

Outline Project Specification

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Project Description

The aim of the project is to develop a tool to model acrobatic flights of aircraft. The main aspect of the model being modelled is the path of the aircraft, which is to be represented visually in a 3D way, allowing the user to see how the aircraft moves. A secondary objective is to provide some kinematic responses matching the manoeuvres, providing a way of replicating the movement using a controller.

The flights of aircraft are encoded using the OLAN or Aresti system. This project will use the OLAN system, which assigns a character to each manoeuvre in the flight to build flights using strings of these characters.

The platform of choice for this project will be Android, specifically, an app. The reasoning behind this is that having the tool available to large number of people on a highly portable platform will probably provide the most value to the most users (most likely people learning to fly these series). It is of course true that the range of devices is large, and this could cause issues. For this reason, testing is important and the target platform (Android version etc.) is important to consider.

The project can be described as an engineering one. While it is a novel problem – searching online finds no visualisation tools for this subject – the work consists mainly of utilising existing techniques and applying them to a new scenario, rather than developing new techniques.

Proposed Tasks

Initially, there'll be a degree of research, to investigate both the subject of the project and the technology to use. As there are many different ways to build any application, it is important to first develop a full understanding of the breadth of the project's brief, as well as consider the possibilities afforded by different technologies.

The subject of the project – the modelling of aircraft movement – needs to be researched to develop an understanding of the manoeuvres and their notations. The catalogue of available manoeuvres is fairly large, and some have various modifiers. Influences on the movements of aircraft need to be investigated – thing like the effect of gravity and aerodynamics – and decisions made with regard to whether to include them, for simplicity's sake.

The other main aspect of research is the technologies available, from the Android SDK to potential libraries. Graphics libraries and environments need to be researched, to see what is available for making development easier and avoiding programming antipatterns such as reinventing the wheel.

In the actual application, the catalogue of manoeuvres needs to be encoded with an internal representation corresponding to an OLAN figure. These will be used to build sequences and draw/animate them. This starts with an analysis of each movement to see how best to break down it into simple reusable components with reference to movements realistic for aircraft to perform. Sets of these components can be used to represent an manoeuvre, and these sets can be considered data, and stored in a catalogue using a static resource file (something like XML). Flights are represented with strings of OLAN notated manoeuvres, and these will need to be parsed and interpreted as part of the application.

An effective way of visualising the flight in a 3D space, with movement and rotation in three directions (x, y, z and pitch, yaw, roll) needs to be developed. There are plenty of different ways of doing this, and the most effective, suitable one needs to be found. This will likely involve some experimentation of various methods. This also includes thinking of ways to show the progression of the flight as well, from animation to the perspective to view the animation from and more.

Project Deliverables

The final system will be the primary deliverable of this project. This will take the form of a standalone Android application, providing all of the functionality discussed in the project description. Alongside the APK (Android Package File), it will include the full source code and accompanying documentation (Javadoc-style description of functions).

A weekly progress blog post will be written every week to discuss how development is going each week. Posts will talk about how the design of the application is evolving, what new features have been introduced, implementations of algorithms and more etc. It'll also provide a platform to describe ideas and challenges encountered.

A final report, consisting of an in-depth look at the development process from its inception through to its completion. This document will critically cover and analyse every aspect of the development, including the research carried out, regime in which the project was built (methodology), overall architecture and implementations of algorithms.

Bibliography

1. OpenAero, (accessed 2015-01-22) <http://www.openaero.net/>
A GNU-licensed aerobatic sequence design tool for converting the OLAN notation into Aresti diagrams. Useful for developing an understanding of the shapes of manoeuvres, their modifiers and how sequences are built up. Also potentially useful, due to its open-source nature, for extracting OLAN flight description
2. Google's Android developer training, (accessed 2015-01-23):
<https://developer.android.com/training/>
An introduction to developing Android applications, covering a wide range of topics to a basic level, including configuration, activity and intents, testing and to a degree, a graphic environment (OpenGL ES). Sums up the key parts of building applications for the Android platform, including architecture and design.
3. Google's Android API documents, (accessed 2015-01-23)
<https://developer.android.com/reference/android/>
The majority of the libraries used will be standard Android libraries, for simplicity's sake, so the official API documentation is an invaluable resource.
4. Android best practices, (accessed 2015-01-25) <https://github.com/futurice/android-best-practices/>
A Creative Commons licensed list summarising the best practices for developing Android applications from many contributors. Useful for starting off developing on the platform and producing high quality architectures and designs.