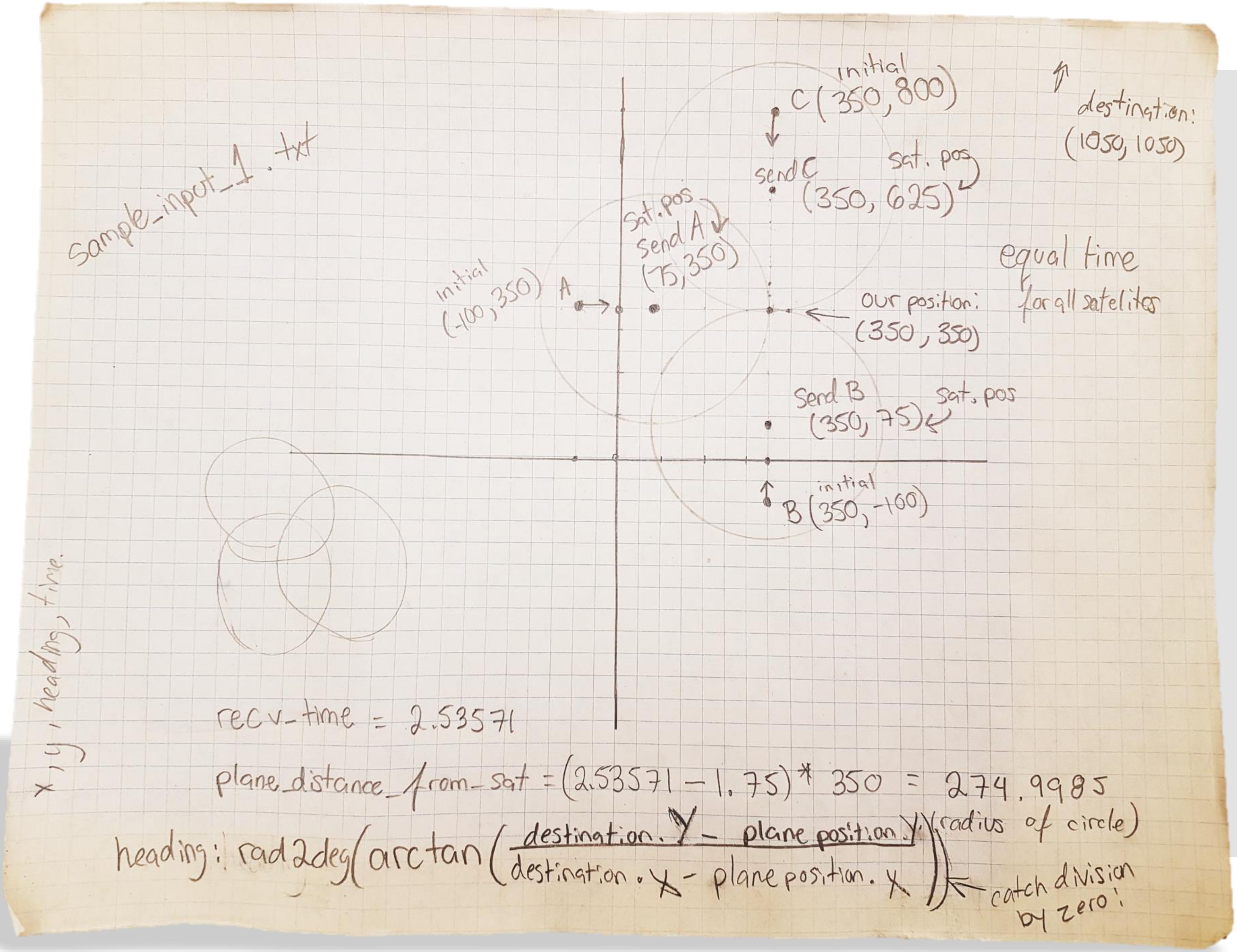
Pseudocode : Algorithm - Target Point , Input - intersection
# Filter out points , basic brute force algorithm
intersection = List of sat_pos points
maxPoints = 0 ; increment = 0 , current Points = 0, target Point
for sat_point1 in intersection :
    for sat_point2 in intersection: [illegible]
        if distance (sat_point1, sat_point2) <= 0.1 and
                                        sat_point1 is sat_point2
                                        != true
            currentPoints ++
    if currentPoints > maxPoints
        maxPoints = current Points
        targetPoint = sat_point1

# running time is O(n²)
```

HOW TO IMPROVE RUNNING TIME ???

# preliminary analysis



sample_input_1.txt

x, y, heading, time.

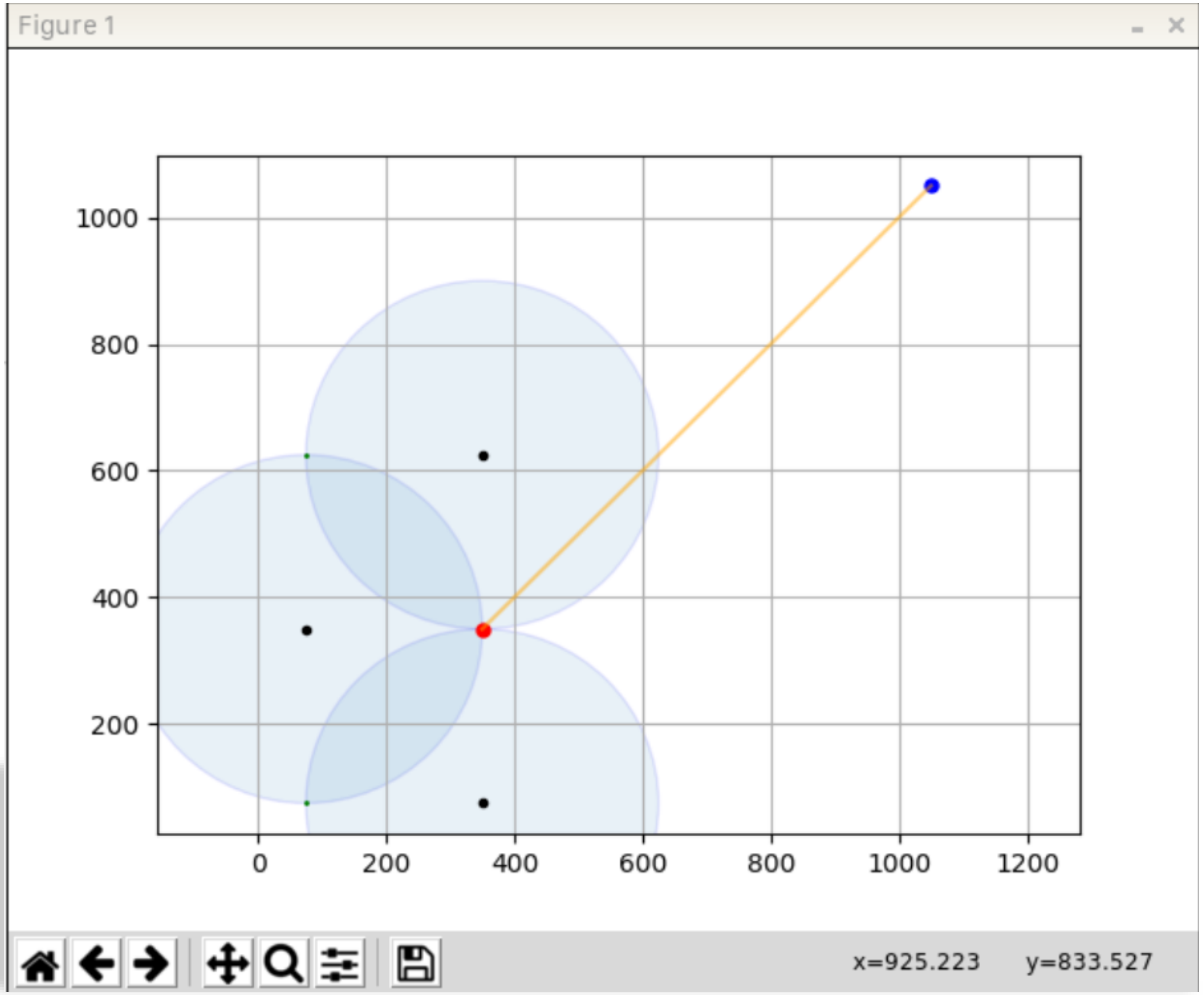
recv_time = 2.53571

plane_distance_from_sat = (2.53571 − 1.75) * 350 = 274.9985 (radius of circle)

$$\text{heading: rad2deg}\left(\arctan\left(\frac{\text{destination.Y} - \text{plane position.Y}}{\text{destination.X} - \text{plane position.X}}\right)\right)$$

← catch division by zero!

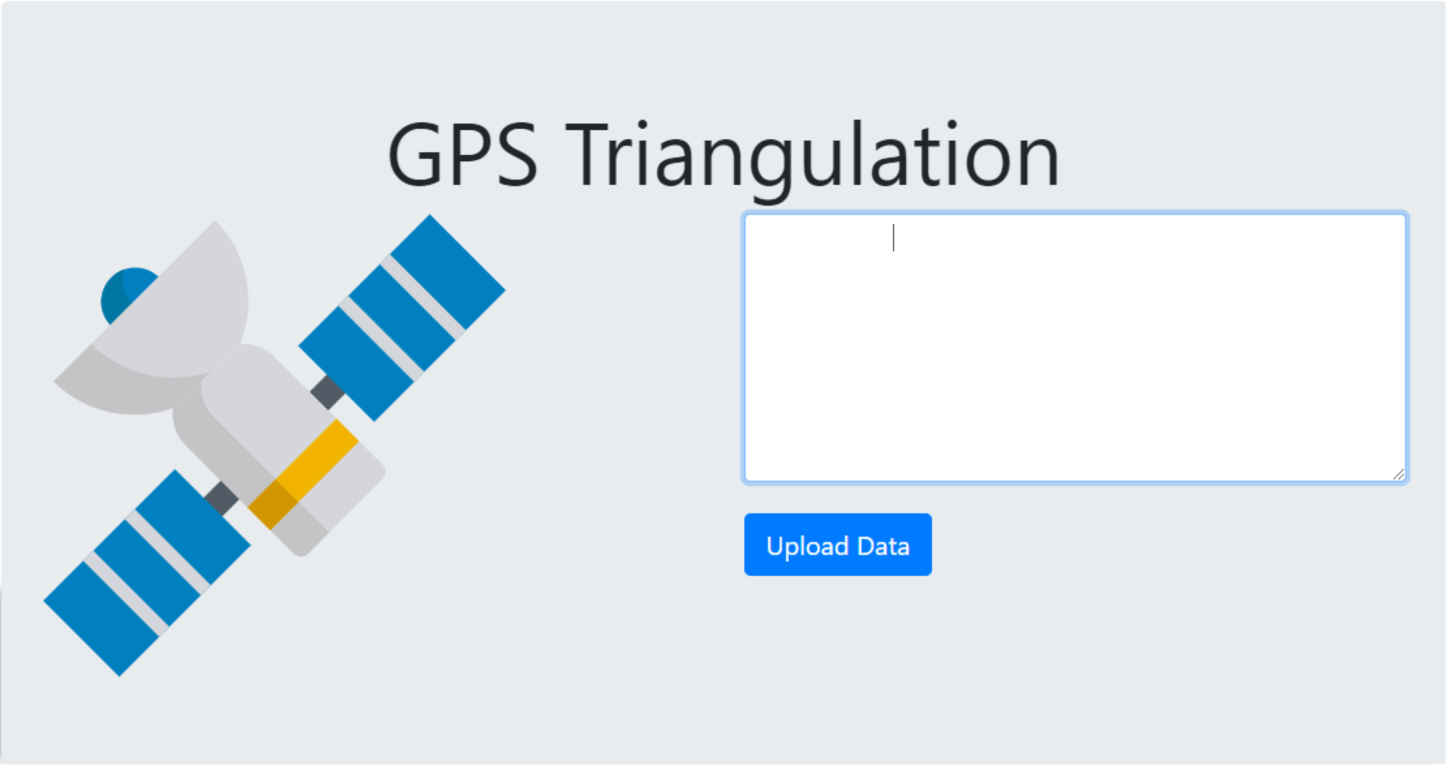
# visualizing program output



Created a graphical output for debugging the code using matplotlib.pyplot

# designing the GUI

- Made a web-based GUI using Bootstrap and Chart.js



GPS Triangulation

# optimizing the process

- We used an intuitive algorithm
- Exit early if invalid data detected as to not waste time and system resources
- Our algorithm runs in less than 1 ms in most cases.