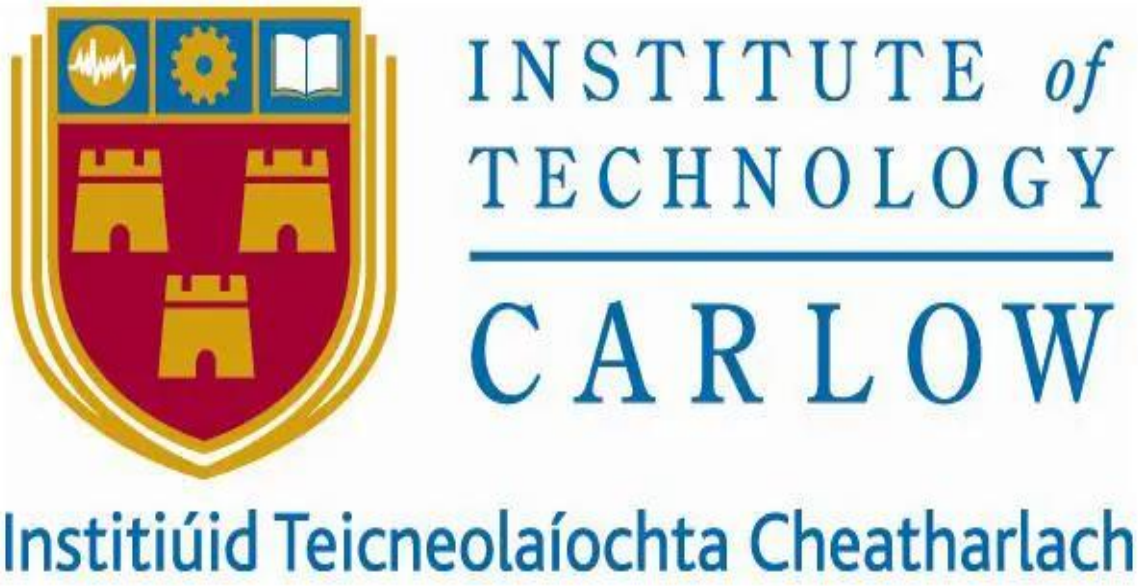
Research Document



Institute of Technology Carlow

Interactive Map of Campus

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Date: 13/11/2020

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1. Abstract

The purpose of this project is to develop an app/website that will allow users to navigate to their classroom. The app will also allow users to create an account which will allow them to set a schedule for each day. This would automatically show them the way to their desired destination at a specific time. This feature would be unavailable for people without accounts. Visitors and people without accounts will be able to navigate to classroom/building however it would not be done automatically and they will have to manually search for the room/building.

2. Introduction

Many people in third level education do not know campus layout or all the classrooms. Classes could be held at different classrooms throughout the year. This means that people can get lost on campus while searching for their classroom or it can cost them valuable time which could be spent differently. The aim of this project is to provide an app that eliminates these problems. This app will allow people to traverse the campus in an easy manner that would save them time by bringing up the route to their destination (e.g. classroom) that is shortest relative to their position. It will allow people to choose a point on the map if they are not comfortable with using their phones location tracker. The app will allow a student/lecturer to create a profile. This will allow them to create a schedule for each day and automatically show way to desired location that was set (e.g. 10am lecture at room A323).

There are many apps on the market that have this functionality. However, not many/any at all have this available for Institute of Technology Carlow. This is what will differentiate this app from others.

3. Existing Apps

3.1. Mazemap

Mazemap is a company which builds map apps for businesses around the world. Some features of their apps are:

- Indoor map
- Wayfinding
- Indoor positioning
- System Integration

The app allows the user to navigate indoors and outdoors. [1]

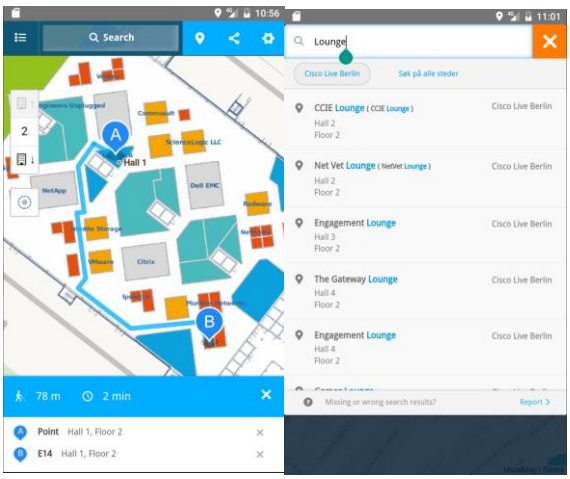

Figure 1: Mazemap UI [1]

3.2. Campus Maps

Campus Map is an app that provides users to maps of over 250 campuses. It uses GPS to locate a user on the map. The app uses a google maps API to provide a map. This allows the user to navigate through the campus, but user is not able to navigate indoors. It provides user with satellite map. [2]

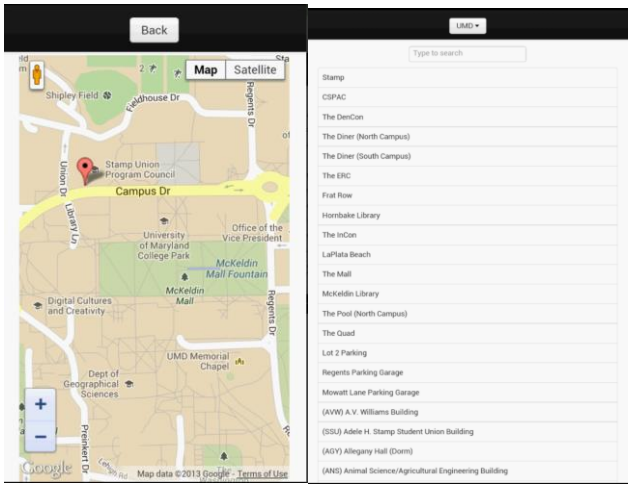

Figure 2: Campus Maps UI [2]

3.3. UniversityGO

UniversityGO is an app that contains map of over 10 campuses in the US. The app allows users to navigate the campus and provide additional information on the buildings. Users can search buildings by name or code. This app does not allow users to navigate indoors. [3]

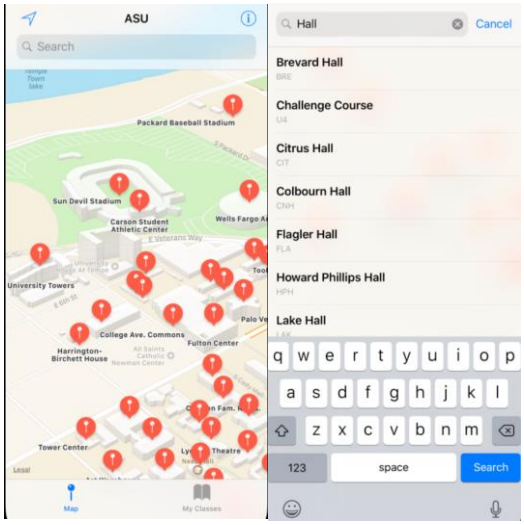

Figure 3: UniversityGO UI [3]

4. Technology

4.1. Native vs Hybrid

Native app development can use specific features of the OS that it is running on such as fingerprint scanner and GPS. Native development is mostly done in Swift for iOS and Java on Android. Kotlint is gaining popularity for app development on Android. [4]

Pros of Native:

- Has better performance
- User friendly UI
- High accessibility to features of specific OS (e.g. Android or iOS)

Cons of Native:

- Cost of development is higher
- Longer development time if you are building an app for more than one OS
- Harder to support as you need specific support for multiple OS

Hybrid app development cannot use specific OS features as it is built for multiple platforms.

Pros of Hybrid:

- Cost of development
- Easy scaling of the apps

Cons of Hybrid:

- Cannot use native features of the OS
- Limited design representation
- Slow loading time

4.2. Java

Java is most popular language for native Android App development. It is one of two supported languages in Android Studio. Java has a lot of support and libraries which can be used by developer. [5]

Pros:

- Object Oriented Programming
- Automatic Memory Management
- Stability

Cons:

- Paid Commercial Licence
- Poor Performance

4.3. Python

Python is one of the most popular programming languages due to its simplicity. Python is not popular choice for app development due to existence of native development which can use OS specific features. However, Python is used for app development by Spotify, Instagram and Disqus. [6]

Pros:

- Easy to use
- Open-Source
- Portability

Cons:

- Design Restrictions
- High Memory Consumption

4.4. Swift

Swift is most popular language for native app development for iOS. It is mostly used for native iOS app development as it is developed by Apple. Swift has a great performance when it comes to app development. [7]

Pros:

- Easy Maintenance
- Open-Source
- Faster Development

Cons:

- Compatibility Issues
- Quite Young (6 Years)

4.5. Frameworks

React Native

React Native is a framework which uses JavaScript to build apps for Android and iOS. It allows the developer to access the native functions of the OS. React Native uses JavaScript library to build user interfaces for mobile apps. This makes it easy to develop for both Android and iOS. [8]

Xamarin

Xamarin is framework which uses C# to build the apps. As is the case with all frameworks, Xamarin has access to native APIs. It has great user interface and controls which makes it a god choice for native development. It also allows for easy API integration and is available as a module in Visual Studio. [9]

Flutter

Flutter is framework which uses Dart to build apps. It has access to native APIs. Flutter is a widget which can make starting a project difficult. Flutter has a feature called “hot reload” which allows developer to make changes to code and see them without the need to recompile which is great for debugging. Dart is immature as a language which means it might lack some features that will be used in a project. [10]

4.6. Database

This project will require a database to store all the rooms and buildings. It will also require additional database for the users as there will be option for them to register. It is very important to choose a right database for the project.

SQL database uses tables to organise the data. It is vertically scalable which means that giving server more RAM or CPU will allow to increase the load on the database. SQL uses structured query language for defining and manipulating data. It is good for complex queries however it can be restrictive as you need predefined schemas to determine the structure of data before working with it. [11]

Examples: MySQL, Oracle, PostgreSQL, Microsoft SQL Server.

NoSQL database on the other hand stores data in many ways such as documents, columns, or key-value pairs. It is horizontally scalable which means that instead of giving server more RAM or CPU, you give more servers to the database. NoSQL does not require data to be structured and it has dynamic schemas. Syntax can vary from database to database. [12]

Examples: MongoDB, BigTable, HBase, Redis.

4.7. Cloud

AWS

AWS (Amazon Web Service) is cloud provider. It provides 165 services to the costumer on pay-as-you-go basis. AWS provides a free 12-month trial of its services. Most of the services are available through free tier such as EC2, Bucket, SQL Database. It is easily scalable and has great support from Amazon [13]. AWS main drawback is that it is hard to migrate to a competitor later due to AWS using proprietary storage. Another drawback is that while SQL Database is part of the free tier, NoSQL Database is not. AWS might have some services locked as some are country specific. [14]

Microsoft Azure

Azure is cloud computing service for building, testing, deploying, and managing applications. It provides 100+ services to customers such as storage, servers, SQL Database and Virtual Machines. Azure provides 12-month free trial and 25+ services that are always free [15]. Azure has the same main drawback as AWS. It also might have some services locked as they are region / country specific. Azure does provide NoSQL Database in its free tier. [16]

Google Cloud Platform (GCP)

Google Cloud Platform is suite of cloud services. It provides services such as storage, data analytics, SQL Database, and machine learning. GCP does provide 12-month free trial of its services and gives out $300 to use for its premium services [17]. GCP is global which means that you do not have any region locked service. It has lack of documentation for their services. [18]

5. Testing

Hardware Testing

I will be looking to test the app on multiple devices with different screen sizes, RAM capacities, CPUs, and versions of OS to see if everything works as intended. This can be done on phones, tablets, and emulators. [19]

Software Testing

This test the app for any bugs that might be in it ensuring that the app is of highest quality when completed. There are many tools on the market such as TestingWhiz, TestComplete, Ranorex, Telerik TestStudio, and Katalon Studio. [20]

6. Conclusion

Language/Framework

At the time of this document being created, it seems my best choice would be to build a native app for Android using Android Studio and Java. Android Studio with Java support all of the features of the app.

Database

For this project I will be using a SQL Database. I decided on this as my databases will not be changing often.

Cloud

I decide to go with Google Cloud Platform for this project as it provides all the features that I need for this project. It has Google Firebase which is a platform that was developed with mobile app development in mind. Firebase pairs very nicely with Android Studio.

7. Declaration

Declaration

- I declare that all materials in this submission e.g. thesis/essay/project/assignment is entirely my/our own work except where duly acknowledged.
- I have cited the sources of all quotations, paraphrases, summaries of information, tables, diagrams and other material; including software and other electronic media in which intellectual property rights may reside.
- I have provided all bibliography of works and sources used in the preparation of this submission.
- I understand that failure to comply with Institute's regulations governing plagiarism constitutes a serious offense.

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Date: 13/11/2020

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