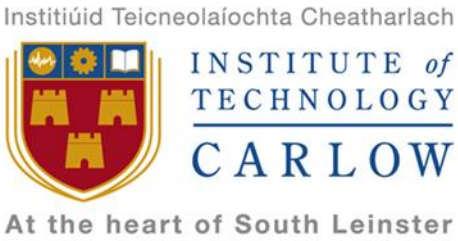

DRONE AIR TRAFFIC CONTROL SYSTEM

Functional Specification

By

Brendan Mitchell

Title: Drone Air Traffic Control System - Functional specification

Author: Brendan Mitchell(c00220212)

Supervisor: Dr. Oisin Cawley

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Contents

Section 1 - Introduction

The following document will introduce the features and the functionality of the Drone Air Traffic Control System. It will be shown what the application is supposed to do, what the product is, the functionality of the application in order of importance and the target audience of the application. A context diagram and use cases will be used to outline the architecture of the application and the functions the application should provide. Metrics will be used to gauge the success of the application. The FURPS+ method will be used to determine the application's success. Furthermore, it will be determined if there are any other similar applications in the current marketplace and a comparison will be done to see if this application is similar or different to those found.

Section 2 – Applications purpose

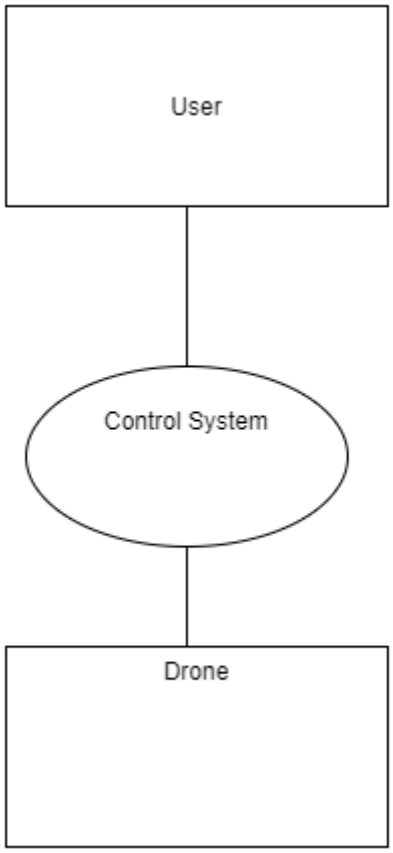
The core pieces of functionality of the system are:

- The system will control the drone/drones.
- The system will detect and prevent the drones from colliding with each other.
- Drones will be able to be added to the system.
- A flight plan will be added for each of the drones.
- Telemetry such as battery, altitude, speed and other important data will be collected from the drone during the flight.
- The application will be able to use the camera and video capabilities of the drone.

Section 3 – Applications target audience

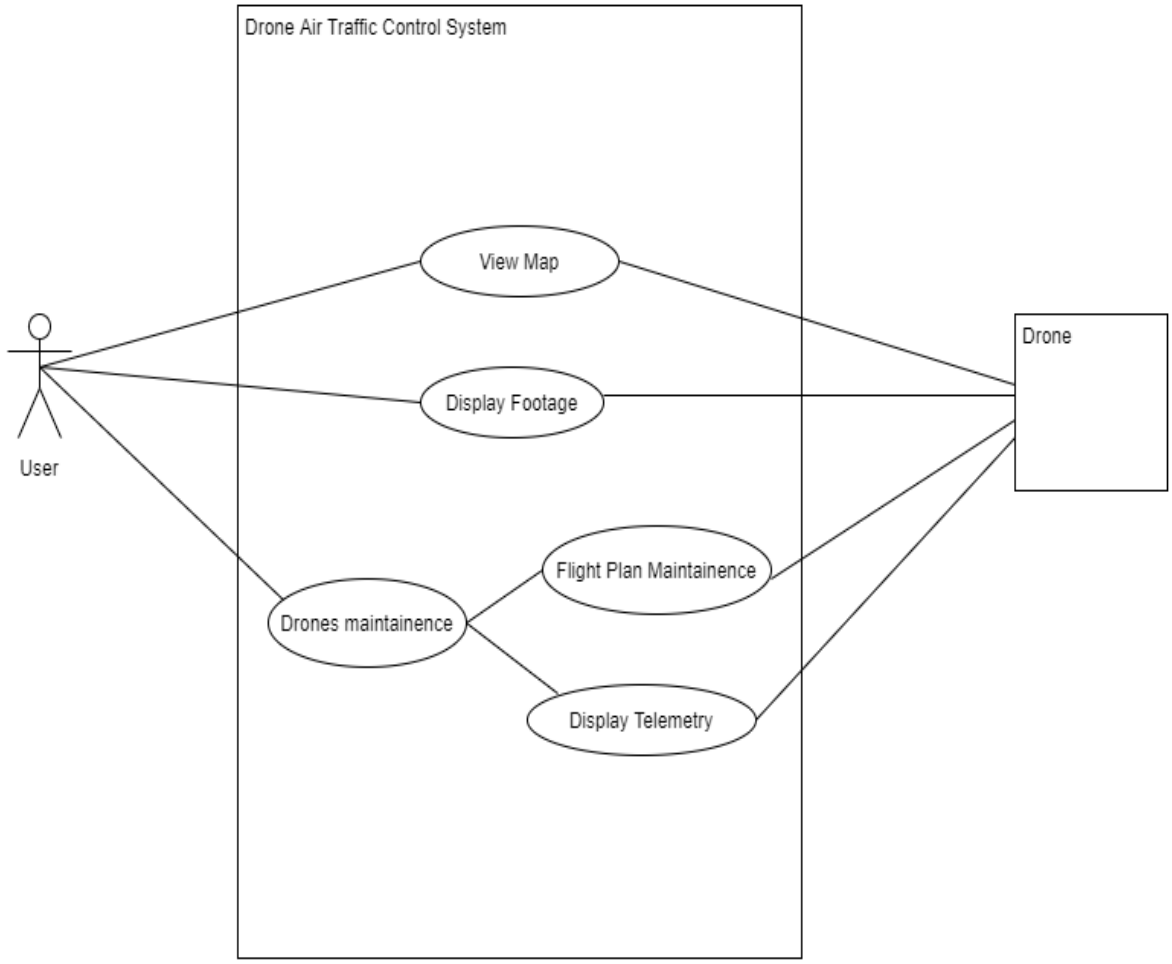
The target audience for this drone project is anyone who needs to control multiple drones in an air space. It can be used by the general public who use drones just as an outdoor pursuit, or it could be used by any number of sectors to help them perform their duties in their workplace. Examples of such sectors are search and rescue, security firms, agricultural sector, delivery companies and land surveying. Search and rescue can use the drones to find missing people in hazardous condition such as a burning building, security firms can use the system to control multiple drones when checking premises to ensure that no unlawful entry has been gained and delivery companies can use the drones to make deliveries to their customers.

Section 4 - Context Diagram



Section 5 – Use Case Diagram and Use Cases

Section 5.1 – Use Case Diagram



Section 5.2 – Use Cases

The use cases show how the user will use the drone traffic control system. It will describe the use cases, give any pre-conditions necessary so the user can use the system and it will give numbered steps on how the user will use the system to perform the task the wish to do.

Section 5.2.1 – Add Drone

Use Case Name	Add Drone
Pre-Conditions	The control system must be installed on the computer being used.
Description	This allows the user to add a drone within the system.
Scenario	1. The controller clicks the drone button. 2. The user then selects the drone from the list of drones currently available. 3. The drone selected is added to the system
Scenario Success	The selected drone was added to the system.

Section 5.2.2 – Delete Drone

Use Case Name	Delete Drone
Pre-Conditions	The control system must be installed on the computer being used and there must be 1 or more drones currently added within the system.
Description	This allows the user to delete a drone within the system.
Scenario	1. The controller clicks the drone button. 2. The user then selects the drone from the list of drones currently available. 3. The drone selected is deleted from the system
Scenario Success	The drone selected by the user is deleted from the system.

Section 5.2.3 – Add Flight Plan

Use Case Name	Add Flight Plan
Actors	Control system, User
Pre-Conditions	There must be 1 or more drones currently added within system.
Description	A flight plan can be added to the selected drone.
Scenario	1. The user selects a drone from the list of drones in the system. 2. The flight plan will be added to the system.
Scenario Success	The drone will follow the flight plan.

Section 5.2.4 - View Flight Plan

Use Case Name	View Flight Plan
Actors	Control system, User
Pre-Conditions	There must be Drones and flight paths already in the system.
Description	Users can view the flight plan of the selected drone.
Scenario	1. The user selects a drone from the list of drones in the system. 2. The flight plan of the selected drone is displayed.
Scenario Success	The user views the flight plan of the selected drone.

Section 5.2.5 - Delete Flight Plan

Use Case Name	Delete Flight Plan
Actors	Control system, User
Pre-Conditions	There must be Drones and flight paths already in the system.
Description	Users can delete flight plans within the system.
Scenario	1. The user selects a drone from the list of drones in the system. 2. The selected flight plan is deleted from the system
Scenario Success	Flight plan for the selected drone is deleted.

Section 5.2.6 - Update Flight Plan

Use Case Name	Update Flight Plan
Actors	Control system, User
Pre-Conditions	There must be Drones and flight paths already in the system.
Description	The user can update the flight plan of a drone.
Scenario	1. The user selects a drone from the list of drones in the system. 2. The user then updates the flight plan details.
Scenario Success	The selected flight plan was updated.

Section 5.2.7 – Control Drone

Use Case Name	Control Drone/Drones
Pre-Conditions	Drone must be added to system and a flight plan must be entered
Description	The system controls the drones in the air space. The system can alter the speed, altitude and direction of the drone.
Scenario	1. The system connects to the drone 2. The system sends commands to the drone telling it the direction, speed and altitude to use.
Scenario Success	The drone is controlled according to the flight plan for that drone.

Section 5.2.7 - Collision Avoidance

Use Case Name	Collision Avoidance
Pre-Conditions	Drone must be added to system and flight plan must be entered
Description	The system will run a collision avoidance algorithm. Steps will be taken if a collision is predicted.
Scenario	1. The system's collision avoidance algorithm checks for any possible collisions. 2. The system controls the drone to avoid the collision. 3. The flight path is updated for the drone. 4. The drone follows the new flight path
Scenario Success	The drone avoids colliding with another drone.

Section 5.2.8 – Display Telemetry

Use Case Name	Receive Telemetry
Pre-Conditions	Drone must be added to system and the drone must be in flight
Description	This use case allows the user to receive telemetry from the drone. Telemetry such as GPS coordinates, speed and altitude of the drone.
Scenario	1. The user selects the drone from the list of drones currently within the system. 2. The user then selects the receive telemetry button. 3. The drone's telemetry is displayed on the screen.
Scenario Success	The telemetry is displayed on the screen

Section 5.2.9 – Display footage

Use Case Name	Display footage
Pre-Conditions	Drone must be added to system, must be in flight and the camera and video must be turned on.
Description	This user can view footage from the drone.
Scenario	1. The user selects a drone from the list of drones currently within the system. 2. The user then selects the display footage button. 3. The footage is displayed on the user's screen.
Scenario Success	The footage is displayed on the user's screen

Section 5.2.10 – View Map

Use Case Name	View Map
Pre-Conditions	Drone must be added to system and the drone must be in flight.
Description	The user can view a map which shows the drones currently flying within the system
Scenario	1. The user selects the view map button. 2. A full screen map will be displayed showing the drones currently flying.
Scenario Success	A map will be displayed to the user showing the drones in flight.

Section 6 – FURPS

Functionality

The drone air traffic control system will allow the controller to add a drone or drones to the system. The controller can then enter a flight plan for each of the drones added. The system will control the drones in the air space ensuring that the drones don't collide with each other and that they get to their destination as stated in the flight plan. The controller of this system will be able to view the drones through a virtual environment and they will also be able to receive telemetry such as the speed, altitude and coordinates relating to the drone and its flight. The controller will be able to view footage from the drone. This footage can be pictures or video footage.

Usability

- The user should be able to use the system without any tutorials.
- The user should be able to navigate their way around the system with ease.
- The user should be able to get footage from the drone in less than 10 seconds.

- The user should be able to add and delete drones from the system in under 10 seconds.

Reliability

- The system should recover quickly from any failure.
- The system should be able to cope with an increase in the number of drones being added to the system.
- The system should behave in a predictable manner.
- The footage returned from the drone should be of good quality.

Performance

- The drone should carry out the command sent from the system within 2 seconds.
- The system should load on the user's computer in no more than 20 seconds.

Supportability

- The system should be easily maintained.
- The system should allow for more features to be added in the future.
- The system should be able to be ported to any platform easily.

Section 7 – Other Similar Applications

In this section, it will be discussed what other similar applications to this drone air traffic control system exist. Wing have a similar system to the one being developed for this project. Their system is called Opensky. It has been approved by Australia's Aviation Authority (AAA). The drone used in their system has fixed wings and propellers to help it navigate the skies (Wing 2014). Altitude Angel is another such company developing a system that control drones and has a collision detection system preventing the drones from colliding with each other and any other objects in its air space (Butcher M. 2018). Kitty Hawk is another drone control system. It has permission to launch a commercial enterprise in New Zealand. Other companies include AirMap and Iris Automation (Hawkins A. 2019).

Section 8 – Conclusion

In this document it has been shown how a user will use the air traffic control system. It has been discussed how the users will add and delete drones from the system, add and change flight plans, view both telemetry and footage from the drones, how the user will control the drones and how the user can view the drones currently flying using a map. The functionality, usability, reliability, performance and supportability of the system has been investigated and it has been determined what metrics there should be to make the system a success. During investigations it has been found that there are other similar systems already in existence.

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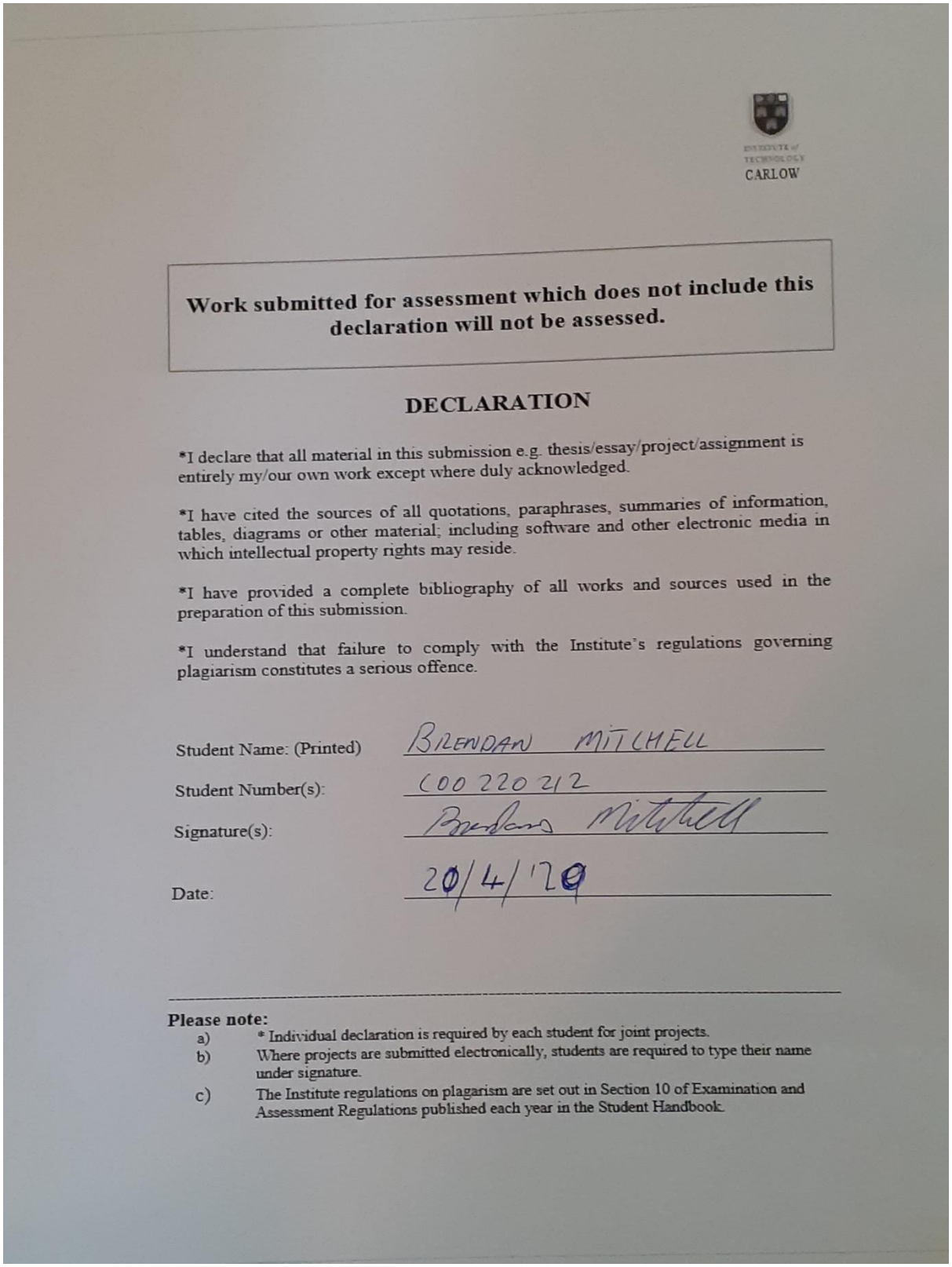

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