OLANdroid

Final report for CS39440 Major Project

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Declaration of originality

In signing below, I confirm that:

* This submission is my own work, except where clearly indicated.
* I understand that there are severe penalties for plagiarism and other unfair practice, which can lead to loss of marks or even the withholding of a degree.
* I have read the sections on unfair practice in the Students’ Examinations Handbook and the relevant sections of the current Student Handbook of the Department of Computer Science.
* I understand and agree to abide by the University’s regulations governing these issues.

Signature ……………………………………………. (Gideon MW Jones)

Date …………………………………………………

Consent to share this work

In signing below, I hereby agree to this dissertation being made available to other students and academic staff of the Aberystwyth Computer Science Department.

Signature ……………………………………………. (Gideon MW Jones)

Date …………………………………………………

Acknowledgements

I am grateful to… I’d like to thank…

Abstract

The acrobatic flight of aeroplanes

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# Background, Analysis & Process

## Aerobatic flight

The acrobatic flight of aeroplanes is the practice of flying in patterns not commonly used in flight. There's a number of different motivations behind this, including recreation, entertainment, sport and training. A range of flying vehicles can participate in aerobatics, while primarily aeroplanes are used, gliders and helicopters can also perform, the latter with its own more specific set of movements available.

Model aircraft – of the powered and controllable variety – are quite commonly used for performing aerobatics in the hands of hobbyists.

The smaller nature of the model aircraft means that forces exerted on them are far less significant than those on a full-sized plane, and that there's no worry about the *in situ* G-force a pilot would have to endure. A result of this means that, with model aircraft, far more intense flights can be undertaken.

An aerobatic flight can be broken down into a series of manoeuvres, each representing a pattern of movement for the aircraft to follow. An commonly known example manoeuvre would be a “loop-the-loop”, consisting of flying a plane round in a vertical loop.

A wide range of manoeuvres exists, describing many different patterns involving movements on every axis – pitch, yaw and roll – as well as even backwards movement (tailslides).

Manoeuvres can be described in two main different ways – the Aresti and OLAN notations.

The Aresti system was developed by Spanish aerobatic pilot José Louis Aresti Aguirre, and is now adopted by the Fédération Aéronautique Internationale (FAI) as a standard. It is a way of representing manoeuvres using numbers.

OLAN – One Letter Aerobatic Notation – was developed by Michael Golan

## Problem definition

Within the realm of this subject, the task this project is undertaking is the visual modelling of acrobatic flight.

This project goes a bit further than that definition of the task, as it's quite a wide description. The project's goal is to provide a tool for people who want to visualise these aerobatics. This definition allows for a wider scope of thought with regard to features, encompassing things like

There's a number of reasons for this extension to the task brief. Primarily, it's due to the narrow breadth of options

MODELLING ACROBATIC FLIGHT

- what does it *mean* how is it being modelled

## Background

Part of the motivation for this project was the fact that there were no systems available providing functionality anything like this.

One system that was of use for the development of this project was OpenAero. This is a tool for the interpretation of the OLAN system.

Research on that model flying website

What was your background preparation for the project? What similar systems did you assess? What was your motivation and interest in this project?

## Platform

The other side of the background research was looking into the Android platform and development.

This section should discuss your preparation for the project, including background reading, your analysis of the problem and the process or method you have followed to help structure your work. It is likely that you will reuse part of your outline project specification, but at this point in the project you should have more to talk about.

**Notes:**

* **All of the sections and text in this example are for illustration purposes. The main Chapters are a good starting point, but the content and actual sections that you include are likely to be different.**
* **Look at the document on the Structure of the Final Report for additional guidance.**

## Analysis

The first task highlighted by the research was that of developing a representation of the manoeuvres in-application. There are, of course, a number of different ways of doing this, including hard coding every manoeuvre.

The most logical approached was to analyse each manoeuvre and find effectively the highest common factor between them all. As the standard catalogue consists of a lot of different manoeuvres, this is an extensive task, but there are definitely some common features between various movements, for example a straight line forwards and a turn upwards.

Alongside this, another angle which could be taken was interpretation manoeuvres in the context of being flown by an aeroplane. In this context, it is obvious that manoeuvres can only exist if they can actually be performed, and thus the movements of a manoeuvre are limited by the mechanics of flight. From this, we can distill that that components of the manoeuvre can only move in the ways a plane can move – a plane cannot suddenly switch from flying straight flying upside-down – so a series of small sections can be built up, using operations such as a realistic change in pitch, yaw, roll and movement forwards (or backwards, in some cases).

Further on this, each piece of the aircraft's movement and progression through a manoeuvre is reliant on its previous position and orientation. Any set of simple components, representing an aircraft's movement, needs to be a cumulative progression.

However, this cannot be completely accurate, as the ability for an aircraft influence its position and orientation while flying straight line forwards is different to doing the same thing but upside down. The influence of both gravity and the thrust generated by the wing are two large factors which need to be considered, or ignored.

The background research brought about some questions:

limiting the model to planes & their manoeuvres

whether or not to bother with a gravitational model

Decision to use the open OLAN notation over aresti

### Features

Looking at the task in hand brings about some questions with regard to the feature set. Deciding on a set of features to accomplish is an important part of the project, as it essentially dictates what the final product will include.

To fufill the brief of the project, there are a number of most basic features which need to be implemented:

* Have an internal representation of the manoeuvre catalogue.
* Interpret string descriptions of flights.
* Visually model

Besides a completely utilitarian direction, coming at the project with an emphasis on the users of the application is way to approach the feature set. This way of thinking opens the project up to a wider range of features, with thought given to how users of the application would utilise it.

Prioritising features

Features we need vs features we like

functional features, for the core of the program, vs features for usability – actual visualisation vs things like flight saving etc.

Taking into account the problem and what you learned from the background work, what was your analysis of the problem? How did your analysis help to decompose the problem into the main tasks that you would undertake? Were there alternative approaches? Why did you choose one approach compared to the alternatives?

There should be a clear statement of the objectives of the work, which you will evaluate at the end of the work.

In most cases, the agreed objectives or requirements will be the result of a compromise between what would ideally have been produced and what was felt to be possible in the time available. A discussion of the process of arriving at the final list is usually appropriate.

## Process

Evolutionary design

Not TDD, test backed up

Feature driven

XP-ish

well documented code

weekly development diaries & demos

You need to describe briefly the life cycle model or research method that you used. You do not need to write about all of the different process models that you are aware of. Focus on the process model that you have used. It is possible that you needed to adapt an existing process model to suit your project; clearly identify what you used and how you adapted it for your needs.

# Design

Use of design patterns

Compromise of MVC

Class diagrams

Reusability of components, design of components to match the potential movement of aeroplanes

technology – java, gradle, android sdk, emulator, devices

Developing a working environment – IDE & use of xml-generating ui tool

relationship between the model of the application – manoeuvre representation & class diagram

You should concentrate on the more important aspects of the design. It is essential that an overview is presented before going into detail. As well as describing the design adopted it must also explain what other designs were considered and why they were rejected.

The design should describe what you expected to do, and might also explain areas that you had to revise after some investigation.

Typically, for an object-oriented design, the discussion will focus on the choice of objects and classes and the allocation of methods to classes. The use made of reusable components should be described and their source referenced. Particularly important decisions concerning data structures usually affect the architecture of a system and so should be described here.

How much material you include on detailed design and implementation will depend very much on the nature of the project. It should not be padded out. Think about the significant aspects of your system. For example, describe the design of the user interface if it is a critical aspect of your system, or provide detail about methods and data structures that are not trivial. Do not spend time on long lists of trivial items and repetitive descriptions. If in doubt about what is appropriate, speak to your supervisor.

You should also identify any support tools that you used. You should discuss your choice of implementation tools - programming language, compilers, database management system, program development environment, etc.

Some example sub-sections may be as follows, but the specific sections are for you to define.

## Overall Architecture

## Detailed Design

### Even More Detail

## User Interface Design

Various iterations, in terms of flow dependant on features being added

## Other Relevant Sections

# Implementation

The implementation should look at any issues you encountered as you tried to implement your design. During the work, you might have found that elements of your design were unnecessary or overly complex; perhaps third party libraries were available that simplified some of the functions that you intended to implement. If things were easier in some areas, then how did you adapt your project to take account of your findings?

It is more likely that things were more complex than you first thought. In particular, were there any problems or difficulties that you found during implementation that you had to address? Did such problems simply delay you or were they more significant?

You can conclude this section by reviewing the end of the implementation stage against the planned requirements.

# Testing

Detailed descriptions of every test case are definitely not what is required here. What is important is to show that you adopted a sensible strategy that was, in principle, capable of testing the system adequately even if you did not have the time to test the system fully.

Have you tested your system on ’real users’? For example, if your system is supposed to solve a problem for a business, then it would be appropriate to present your approach to involve the users in the testing process and to record the results that you obtained. Depending on the level of detail, it is likely that you would put any detailed results in an appendix.

The following sections indicate some areas you might include. Other sections may be more appropriate to your project.

## Overall Approach to Testing

## Automated Testing

### Unit Tests

### User Interface Testing

Monkey

### Stress Testing

monkeyrunner

### Other Types of Testing

Various devices

## Integration Testing

Play store beta testing

## User Testing

Got family to use it to raise issues

crash reports & ANR ones too

# Critical Evaluation

Examiners expect to find in your dissertation a section addressing such questions as:

* Were the requirements correctly identified?
* Were the design decisions correct?
* Could a more suitable set of tools have been chosen?
* How well did the software meet the needs of those who were expecting to use it?
* How well were any other project aims achieved?
* If you were starting again, what would you do differently?

Such material is regarded as an important part of the dissertation; it should demonstrate that you are capable not only of carrying out a piece of work but also of thinking critically about how you did it and how you might have done it better. This is seen as an important part of an honours degree.

There will be good things and room for improvement with any project. As you write this section, identify and discuss the parts of the work that went well and also consider ways in which the work could be improved.

Review the discussion on the Evaluation section from the lectures. A recording is available on Blackboard.

# Appendices

Third-Party Code and Libraries

If you have made use of any third party code or software libraries, i.e. any code that you have not designed and written yourself, then you must include this appendix.

As has been said in lectures, it is acceptable and likely that you will make use of third-party code and software libraries. The key requirement is that we understand what is your original work and what work is based on that of other people.

Therefore, you need to clearly state what you have used and where the original material can be found. Also, if you have made any changes to the original versions, you must explain what you have changed.

As an example, you might include a definition such as:

**Apache POI library** – The project has been used to read and write Microsoft Excel files (XLS) as part of the interaction with the client’s existing system for processing data. Version 3.10-FINAL was used. The library is open source and it is available from the Apache Software Foundation Apache Software Foundation (2014) “Apache POI - the Java API for Microsoft Documents” (Online) Available at: http://poi.apache.org Accessed: 14th March 2014.. The library is released using the Apache License Error: Reference source not found. This library was used without modification.

Android SDK –

Code Samples

This is an example appendix. Include as many appendices as you need. The appendices do not count towards the overall word count for the report.

# Annotated Bibliography

# 

This final section should list all relevant resources that you have consulted in researching your project. Each reference should also include a brief annotation.

1. Sylvia Duckworth. A picture of a kitten at Hellifield Peel. <http://www.geograph.org.uk/photo/640959>, 2007. Copyright Sylvia Duckworth and licensed for reuse under a Creative Commons Attribution-Share Alike 2.0 Generic Licence. Accessed August 2011.  
     
   This is my annotation. I should add in a description here.
2. Mark Neal, Jan Feyereisl, Rosario Rascunà, and Xiaolei Wang. Don’t touch me, I’m fine: Robot autonomy using an artificial innate immune system. In *Proceedings of the 5th International Conference on Artificial Immune Systems*, pages 349–361. Springer, 2006.   
     
   This paper…
3. W.H. Press et al. *Numerical recipes in C*. Cambridge University Press Cambridge, 1992.  
     
   This is my annotation. I can add in comments that are in **bold** and *italics*and then further content.
4. Various. Fail blog. <http://www.failblog.org/>, August 2011. Accessed August 2011.  
     
   This is my annotation. I should add in a description here.
5. Apache Software Foundation (2014) “*Apache POI - the Java API for Microsoft Documents*” (Online) Available at: [http://poi.apache.org](http://poi.apache.org/) Accessed: 14th March 2014.   
     
   Annotation...
6. Apache Software Foundation (2004) “Apache License, Version 2.0” (Online) Available at: <http://www.apache.org/licenses/LICENSE-2.0> Accessed: 14th March 2014.   
     
   Annotation...