Intelligent low-altitude air traffic management system

Table of contents:

List of figures:

List of tables:

List of symbols:

List of definitions:

Section 2:

2.1 Acknowledgement:

Our group is working with professor peng wei to create a system that manages air-traffic in low altitudes. The system will be a simulation interface, a software that simulates the delivery process using drones in 2D where you have x number of drones fulfilling an ever growing demands over time. Similar to a flight tracker for commercial planes, our software will display and update each specific drones movement at any point of time.One of the main key features is to make sure that drones will not collide into each other especially when they have intersected trajectories. Our project, being software based requires little or close to none equipment utilities. Therefore we are not given any monetary aid for the creation of our system.

In the second semester, our group might be incorporating real datas from actual drones (two drones) to increase the quality of our software.

2.2 Problem Statement:

In this project, we will be working on a system that simulates some of the common conditions encountered by drone deliveries. Our system would have a fixed number of warehouses where each of them would be assigned a unique drone to complete the demands of simulated customers. As drones receive their designated place for delivery, they will fly from their warehouse to the place of interest and eventually get back to their warehouse.

The problems we are expecting to face are:

1- collisions between drones with intersected pathways
2- updating drone's latest position on the map,
3- Erasing completed demands off the map
4- Generation of random demands over time
5- Developing an algorithm that helps us to satisfy demands around warehouses in an efficient manner
6- Generation of the shortest pathway to take to complete orders in a safe and efficient manner

Solutions:

We are working on algorithms that will solve the above mentioned problems. Each problem will its own algorithm then we make sure they all work together.

2.5 Assumptions:

The software will only work in the city of Ames, IA for the time being, since we will be using specific coordinates as limits for our 2D system. We will assume that each warehouse has unlimited number goods for delivery and there will only be a unique drone associated to each warehouse. After each successful delivery, the unique drone will take the same path back and wait for new orders to come in. Possible real life obstructions such as buildings, birds,cranes,trees will be removed. The goal is to simulate an environment where only drones would be present(minimal obstructions). The simulated drones flying velocity will be base of the

specifications of the dji phantom 3 drone in the market. Trajectory paths would always be assumed as a “straight line” drawing from the warehouse to the point of demand.

2.6 Limitation:

The aircraft will not leave outside of Ames, IA. There will be a fixed rule where the number of intersected trajectories at a given time should not exceed 4. This is to ensure that the algorithm used for collision prevention is doable. The software will only monitor collisions between drones and will not handle collisions with “things” that gets in the way of the drone making the delivery.

2.7 Expected End Product and Other Deliverables:

By the end of this semester, we will be able to present a software that works the way we had described. We won’t be using real drones for the testing of the software, but instead we will simulate everything.

By the end of the second semester, we might be able to incorporate real data from real dji phantom 3 and use it as a random factor to test the limits of our simulated 2D software. If things worked out really well, we might upgrade our 2D simulation software to a 3D system.

Related work / market survey / literature review:

There has been many work done with aircrafts. For example, Amazon started working on Amazon Prime Air earlier this year which is basically a drone that delivers packages. It is based in kentucky and deals with other airports across the states as well. The product has limits as the packages has to be small enough to fit the drone and packages can be delivered to customer within 30 minutes as long as they are in a radius of 16Km. Also, google have been testing the same concept with a project called “Project Wing” although they haven’t been very successful with dropping the packages that could potentially cause a safety problem.

Section 3:

3 Proposed Approach and Statement of Work

3.1 Functional requirements

The aircraft can receive requests from a customer to get items from the warehouse to the location of the customer and it goes back. The software should be able to track all drones.

3.2 Constraints considerations

We will follow the standard protocol and it will be approved by the organizations. We will basically write the code the way as we learned in our previous coding classes.

3.3 Technology considerations

The code will have a couple of algorithms for each function to do specific tasks. Having good algorithms will minimize the number of obstacles we might face and will keep the project as simple as we could. For the simulation part, we don't have the experience to make simulation that demonstrate the functionality of our project.

3.4 Safety considerations

The project is 100% safe for the first semester at least because it is just a simulation software. For the second semester, we will be using actual drones to test the software and how well it will be working. For safety reasons, we will be testing the drones in limited area with signs saying that there are drones being tested in the specific area. This area will indoor test to make sure the safety of others.

3.6 Possible Risks and risk management

There will be no risks because it is just a simulation software. Therefore, we are not expecting any risk.

3.7 Project Proposed Milestones and evaluation criteria

There will be no tests done in this semester for it is just a simulation. We will however run the code itself and make sure that is works.

3.8 Project tracking procedures

We will track the progress by asking the professor if we meet his requirements. We will make sure the code has no errors and that is works.

3.9 Objective of the task

The goal is develop a software that will manage to monitor the movement of aircrafts and avoid collision with other aircrafts.

3.11 Expected Results and Validation

The desired outcome is having a working software that will be able to monitor trajectories and aircrafts. It will be able to avoid collision with other aircraft and will be suitable and easy for a user to use.

Section 4:

4.1 Personnel effort requirements

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be based on the projected effort required to perform the task correctly and not just “X” hours per week for the number of weeks that the task is active

Names:	Work done
Humaid Alkaabi	Worked on the code and done research.
Junan	Worked on the code and done research.
Saad alsudayri	Done research and do the write up
Suhail Aldhaheri	Done research, set up meetings and worked on the reflections

4.2 other resource requirements

There will be no parts used as we will only work with java on a program called Eclipse. There is no parts used because it is a simulation this semester.

4.3 Financial requirements

There will be no financial resource.

4.4 Project Timeline

Week 5	We did more research on the project. We set up the platform and the compiler. We looked over the GPS equations and we worked on the project plan.
Week 6 (Sep 25th to October 2nd)	We will look into functions that will deal with the collision between the aircrafts that will cross paths.
Week 7 (October 2nd to October 9th)	We will work on the algorithm of the collision function and we will write up the code for it.
Week 8 (October 9th to October 16th)	We will begin figuring out how to update the drone's latest position on the map for the user to see.
Week 9 (October 16th to October 23rd)	We will write up the code lines to update the drone's position. We might use a GPS.
Week 10 (October 23rd to October 30th)	We will figure out the how to delete or erase the demands from the map after the aircraft has completed it's task
Week 11 (October 30th to November 6th)	We will do more work on erasing the demands and making sure it is done accurately.
Week 12 (November 6th to November 13th)	We will write a function that will unable us to get random demands over the time we have.
Week 13 (November 13th to November 20th)	We will figure out an algorithm that completes demands around the warehouses in a suitable efficient manner.
Week 14 (November 20 to November 27th)	We will make sure that the aircraft is taking the fastest and shortest path to complete it's task. We will begin the simulation.
Week 15	Do more tests and make sure everything is working and our end goal is completed.
Week 16	We will finish and present the project and do the simulation.
Week 17	finals

5 Closure Materials

5.1 conclusion

Our plan is to develop a working software that will be able to get aircrafts such as drones to be able to move around and avoid collision with other aircrafts. The software would be convenient for the user to use in the city of Ames, IA.