

COMP41690: Practical Android Programming

Prof. David Coyle

Clog - The Climbing Log Report

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Contents

Introduction	2
Background Research	3
Initial Brainstorming	3
Literary Review	3
Survey	4
Market Research	5
Technical/Implementation Description	6
Fragments	6
Application Road Map	6
User Flow Features	6
Permissions	7
Internal Database	7
Handling Resources in response to Fragment Lifecycles	7
Technical Difficulties	7
Originality and Innovation	8
Future of the App	8
Conclusion	9
References	9

Introduction

The first smart phone was created by International Business Machines Corp in 1993 as a combination mobile phone/PDA/pager/fax machine. Research and development into furthering this product was carried out by Nokia, Ericsson, Palm and Blackberry over the late 90s/early 00s, before Google and Apple entered the market. The operating systems developed by these companies (Android and iOS respectfully) are in use on the majority of smart phones today.

Mary Meeker's 2016 Internet Trends Report[1] shows that Android currently dominates the smart phone market, with an 81% share of unit shipments in 2015. Google announced at their Nexus event in September 2015 that the Android OS now had over 1.4 billion users, which will only have increased in the last year, while iOS popularity is decreasing in recent years. 45% of iPhone users believe Android phones are more advanced than iPhones in an article from International Business Times[2].

With the number of smart phone users constantly rising, and the average Android user touching their phones approximately 2,617 times a day[3], it is clear that a knowledge of Android programming is incredibly beneficial in today's society, in particular as a computer science graduate. As part of our final year, we undertook a module in practical Android programming with the final goal of producing a functioning, innovative Android App. This adds versatility to our profile of work produced throughout the degree and gives us experience in an ever-growing field of mobile technology. The app must include:

- the use of a range of user interface elements
- at least five distinct screens (Activities/Fragments)
- data stored locally
- the use of at least two sensors or web services
- at least one Activity from another Android application

As avid climbers, we decided to merge our common personal interest with our technical background and produced Clog - the Climbing Log. Upon completing an outdoor climbing route, climbers can record the route by entering the name, a photograph, difficulty grade, length and location and store them on their device for future reference. In this report, we will discuss the technical aspects of the App and our methods of meeting the design brief, as well as our journey to the end goal - inspiration, idea generation, research, and ensuring dedication to our specific target audience.

Background Research

Initial Brainstorming

Through several brainstorming sessions, we concluded on developing some sort of climbing app given present holes in the market and our high level of knowledge in mountaineering. We are regular users of UK Climbing, a website that acts as a climbing forum/news broadcaster with a climbing logbook section. Users create a profile and can document their recent climbing routes, styles and partners by name or location searches through an enormous database of climbs. The logbook feature is heavily used by climbers worldwide, with thousands of new logged climbs each day. It is very user friendly, with graphs on each users profile showing grades climbed or countries climbed in, wishlists of what users intend to accomplish in the future, and other features that create a nice web experience. UKC has its own app, which is only available on iOs, requires payments to download location information, and is more of a replication of the website rather than an app to accompany a climber on a mountaineering adventure.

Literary Review

Due to the specific nature of our app, our literary research was limited to papers on general mobile development and user satisfaction. We focused our research on how our intended market would interact with our app, hoping to further aid us in our goal of appealing to our chosen target audience.

The first paper we looked at was 'UX Curve: A method for evaluating long-term user experience'[4]. Here UX was defined: "to improve customer satisfaction and loyalty through the utility, ease of use, and pleasure provided in the interaction with a product." With a test group of over 100 users, this paper worked on the idea of a UX curve, created by reporting on areas of satisfaction/unhappiness with certain mobile phone features. Research carried out within this study showed unhappiness with key size caused a drop in the UX curve, which dropped further after connectivity issues occurred. The effectiveness of the camera app caused the curve to begin to rise again. These changes in the curve allowed the researchers to map anything that affects a user's experience while interacting with apps and phones.

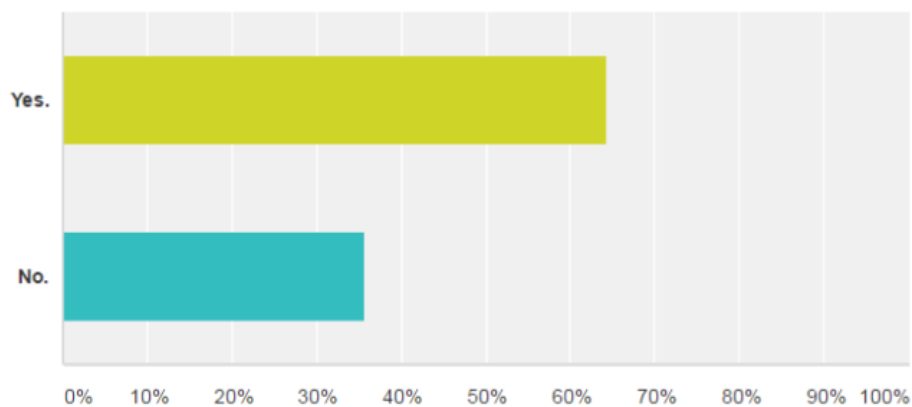
The overall findings of the researchers showed the positive affect of Utilities on a user's experience, the number one method of improving customer satisfaction, and the negative effects of Usability, the main cause of dissatisfied customers. Our app will be providing a helpful utility, which we hope will improve customer satisfaction through usage. This research also highlighted to us that usability was of great importance to consumers and would need to be a priority during our development process.

We also examined a second paper - 'Understanding, Scoping and Defining User Experience: A Survey Approach'. This further enforced the importance of usability, and also focused on the use of a survey to receive customer feedback on satisfaction levels. Researchers not only tracked survey responses, but also the background of the survey takers, which allows them to see trends in which areas (e.g. academia, workers in different industries) favoured which responses. Overall, the study showed that those with similar backgrounds and high agreement levels, which shows the importance of varying your survey sample for apps with a wide user base. Given the specific use case of our app, we were inspired by this to carry out a survey of our own with a sample group of climbers, our target users. This would give us accurate information into what would appeal to our future users and the direction in which we should go with our app.

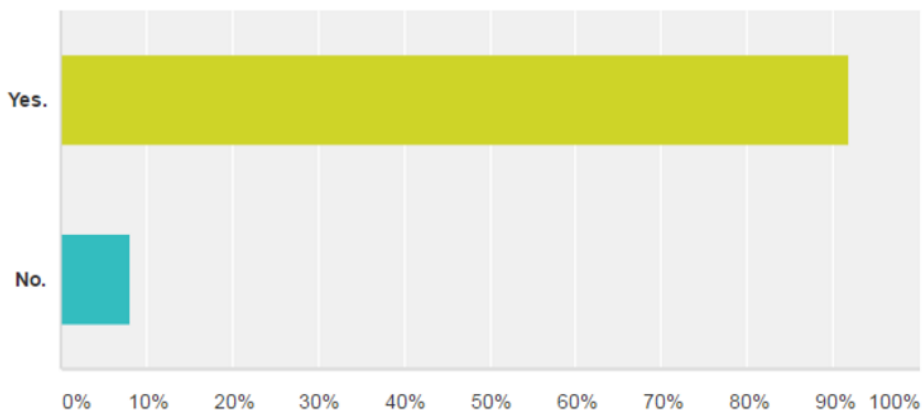
Survey

To fully understand what our target audience would appreciate from a climbing companion app, we created a short online survey. We compiled several short questions aimed to receive the largest amount of useful information while retaining the interest of the participants. The survey was sent to the UCD Mountaineering Club, a popular outdoor society with over 350 active members. With responses from young climbers of all levels, we received information into the preferences of our target market and how we can alter our ideas to best suit these users.

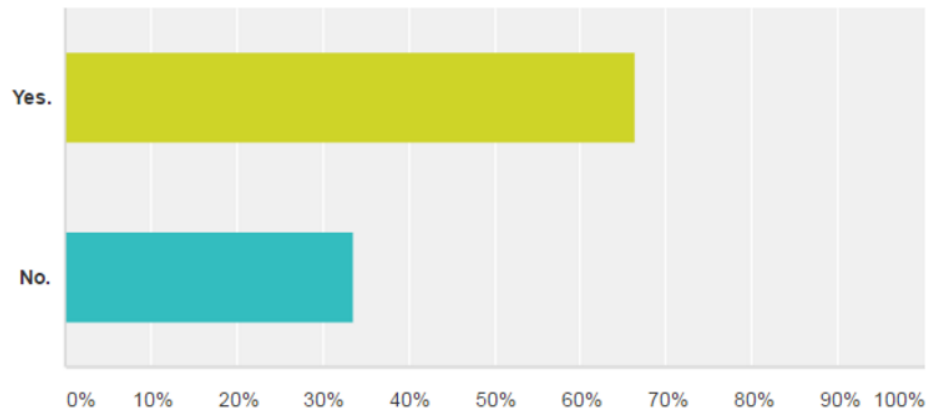
We observed from our survey results that almost 65% of participants take their phones with them as they climb outdoors, an expected result given the dangerous nature of climbing and the possible need of contacting emergency services/mountain rescue. Climbers could therefore enter information about climbs immediately as they have their smart phone to hand. Over 85% of participants said they would benefit from having information about climbing routes and areas on their phones.



We then asked if users regularly take photos while climbing outdoors, be it with a smart phone or a camera. Over 90% of participants regularly photograph their climbs, which can then be used to create a climb instance on our app. Photographs of the route as well as a technical description allows for a solid record for the user's future use.



We also asked survey participants if they ever repeated climbs that they had previously completed. Almost 70% of those surveyed said they would repeat enjoyable climbs, with further comments indicating that longer climbs of easier grades are repeated more frequently. Having a database of climbs completed, with key information (gear required, rope length) stored alongside would be very beneficial for this.



At the end of our survey, we allowed participants to add additional comments on what they would like out of a climbing companion app. The general consensus was for it to be free and have no advertisements, a common desire for most apps available on the market. The addition of rubber ducks were also mentioned on several survey responses due to being the unofficial mascot of the UCD Mountaineering Club, our initial primary target audience.

Market Research

As part of our idea generation, we researched into other climbing apps available on the market. We selected four apps that seemed to target a similar audience to us and examined these in more detail.

27 Craggs is an American based app which allows users to browse through climbs from a world map or keyword search, share crags with friends, and download climbs for offline mode. This app lacks a lot of user-friendly features. Ads constantly pop up as you attempt to use the app, and there are several "buttons" with no functionality that make navigating through the app difficult. Their database of climbs does not seem to allow users to make additions, made worse by the fact that many areas have no recorded climbs at all. Climbs have inconsistent descriptions, meaning users cannot rely on finding the information they require from the app. Overall, the app lacks consistency and is not very user-friendly.

MyClimb is another American app which focuses on the social aspect of climbing. You can create a profile, add current friends, and send requests to meet new climbing partners. This app also had an interesting feature which gave you points based on the climbs logged, with different amounts given based on difficulty or style of the climb. While we found this to be an interesting features, the social media aspects of the app was too close to Facebook or Instagram style, showcasing what has been climbed rather than assisting climbers as we wish to address.

RackUp provides a large library of guide books from regions all over the world which give thorough information on the climbs and the surrounding area. Users are required to pay to download any of the guidebooks, making the app into a sort of guide book Kindle but with less power saving capabilities. Downloading a large number of guide books will cost a lot, as well as taking up valuable space on your device, which is what we are attempting to avoid with our app.

Mountain Project is another American based app which contains logs of thousands of climbs around the world, with a map to help identify locations and photos to show the route. This app contains a huge amount of information in large blocks of text, which makes it more like a website than a useful, on-the-go app.

This research gave us inspiration on how to implement our app, and added features we may want to include. It also cemented who our target audience for the app is - outdoor climbers and android users who want to incorporate the usage of their smart phone into their climbing adventures.

Technical/Implementation Description

Fragments

Our app consists of one main activity with a large content pane as the single view, and a navigation drawer which allows user selection of which fragment to display in the content pane using the fragment manager.

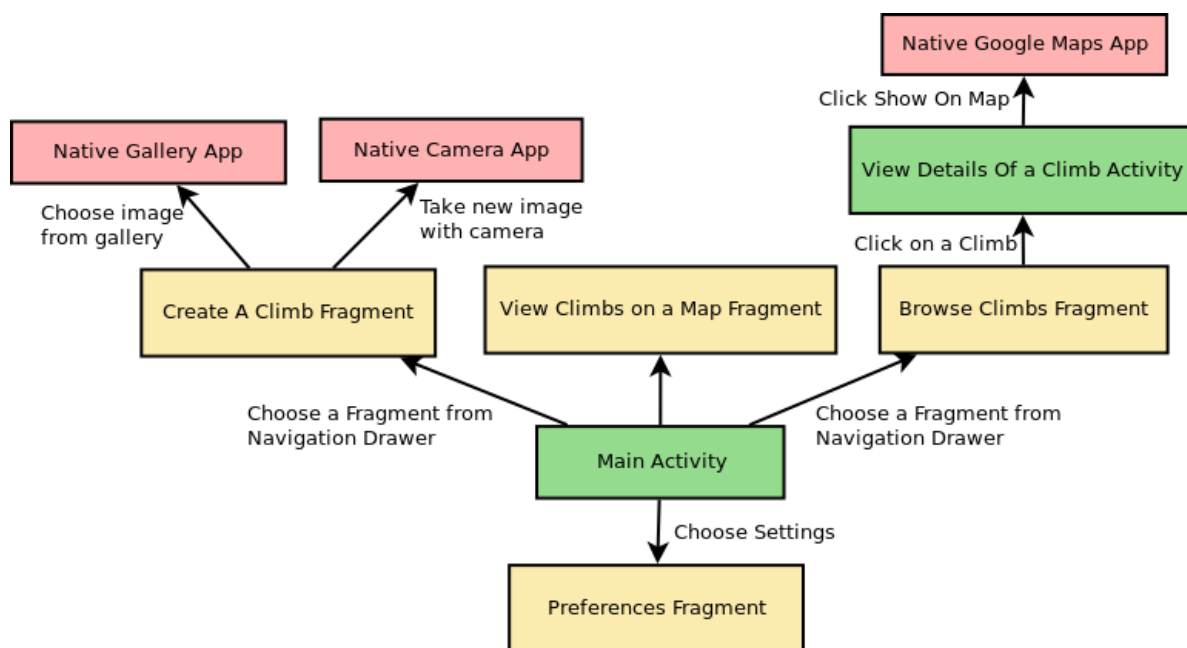
Climb Creator allows users to log details on a completed climbing route using EditText and Spinners. Users can select an image from their gallery (which loads the image resource from the Android file system) or from the camera (using the Android native camera app to share the captured image between the apps). There are buttons to clear information or save it to the database, as well as to add the current GPS location from the location sensor or manually enter the desired coordinates.

Climb browser is a ListView with button to choose the sort order. It is populated with a custom view containing the climb's image and information. Selecting items in ListView launches a new activity with the information on that particular climb. This activity allows you to further edit that climb and save it in the database, or view the location of that climb on the native Google Maps application.

The preferences fragment uses SharedPreferences where the default climb information (grade/length etc.) is set for creating a climb. When create a climb is selected, the values are initialized to the default settings from SharedPreferences.

Application Road Map

The below diagram depicts the way in which our app is put together: four fragments floating on a main activity, with all app functionality fully accessible from these fragments.



User Flow Features

During development, we took several precautions to ensure that we had a cohesive, user-friendly app. When the app is initially opened, the navigation drawer is by default open. We overrode the onbackpressed method so that, while viewing a fragment, the back button will open the navigation drawer, and while the navigation drawer is open, the back button will exit out of the app.

Permissions

Beginning in Android 6.0, developers were required to hard code permissions into their apps, and to block functionality if permission isn't granted. Our app requires fine location permission and external storage permission from the user. If permission hasn't already been given, a dialogue activity appears asking for permission, an on-permission changed listener is called if permissions have been granted, and functionality is unlocked. We did not require camera permissions for our app by using the native camera application present on phones.

Internal Database

We implemented an SQLite database to internally store our climb objects. When a climb is created, it is passed to a database handler, which gets an instance of the app's database and updates it accordingly. All database operations are threaded using async tasks which, upon thread completion, hosts a toast and inform the user of the successful completion of the action. The database handler is a wrapper for the SQL statements and, upon calling one of its methods, it generates the SQL for the called method. This allows database access through Java method calls instead of SQL queries.

Handling Resources in response to Fragment Lifecycles

We attempted to ensure efficiency in resource handling with regards to fragment lifecycles through the entirety of our app. If a fragment in climb creator is stopped by going to a different fragment, we are then disconnected from the Google API client which provides the location updates. Reconnection to the client occurs upon returning to the fragment, which frees resources when they aren't needed. When we resume the preferences fragment, we register an on-shared preference change listener and, upon pausing that fragment, we unregister the listener. We also specified the screen orientation in the manifest to be portrait for both the main and detail view activities. The whole app is designed for a portrait layout, which flows well with the standard portrait pictures taken from the bottom of climbing routes.

Technical Difficulties

During development, several issues arose with our locally stored database. We found that when users browsed their stored climbs, all climb images were required at once to populate the ListView with these images which overflowed the database cursor. To solve this, we considered using the database read/write on the UI thread, but this would have caused lag in our application. Instead, we created a separate async task to retrieve each image separately.

We also found that full resolution photograph of the climbs were too large to fit into the database. We created a method to scale the images to 1080 by 1080 pixels, adding in filler around the photo if required, to achieve the correct size without altering the photo too much.

Originality and Innovation

As of June 2016, there were 2.2 million apps available for Android users, with two million on Apple's App Store[4]. With this vast quantity of apps available to consumers, standing out from the crowd with a different and innovative app is a difficult task.

Through our market research, we saw that there are very few climbing-related apps on the market, and our exploration of these apps showed the lack of user-friendly features present. None of these apps are developed with portability and outdoor use in mind, which reduces its appeal to outdoor climbers. Our app focuses on allowing the users to carry the vital information they require to complete a climb, without the bloat of redundant information present in some of the other apps.

We were also determined to provide our app free of charge, unlike most of the other apps available. Some of the other apps appeared to be free of charge, but required payment to download any information from the app. We also would not be allowing pop-up advertisements to plague users as they attempt to navigate through the app.

By selecting a niche area with a large hole in the market, we can possibly monopolize the market by producing a user-friendly and free app that is more in-keeping with what the climbing community actually wants. No other climbing apps provide a means of documenting your own climb with your own information, and ours is specifically tailored to meet the desires of our target audience - young outdoor climbers. Overall, we feel our app is different and more appealing than all others on the market, is practical and designed to be used in a mobile capacity, and allows for further development in the future with more time and resources to continually expand with the growing requirements of our users.

Future of the App

Given the time constraints involved with a 12 week development module, we were unable to achieve all of our desired functionality we had initially planned for. We feel we made a solid application that appeals to our target market, fits our brief well and fills a void in the market given the increasing popularity in both smartphones and outdoor climbers. With more time and resources, we believe we could accomplish even more with our app.

Our next step to progress on with this app would be to implement a firebase database to store climb information on the cloud. After users logged a climb, it would be saved both internally and on the cloud, and other users of the app would be able to download this information in preparation for completing the climb themselves. Through information inputted by other climbers, users could use this app as an exclusive method of finding climbs and reading how to climb the route or required gear that would be beneficial. This could remove the necessity of cumbersome and expensive guidebooks, with a possibility of increasing both accuracy in finding climbs because of the information provided by other climbers, and safety. If there is loose rock on a climbing route or animals nesting in an area, the app can be updated with this information, whereas the printed guidebooks can be quite out of date.

Conclusion

After completing this module, we feel we have gained a better understanding of how to develop applications for Android, and have experience for possible future work within this field. The development of a fully functional app added to the versatility of our project portfolio upon leaving college, and gave us insights into problems we may have not been aware of through studies alone. We learned a lot about the permissions required for apps to interact, and how to block functionality if permissions aren't received. We also learned a lot about android databases, in particular their limits. With a maximum cursor size of 2MB, queries must be designed so that the cursor being returned is less than this, something that we were not aware of before starting this project and ended up working around this after issues arose.

Overall, we feel that we succeeded in creating an app which met the brief required, both in technical complexity and in originality and innovation. Our app uses several user interface elements and sensors, interacts with other Android apps, includes several distinct activities, and stores data locally. It also fills a hole in the market for a climbing companion app, given the huge increase in climbers in the last number of years, and a possible further increase after the addition of climbing in the 2020 Olympic Games. Given further time and resources, we feel we could implement the online database and increase the database of climbs available to users, giving added use functions to our application.

References

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