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CPU 6001-Major Project

BSc Computing & Website Development

Investigation into the use of mobile applications as a platform for reporting social issues to the council

**Literature Review Report**

Project Supervisor - Martin Stanhope

# Summary

It has been discovered that more than a third of all internet users in the UK in 2015 use smartphones, rather than computers to access the internet (Ofcom, 2015), which shows that the technology sector evidently trends towards mobile technology, most likely as a result of a growing demand for those devices. In spite of an increasing role of mobile devices in various aspects of most business fields, there are sectors, such as government, where mobile technology has yet to be fully employed. With a greater access to mobile technology than ever before, local government areas seek a way to maximise the full potential of said technology. Currently, a number of local city councils focus on utilising mobile technology. Some of them provide a mobile platform for reporting social issues within each city, such as road furniture issues or environmental health issues.

This report has therefore been written to investigate various issues that are usually reported to the local council offices and the use of mobile applications as a platform for reporting those issues. This document analyses important aspects of application development, such as the differences between native, hybrid and web applications, or common problems that mobile app developers might have to face. The information collected within this report could potentially help to build a hybrid application using Apache Cordova that has been chosen for this project, as well as to identify social issues reported to the council.

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# Introduction

It has been estimated in the first quarter of 2016 that within a metropolitan area of 24.7 million people 66% of the population use their mobile devices to access the internet, whilst within the first quarter of 2015 the amount of people accessing internet on their mobile devices was 61% (Ofcom, 2016). With such enormous proportion of the population adopting mobile technology, a number of business sectors make an effort to exploit the technology in order to maximise the profit and productivity and diminish the overhead.

There are numerous businesses that managed to achieve that goal through the use of mobile technology. According to a poll conducted by AT&T and Small Business Entrepreneurship Council in 2014 the use of mobile applications by small-to-medium businesses in the U.S. has increased by 65% over the previous two years (SBE Council, 2014). It seems that it is just a question of time until every single business company in the world will adopt the fastest growing technology of all time (Bezerra et al., 2015) to allow their business to thrive.

One of the business sectors currently being in the process of implementing the mobile technology into its structure is the public sector. The public sector involves police, infrastructure, public education, health care, and government. Although some of the public sector organisations, such as certain public schools or healthcare institutes or local GP surgeries have successfully employed mobile technology as a platform to communicate with their “customers”, as well as to provide a range of on-line services that can be accessed through a mobile device, there are organisations that are currently in the process of implementing mobile technology. Examples of such organisations are city councils in Manchester and Bolton. Their reporting system for social issues is currently based on the use of computers, and can be accessed only via computer. Alternatively, a person reporting the issue can visit the local council office and submit a formal report, should any issue be encountered.

It has been stated that clearing the illegally dumped waste on public land in Manchester does cost the Council Tax Payers an estimated amount of £300,000 every year (S4B & Manchester City Council, anon). An issue such as this could be partially solved by deploying a mobile reporting system, which in the wake of the public trend in using mobile devices, could prove a huge convenience to the local residents.

For that reason, this report is going to investigate the use of mobile applications for reporting the social issues to the city council, as well as attempt to provide an overview of different methods of developing mobile applications. This project is based on building a mobile application for a company called Biodata, which hopes to further develop the said application so it could potentially be employed by a local council, as a platform for reporting issues by the public.

This report is going to focus on various types of research that has been carried out in the past, which includes journal articles, websites and case studies. This document will provide a description of the research methodologies used to gather information, as well as an analysis and evaluation of the findings.

# Approach and Methods

The approach to the project as a whole requires a certain degree of knowledge in developing hybrid mobile application through the use of an application development framework, expertise in the social issues that are to be reported, as well as HTML, CSS, and JavaScript programming skills. The company that the application is going to be developed for has clearly specified that a particular mobile app development framework should be used, known as Apache Cordova.

In order to carry out a literature review, a number of copies of written literature had to be identified and assessed in terms of their relevance to the area of research, along with copious amounts of statistics, figures or case studies, which have been used to learn about the topic and to support a specific standpoint regarding the subject. A number of different resources have also been used to construct this report, such as newspaper articles, journal articles or websites. In order to find information regarding development of mobile applications in Cordova development framework (The Apache Software Foundation, 2016), various websites have been used along with other types of resources that are available these days, such as YouTube videos.

The plentiful types of resources have provided a range of different views, opinions and conclusions regarding the subject, which have proven valuable as they allowed the author to answer a few questions, which have been raised throughout the report, as well as to explain the concepts of mobile application development. The various points of view that coming from different authors have significantly aided the production of this written piece.

The mobile application development concept is considered the main theme of this report. Due to the volume of information that this report attempts to convey, the main section of this document has been divided into a few subsections that describe a specific part of the main subject.

Before fully investigating the mobile application development, a secondary research had to be carried out, in attempt to identify the different types of social issues that could be reported to the local council by the residents. The research for this particular section involved a detailed inspection of several websites used by a number of city councils in the United Kingdom, such as Birmingham, Sheffield, Manchester, Bolton, and Glasgow city council websites. The information gathered as a result of said research, has been filtered and analysed, before being further described in this report.

Besides social issues that could be reported to the local council, this report identifies different ways of developing mobile applications, where it describes different types of mobile applications and elucidates how each type of application is developed. The main section does also scrutinise the hybrid application development tools that are available, as well as reflects on other aspects that might be important when developing an application for a council. The major source of information for this part has been the existing literature on mobile application development, along with several websites. The amount of resources containing information about mobile development has been large, hence a selection had to take place. Every resource identified as potentially valuable has been read and evaluated in terms of how relevant they are to the subject, and how much it could aid the development of the report.

The two main on-line resources that have been used to gather the information in order to construct this academic report are the online databases of ACM Digital Library and Science Direct. Both of those online resources contain large amounts of documents ranging from journal articles to books and academic reports written by researchers. There have been a few documents that were not available for free, however the majority of the documents that were needed for this report, were freely accessible.

# Findings

## Social issues

Having looked through a number of websites used by several city councils across the United Kingdom, the first observation is that there is a wide range of social issues that tend to be reported on a daily basis to the local offices of city councils. Due to the high volume of issues, they tend to be categorised in order to facilitate the process of selecting the right problem to report (Birmingham CC, 2016) (Glasgow City Council, 2016). The current reporting system of some of the major cities relies mainly on two types of submissions. The first method of reporting an issue is the traditional way, which is by contacting the appropriate authorities via telephone, letter or in person, whilst the second option is through the use of an online form, which is available through the official website of most city councils, and can be accessed through a web browser on a computer (Manchester CC, 2016). Such a system is used by the majority of city councils at the present time, although there are local government areas that have already deployed a mobile application reporting system, or are in the process of doing so, as a third potential method of reporting of social issues. A good example of such council is Glasgow City Council (Glasgow CC, 2016).

There is a wide range of issues that can be reported by the public. Some of the major categories are road and pavement issues, waste and recycling, or public transport (Bolton City Council, 2016). Some of the most common problems that people report frequently are potholes, bus shelter damage, and various forms of vandalism, including graffiti or a wide range of environment related issues (Bolton CC, 2016).

Every issue report that comes through to the local council has to be carefully reviewed by the appropriate department and dealt with as soon as possible. Depending on the scale of the problem, councils might have to launch an investigation before the problem could be solved, and contact the person reporting the problem in order to gather extra evidence and information. An example of such issue can be fly-tipping, which is illegal (British Government, 2016). As stated by the Manchester City Council, the amount of money spent on acting on fly-tipping every year is an estimated amount of £300 000 (S4B & Manchester City Council, anon).

## Approaches to mobile application development

As the most recent figures show, 68% of the entire adult population in the UK report owning a smartphone in 2016 (Poutsher, 2016). With such a large proportion of the population in possession of smartphones, it is imperative to consider a mobile platform as a medium of communication with the public, which includes providing various services via mobile applications.

As found by several research articles and online resources, there are currently three common approaches to mobile application development (Charland & Leroux, 2011; Heitkötter et al., 2012; Korf & Oksman, 2016). The traditional method, known as native application is a specialised approach to develop a mobile application for only one particular platform using the software development tools of that platform, the product of which is limited to one specific environment that has been targeted (Heitkötter et al., 2012). The other types of approach to mobile application development are known as web mobile application, and hybrid approach. The web approach is considered slightly atypical, as a combination of the three main web-based laguages that are HTML, CSS and JavaScript are used to develop a cross-platform application. Web mobile applications are not considered an extension of native applications, mainly due to their lack of access to the native device functionality, such as camera or calendar (Korf & Oksman, 2016). The core of web mobile applications relies on the good browser support of the mobile devices that are running the said application. This is because web applications are implemented as a sigle website that is adjusted for mobile devices and hosted on a server, rather than the device itself (Heitkötter et al., 2012). Finally, the hybrid approach has been developed, in order to combine the functionality provided by native and web applications. Hybrid applications appear to resolve the common problem with web applications, which is the lack of access to the functionality of native devices, while allowing some of the common web technologies to be used by the application (ibid.).

Although hybrid applications provide the hardware functionality of the native devices, they are still considered web applications, mainly because they are not built in the native language used by the specific platform, and use a web rendering engine, however because the engine of the hybrid applications is also wrapped inside a native engine, hybrid applications can access the native platform features (Heitkötter et al., 2012) (Korf & Oksman, 2016). As opposed to the web approach, hybrid applications can be accessed both offline and online, as hybrid applications can be stored both locally and on a server.

As found by Charland and LeRoux, due to certain restrictions that systems of various platforms impose upon web applications, which results in the lack of access to hardware functionality among other issues that affect the overall user experience, web application approach is not an ideal solution to the cross-platform development issue. Native applications appear to solve the problem of the lack of access to the native device functionality, however they appear to be bound to their target platform and entail certain design implementations that can be resolved through the use of web application approach (Charland & Leroux, 2011). With neither of the two approaches fully meeting the requirements, hybrid approach seems to be a perfect solution. The other researchers also declare that hybrid applications, despite their dependence on the native browser, support a faster and simpler development, whilst preserving the application’s ease of maintenance and native-like functionality (Ziflaj, 2014).

## Tools used to develop hybrid apps

There are a number of development tools, used to develop hybrid applications. The most popular frameworks used nowadays are Xamarin, Apache Cordova, Appcelerator Titanium and Intel XDK. Each framework relies on a different set of languages and requires a different array of skills. Carrying out the research in this field was not easy itself, due to the amount of contradictory resources, which could not clearly specify, which development tool is the most effective for the development of hybrid applications.

For this project Apache Cordova has been chosen as a tool for development of a mobile application. Cordova is a development framework used to develop cross-platform applications that has been created in 2009 under the name PhoneGap. It is a tool, which is used to build an application with a combination of the three most common languages used to develop websites that are HTML, CSS and JavaScript. Applications developed in Cordova are web applications in nature, however because Cordova provides a native application container for running the web application implemented with HTML, CSS and JavaScript, mobile developers are able to use the hardware functionality of the mobile devices that are running the application with JavaScript (Virinchy, 2014; Griffith, 2016). The applications developed in Cordova do not require a mobile browser to run an application, as opposed to web applications, and install just like native applications, unlike the products of other hybrid appplication development tools (Cowart, 2013).

## Other considerations when developing an app for a council

When building an application that can be potentially used by such organisations as the city council, there are certain considerations that need to be taken into account. One such consideration is the potential data transfer between the mobile application, and the city council office. Depending, on whether the preference of the local council would be to receive the data on a database table or an MQTT server, there are several ways of ensuring the data is transferred remotely to another medium of storage. It is a machine with messaging software that uses the MQTT messaging protocol, which is a lightweight standard based on a “publish-subscribe” messaging pattern, used to receive a message and then to distribute it to other devices that “subscribe” to the MQTT server (HiveMQTT team, anon). Every device sending a message is considered a “publisher”, whilst every potential recipient is a “subscriber”. The MQTT server uses “topics” in order to determine, which messages should be distributed to whom.

# Evaluation and Reflection

The mobile technology has clearly undergone a huge transformation, and has lately become a major part of the society and lives of many people. As the number of statistics has shown, it is only a question of time until the entire population will be using smartphones to access the internet and carry out various types of operations, ranging from banking to reporting of various types of issues. The use of mobile technology as an additional platform for various types of interaction with the customer has proved to be a successful strategy for several small-to-medium companies that want to stay afloat in the competitive business environment.

One of the business sectors, currently in the process of adapting the mobile technology as a medium of both internal and external communication is the public sector. Government, military, police or public education institutes are a few of the public sector organisations that do not reap the full potential of mobile technology. City council is another example of such establishment. The amount of various issues, along with the increasing costs of eliminating the negative effects of such problems as fly-tipping or potholes, forces several councils to seek an alternative solution, in order to reduce the overhead. The development of a mobile application for reporting of the social issues to the council appears to be a perfect solution, seeing how successful this method of communication seems to be within other business sectors.

When developing an application, important concepts to analyse were the approaches to mobile application development. Out of the three mobile application approaches, one that would seem ideal for a council reporting mobile system is the hybrid approach. The main reason for employing such approach is that an application used as a platform for reporting of the issues should be available for the vast majority of mobile platforms that are available, these days. Despite certain limitations that the hybrid approach would impose, the inability to develop a native application compatible with a variety of mobile platforms or the lack of access to the hardware functionality of the device by the web application proves that the hybrid approach is a perfect combination of native and web applications.

The tools used to develop hybrid applications, was another crucial concept that has been analysed within this report. Despite the huge amount of various hybrid development frameworks, Apache Cordova has been chosen for the development of the project. The further analysis of the information gathered, as a part of the research has proved that Cordova is a leading application development framework, and due to its relatively easy to use toolset it is a preferred tool for many companies. Although Cordova appears to have certain limitations in the user interface department, it is a good solution for simple applications, the functionality and portability of which can be further extended.

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