Pavements

Research Document

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Research Document

Abstract

The purpose of this document is to have a written account of the research required for the course of this project. In this document as this project is for an external company, the problem the company has and how this project will help will also be discussed. The following document will compare technologies that are available to help solve the problem.

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1. Introduction

The following document provides a detailed insight into the research that is relevant to the project. As this project is for an external company what will also be discussed is what the company currently has in place and what the company is currently looking for. As the company is looking for an application to be built, this document will provide a background of the following technologies that are used to build applications:

- Xamarin
- Kivy
- Ionic
- Swift
- Android Studio

Also, in this document will also discuss research conducted to any similar applications.

2. Overview of areas, technologies or topics researched

As this project is going to be an application for a tablet, there are many technologies that could be used. This part of my research document is going to focus on the different technologies available and what is best to use, whether it be a cross platform technology to work on both Android and iOS or just focus on one platform and be platform specific. Also going to explore what backend structures are available and what is best to use.

2.1 Xamarin

Xamarin is a tool used that allows engineers to develop cross platform applications with 90 percent code coverage across major platforms. Xamarin as a company was founded on 16th May 2011 and was built by the developers behind Mono, an open source development platform based on the .NET framework. The company was acquired in 2016 by Microsoft and became a popular cross platform framework within the Microsoft ecosystem and also became part of Xamarin Visual Studio Integrated Development Environment.

All Xamarin apps are created in a single language, c# and based on the .NET framework. Xamarin is natively compiled which is a good option for building high performance apps with a native look and feel. [1]

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[1]

2.2 Kivy

Kivy is an open source Python library that is also cross platform that use innovative user interfaces, such as multi touch apps, so can be developed on both Android and iOS using the same code on all supported platforms. [2] Multi touch apps is a technology used that enables the touchscreen to recognise the presence of more than one point of contact within the app. [3]

2.3 Ionic

Ionic was created in 2013 as an open source SDK for hybrid mobile applications which has more than 5 million applications built using it. Like Xamarin, Ionic is also cross platform technology with a single codebase to work on both Android and iOS. Ionic uses front end technologies like HTML, CSS, JavaScript and Angular which allows developers to create web pages that run inside a device's browser instance called WebView which renders web pages and displays them as a native application.

Ionic uses a tool called Cordova for building mobile applications using web technologies which relies on its own APIs instead of platform specific ones. The Cordova Bridge is a set of

APIs that are packed with plugins which give access to functions to the smartphones camera, gyroscope and sensors. [4]
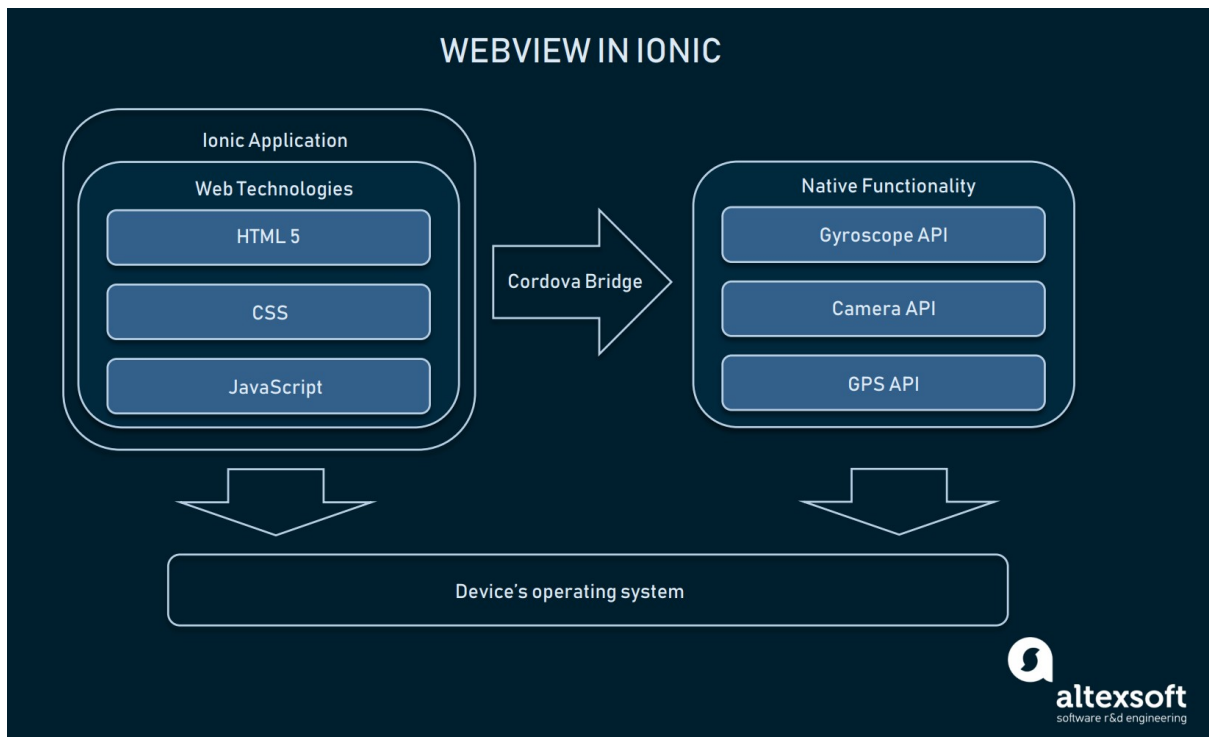

[4]

2.4 Swift

Unlike Xamarin, Ionic and Kivy, Swift is a programming language which just focuses on iOS. Swift was created by Apple in 2014 and is set to become the dominant language for iOS development. Swift was built with performance in mind, so stated by Apple, Swift is 2.6x faster than Objective-C and 8.4x faster than Python. [5]

2.5 Android Studio

Android studio is the official IDE (Integrated Development Environment) for the development of Android applications. Android studio uses primarily Java and is based on IntelliJ IDEA which is a Java IDE for developing software. [6]

Android Studio is structured using the Android software stack comprising applications, an operating system, runtime environment, middleware, services and libraries. Each layer of the stack is tightly integrated for optimal application development and execution environment for mobile devices. [7]
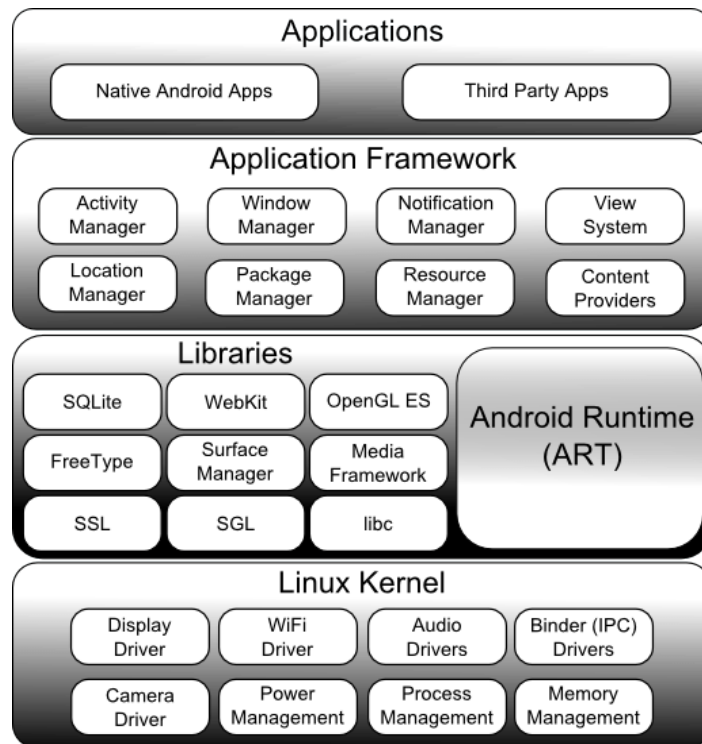

[7]

2.6 Backend Structures

This part of my research document is going to look at what backend structures are available, and which one is most likely going to suit the overall project.

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2.6.1 SQLite

SQLite is a software library that provides a relational database system. The lite means light in terms of setup, data administration and required resource. Self-contained, serverless and zero configuration are some of the main features of SQLite.

SQL requires a separate server to operate as you can see from the image below which illustrates (RDBMS) Relational Database Management System architecture:
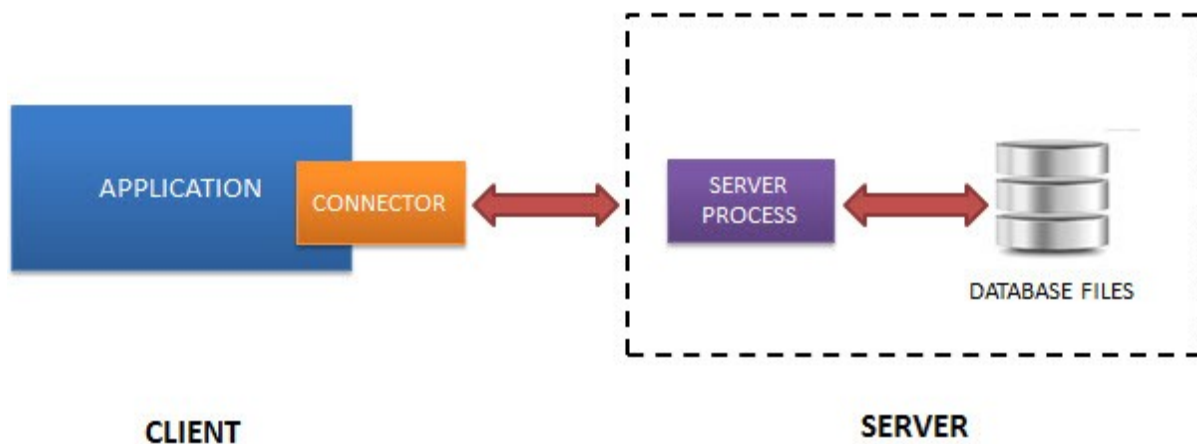
[8]

SQLite does not work this way and doesn't require a server to run and the image below illustrates the SQLite serverless architecture:


[8]

This may be a useful option for mobile applications as this can be integrated into technologies like Xamarin and Android Studio. [8]

2.6.2 Realm

The Realm Platform is made up of two major components, the Realm Database and the Realm Object Server. These two components work in conjunction to automatically synchronise data enabling a lot of use cases ranging from offline applications to complex backend integrations. Realm is built for our modern mobile development demands is one of its key factors. [9]
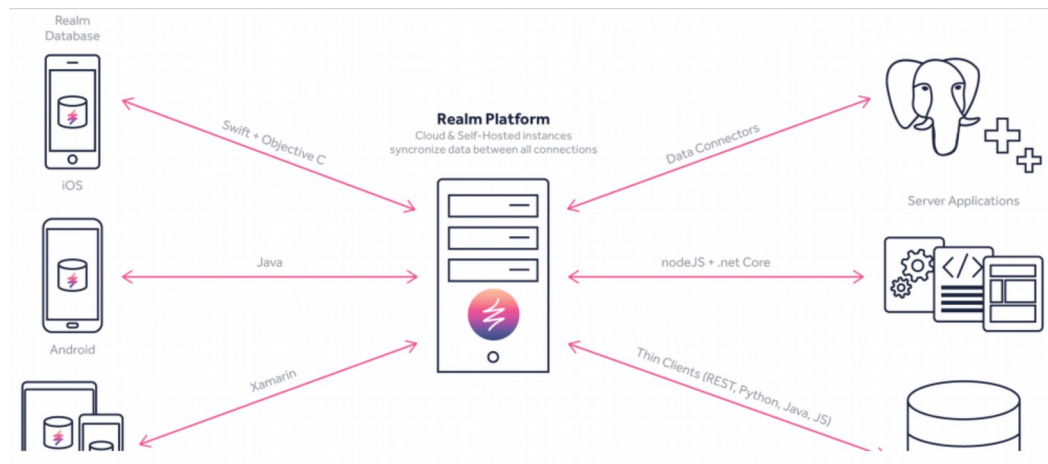
[9]

2.7 GPS On A Mobile Device

As part of this project, the external company is required to take photographs of imperfections in the roads or paths. As part of these photographs that are taken, they also require the coordinates of where the photo was taken to know exactly where in the road, the imperfections are.

2.7.1 What is GPS?

Global Positioning System is a technology owned by the U.S government which is free for everyone to use. It uses radio waves between satellites and a receiver inside your phone to provide your location. You don't need to send any data back to space, you only need to receive from four or more of the 28 satellites for the GPS to work.

As for this project, we need GPS to be as accurate as possible. After some more research into this, a device required for more accurate location is one that supports (AGPS) Assisted Global Positioning System.[10]

2.7.2 What is AGPS?

The Assisted Global Positioning System takes assistance from mobile towers which have GPS receivers to continuously receive signals from GPS satellites and powerful servers to process the received information. The mobile device can access this information to increase time to fix the first location. Some advantages include:

- Faster location acquisition
- Less processing power, means saves battery
- Indoors location acquisition [11]

3. Current System

This section of my research document is going to explain the system the external company is currently using and why they are looking to digitise their whole system.

3.1 Detailed Visual Condition Survey

Detailed Visual Condition Survey is a document a surveyor uses while inspecting the road in which they have been tasked to do. This document is currently used by the external company and after some research and conversations here is a list of disadvantages of conducting a survey with the document:

- If conducting the survey while it's raining, the document can get wet and then become damaged
- When finished their survey, all data manually has to be entered into a (PARR) Pavement Assessment Repair and Renewal report by the surveyor
- If another surveyor needs to write up the PARR report, they may be unable to read the surveyor's writing.

Below is an example of a Detailed Visual Condition report.

As well as filling out this report while conducting their survey, the surveyors need to take photos of imperfections in the roads or paths. They need to take photos of cracks, road markings fading, potholes and if there are kerbs broken/missing. The external company currently uses an application called "Camera Timestamp" which records the coordinates of where the photo was taken. This is useful, but I have found that the coordinates of where the photo has been taken from the application to be not as accurate as they would like.

4. Similar Projects

During the research of this project, there were no existing systems exactly or mobile applications like this project. One I found familiar was from wdm.co.uk where the surveyors use software and vehicles specifically designed to collect visual data without the need to walk. A digital map is installed in the vehicle where the operator uses a touch screen to select the route with a start and end point. All defects on the road in which their route is on is all recorded automatically using a Brantz distance measurement device. The severity of each defect is defined by the operator using the touch screen in the vehicle and at the end the route the software compares the route length and the survey length and give the operator the choice of accepting or rejecting the CVI data.[12]

5. Conclusions

After some interesting research into the different types of cross platform technologies for both Android and iOS also and also into individual technologies for a specific platform I found them all to be quite similar but implemented in slightly different ways. For example, when building for both Android and iOS using a technology like Xamarin where you just have to write the code to build the software once for both platforms makes the most sense as even if the initial requirements are platform specific, this might change and be required on both Android and iOS further into the project.

Also, after discussions with the external company that this project is for and further research into GPS, I found that GPS is not as accurate and gives an accurate location as required for this project on a mobile device. This will require mobile devices that support Assisted GPS(AGPS) that will give a more accurate location that is required when taking photos for this project.

6. Plagiarism Declaration

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*I have provided a complete bibliography of all works and sources used in the preparation of this submission.

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7. Bibliography

[1]Altexsoft. 2019. The Good and The Bad of Xamarin Mobile Development. [ONLINE] Available at: https://www.altexsoft.com/blog/mobile/pros-and-cons-of-xamarin-vs-native/. [Accessed 21 October 2019].

[2]Kivy. 2019. Kivy. [ONLINE] Available at: https://kivy.org/#home. [Accessed 21 October 2019].

[3]Wikipedia. 2019. Multi-Touch. [ONLINE] Available at: https://en.wikipedia.org/wiki/Multi-touch. [Accessed 23 October 2019].

[4]Altexsoft. 2019. The Good and the Bad of Ionic Mobile Development. [ONLINE] Available at: https://www.altexsoft.com/blog/engineering/the-good-and-the-bad-of-ionic-mobile-development/. [Accessed 23 October 2019].

[5]Altexsoft. 2019. The Good and the Bad of Swift Programming Language. [ONLINE] Available at: https://www.altexsoft.com/blog/engineering/the-good-and-the-bad-of-swift-programming-language/. [Accessed 23 October 2019].

[6]Android. 2019. Meet Android Studio. [ONLINE] Available at: https://developer.android.com/studio/intro. [Accessed 26 October 2019].

[7]Techotopia. 2019. An Overview of the Android Architecture (Android Studio). [ONLINE] Available at: https://www.techotopia.com/index.php/An_Overview_of_the_Android_Architecture_(Android_Studio). [Accessed 26 October 2019].

[8]Sqlitetutorial. 2019. What is SQLite. [ONLINE] Available at: https://www.sqlitetutorial.net/what-is-sqlite/. [Accessed 28 October 2019].

[9]Dev. 2019. Intro to Realm Database. [ONLINE] Available at: https://dev.to/lemuelogbunude/intro-to-realm-database-1g3o. [Accessed 28 October 2019].

[10]Androidcentral. 2019. How does GPS work on my phone?. [ONLINE] Available at: https://www.androidcentral.com/how-does-gps-work-my-phone. [Accessed 1 November 2019].

[11]Medium. 2019. Understanding AGPS (Assisted GPS). [ONLINE] Available at: https://medium.com/ivymobility-developers/understanding-agps-assisted-gps-3ae23cc691ab. [Accessed 1 November 2019].

[12]WDM. 2019. VISUAL CONDITION SURVEYS. [ONLINE] Available at: https://www.wdm.co.uk/surveying/visual-condition-surveys. [Accessed 1 November 2019].