

Adapting Access Aber making use of native Android functionality.

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

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

Date

Acknowledgements

I would like to thank myself for all my hard work.

Cheers.

Abstract

The aim for this project was to provide an alternative android native application to the current Access Aber web application, while also improving on the groundwork laid out by the initial work. This was done due to the help it can provide to users who are visiting the University as well as providing at least some assistance to those with disabilities. Aberystwyths campus can be a hard place to navigate and the benefits provided from a mobile device can benefit users to a large degree.

The application was developed for the android OS using the Android Studio IDE and relies heavily upon the Google Maps API. It provides a range of services to the user, some of which were brought over from the existing application and improved, some new. These include route finding around campus, user refined display's of building locations, route plotter with application compatible outputs and a location based help system.

This dissertation covers the original analysis, requirements, design and implementation of the project as well as details on the testing and design decision made throughout the development.

The conclusion is an android application which met its original requirements specification and adds further complexity to the initial web version of the project. This includes route grading and the representation of this along with an extendable solution to route finding using Google Maps and graph searching techniques.

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Chapter 1

Background & Objectives

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.

Note:

- 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.

1.1 Background

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

1.1.1 Background and Preparation

Background research was compromised of analysing existing systems like the original Access Aber, previous work completed by the developer that used map technology within Android and general research into the map technology to gather a strong understanding of exactly what was possible.

A majority of time was spent analysing Access Aber and the currently existing criticisms of it, a lot of the problems were clear without the user feedback that had been provided but some criticisms were more subtle but easy to understand like how the application provides no main menu as such causing the user to feel lost from the start. It was also obvious that at a technical level, the included features were not overly complex, at least not to complete on the Android platform. Due to the application originally being developed on a system which allowed it to be run both on iOS and Android there probably were limitations from both sides which leads to having to develop around the weak elements in both platforms. As stated developing for a single platform should

help us avoid these problems while also giving us the ability to take advantage of what is there. Due to this a large amount of research was completed into both UI design within Android as well as the technical benefits both Open Street Maps and Google Maps could provide the development.

Research was also completed into exactly how the mesh of locations would be created and represented, within the design specification it was concluded that a searchable graph was a possible solution and one worth researching further. This also meant analysing how other existing applications had mapped roads to graphs and the general area of map representation. While this gave a fair amount of answers further decisions needed to be made on both how to search the constructed graph and how to make it an extendible system for future additions. This was one of the main conditions brought up in meetings with the original 'customers' of the Access Aber application, it had to be functional after the initial developers had left. It was also described that it would be beneficial for the application to be developed in such a way that a possible future development that involved a central file store of the information for ranging versions of the application. Due to this further research was done on how we could leave the application in such a way that it facilitated the addition of this feature possibly without using it upon the current cycles completion.

Past work by the developer was also analysed for anything of use that may come out of it, the application analysed was proven to have functional working code and as such was a place where possible solutions could be found. This included implementation of maps in an Android environment, the logging of a route which is something that has been previously outlined as a key requirement and a fair amount of small features relating the monitoring of a users location and the information which can be gathered from that. Most information gathered from this however was fairly irrelevant, it was decided it was not the best place for referencing in future.

Finally the Android API and several Android libraries were examined for the benefits they could provide the development with, along with the search for several features that had already been selected for inclusion within the application. This ranged from simple research on Expandable List Views to research on the best way to present the application in an intuitive way, a lot of factors were gathered from the original feedback which guided a lot of the research. While a slide function for the screens was visually appealing the possibility of it confusing users was something that removed it as a possibility very quickly. Research was also performed into Google's Material Design program, a set of guidelines for good design within the Android environment. It contained a large amount of information relating to designing professional and good looking applications, while the information was too much to be fully applied in the projects time line some key ideas were taken from it relating to the design of elements within an application and general theme layout. Furthermore some sites were analysed for basic colour themes and how to implement a simplistic design without it looking unprofessional.

1.1.2 Interest

This project has been chosen due to a variety of reasons, revolving around both the developers interests and the possibility of the project leading to something that can have real world influences. The main source of interest is that the project allows for a development environment that takes input from the real world, mobile devices are of a great deal of interest to the developer due to the data that can be gathered from them and the manipulation of this data. Mobile devices are steadily changing the way we live, with applications that not only help us find where to go but tell us what we can do when we get there. Where other people have liked and even what is best suited to us based on past choices we have made and the device has noted. While some systems outside of

mobile development clearly have massive real world influences it is felt by the developer that the easy entry and possibilities provided with mobile development make it one of the most accessible and revolutionary platforms.

1.2 Analysis

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 research questions, 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.

1.3 Research Method

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 or research method that you have used. It is possible that you needed to adapt an existing method to suit your project; clearly identify what you used and how you adapted it for your needs.

Chapter 2

Experiment Methods

This section should discuss the overall hypothesis being tested and justify the approach selected in the context of the research area. Describe the experiment design that has been selected and how measurements and comparisons of results are to be made.

You should concentrate on the more important aspects of the method. Present an overview before going into detail. As well as describing the methods adopted, discuss other approaches that were considered. You might also discuss areas that you had to revise after some investigation.

You should also identify any support tools that you used. You should discuss your choice of implementation tools or simulation tools. For any code that you have written, you can talk about languages and related tools. For any simulation and analysis tools, identify the tools and how they are used on the project.

If your project includes some engineering (hardware, software, firmware, or a mixture) to support the experiments, include details in your report about your design and implementation. You should discuss with your supervisor whether it is better to include a different top-level section to describe any engineering work.

Chapter 3

Results and Conclusions

This section should discuss issues you encountered as you tried to implement your experiments. What were the results of running the experiments? What conclusions can you draw from these results?

During the work, you might have found that elements of your experiments 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?

If you had multiple experiments to run, it may be sensible to discuss each experiment in separate sections.

Chapter 4

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

Appendix A

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 clients 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 [2]. The library is released using the Apache License [1]. This library was used without modification.

Appendix B

Code samples

2.1 Random Number Generator

The Bayes Durham Shuffle ensures that the psuedo random numbers used in the simulation are further shuffled, ensuring minimal correlation between subsequent random outputs [6].

```
#define IM1 2147483563
#define IM2 2147483399
#define AM (1.0/IM1)
#define IMM1 (IM1-1)
#define IA1 40014
#define IA2 40692
#define IQ1 53668
#define IQ2 52774
#define IR1 12211
#define IR2 3791
#define NTAB 32
#define NDIV (1+IMM1/NTAB)
#define EPS 1.2e-7
#define RNMX (1.0 - EPS)

double ran2(long *idum)
{
    /*-----*/
    /* Minimum Standard Random Number Generator */
    /* Taken from Numerical recipies in C */
    /* Based on Park and Miller with Bays Durham Shuffle */
    /* Coupled Schrage methods for extra periodicity */
    /* Always call with negative number to initialise */
    /*-----*/

    int j;
    long k;
    static long idum2=123456789;
```



```
static long iy=0;
static long iv[NTAB];
double temp;

if (*idum <=0)
{
    if (-(*idum) < 1)
    {
        *idum = 1;
    }else
    {
        *idum = -(*idum);
    }
    idum2=(*idum);
    for (j=NTAB+7; j>=0; j--)
    {
        k = (*idum)/IQ1;
        *idum = IA1 *(*idum-k*IQ1) - IR1*k;
        if (*idum < 0)
        {
            *idum += IM1;
        }
        if (j < NTAB)
        {
            iv[j] = *idum;
        }
    }
    iy = iv[0];
}
k = (*idum)/IQ1;
*idum = IA1*(*idum-k*IQ1) - IR1*k;
if (*idum < 0)
{
    *idum += IM1;
}
k = (idum2)/IQ2;
idum2 = IA2*(idum2-k*IQ2) - IR2*k;
if (idum2 < 0)
{
    idum2 += IM2;
}
j = iy/NDIV;
iy=iv[j] - idum2;
iv[j] = *idum;
if (iy < 1)
{
    iy += IMM1;
}
```

```
if ((temp=AM*iy) > RNMx)
{
    return RNMx;
}else
{
    return temp;
}
}
```

Annotated Bibliography

- [1] Apache Software Foundation, “Apache License, Version 2.0,” <http://www.apache.org/licenses/LICENSE-2.0>, 2004.

This is my annotation. I should add in a description here.

- [2] ———, “Apache POI - the Java API for Microsoft Documents,” <http://poi.apache.org>, 2014.

This is my annotation. I should add in a description here.

- [3] H. M. Dee and D. C. Hogg, “Navigational strategies in behaviour modelling,” *Artificial Intelligence*, vol. 173(2), pp. 329–342, 2009.

This is my annotation. I should add in a description here.

- [4] S. 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.

- [5] M. Neal, J. Feyereisl, R. Rascunà, and X. 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*. Springer, 2006, pp. 349–361.

This paper...

- [6] W. Press *et al.*, *Numerical recipes in C*. Cambridge University Press Cambridge, 1992, pp. 349–361.

This is my annotation. I can add in comments that are in **bold** and *italics and then other content*.

- [7] Various, “Fail blog,” <http://www.failblog.org/>, Aug. 2011, accessed August 2011.

This is my annotation. I should add in a description here.