BAINISTEOIR BEAG MOBILE APPLICATION

RESEARCH MANUAL

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Contents

Abstract

The purpose of this research document is to provide an account of the various technologies considered during the development of the Bainisteoir Beag mobile application. This document will outline the research conducted in relevant areas such as development environments, frameworks and mobile application platforms.

Abstract

Introduction

Bainisteoir Beag is a pupil led activity programme that encourages children to partake in fun and healthy exercise regimes, teaching from a young age that exercise is both necessary and enjoyable. [1] As stated by the Kilkenny Recreation and Sports Partnership it endorses pupil led activities performed during break times in school. The main objective of the programme is to influence a proclivity towards leadership from the older students and to create a positive perspective of exercise for the younger students.

In its current form the programme is paper based using activity cards and is already widely utilized in national schools. The main objective of rejuvenating the programme is to create a wider spectrum of people that may use the service as it will be very beneficial for students to be able to use this. It would help to transcend the programme from just a paper-based activity to an easily accessible app that can be used in schools, camps and parents. In the growing climate of digitisation it's important that something as educational as this is modernized so as to keep its usage as prominent as it should be.

The purpose of this document will be to further display how the digitization of the programme will be rolled out and which methods will be used to make it accessible to all ages. It needs to be as simple as playing card games while also having methods of data collection to ensure the app stays up to date and can be modified if the need for improvements arises. This document will investigate and examine six key areas; existing systems that are already available to students, various mobile platforms, development technologies, cross platform development, mobile development languages and hosting platforms. This will ensure that a thorough level of research is performed which will aid towards to the future successes of the programme in its new digital state.

Societal Impact

In this section of this research document the socio-economic climate of programmes such as this will be examined to solidify the necessity and marketing potential of an application of this kind. Technology follows social needs, developments in technologies are no different. If there is a social, economic or political need for something, technology will advance to make it a reality. We live in a society where in its current state more children are suffering with identity crisis, depression and obesity. This type of programme which involves creating positive views of the individual and leadership in general is incredibly valuable. As a society we must teach the younger generations to be resilient and healthy and partake in healthy activities such as this programme encourages. Exercise is beneficial for both body and mind, by creating healthy habits at a young age we are giving the youth of today the tools they need to help their mental and physical health.

Mobile Platforms

Mobile device usage is prevalent all over the world today and as technology advances, the number of mobile device users increases with it. It is estimated that there are 2.7 billion smartphone users and 1.35 billion mobile tablet users worldwide, and that mobile applications are expected to generate $189 billion in revenue by 2020. [2]

While many people use mobile devices for personal use on a day-to-day basis, mobile devices are often used to augment the work of businesses and organisations. It is therefore no surprise that educators may opt to integrate mobile devices into the education system. For example, some schools in Ireland have been phasing out paper-based books in favour of E-books for students' tablets.

Currently, there are two major mobile platforms upon which most mobile apps are developed. Both of these platforms will be discussed below.

Android

Android is currently the most popular mobile platform by a wide margin, with a market share of 76.24% as of September 2019. [3] This domination of the market is due to a few key reasons. In general, Android devices are more affordable, with a wide variety of entry-level phones and tablets available. Android is also available to many mobile device manufacturers such as Samsung, Sony, Huawei, etc. Whereas iOS is reserved for Apple branded devices only.

While Android's market share may be a major influence on which platform developers will choose for their apps, Android's open-source approach and lack of subscription-based fee for application hosting are significant factors as well.

Android's applications are available for users to download via the Google Play Store, which hosts 2.8 million applications as of September 2019. [4]

iOS

iOS, developed by Apple, is the second most popular mobile platform, holding a market share of 22.48% as of September 2019. [3] iOS is most commonly seen on the Apple iPhone and iPad devices, which are generally seen as more high-end and therefore not as easily affordable as some Android devices.

iOS has a large and loyal user-base, as Apple are well known for delivering quality products, and this reputation is upheld by a requirement for iOS apps to be approved before being hosted on the App Store. iOS developers are also required to pay a subscription fee once an app is made available on the store.

Despite the scrutiny and price-point, native iOS development is often regarded as faster and therefore more cost-effective than developing on Android.

Development Technologies

Developers may develop mobile applications with the aid of many kinds of development technologies, programming languages and frameworks. It is therefore key to identify the technologies which fit an application's requirements best. This section aims to examine several different unique technologies used in mobile app development and identify the best fit for this project.

IDEs

Overview

An IDE (Integrated Development Environment) is a software which provides tools to aid in software development. IDEs typically consist of a text editor, compiler, and debugger. Popular IDEs may also contain helpful features such as tutorials, easy integration with cloud services, support for extensions and multiple programming languages. This section aims to examine some of the most relevant IDEs in relation to the project at hand.

Visual Studio

Visual Studio by Microsoft is one of the most popular IDEs for software development in general, supporting 36 different programming languages (with the aid of Packages). It is a robust IDE with built-in functions for easy debugging and testing, code suggestions, customization, Git integration, automatic tidying and formatting of code, and many other features with the aim of providing a developer with everything they need in one suite.

While Visual Studio is well suited to beginners with its simple GUI and wealth of tutorials, it is a very powerful IDE for developers of all levels. Moreover, in terms of mobile app development, it is the only IDE available for Windows which supports the cross-platform framework for mobile development, Xamarin.

Visual Studio also features a mobile device emulator, which can be extremely useful for mobile developers who what to test their application on a variety of different device types (different operating system versions or screen sizes).

Android Studio

Android Studio is a powerful IDE dedicated to mobile app development. It is currently one of the most popular IDEs, owing not only to its many useful features, but also to the increase in popularity of mobile app development in general. Android Studio was developed by Google and is built on the IntelliJ IDEA by JetBrains.

Android Studio's primary function is native mobile app development for Android, as the name suggests, with built-in support for either Java or Kotlin. As the IDE is focused on mobile development, it features many useful templates when creating projects to aid in getting started with an application. These templates may range from an empty main activity to an activity which is already set up to use Google Maps functionality.

As it is developed by Google, it also features easy integration of Google Firebase cloud service into an application. This includes automatic insertion of code for Firebase's many features, from implementing user authorisation for register/login activities to reading and writing data to a realtime database.

While Android Studio's primary function involves building Android applications, it may also be used for developing cross-platform applications with Google's Flutter framework, with the aid of a downloadable extension for the IDE. Flutter applications may be built within Android Studio with access to the same useful features that a developer has access to, such as the availability of mobile device emulators for testing the application.

XCode

XCode is an IDE exclusive to MacOS, commonly used in developing applications for macOS and iOS for iPhones, iPads, and various other Apple devices.

XCode is a general-purpose IDE, with support for many programming languages such as C, C++, Java, etc. More notably, in terms of mobile app development, XCode also provides support for Swift programming language for native mobile app development for iOS.

In terms of mobile app development, developing for iOS with Swift is made easy in XCode, with built in emulators, drag-and-drop functions for visual elements, and Live Mode for seeing changes to the application in real time.

Cross-Platform Frameworks

Overview

Cross-platform mobile app development refers to developing an application in a framework which allows for deployment of the application to multiple platforms at once. This approach is considered faster and cheaper in terms of development, as the only alternative involves developing the app natively for each individual platform necessary.

Certain frameworks exist to allow a developer to develop one application which can be deployed to both Android and iOS. This section will examine some of these frameworks.

For the purpose of this project, cross-platform development should be strongly considered. Given the primary target of the application is to be primary schools, it would be desirable to cater to schools which carry either Android or iOS devices.

Flutter

Flutter is a software development kit developed by Google which can be used to create applications for Windows, Mac, Linux, and most notably in this case, Android and iOS. Flutter mobile applications, once written, may be deployed to both mobile platforms simultaneously.

Flutter mobile applications are written in DART, a programming language developed by Google based around elements known as Widgets, which are small UI components which are combined to create a complete mobile application. Each Flutter application starts with a parent widget, with corresponding child widgets branching from parent widgets, as shown below.

Flutter applications may be written in Android Studio via an extension and is designed to work well with Google Firebase. Flutter differs from other cross-platform frameworks like Ionic or React Native in that it relies on Dart as a singular codebase rather than web-based languages like JavaScript and HTML.

One of the key features of Flutter, Hot Reload, is apparent when testing an application on a mobile device. This allows the developer to reload the application once any changes are made and see these changes instantly without losing any data. This differs from developing native Android apps, for example, where the app must be closed, rebuilt, and restarted before changes can be seen. This makes testing applications on the fly much faster and more efficient.

Flutter boasts high performance and a consistent UI across platforms, which, in terms of development efficiency and time-to-market, may give Flutter an edge over other cross-platform development options.
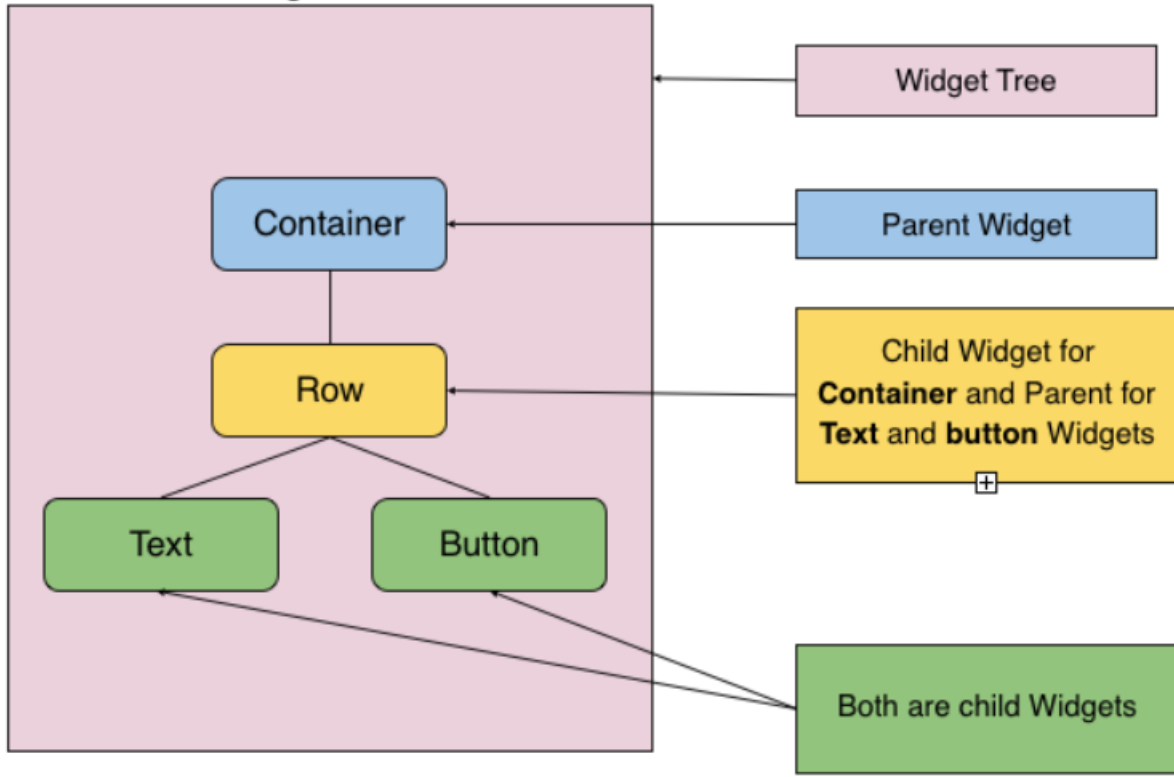
Figure 5.1: Flutter Widget Tree Example [5]

Ionic

Ionic is an open-source framework for developing cross-platform mobile applications developed by Drifty in 2013. Ionic uses web-based technologies in its development process like HTML, JavaScript and CSS and is focused on the frontend user experience. Ionic currently has support for integration with both Angular and React, two of the most popular frameworks for building web apps and user interfaces.

Ionic may also use Cordova Bridge, a set of APIs that aids in allowing ionic apps access to a mobile device's operating system to gain access to device features like the camera, as shown below.
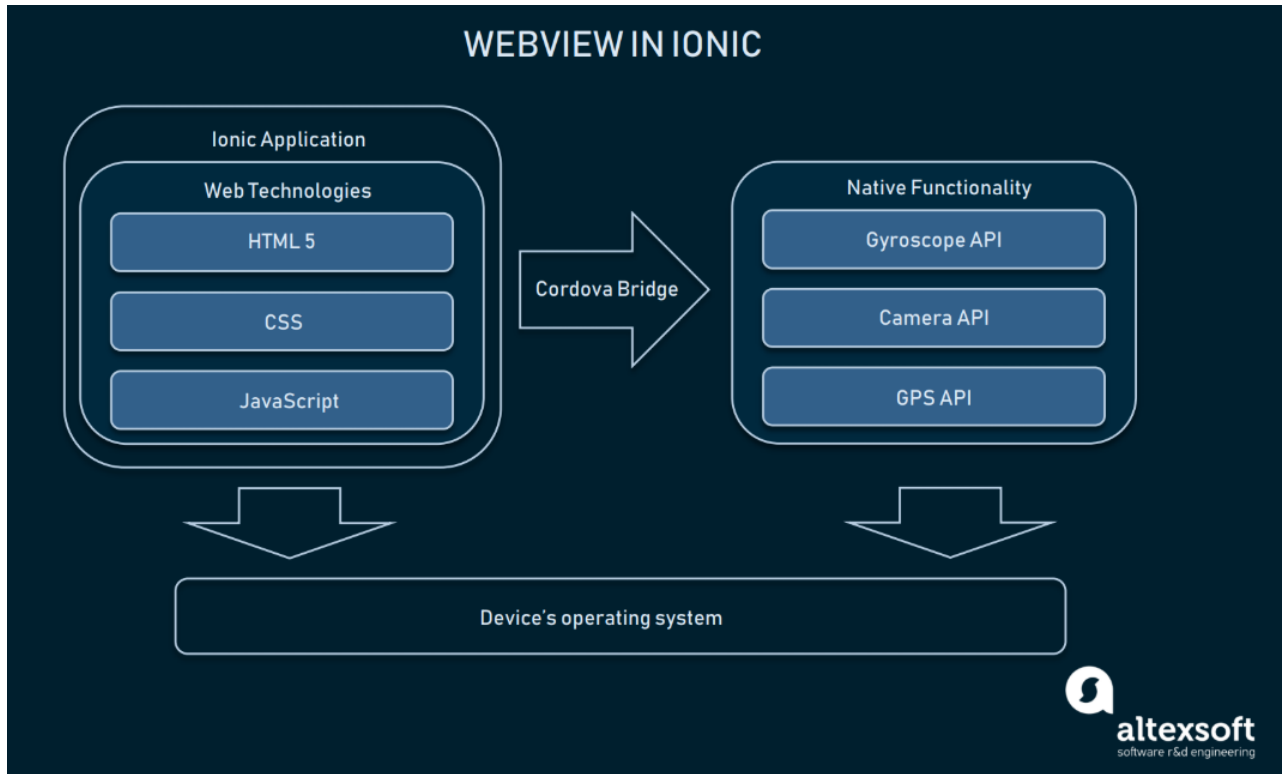
Figure 5.2: Ionic application in a nutshell [6]

Cloud Services

Overview

"Cloud computing is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing. Instead of buying, owning, and maintaining physical data centers and servers, you can access technology services, such as computing power, storage, and databases, on an as-needed basis from a cloud provider." [7]

Cloud computing has become increasingly popular for developers and companies of all sizes and may provide many solutions to aid in software development, with services such as databases, authentication, web hosting, and more. This can be extremely beneficial to companies as using a cloud service may decrease costs and increase scalability. [8]

For smaller, individual projects, such as this one, the use of a suitable cloud service can help greatly with development time and some services may be used on a small scale for no cost at all throughout the development process, subject to an allocated amount of free data provided by the service.

Amazon Web Service (AWS)

Amazon Web Service (AWS) is the market leader in cloud computing and offers a wealth of services available for mobile, web, and desktop applications. Some of the services AWS provides on its platform includes cloud storage, web hosting, databases, analytics, and a wealth of other features. [9]

For mobile development, AWS offers a suite of services for building, deploying and testing, and usage may also be monitored via the administrator's account.

Google Firebase

Google Firebase is a relatively young cloud service, compared to AWS or Azure but still offers a wealth of useful features for web and mobile development. Firebase provides analytics, authentication, two kinds of database, cloud storage and more, and can be set up immediately if the developer possesses a Google account.

Each firebase project may be linked with multiple applications, for example, a mobile application and a web application may be set up with the same project and therefore have easy access to the same databases and cloud storage directories as each other. This is useful for projects such as this one, where a web application may need to be set up for administrator use for managing the data which the mobile application reads.

Firebase's database service, Cloud Firestore, also provides "persistence", wherein data read from the database is cached and will still be available to the end-user when the device is offline. This can be extremely useful for applications which rely on reading from a cloud database.

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- I have provided a complete bibliography of all works and sources used in the preparation of this submission.
- I understand that failure to comply with the Institute's regulations governing plagiarism constitutes a serious offense.

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