Pro Events

Final Report

Institiúid Teicneolaíochta Cheatharlach

INSTITUTE *of* TECHNOLOGY

CARLOW

At the Heart of South Leinster

Name: Jonathan Finlay

Student Number: C00193379

Course: Bachelor of Science (Honours) Software Development

Tutor: Hisain Elshaafi

Date: 18-04-18

Contents

Abstract

The purpose of this document is to provide an overview of this project. It will outline the specification of it, what was achieved, what wasn't, learning outcomes and problems encountered throughout the project.

Introduction

This document reflects the final product that was made as part of my fourth-year project, for Software Development in I.T. Carlow. The project began mid-October and came to an end mid-April.

This document aims to give the reader an understand of the development and thought process behind this project and why some decisions were made. The achievements of this project will be discussed along with any complications and how they were solved/worked around. What ideas had to be changed throughout the project and what is planned for the future.

ProEvents is an Android Application for all users. It can help users find events suited towards their interests and location. If a user finds an event that suits them or looks interesting, they can follow it. By following it, they can other users can see who's following events when searching while your name will also be on that list. Coming up to the event, the creator can send out a reminder email and all users following that event will be notified. You can also search for connections by Interest and Nearby. When following a connection, you can view their profile and view events they're following.

Product Description

Purpose

Social Media today is a massive factor in many peoples' life's. This app was designed to help the user keep organised with events they had or wanted to create. It's easy to use, so the user can navigate around the app without feeling lost or confused. The user can search for events to whatever interest they may have at the time. These searches can also be filtered to show events nearby. All events they are following will be kept in a list where the user can easily access. Same with events they create. All events the user creates will be kept in the one place so they can edit if necessary, cancel the event if it no longer suits and send a reminder to all that's following so nobody forgets. Same goes with the users' connections. All following connections are kept in the one place where the user can then view their profiles and view events they plan on attending. If they want to find other users that share the same interest as their self, they can simply search any interest they choose and select the nearby option if they want.

This app is best suited for college students who share an interest in what they're studying. If a student is learning a new topic, e.g. a new language to them like Java, all the user has to do is create an event with a suitable name, put the right category on it, location, date, time and a description on it. Any users searching under that category can find that event and if they can contribute to it or feel they want to try learning java too, they can simply follow the event.

A potential user of this app is employers. The main way to find job advertisements at the moment is either through our lectures or visiting an event like Grad fair in person and asking at each boot what jobs are available. This app can allow companies to advertise their openings to potential employees. Companies can create an event and invite these potential employees over for an open day. In the description of the event the company can mention what positions are open so users know if it suits their self.

Application Description

This app was designed in Xamarin Android and Azure used for sending notifications and Azure's Storage services provides REST and SDK APIs for storing and accessing data on the cloud.

The frontend was going to be designed in either Xamarin Android, Android Studio or PhoneGap/Cordova.

My reasons for not choosing PhoneGap/Cordova was, after working with it in the past, I know capabilities of it. The developer creates a website which PhoneGap/Cordova then transfers into an app. This restricts the developer on what can be done. The developer can no longer use native Android functions such as toast notifications, Calendar popup and Clock popup which were needed in this app.

Android Studio was originally the first choice, even though there were many issues had previously. Once those issues appeared again, I did some more research and found Xamarin.

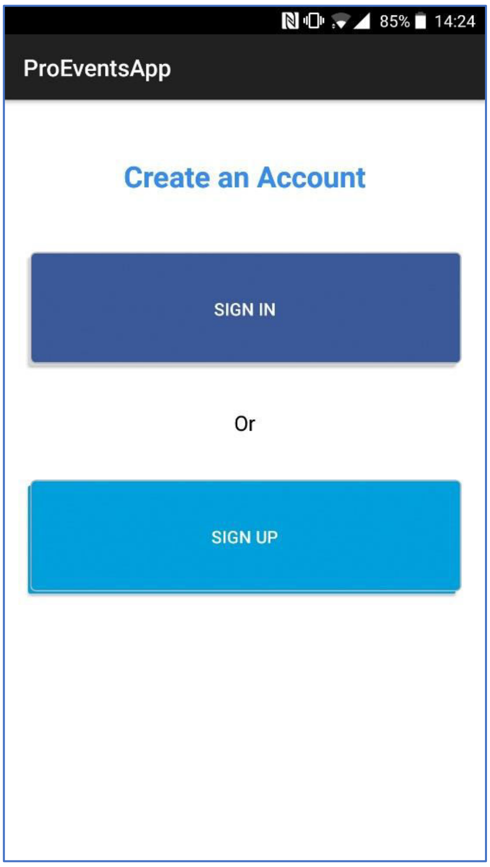
After the issues with android studio reappeared, I found Xamarin. There were many good reviews and recommendations so, I said I'd give it a try. It a downloadable feature in Visual Studio which I had previous experience with so I already felt more comfortable. It also had the ability to use native Android functions which showed it was already more favourable than PhoneGap/Cordova. When researching into Xamarin, I found an extremely useful YouTube channel. Joe Rock, the creator of this channel, put out many practical and insightful tutorials. I learned the basics from watching his videos and some features within this app I learned from his videos.[1]

For the backend I originally planned to work with Blacknight but when I made the switch to Xamarin, the recommended backend was Azure.

Azure is an Infrastructure As A Service (IaaS). This storage service provides REST and REST APIs for storage and accessing data on the cloud. SendGrid API is a feature that works with Azure that allows developers send notifications to the users. After finding all this, it was a clear choice what to pick as the backend[2].

Screens

Opening screen



Create an Account

Fig. 1. Opening Screen.

When opening the application, the will be greeted with this screen. If they are a new user they will press the ‘Sign Up’ button and will be brought to the Register page or if they’re a returning user, they will press ‘Sign In’ and brought to the login form.

Register

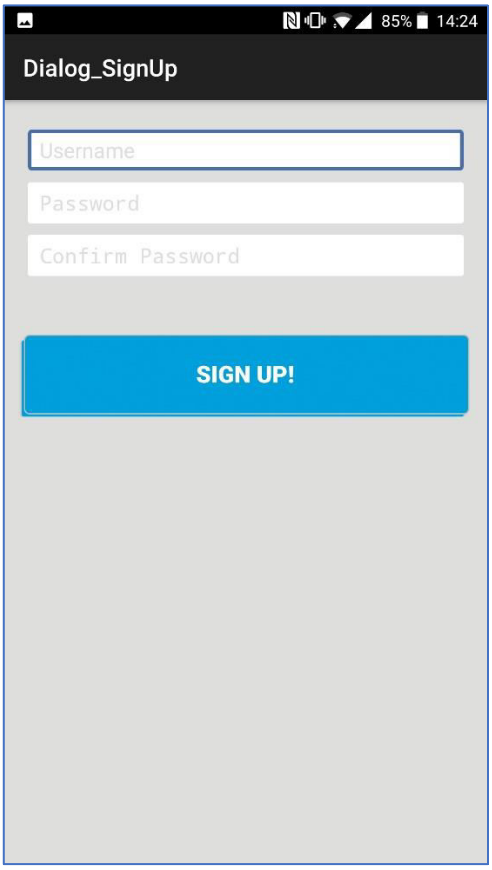


Fig. 2. Register Screen.

Here the user will input their username and password. The username must be unique, and password must have an Upper-case letter, lower-case letter, a number and also be eight characters long. With how advanced technology is becoming a secure password is a must with all apps, and websites. Most users use the same password for many accounts so securing the password is key for trust. This app takes the password entered and salts it and hashes it on the device before storing it in the database[3][4]. This prevents any leakage of passwords so the users have full confidence of their privacy.

If the username is already taken, the user is notified and it is taken and allows them to change it. If the passwords do not match or don't meet the requirements, they will also be notified.

Login

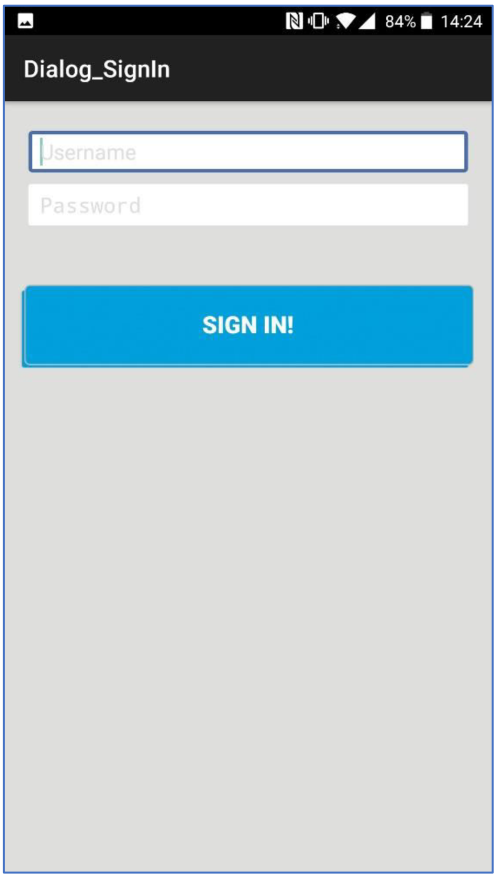
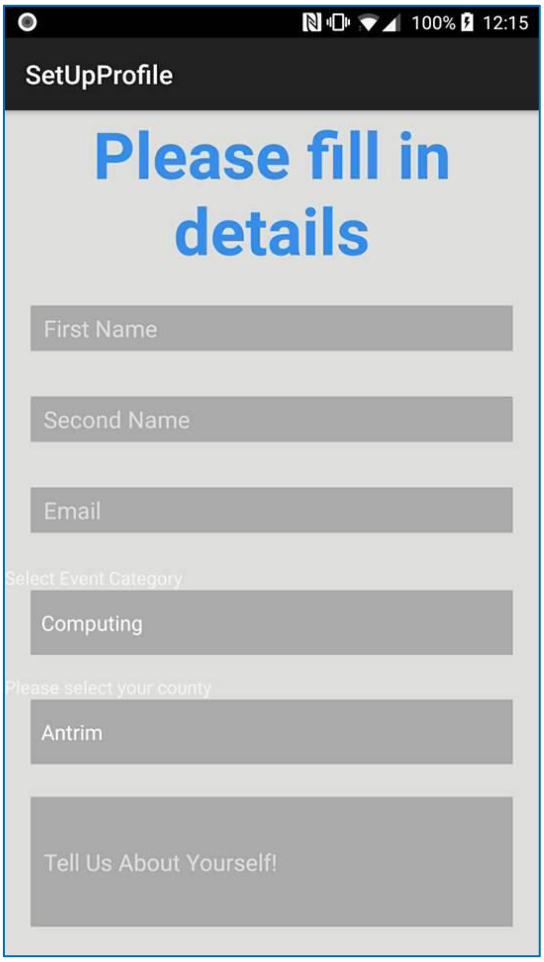


Fig. 3. Login Screen.

The user enters their username and password. The systems checks if the username exists. If not, the notifies the user the details are incorrect. If it does find that username, it compares the password entered to the encrypted password. If they don't match, the user is notified the details are incorrect. If they do match, the username is saved to the shared preferences and logged in. Shared Preferences is a type of session on Android. It's used to identify who's signed in and it is cleared when the user closes the app or clicked the logout button.

Set Up Profile



Please fill in details

First Name

Second Name

Email

Select Event Category

Computing

Please select your county

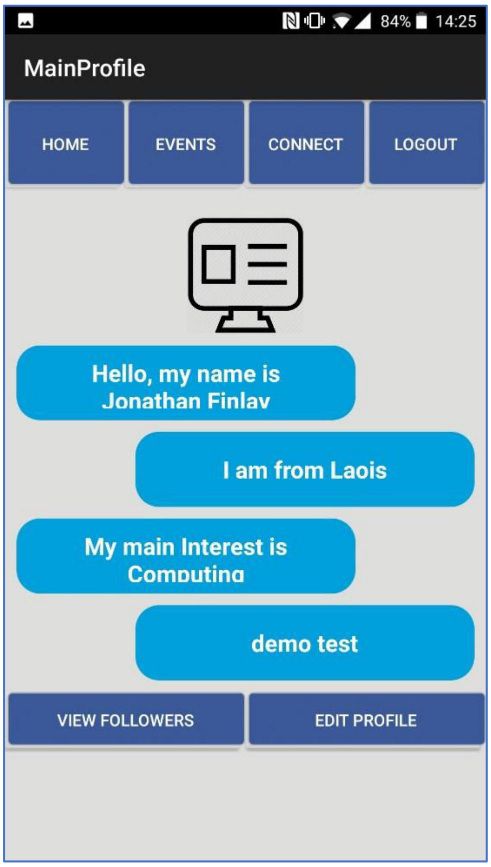
Antrim

Tell Us About Yourself!

Fig. 4. Set Up Profile

If the user has never created their profile, they are brought to this screen. Here they enter their name, email, Interest, where they're from and a short description about them self. The system checks the details entered is valid and then saves them to the database. If the details entered contains an error or they enter a character where they shouldn't have, the system notifies them. Once their profile is created, the user can easily login to their profile. All this information will be able on their profile and any users who follow their profile and view this information. This information will also be used with the search function.

My Profile



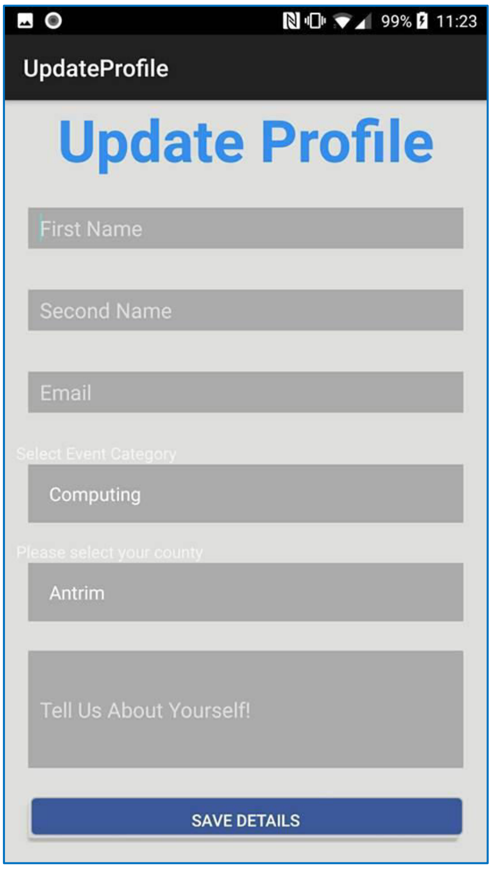
Hello, my name is Jonathan Finlav

I am from Laois

My main Interest is Computina

demo test

Fig. 5. My Profile.



Update Profile

First Name

Second Name

Email

Select Event Category

Computing

Please select your county

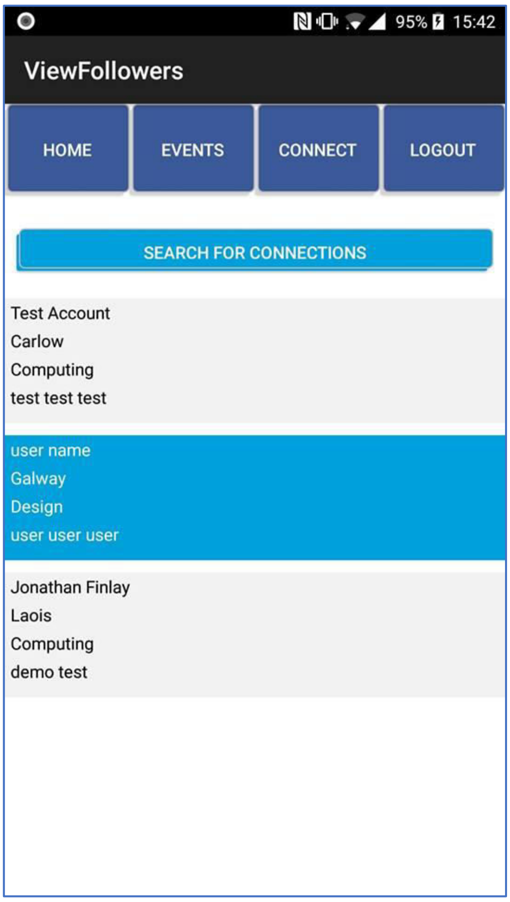
Antrim

Tell Us About Yourself!

Fig. 6. Update Profile.

Once logged in, the user is brought to their profile. This page features their own information which can be edited by pressing the ‘Edit Profile’ button which will load fig. 6. Update Profile. Here the user can change their details and update the database. Back to fig. 5. My profile, the buttons log the top feature on all pages and allow the user to navigate around the app. The ‘Home’ button brings the user back to the ‘My Profile’ page. The ‘Events’ button will bring the user to the page that displays all the events they are following, this will be discussed further down. ‘Connect’ button brings the user to a list of all the users they are following, again, this will be discussed further down. And finally, for the top bar, the ‘Logout’ button does as it says. When the user clicks the logout button, the shared preferences are cleared and the user is brought to the fig. 1. Opening screen. The last feature of this page, ‘View Followers’. This button allows the user to view who is following them.

View Followers



Test Account
Carlow
Computing
test test test

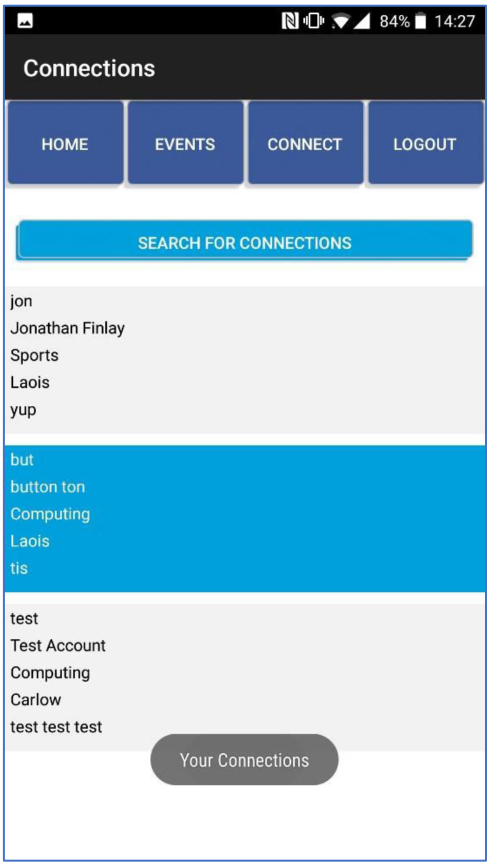
user name
Galway
Design
user user user

Jonathan Finlay
Laois
Computing
demo test

Fig. 7. View Followers.

Here the user can view every user that clicked follow on their account. It features the top bar which was mentioned under ‘My Profile’, it has a button that redirects the user to search for connections, which will be talked about more below, and most importantly, the followers. The system searches for all users that follow the logged in user and displays them here. Originally on the connections page, it was planned to only view profiles that the current followed but here, it was decided to have the ability to view profiles that already follow the current user. When you click on a user, you have the option to follow or view profile. If followed they will be added to a list of followings which is available on the connections page.

Connections



jon
Jonathan Finlay
Sports
Laois
yup

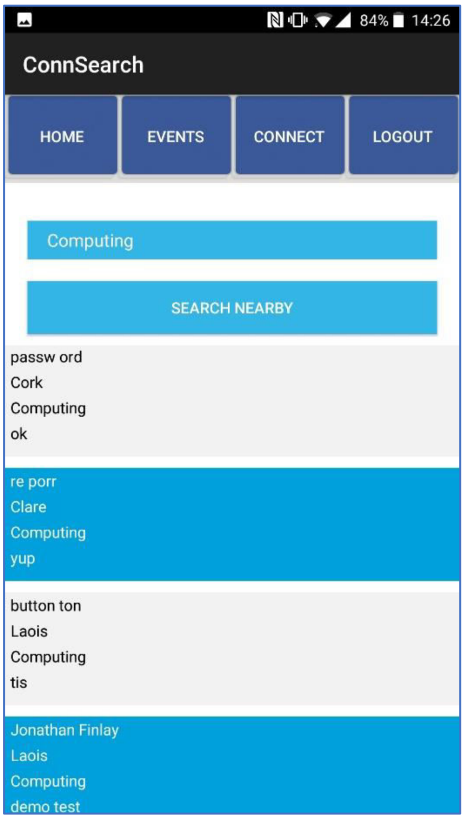
but
button ton
Computing
Laois
tis

test
Test Account
Computing
Carlow
test test test

Fig. 8 Connections.

This page features all the users, the logged in user, follows. The ‘Search for Connections’ button will be talked about next. This page features the users’ username, full name, interest, location and short description. For every user followed you can view their account and/or unfollow them.

Search Connections



passw ord
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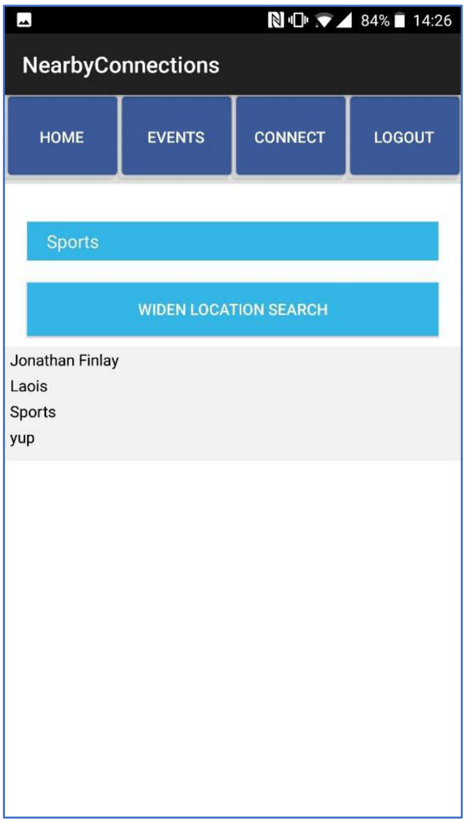
Computing
ok

re porr
Clare
Computing
yup

button ton
Laois
Computing
tis

Jonathan Finlay
Laois
Computing
demo test

Fig. 9. Connection Search

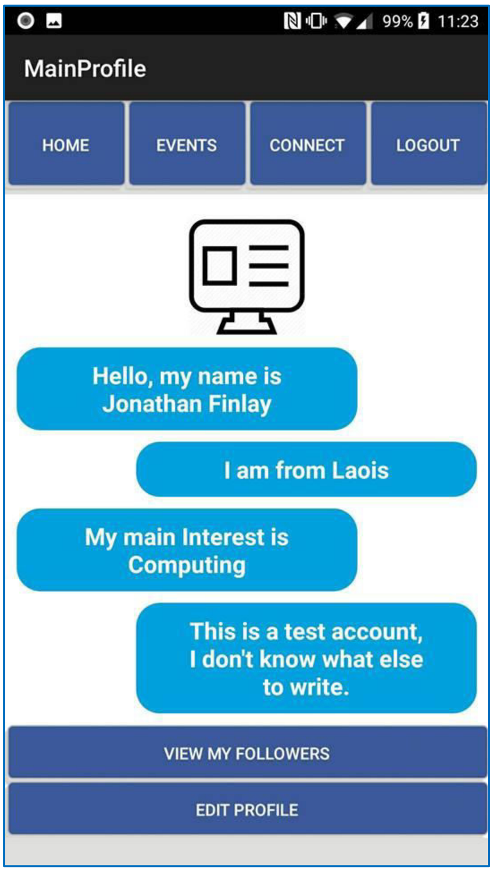


Jonathan Finlay
Laois
Sports
yup

Fig. 10. Nearby Connections

Connection search is to help you find users that you'd be interested in following. In fig. 9. Connection Search, the user can search for connections by interest. It lists all other users and some information on that user. You only have the option to follow the user here. In fig. 10. Nearby Connections, the search is filtered to only show connections that share the same location as you. The user can still change the category to what they choose at the time. On the nearby search, they can widen the search to show from all locations.

View Profile

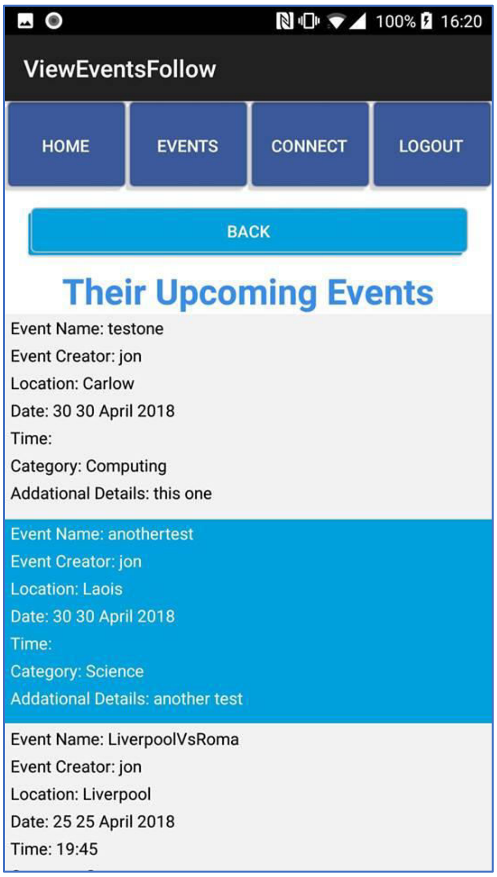

MainProfile

Hello, my name is Jonathan Finlay

I am from Laois

My main Interest is Computing

This is a test account, I don't know what else to write.


ViewEventsFollow

Their Upcoming Events

Event Name: testone
Event Creator: jon
Location: Carlow
Date: 30 30 April 2018
Time:
Category: Computing
Addational Details: this one

Event Name: anothertest
Event Creator: jon
Location: Laois
Date: 30 30 April 2018
Time:
Category: Science
Addational Details: another test

Event Name: LiverpoolVsRoma
Event Creator: jon
Location: Liverpool
Date: 25 25 April 2018
Time: 19:45

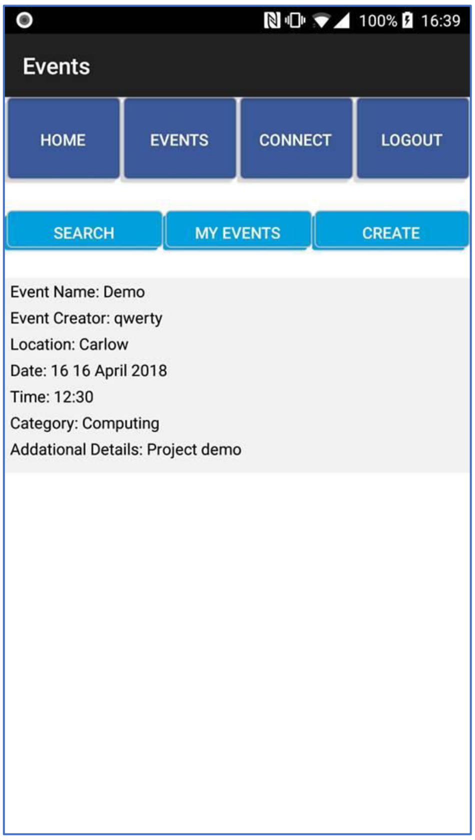
Fig. 11. View Profile.

Fig. 12. View Followers Events

Here, you can view a user's profile. It shows all their information and gives you the option to view any upcoming events they may be attending. This can be useful as if you can find someone who has similar interests to you, they could find events that you too could be interested in. It's a handy feature this app contains. The 'Back' button brings the user back to the page they were previous at. Most pages don't have a back button but figured it would be best to have on a page such as this.

Fig. 12. View Followers Events contains all the events that user has a current interest in. The current user can interact with these events and view the event, which will be talked about below, and follow the event if they plan on attending.

Events

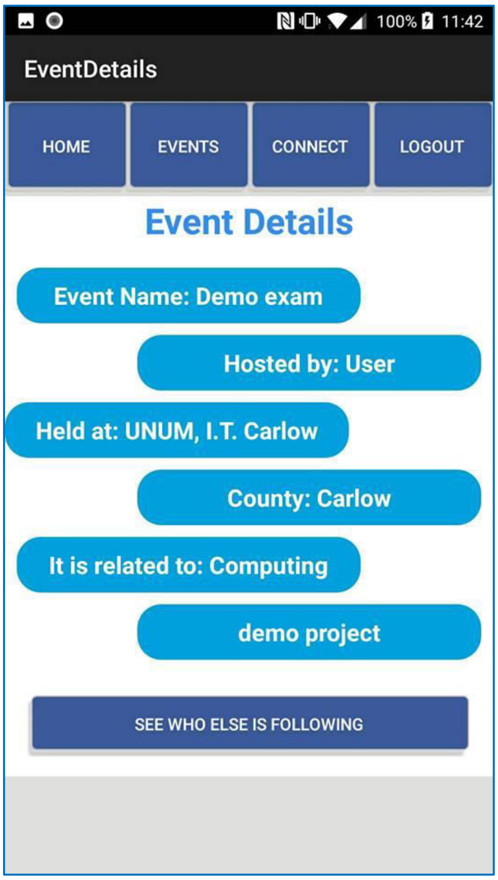


Event Name: Demo
Event Creator: qwerty
Location: Carlow
Date: 16 16 April 2018
Time: 12:30
Category: Computing
Addational Details: Project demo

Fig. 13. Events

This page keeps track of all upcoming events the logged in user has. The user weather they plan on going or not, can keep note of the event details by keeping it here. If it's updated, the user can see updated details here, if they are keeping an eye on the event. If they no longer have an interest in the event, they can simply unfollow the event here. If they choose they can view the events details and view who else is planning on following. These details will be discussed next. The 'Search' function redirects the user to the Search Events page. 'My Events' button, displays all the events this user has created, while 'Create' allows the user to create an event.

View Events



Event Details

Event Name: Demo exam

Hosted by: User

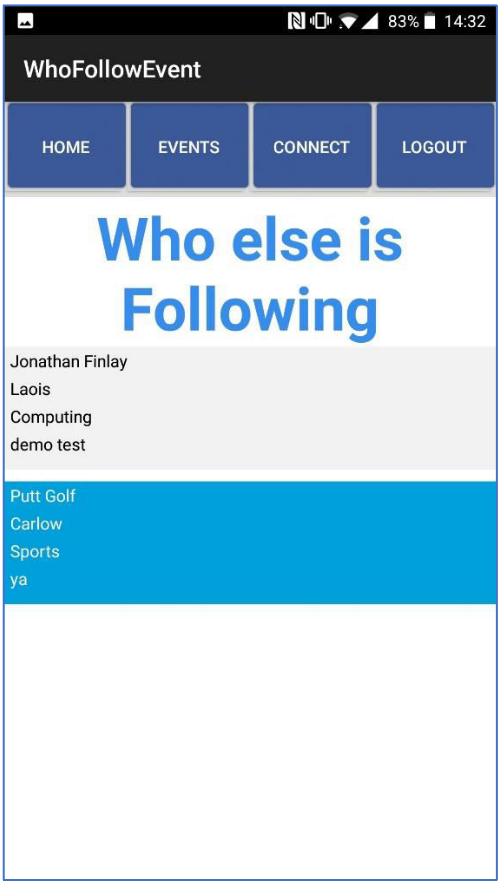
Held at: UNUM, I.T. Carlow

County: Carlow

It is related to: Computing

demo project

Fig. 14. Event Details.



Who else is Following

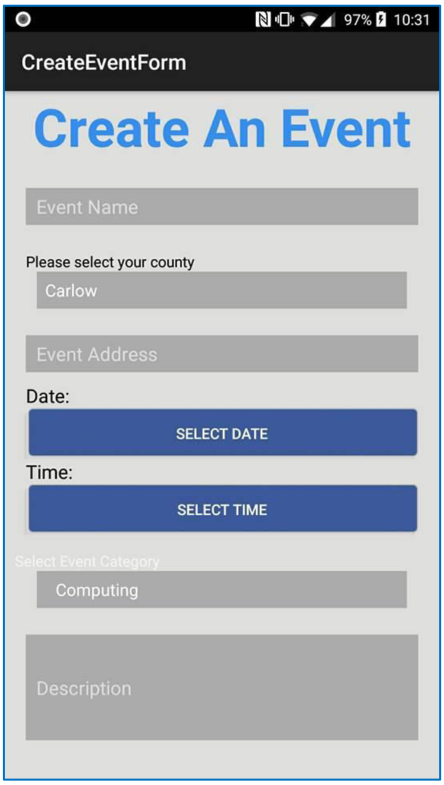
Jonathan Finlay
Laois
Computing
demo test

Putt Golf
Carlow
Sports
ya

Fig. 15. Who’s Following Event.

The Event Details page, shows all information needed on the event. It gives the event name, who it’s hosted by, where it is, it’s category and short description on it. It also gives you the option to view who else if following by clicking the button at the bottom. Fig. 15. Who’s Following Event, shows the user who else is interested in this event. The list is interactable as you can follow the users who plan on attending.

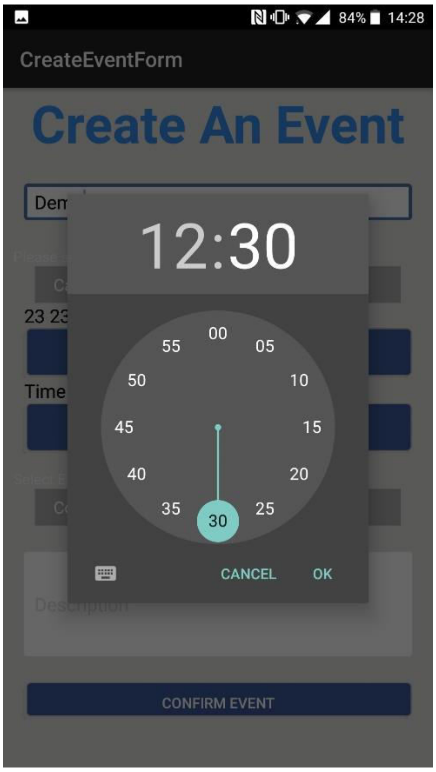
Create an Event



Carlow

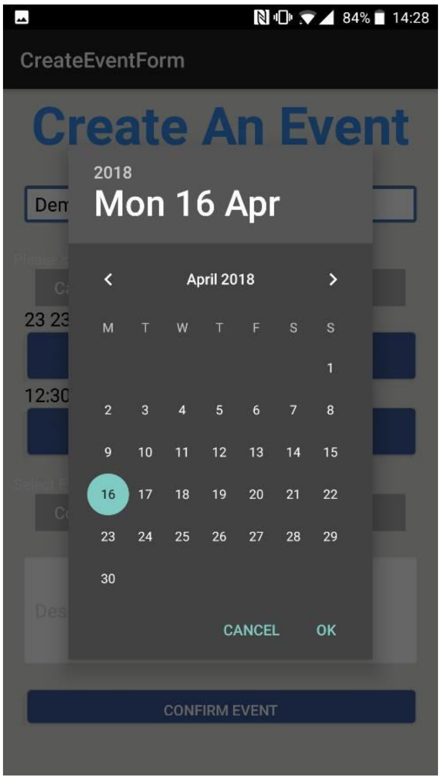
Computing

Fig. 16 Create an Event.



12:30

Fig. 17. Time



2018
Mon 16 Apr

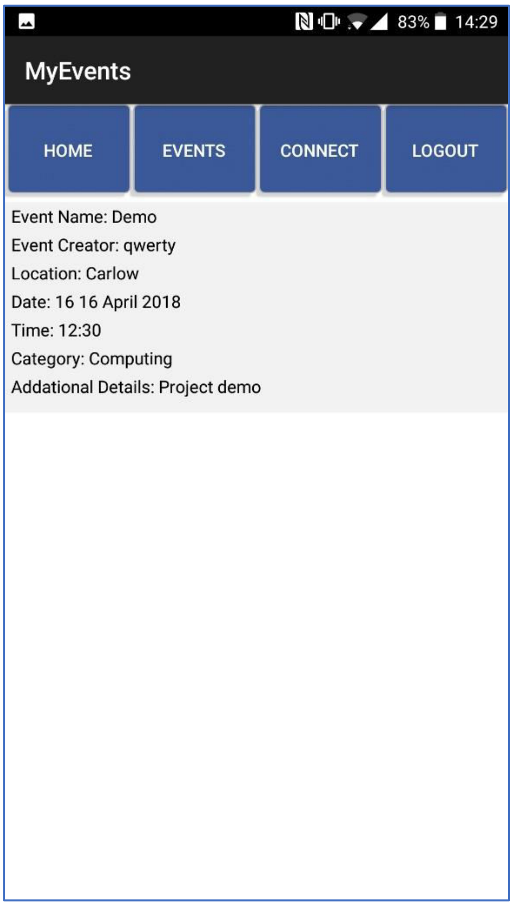
Fig. 18. Calender

Fig. 16. Create an Event, allows any user create an event of their choice. They can create an event to suit whatever group of their choosing from sports, computing, to science. You are not limited to just one specific category that you signed up with. The user must give the event a name, location, category, Date, Time, and a short description. All are necessary to create the event. All these details will then be avilable to an user who comes across this event and any user can follow this event. Any event advertised here is open to everyone. It's about meeting new people who share the similar interests to you.

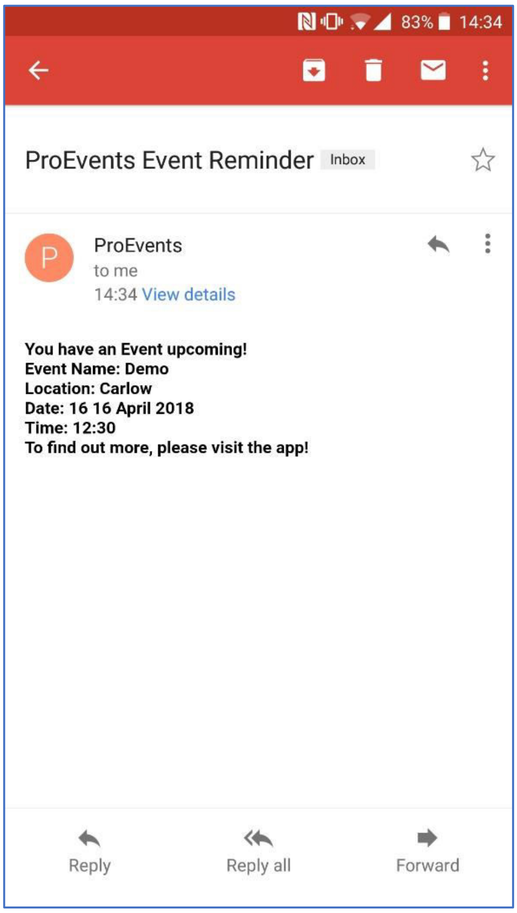
This page contains to native android functions as seen in Fig. 17. Time[5]. and Fig. 18. Calender[6]. This is a useful feature and increases the user experience. In frontends developed in PhoneGap/Cordova, this feature is not available and would have to be entered in manually, which can cause confusion and many errors. This way the user can easily enter the time and date that the event will take place without any confusion or errors.

The edit event form will contain the same features where the user fills out the form and also use the two native functions seen and mentioned above. This does not create a new entry but update the old one. The database also keeps track of the last update made to the entry, as it does for all entries.

MyEvents



Event Name: Demo
Event Creator: qwerty
Location: Carlow
Date: 16 16 April 2018
Time: 12:30
Category: Computing
Addational Details: Project demo



ProEvents Event Reminder

ProEvents
to me
14:34 View details

You have an Event upcoming!
Event Name: Demo
Location: Carlow
Date: 16 16 April 2018
Time: 12:30
To find out more, please visit the app!

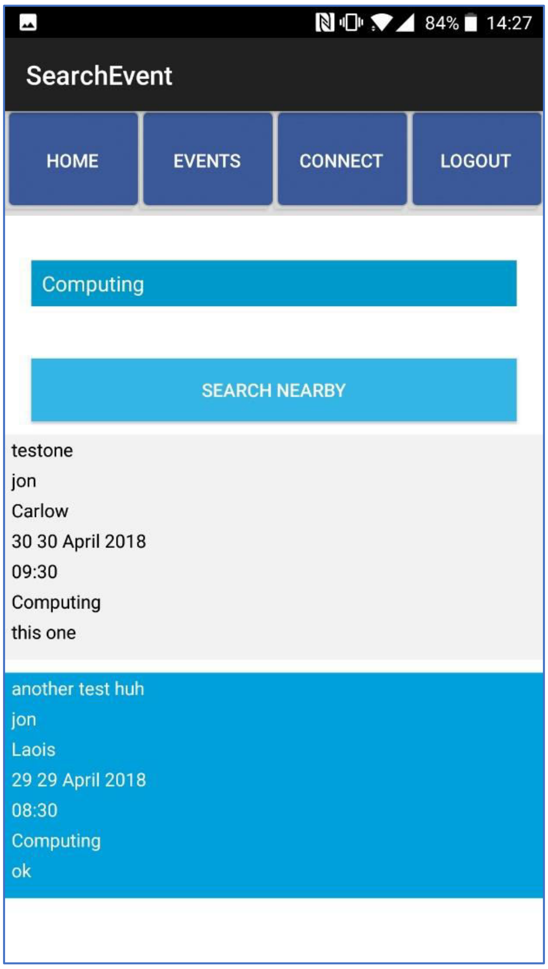
Fig. 19. MyEvents

Fig. 20. Email Reminder

This is an important page for all users who create events. It allows them to interact with the event they created. The creator can edit events, which was mentioned above, send a notification and cancel the event. Cancelling an event sets the deleted value in the database to false. The information will remain in the database but currently not available to the user. This could possibly be a future feature added to the app that allows the use to view cancelled events.

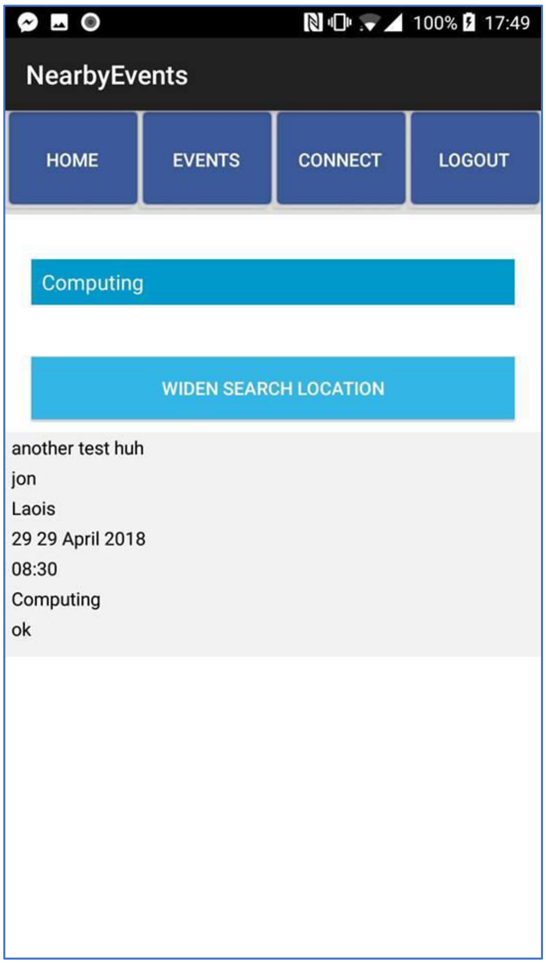
But the main function and possibly the most important function in this app, send notification. This is a reminder email that the creator can send to all those who are following this event. In fig. 20. Email Reminder, you can see the details of the event has been sent to a users' email reminding them. This feature is key as must people now rely on technology to remind them of birthdays, to go collect something, and the same for events. The system uses the API, SendGrid[7]. SendGrid interacts with Azure and gathers the information of the event sent to it and sends out an email to all those who follow the event. The email address that sends it is a generated one made within the system. It is a 'Do-Not-Reply' so the user knows it's not worth replying too.

Search Connections



testone
jon
Carlow
30 30 April 2018
09:30
Computing
this one

another test huh
jon
Laois
29 29 April 2018
08:30
Computing
ok



another test huh
jon
Laois
29 29 April 2018
08:30
Computing
ok

Fig. 21. Search Events

Fig. 22. Nearby Events

The ‘Search Events’ page is accessible by the ‘Events’ page. Here the user can search any event of interest by entering the category in the top. They can scroll through and view and events page, which was mentioned above and also follow any event which was also mentioned above.

If the user wants to search for events that are nearby, they can press the ‘Nearby’ button, which filters the search to only show events with the same location as you. By clicking the ‘Widen’ button is takes off the location filter.

All events followed here will then be displayed on the ‘Events’ page.

Conformance of Specification and Design

The project has conformed to many of the specifications that were stated on both the Functional Specification and Design Document. Some of the idea's and plans expressed were slightly modified but still suited model put in place. The main function of organising events, creating and displaying still went ahead as planned.

One of the first changes was the software used. It was originally planned to use Android Studio. I had used this software for a brief period but came across many errors and complications, where I eventually scrapped it, and moved to PhoneGap/Cordova. This time, the same errors and complications came up, where the decision to scrap it was made again. But this time, more research was done where, and I held a poll looking for on 'Reddit', where I asked other Android App developers for a substitute to Android Studio. Most responses were against using PhoneGap/Cordova while many had nothing but praise for Xamarin.

Another minor change made was with the profile pictures. The original plan was to allow users to upload their own pictures but after a few tests, the cost of uploading a picture to the database cost too much. Having some icon on the profile was key which was where I came up with the idea of having an icon match the user. These images are saved to the device so they don't put a cost on the server.

The biggest change made was notifications. Originally it wasn't in the plan, but after receiving feedback on the project, notifications were added to the plan. I researched into how to use push notifications within exam but came across many complications and couldn't figure it out. During this, I found SendGrid. SendGrid is an API which works extremely well with Xamarin and Azure. By downloading the libraries and registering your SendGrid on Azure, it was set up. There were many tutorials online to help learn this function which I found more success in than push-notifications. Emails are something most students check regularly and most mail platforms have apps on Android phones. These apps use push notifications when an email is received. Through emails, more information is can be available to the user than push-notifications.

Learning Outcomes

Technical

This project enabled many technical skills to be exercised. I had a brief encounter with C# in 3rd year for a task and the same with android development. I had a small task with Android Studio, which is where I first noticed some issues with it. Learning a new language is never an easy task, especially when using features like Xamarin android, which is required for android development. But now that the project is done, I can happily say it would be my most experienced language. I feel comfortable using C# and the functionality within it. Visual Studio provides great resources to help the developers and the debugging system. While debugging it requires you to think more logically. By watching the debugger work through the code, it makes it further your knowledge of logically thinking.

The Search function has increased my understanding of connecting tables. As you cannot straight up compare two tables, working around that was a challenge at first. The more I worked on it, the more it came to me. By the end of the project, I didn't even need to think too much into what had to be done, it was almost like it was common knowledge to me. When first learning Azures API for storage, it recommended you use a separate class for the calls so they could easily be reused. I attempted this at the start for the login and setting the users account up but fell back to writing the code where it was needed before eventually returning to this process when working with the SendGrid API.

This project helped me understand how APIs work. I never worked with an API before this project. This project helped me get use to working with an API. Both connecting to the Azure database and SendGrid notification service required API calls. The Xamarin, Azure and SendGrid docs, which are available online, I found to be very useful and make my experience a little less stressful.

Having deadlines early for the project helped with time management. These documents allowed me to think ahead of what was needed for this project, the process which should be taken and had a more professional feel to it. Having early deadlines on the documents made me have a more agile approach to the development of this app. These documents show the thought process that was involved and why decisions were made.

The further and we got into project the more I learned not of just C# but programming in general. I learned each function and variable were to be labelled a certain way. Visual studio helps correct improper naming to a certain degree. Having proper function and variable naming is crucial as you mightn't be the only person working on this code. If another developer came to work on your code without proper naming, it would take hours to figure out what it is going on.

Personal

I’ve learned many personal skills thought out this project. Time management is a major importance is the work place and staying on-top of your work is key. Having early deadlines forces us to have an agile approach to this project. If those early deadlines weren’t there, I would have been behind schedule. Setting out goals to reach by certain dates helps. Every week, I sat down, looked at my project, looked at what was done, what was still to do and what could be improved. I then set goals to reach to try stay on top of my work. Granted some tasks were more difficult than others, some stages I missed deadlines, some I achieved the goal before the deadline, I was able to keep with my schedule.

There were many personal achievements with learning within this project. I was learning a new software development tool in Xamarin. I was very inexperienced with app development. Now I’d say my skills in Android App development have increased vastly. To be given another project similar to this would suit me perfectly. What I achieved from knowing pretty much nothing to what I have now, impresses me personally.

This app forced me to work with an API for the first time. Beforehand I had no experience with APIs, had no idea how they worked or what they did not the app. Working with Azure and SendGrid, required API calls and an API key. After some research on these and tutorials, I quickly achieved another goal of understand APIs and process to go through to use them. Working with some sort of an API is key for a successful app. Looking at any popular apps on the market, they all use some sort of API so having that skill will stand to you.

Working with SendGrid was personally my biggest achievement from this project. Having the ability to pull an email address from the users account and the event details and notify them of an upcoming event, showed me, the project I was working hard on, is finally looking like a fully working app.

Due to time restraints from deadlines from other subjects, this forced me to make important decision. I couldn’t waste too much time on deciding what software to or how a certain function should work. I had to make a decision and work with it. Before a final decision was made, the research had to back up the decision and prove why I choose to do it that way or why certain software was decided on.

Project Review

What went right?

I would consider this project to be and overall success. Users can successfully create and follow events and connections, all displayed to the users where appropriate and allows the users to search accordingly to interest and nearby location. It also notifies the user of upcoming events. These were the main goals I set out at the beginning of the project, help users find events and connections related to their interests and location.

The technologies used were the right choice in my opinion. All android developers should consider using a native android developing software over software like PhoneGap/Cordova as the frontend. Weather you prefer Java, use Android Studio or C#, use Xamarin. More options were available to make the users experience more enjoyable and less complicated. After researching Azure and reading the documentations on it, it proved to be a pleasant and stress-free experience for the developer. Once you learn how the functions work, what's aloud, what isn't, I'd consider it a better service to use than ones I've increasingly more experience with like PHP and Blacknight. I've only really worked with these but after working with Azure, the difference in quality is vast. I find Azure does commands and tasks more logically while working with PHP can be a nightmare.

It took longer than I would have liked, to figure out how to compare lists that shared the same unique value, but once I overcame this obstacle, the work started to more smoothly. The biggest obstacle thought out this project was learning the functions and libraries available. Once learned, the work project started to take shape.

SendGrid notifications worked just the way I envisioned them too. It took some time setting up as I never worked with an API like this before. The documentation was very well written and helped me set up this service. I had to play around with how the message layout and convert the message to HTML to look proper when the email was sent. This is where I learnt a good bit about how the Azure database worked. Transferring data from many tables to be sent to the user took some brainstorming which in the end was one of the more enjoyable parts of the project.

What went wrong?

Projects off all sizes are bound to encounter errors. This project came across a few. The only way to deal with them and not fall behind was quick thinking and have the research to back up the decision.

The first issue I came across was the type of software I chose. I didn't do enough research and settled on the first Android Development software I found, Android Studio. Even though my past experience with software didn't go well, I still to use it. This wasted a few weeks of development but the research done during this time didn't. This struggle ended up being a success as it made me do more research and I ended up finding Xamarin.

Profile picture were an issue with my database. It increased the cost of the database dramatically, so I thought of a substitute of using the users interest as a temporary profile picture. The images are saved on the system so it doesn't require a fast or strong internet connection to load it. Once the basic information is loaded from the user profile, the image will load.

The Azure subscription I signed up to was a free trial with ~€170 balance. I didn't read the small print which stated you get that balance for 30 days only. I got in contact with their support team in which they generously extended. This setback cost me two weeks of development. As majority of my project required being connected to a database, I couldn't process during the two weeks. If I went ahead and coded but not tested, by the time my database was back up and I could test it, there could of be many errors throughout the code and would of took many days to find all the errors. I spent the time doing research.

The original plan for notifications was, push notifications. The process for this was much longer and complicated than emails. Connecting Xamarin to Azure and google firebase was taking up too much time and there was little progress being made. During this research, I found the documentations on sending emails via SendGrid. After doing research into SendGrid, I found the results similar to push notifications. Granted they aren't as reliable as push notifications.

Future Features

This app has the potential to go many ways and add a variety of features. Two features that would be high up on the list would be adding profile pictures and push notifications. Profile Pictures didn't go to plan as. As go as the Azure service is, it is costly. Profile pictures were taking up a good bit of the balance and were slow to load as the service isn't fast as it's free. If it was upscale payment plan, it would be given its own space on their server but since it's free, it shares time with the other free users. This isn't a major issue though. With funding behind this app, the connection speed would be increased and profile pictures would be an option. With more time a research, push notifications would be added. It was a problem of time and difficultly. If there was more time on this project, it would be added successfully.

Another additional feature which could be added is connecting to a social media. Facebook suits this app well but many users at the moment would probably rather not join an app connected to Facebook with the scandal around them now. LinkedIn is a possibility as users have their professions connected to their account which could help make the search more advanced.

With the time constraint, I focused on core features. The design of the user interface (UI) could be improved. I tried to make it appealing without spending too much time on the interface and not enough on the user experience (UX). UX can be as important if not more importance than the UI which is why more time was spent there and not on the UI. Each feature on the interface is clearly labelled though so the user can still easily navigate around the app. Mainly displaying of the profiles could be designed better.

Xamarin Forms is another version. It's similar to Xamarin Android but the libraries work slightly different. The payoff is higher though as the application works on both Android and IOS. I noticed when looking for solutions online for, two thirds of the results were for forms over android. For any app development for myself I'd be looking at Xamarin Forms first unless Xamarin Android is a requirement. For anyone developing an app and not sure what to use, I'd recommend doing some research into Xamarin forms or android. The results given from these can be higher quality of those on PhoneGap/Cordova.

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Bibliography

[1] YouTube. 2018. *Joe Rock - YouTube*. [ONLINE] Available at: https://www.youtube.com/channel/UCFH-Tn6ggt9yLWJ4V9NizZA. [Accessed 18 April 2018].

[2] conceptdev. 2018. *Get Started with Azure Mobile Apps for Xamarin.Android apps | Microsoft Docs*. [ONLINE] Available at: https://docs.microsoft.com/en-us/azure/app-service-mobile/app-service-mobile-xamarin-android-get-started. [Accessed 16 April 2018].

[3] c# - How to hash a password - Stack Overflow. 2018. *c# - How to hash a password - Stack Overflow*. [ONLINE] Available at: https://stackoverflow.com/questions/4181198/how-to-hash-a-password/10402129#10402129. [Accessed 16 April 2018].

[4] GitHub. 2018. *GitHub - defuse/password-hashing: Password hashing code.*. [ONLINE] Available at: https://github.com/defuse/password-hashing. [Accessed 18 April 2018].

[5] mgmclemore. 2018. *Time Picker - Xamarin | Microsoft Docs*. [ONLINE] Available at: https://docs.microsoft.com/en-us/xamarin/android/user-interface/controls/pickers/time-picker. [Accessed 16 April 2018].

[6] mgmclemore. 2018. *Date Picker - Xamarin | Microsoft Docs*. [ONLINE] Available at: https://docs.microsoft.com/en-us/xamarin/android/user-interface/controls/pickers/date-picker. [Accessed 16 April 2018].

[7] https://docs.microsoft.com/en-us/azure/sendgrid-dotnet-how-to-send-email