Dictionary based text entry method for mobile phones

Mark Dunlop and Andrew Crossan

Extended Abstract

Introduction

Mobile phone networks are increasingly supporting the transmission of textual messages between mobile phones (e.g. SMS short messages). It is reasonable to envisage increased use of these facilities and increased integration with other electronic services such as e-mail and large screen pagers. However, the use of textual messages from mobile phones is inherently limited by the very poor text input facilities: mobile phones only have 12 main keys with 5-10 additional function keys (compared to the smallest laptop keyboard of around 65 keys).

The traditional approach to text entry on a mobile phone is to overload the number pad with characters so that, for instance, the number 2 is mapped to A, B and C. When in text entry mode the end user presses 2 once for an A, twice for a B, thrice for a C and four times for a 2 (this is actually a simplification as many phones have more than four characters mapped to each button). This is further complicated by a problem in differentiating some key presses, for example 222 could be a C or the two characters AB. This is usually solved by forcing users to wait around one second before entering subsequent characters on the same key, so AB is keyed by 2-22 where '-' is a one second pause. Clearly this is a slow method for text entry and likely to be highly error prone.

This paper introduces a new form of text entry based on single presses of each key for each character and resolution of whether a 2 is an A, B or C being carried out in the context of a whole word with reference to a large dictionary of valid words. The paper also reports results of initial experiments which indicates this could be a faster input method for long textual messages.

Fig 1: Mobile phone modelled in experiments

Overview of text entry method

This section will start with a worked example of entering a short piece of text using the traditional and an ideal dictionary-based system, it will then give an overview of the ambiguity problems and proposed solution plus a proposed extension to the basic dictionary approach.

To enter the phrase *see you at the pub* on a traditional mobile phone would involved the following sequence of keys 777722-22 1 99966688 1 28 1 84433 1 78822 [1]. Under an ideal implementation of the dictionary model it is proposed that the user enters 733 1 968 1 28 1 843 1 782 and the dictionary will disambiguate, say, 968 to *you* as the most likely word from the possible set of words which can be made from WXYZ as the first letter, MNO as the second and TUV as the third.

Of course this approach faces an inherent weakness, what if the most likely word from a given sequence of key presses is not the word the user is wanting to enter. The proposed solution to this is to present the user initially with the most likely word when (s)he presses the space button (1). If this is not the word the user is wanting, (s)he presses the space button repeatedly until the desired word is shown then (s)he can carry on with the message as normal.

This approach requires a large dictionary of words in the language of usage of the phone and, furthermore, all morphological variants of these words which are used in the language together with information on how often each variant is used in the language (i.e. some measure of how common a word is, so that *you* can be proposed over *wot* (assuming *wot* is a valid word!)).

An extension of this model would be to give the user the ability to carry out automatic word completion, much like many Internet browsers now support URL completion. When a user starts a word the most likely word with that start could be proposed as a suggested word for auto-completion thus further accelerating the input process.

Initial experiment

While clearly reducing the number of keystrokes required in an ideal implementation, it is not clear whether the number of keystrokes would actually be reduced for actual messages based on real distribution of words in English. Furthermore, the dictionary based entry method may involve significantly higher cognitive load which would undo any benefit gained from fewer keystrokes. Finally, it is not clear whether a suitable set of statistics could be derived from usage information. To gain an initial feel for these a test experiment was conducted using students in the university entering messages on a Java on-workstation emulation of a mobile phone.

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[1] spaces are used around the 1 key to separate words for ease of reading, 1 acts as a space on the modelled mobile phone

Since the user experiments were to be conducted within The University of Glasgow, it was decided to base the dictionary and statistical estimates of usage of words on a local newspaper. We had access to six months of *The Herald* [2] on-line and carried out analysis to extract various lists of the most common words from the collection. The final experiments were based on an 8000 word collection.

In this pilot study 14 users were to enter three sentences on a mobile phone emulator twice: once using the traditional multiple click method and once using the proposed dictionary based method. The users were split into two groups, half of whom did traditional first, half dictionary-based. All groups were given a short period of training in each method just before using that method.

The results showed statistically significant differences for only one of the sample sentences: the longest sentence proved to be significantly faster with the dictionary based method than with the traditional method. Furthermore NASA TLX tests showed no statistically significant differences in workload between the two methods and a general preference for users to the new method.

Discussion

Although the experiment attempted neutrality by using sentences which were written by a third party to be "in the style of a message you would be likely to send by phone message", there were only three sentences in this provisional experiment and it is not clear that these are the kind of message that users would actually send using a mobile phone with better text entry. A more detailed laboratory experiment has to be conducted with more users and more test sentences to make conclusive design decisions. Furthermore, after the design has been refined in the laboratory longitudinal studies would be required of users using the system implemented on a mobile phone.

The use of a national newspaper to gain statistical information worked well but was biased by the language used by a newspaper, for example political terms and political names were more prominent than is likely in mobile phone messages. This is likely to be a bootstrapping problem of the dictionary based phone system, ideally the dictionary would be based on the use of English for sending messages by phone but the current method is so slow to be distorting those message (e.g. by use of very short abbreviations between friends).

[2] A national newspaper published in Glasgow.

A related, but somewhat more serious, issue is the flexibility of the dictionary-based phone system as only words in that dictionary can be entered. There are many solutions to this which would have to be experimented on: the dictionary could be augmented with proper names from, say, telephone directories and birth registrars as well as the users' own telephone book if this could be imported from another device. However, for full flexibility a mode based system would be required where users could force the phone into traditional mode to learn words not in the dictionary. The use of users' own telephone directories also introduces the notion of adapting the statistical model of likelihood for each word to take into account previous usage, so that, for example, one's partner's name automatically becomes easier to enter over time.

Finally, the experiments were conducted on an on-screen emulator since reprogramming mobiles phones is prohibitively costly. However, there were some effects of this, for example double- and triple-clicking with a mouse is considerably quicker and easier than on most phone keypads while users are likely to be more at home with reactive systems on a computer screen than on a telephone.

Conclusions

This paper has introduced a new method of text entry using the limited keyboard of a mobile phone. The entry method, based on use of a dictionary with occurrence information, was implemented and compared with the traditional entry method on a desktop screen based phone emulator. The experiments, though initial in nature, point to a promising outcome and showed limited statistically significant results in favour of the dictionary based text entry method.