UWS UNIVERSITY OF THE WEST of SCOTLAND

Development and evaluation of the usability of a Mobile Web system used in youth work by YMCA Pailsey

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1 Abstract

(5 p - 300w)

A pilot study on the development of a Mobile Web system (mobile app and webpage) for YMCA Paisley.

Keywords: booking, mobile booking,

2 Aims

(5 p - 125w)

The main aim of this work is to develop a prototype webpage and a mobile application for the YMCA Paisley and to compare it from the usability perspective with the current system that the organization uses for youth work. In this work the term mobile-web system is going to describe the two software artefacts. This mobile-web system would provide valuable insights for the organization regarding their activity and how it can be improved using the mobile and web technology. Moreover, once the study is finished the organisation can decide if it's worth to commission the development of such a system by a company or not. YMCA Pailsey is a nonprofit organization thus it needs to do a thourugh assesment regarding any investition.

3 Objectives

(10 p - 250w)

The first step is to have one or two meetings with the users (manager and volunteers alike) of the mobile-web system in order to derive a set of requirements. Once this is done a project document should be written containing the following headings: description of project, system requirements, system specifications and software design methods. This document should be made available to all the parts invovled (developers, volunteers, manager) so that they can provide additional input. A literature research should be performed to see if there are similar projects in order to obtain a better understanding of this type of booking system. Apart from development, an evaluation is necessary which is split in two parts: technical and non-technical. To perform the technical evaluation of the software the developers have to write unit tests. The non-technical evaluation uses a structured interview regarding the youth activity done by YMCA Paisley. Once the structured interview is devised, the researcher can interview the manager and the volunteers. The next step is to deploy the mobile-web system for 1 - 2 weeks and do the interview again. The data obtained should be analysed to see the effects of the mobile-web system on the activity of YMCA Paisley.

4 Justification

(5 p - 125 w)

The author believes that there is a gap in the literature for research that takes a booking software and analyzes how this can improve(or not) the activity of an organization. Some of the research that the author has found on booking software focuses on usability and how it can be improved (Gündüz and Pathan, 2012; Burmistrov, 2009). There is something similar Abdulah and Kadim (2016) but the quality of the work is questionable as it will later be detailed in the literature review. Some works are similar but they quality is questionable and old (Alawaer, Awni and AL-Zoubi, 2011; Karthick and Velmurugan, 2012; Abdulah and Kadim, 2016).

5 Review of the literature

(20p - 1700w - 2000w)

5.1 Usability for Mobile-Web

The world of phones and computing changed in 2007 when the first iPhone was released due to the fact that this phone allows users to access Internet, has a touchscreen interface and is essentially a small computer that fits in a pocket. The term *smartphone* is used to describe such a device. At the time of writing of this work (2019) there are about 2.71 billion smartphone users around the world and the number is expected to increase in the future (Number of smartphone users worldwide 2014-2020, n.d.). Such a large pool of users drives big companies to invest in their mobile applications and their websites in order to provide better customer experience (Vagrani, Kumar and Ilavarasan, 2017).

All major airlines companies nowadays offer booking facilities both through their website and mobile app. While the purpose of this work is not related to any e-commerce industry, it is still worth to analyze how these booking systems are designed in order to develop a better mobile-web prototype app. One of the crucial factors for using a mobile-web app from the perspective of the users is *usability* and *user experience*. However, there are different opinions in literature to what these terms mean. To eliminate any confusion that might arise their definitions from ISO 9241-210:2010 (2010) are provided below.

> *User Experience - person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service.*
>
> (ISO 9241-210:2010, 2010, non-paginated)

> *Usability - extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*
>
> (ISO 9241-210:2010, 2010, non-paginated)

The user experience and usability have common characteristics, however, the former is harder to evaluate (McNamara and Kirakowski, 2005) thus we will discuss focus on usability. The design of a webpage is not affected by many variables as it's the case for a mobile app. When designing a mobile app one has to take into account that the user might be on the move, a variable screen size, attention interruptions or poor network connection (Oulasvirta et al, 2005). Following their study on usability for a mobile flight booking app Gündüz and Pathan (2012) have identified usability challenges that are going to be briefly detailed. Icons help in saving screen space and aid in completion of tasks, however, *the wrong choice of icons* leads to confusion, it is suggested to use the same icons on web and mobile app to have consistency. Next, the mobile interface needs to have *a smaller number of steps* compared to the web app to achieve a task (e.g. search for flights) due to the fact that network interruptions might occur. Subsequently, the user inputs in a mobile app should be located towards the bottom of the screen to *favor single hand use of the device*. Lastly, there should not be presented a lot of information

at once (cognitive overload) and the most important bits should be highlighted (e.g. departure and return date for a flight).

5.2 Cross-platform development approach

The mobile app needs to be developed for both major mobile **o**perating **s**ystems (OS), namely, Android and iOS. This implies to write the code for the application twice, once in Java for Android and once in Swift for iOS, this approach is known as native app development. While this is the ideal way to obtain app performance it is not feasible given the total time allowed for a MSc project. Therefore, to save time one can use a **c**ross-**p**latform **t**ool (CPT) where the codebase is written just once and the CPT generates an applcation for multiple mobile OSs. However, there are many CPTs available and it is hard to choose one that best fits a project without prior research. To get an ideea of how many options are available, for instance, in an industry report by Slash-Data (2012) there were discussed more than 100 CPTs. The same report (SlashData, 2012) higlights that developers' satisfaction regarding CPTs has been low, however, the author believes that some CPTs are now mature and better suited for development.

There are 5 types of CPTs: i) app factories, ii) source code translators, iii) JavaScript frameworks, iv) runtimes and v) Web-to-Native. The app factories target non-developers and help them to create a basic app by using drag-and-drop visual elements (the process is similar to solving a puzzle). JavaScript frameworks allows web developers to develop mobile apps using client-side technologies (HTML, CSS and JavaScript) the resulting mobile app is basically a webpage for mobile that can be accessed through a mobile browser. Web-to-Native are similiar to JavaScript frameworks in terms of development technologies just that this CPT packs the mobile website into a standalone mobile app that can be installed on the devices. Runtime CPTs allow developers to write the non-native app using a language like Java and provide a special runtime for executing it for each mobile OS; basically, the native app is comprised of the non-native part and the runtime that executes it. Source code translators CPTs allow one to write the app code in a specific language which later is translated to the equivalent code for a specific mobile OS (e.g. Java/Swift) which in turn is compiled to executable code.

A complex analysis of 10 CPTs was done by Willocx, Vossaert and Naessens (2016) resulting in a series of guidelines for picking a CPT. Apps developed with JavaScript frameworks stress more the CPU and consume more memory than native apps, however, their performance is comparable to their native counterparts. The size of the app installer and the memory consumption is increased when using runtime CPTs compared to a native app. The best choice from a technical perspective it seems *source code translators* that provide performances comparable with the native approach. Apart from these technical considerations, there are some non-technical considerations that can help in decision process: existing infrastructure (Webpages can be directly converted to mobile using JavaScript CPTs), skills of developer (one can pick a CPT that uses technologies he knows), flexibility (some CPTs offer better support to access OS specific features) and type of application (some CPTs are better for developing game apps). Given the above guidelines the author is going to use Flutter (n.d.), a CPT developed by Google, which is a source code translator according to the above classification because the performance of the app will be close to the native counterpart.

6 Methodology

(25 p - 1000w)

6.1 Software Development

As was mentioned before in this research proposal the software system is comprised by two components, namely, a webpage and a mobile application for the two major mobile OSs (iOS and Android). These two software products need to share a common database where all the data is stored. Data is generated by the volunteers using the mobile app and can be viewed by the manager and edited.

When it comes to webpage development and Web Development in general there are many technologies that one can use for both client-side development and server-side development. The look and feel of the webpage does not need to have complex visual features, thus, its development can be done using HTML5, CSS3, JavaScript and AJAX. There are many server-side development languages that one can use like PHP, C# (ASP.NET) or Python frameworks (Django, Flask). However, the author is going to use PHP due to the following reasons: past development experience with the language, it has a large community around it (Cass, 2018), can be embedded in HTML code and the stack **L**inux-**A**pache-**M**ySQL-**P**HP (LAMP stack)is free. Due to the fact that the webpage will contain a login feature and use a database extra security measures are needed. Namely, the login input needs to be sanitized to protect the webpage agains all kind of attacks similar to SQL Injection.

Although MySQL database and PHP are often used together when developing webpages, for this project the author is going to use **F**irebase **R**ealtime **D**atabase (FRD). MySQL is a relational database which stores data in tables that have relationships and constraints among them, however, not all types of data can be easily structured in such a database type. Therefore we have document-oriented databases like FRD which work better for storing 'unstructured' data which is going to be the case for this project. Another reason to use FRD is the fact it integrates very well with object oriented programming languages that are going to be used like PHP and Dart (for the mobile development).

The best approach to develop the mobile apps would be the native one, namely, to write the iOS app in Swift with Xcode and the Android one inJava with Android Studio. However, this approach is time consuming, a macOS machine for iOS development is needed and the author is not very familliar with Swift progamming. Therefore, a cross-platform approach will be put in practice, which means that the codebase for the mobile apps is written only once and the two apps are generated by a CPT. As was presented in the literature review there are many CPT to choose from but for this project Flutter (n.d.) is going to be used. To mention but a few reasons to use Flutter: hot reload (allows code to be injected on a running app; improves development time), the generated apps use native UI elements, open-source, good documentation materials and the possibility to use a familliar **I**ntegrated **D**evelopment **E**nvironment (IDE) like Android Studio. However, the iOS application cannot be published on AppStore due to the fact that now Apple accepts only applications that are written 100% native in Swift.

In order to keep track of all the code files there is going to be used a version control website, GitHub (n.d.). The whole codebase is going to be contained in a repository with different submodules that can be updated independently.

6.2 Data collection and evaluation

In order to evaluate the effects of the mobile-web system on the activity of YMCA Paisley a structured interview is going to be used. In total, a number of 6 persons are going to be interviewed, namely, the YMCA Pailsey manager and 5 other volunteers. The YMCA Paisley has around 25 volunteers, therefore, one fifth of the organization is going to be interviewed. The volunteers are selected based on how long they have been volunteering within the organization, from less experienced to more experienced ones. There are two methods suitable to conduct the interviews, namely, *face-to-face* and via *telephone call.* The author is going to use the *face-to-face* approach because it offers also non-verbal data regarding what the interviewees think about the developed mobile-web system. The author is going to organize two meetings to conduct the interviews, one in week 6 and one in week 12 (see Figure 1). There are no monetary costs involved for the volunteers or the author to come to this meetings because they can be held before/after the weekly organizaton's meeting.

6.3 Ethical and practical considerations

Before a young person starts a YMCA mentorship their parents/tutors must agree that YMCA processes and stores data regarding the young person. Due to the fact that such a mobile-web system uploads the young person's data on the Internet it must be very secure and has to comply with tough government regulations. However, because this is a plot study all the data that is going to be uploaded in the time the system is up is going to be spurious. In this way, there are no legal implications for the organization or for the author if somehow the mobile-web app gets hacked.

7 Work plan

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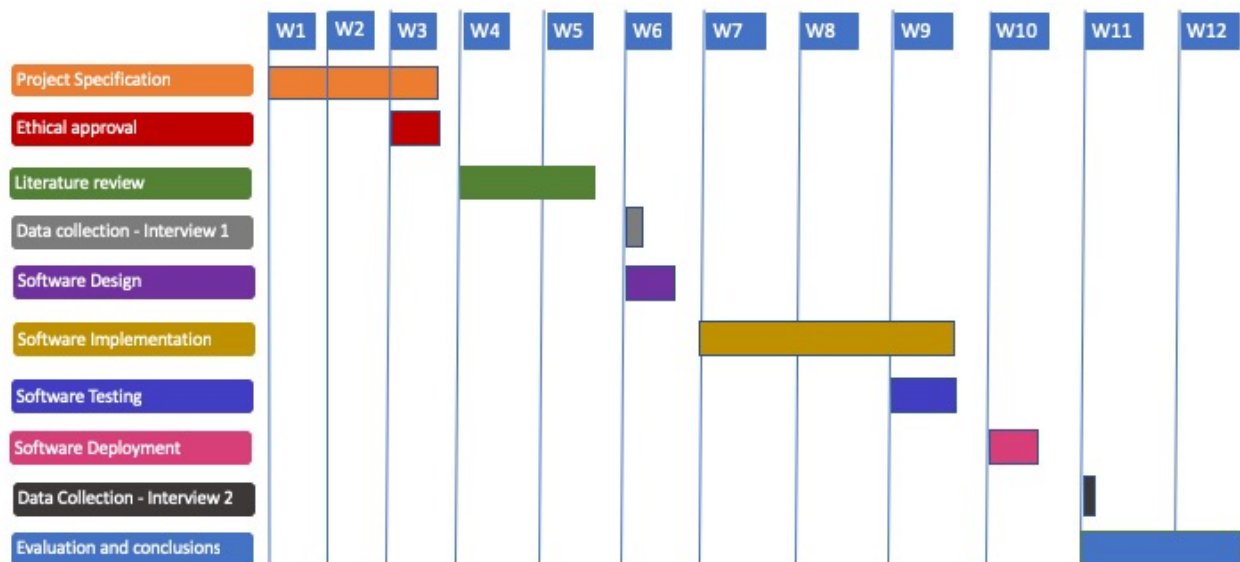

Figure 1: All the activities that need to be undertaken to finish the project

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