1. Task 2.1: Methodology, Results and Discussion
2. Methodology
3. Results
4. Discussion
5. Task 3: Methodology, Results and Discussion
   1. Methodology

|  |
| --- |
| In task 3, our goal is to find out the path that has the lowest cost by designing a 16m2 minus cost area. We defined the best minus cost area is that the area is capable to help us greatly reduce the cost or conduct a path that has the lowest cost. We think that design the minus cost area as a line is more effective and more suitable to decline the cost because the PolyU-A380 can has a full use of the minus cost area. Otherwise, the PolyU-A380 cannot has full use of the minus cost area if we make in to square or rectangular. We will conduct this project by using the formula “C = 𝐶𝐹 ∙ ∆𝐹 + 𝐶𝑇 ∙ ∆𝑇 + 𝐶𝑐 + 𝐶𝑃 ∙ ∆P”.  We assume that the minus cost area is placed along the original path because the original path is the path that has the lowest cost calculated by the python A-star. Meanwhile, we try not to increase the total distance that the PolyU-A380 travels, so we think the minus cost area should be placed along the original path in order to cut the cost as much as we can. |
| Figure 1 (The Original Cost Without Minus Cost Area) |
| Finally, we will also try to put the minus cost area next to the time consuming area and fuel consuming area in order to find out the path that make the increasing cost to be recovered by the minus cost area. For an exmple, place the minus cost area on the one side of the cost adding areas to recover the cost. It should a method to to gain all possible results and prevent losing the potential minus cost area that gives us the best cost reduction.. |

* 1. Results

This is the original PolyU-A380 travelling path calculated by Python A-star in Task 1. The cost in this path is 2941.417. The below picture shows the path of PolyU-A380 in Task 1.

|  |
| --- |
| Figure 1 (The Original Cost Without Minus Cost Area) |

* + 1. Designing Minus Cost Along the Original Path

|  |  |
| --- | --- |
| The Location of Minus Cost Area | Cost |
| Location 1 | 2068.832 |
| Location 2 | 1354.041 |
| Location 3 | 1267.332 |
| Location 4 | 1131.498 |
| Location 5 | 355.203 |

The numbers are the minus cost area locations in the pictures below.

|  |  |  |  |
| --- | --- | --- | --- |
| Figure 2 (Location 1 in Part7.2.1) | | Figure 3 (Location 2 in Part7.2.1) | |
| Figure 4 (Location 3 in Part7.2.1) | | Figure 5 (Location 4 in Part7.2.1) | |
| Figure 6 (Location 5 in Part7.2.1) | |

* + 1. Designing Minus Cost Outside the Original Path

|  |  |
| --- | --- |
| The Locations of Minus Cost Area | Cost |
| Location 1 | 1981.215 |
| Location 2 | 1741.624 |
| Location 3 | 1723.415 |
| Location 4 | 956.830 |
| Location 5 | 1039.791 |
| Location 6 | 792.958 |

The numbers are the minus cost area locations in the pictures below.

|  |  |
| --- | --- |
| Figure 7 (Location 1 in Part7.2.2) | Figure 8 (Location 2 in Part7.2.2) |
| Figure 9 (Location 3 in Part7.2.2) | Figure 10 (Location 4 in Part7.2.2) |
| Figure 11 (Location 5 in Part7.2.2) | Figure 11 (Location 6 in Part7.2.2) |

* + 1. Designing Minus Cost Next to the Cost Adding Areas

|  |  |
| --- | --- |
| The Locations of Minus Cost Area | Cost |
| Location 1 | 2038.494 |
| Location 2 | 2382.230 |
| Location 3 | 2382.230 |
| Location 4 | 264.043 |

The numbers are the minus cost area locations in the pictures below.

|  |  |
| --- | --- |
| Figure 12 (Location 3 in Part7.2.3) | Figure 13 (Location 4 in Part7.2.3) |
| Figure 14 (Location 5 in Part7.2.3) | Figure 15 (Location 6 in Part7.2.3) |

* + 1. Sorting the Data from Part 7.2.1 to 7.2.3

|  |  |
| --- | --- |
| The Location of Minus Cost Area | Cost |
| Location 1 in 7.2.1 | 2068.832 |
| Location 2 in 7.2.1 | 1354.041 |
| Location 3 in 7.2.1 | 1267.332 |
| Location 4 in 7.2.1 | 1131.498 |
| Location 5 in 7.2.1 | 355.203 |

|  |  |
| --- | --- |
| The Locations of Minus Cost Area | Cost |
| Location 1 in 7.2.2 | 1981.215 |
| Location 2 in 7.2.2 | 1741.624 |
| Location 3 in 7.2.2 | 1723.415 |
| Location 4 in 7.2.2 | 956.830 |
| Location 5 in 7.2.2 | 1039.791 |
| Location 6 in 7.2.2 | 792.958 |

|  |  |
| --- | --- |
| The Locations of Minus Cost Area | Cost |
| Location 1 in 7.2.3 | 2038.494 |
| Location 2 in 7.2.3 | 2382.230 |
| Location 3 in 7.2.3 | 2382.230 |
| Location 4 in 7.2.3 | 264.043 |

After placing different minus cost area locations into the map, we can get the data above. In order to find the best potential minus cost area location, we decide to place the minus cost area next to the location which is location 4 in 7.2.3 has the minimum cost in the above chart. Hope to find out the minimum cost.

|  |  |
| --- | --- |
| The Locations of Minus Cost Area | Cost |
| Location 1 | 320.375 |
| Location 2 | 19 |
| Location 3 | 94.042 |
| Location 4 | 26.042 |

The numbers are the minus cost area locations in the pictures below.

|  |  |
| --- | --- |
| Figure 16 (Location 3 in Part7.2.4) | Figure 17 (Location 4 in Part7.2.4) |
| Figure 18 (Location 5 in Part7.2.4) | Figure 19 (Location 6 in Part7.2.4) |

* 1. Discussion

From the above part, we can observe one thing that is the lower cost

1. Reflective Essay (Franky)

In the beginning, when I knew I can have opportunity to choose project related to aviation, I was excited. Although I was excited, I felt a little bit afraid once I heard that this project requiring programming skills because I have never tried in programming in my whole life. Finally, I found this project is not as difficult as I thought.

During this project, I experienced and learned programming skills, which is important to me because programming skills is one of the fundamental skills towards a person who want to enter aviation industry and it can be applied to many aspects in aviation, like navigation, UAV, flight control system, etc.

I found a way to learn programming effectively which is to observe the combination of each command and test each command incessantly and respectively. By trying type in different commands, I could get instant responses from Python and improve my programming skills.

I got involved in task 3 in this project. As I had no knowledge on programming at the beginning, so I had to guess the meanings and test the results of each command downloaded from professor’s github. I felt difficult on task 3 especially on creating an irregular shape minus cost area. After testing the commands, I realized the logic behind most of the tested commands and started to create the area. I was delighted and satisfied when I found the way to achieve my idea on python. Finally, I learned programming and problem-solving skills during the process.

Meanwhile, I also understood that having a good communication between team members can facilitate the work efficiency. All the members have given their own opinions and suggestions towards each task. For example, our group leader is good at programming, so he gave us numerous of tips in doing our task. As a result, most of our tasks were finished smoothly. Also, we helped each other to check their work. For example, when one of us had finished the responsible part, we helped them to check the answers. Hence, we can probably avoid making mistakes.

Moreover, this project makes me role played as a flight dispatcher to design a path for the aircrafts. During the project, I finally knew that programming can be applied on collaborative path planning towards UAV, separating the aircraft to avoid collision as well as increasing the airworthiness and reliability of aircrafts. These knowledges are what I have learnt during the lecture.

Last but not least, this project is really meaningful that provide a chance to engineering students from different departments to collaborate and share own knowledge with each other. I have learnt several things from this project, including programming skills, problem-solving skills, the importance of having a good communication and the importance of programming in aviation discipline.