A PROTOCOL FOR EVALUATING MOBILE APPLICATIONS

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ABSTRACT
The ease with which mobile applications can now be created has produced an enormous number of applications from which to choose in order to accomplish any given task. It is therefore increasingly difficult for developers to establish the current state of the art when developing new software within an existing application domain, and so this paper proposes a systematic method for determining the present standard. The suggested protocol examines applications both in terms of functionality and other key attributes such as efficiency and usability, and it has been validated in two very different application domains, which are outlined here. The domains were chosen because it is believed that existing mobile applications are inadequate for them, and so the protocol has been used to determine why this is so and to identify ways in which the shortcomings can be overcome.

KEYWORDS

1. INTRODUCTION

The emergence of smart phones, with associated software developers’ kits, has made it possible for a wide variety of mobile applications to be developed in a very short space of time. Mobile phone users can now complete a broad range of tasks from information retrieval to complex calculations, and this phenomenon has been summarised by one of the biggest distributors of mobile applications, Apple, in their current catch-phrase “There’s an app for that”.

The availability of such a diversity of mobile applications can be attributed, in part, to the ease with which they can be created. Whilst the development of traditional applications requires a large investment of time and money, mobile applications can be developed quickly and with relatively little cost. Another contributory factor is the ease of distribution, facilitated by the centralised dissemination channels offered by the major phone producers, such as the App store from Apple and the Android marketplace from Google.

The rapid growth in the development of applications has made it increasingly difficult for developers to establish the current standard of mobile applications available for a given task; an important first step in the development of commercial applications. A systematic evaluation methodology is therefore proposed to address this issue and to allow developers to establish the present state of the art within a given application domain. This methodology is outlined in Section 2.

The protocol has been validated through its application to two contrasting domains: spreadsheets and diabetes management. In both cases, the standard of applications currently available is believed to be inadequate and so there are a number of opportunities for improvement. Section 3 outlines these domains and highlights some of the issues that exist. Section 4 then concludes this paper.
2. EVALUATION PROTOCOL

The steps of the evaluation protocol are as follows:

1. **Identify all potentially relevant applications.** There are a number of ways to conduct a search for appropriate applications, including a standard web search. Current software distribution methods make this easier as most of the major mobile phone platforms now have an associated online application store, such as the App store from Apple and the Android marketplace from Google.

2. **Remove light or old versions of each application.** Many software developers release trial versions of their systems, which are often free. Some of these versions include only a subset of the functionality offered by the full application whilst others allow full access to the application but for a limited time period. These types of applications should be removed.

3. **Identify the primary operating functions and exclude all applications that do not offer this functionality.** The primary operating functions include frequently used functions and also occasionally used functions that are essential for the correct operation of the system in a desired context. For example, the initial system setup might include language and currency settings that would depend upon the country of use.

4. **Identify all secondary functionality within the remaining apps.** In addition to the primary operating functions, mobile applications will offer users a range of secondary functionalities which can enhance the application. A thorough knowledge of these functions will enable the application developers to see what functionality is available and may present opportunities for missing functionality to be included in future applications.

5. **Evaluate the remaining applications in terms of:**
   a. **Keystroke level modelling** (Card et al., 1983) to estimate the time taken to complete certain tasks. This will provide a quantitative measure of efficiency of the applications.
   b. **Heuristics** Standard heuristics (Nielsen and Molich, 1990) can be used to evaluate desktop applications. The following heuristics, proposed by Bertini et al. (2008), can be used for the evaluation of mobile applications:
      - Visibility of system status and losability/findability of the mobile device;
      - Match between system and the real world;
      - Consistency and mapping;
      - Good ergonomics and minimalist design;
      - Ease of input, screen readability and glancability;
      - Flexibility, efficiency of use and personalization;
      - Aesthetic, privacy and social conventions;
      - Realistic error management.

3. CASE STUDIES

Two application domains have been selected with which to validate the above protocol. The first is the spreadsheet application, which can allow users to complete a wide variety of tasks from financial planning to statistical analysis. The second domain has much more limited primary functionality: diabetes management software allows users to manage their condition by logging daily information. The following sections outline these two domains.
Spreadsheets

Spreadsheets are ubiquitous software tools used for a variety of tasks from financial planning to statistical analysis. The mobile nature of business is increasing the need for users to access spreadsheets while on the move. Therefore mobile spreadsheet applications are becoming more important and the requirements of users are expanding to include more advanced functionality such as specialist functions and features.

An examination of this domain has been conducted for the iOS platform and identified a number of issues that should be addressed in order for mobile spreadsheet applications to reach their full potential. A full report of these findings will be published in due course.

This evaluation has found that there are many differences between mobile spreadsheet apps. Some applications allow users to view existing spreadsheets on a mobile device while others only allow users to create new spreadsheets in a mobile context. The method by which the user creates the spreadsheet also changes between apps. A Keystroke level modelling evaluation of the applications has shown that the number of keystrokes required to create a simple spreadsheet can vary by as much as 100%.

This evaluation has also identified a number of guidelines that developers should follow to improve the usability of mobile spreadsheet apps. It has been found that a number of applications do not optimise the input method for the data being entered, therefore complicating the way in which the user enters data into a spreadsheet. By considering the most common type of data to be entered into a cell, the developers could optimise the data input methods for inserting particular types of data.

The limited screen size of mobile devices has made it difficult for users to relate the section of the spreadsheet displayed on screen to the overall document. Similar problems were seen when looking at large web pages or large images (Burigat et al., 2008). In these domains the use of a mini-map has been proposed where a scaled down version of the document is placed in a corner of the screen. On this map the currently visible section of the document is highlighted.

The results obtained so far are limited to the iOS platform featured on mobile devices from Apple, including the iPod touch and the iPhone, as this is a commonly used platform. It is intended to do a similar study of mobile spreadsheet applications available on the Android from Google and the Blackberry.

Diabetes Management

Type 1 diabetes occurs when the insulin producing cells of the pancreas are destroyed leaving the body unable to control its blood glucose levels. People with type 1 diabetes have to take insulin regularly to try to stop their glucose levels from becoming too high, but if they take too much insulin their glucose levels may also drop too low, causing a number of symptoms including dizziness and palpitations.

The vast majority of patients with type 1 diabetes in the UK administer their insulin through multiple daily injections, and the remaining proportion use insulin pumps. Most people are offered a structured education programme, such as DAFNE (2011), to help them self manage their condition. This teaches them how to calculate the amount of insulin to administer at each meal according to the current blood glucose level, number of carbohydrates consumed and various other factors such as time of day, exercise and illness. The daily glucose levels are then stored in a hand-written diary which is shared with the healthcare team at regular intervals. It is surprisingly difficult for patients to keep their blood glucose levels within the target range, and yet failure to do so can lead to serious complications which are a huge burden on the health service.

Most insulin pumps come with dose calculators to help patients determine how much insulin to administer, but people on multiple daily injections do not usually have this support, and tend to do the calculations themselves. This trend is beginning to change, with the advent of glucose monitors such as the Accu-Chek Expert, manufactured by Roche, which does have a dose calculator, but its prohibitive cost has meant that it has not yet become widely used.

This need for electronic decision support, combined with the recent growth in smart phone use has led to the development of a plethora of diabetes management applications: a recent search on the App store returned 231 applications associated with diabetes, which is quite extraordinary considering the number of barriers that have inhibited the adoption of telemedicine systems for diabetes management in the past (Belazzi, 2008,
One of the key barriers has been usability, and another has been the economic implication, but the standardisation of controls and rigid human interface guidelines imposed by the providers of most phone platforms has already had a huge impact on usability, and the ease with which software applications for mobile phones can now be developed and distributed helps to mitigate against the economic factors. The protocol described in this paper has been used to evaluate the 231 iPhone applications, and the initial filtering on primary functionality reduced the number down to 8 applications, which were further tested using KLM and heuristics. This produced some revealing differences, especially in data entry methods, and data visualisation. A number of usability problems associated with the primary tasks were also identified. Even a simple task, such as emailing data, resulted in a huge variability in the number of keystrokes, with some applications requiring a full email address to be typed in (which can be a demanding task on a phone with a small keypad) whilst others simply used a default address. The survey of secondary functionality has now been summarised in a matrix, which will be assessed by potential users in order to design an application which maximises usability whilst providing the key functionality desired by most users.

4. CONCLUSIONS

This paper presents an evaluation protocol for establishing the standard of mobile applications within a particular application domain, an important first step during the creation of a new application. The ease with which mobile applications can be developed has meant that the number of applications that are is increasing dramatically. Consequently the task of establishing the current standard of applications is becoming more difficult.

The proposed protocol is currently being applied to two application domains; spreadsheets and diabetes management. These two domains were selected as they each represent a different category of application; a general purpose application and specific application domain. By applying the protocol to both of these domains the protocol will be validated while demonstrating its flexibility.

5. REFERENCES