Penerbit Akademia Baru

Journal of Advanced Research in Computing and Applications

Journal homepage: www.akademiabaru.com/arca.html
ISSN: 2462-1927

The Development of Proactive Actions Women Safety Application using Direct Combination

Open Access

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ABSTRACT

Direct Combination is a user interaction technique that allows users to manipulate objects in a system environment. It presents a narrower range of interactions which may be helpful in situations where a burden of information may not be helpful to users. This research proposes the usage of Direct Combination to develop an application that allows women to view a list of useful actions that can be taken whenever they feel in danger, a proactive action application rather than the more common and reactive panic button applications. The application allows users to select an icon to view an expanded list of situations related to the chosen icon or to combine two icons which return a customised list of situations. The usage of icons promotes recognition rather than recall in users and context-sensitive results from Direct Combination may also help users find needed information in dangerous situations quickly.

Keywords:
Direct combination; graphical icons; mobile application; women safety; personal safety

1. Introduction

Protection of women is some of the biggest concerns among lawmakers. Laws concerning the protection of women against violence and sexual assaults have been declared and many programs have been implemented to reduce the number of cases in violence against women [5]. In the ICT field, efforts toward the same goal are also being taken where applications are developed focusing on promoting personal safety. There exist multiple 'panic button' applications targeted for women that are to be used when feeling in danger, but the operation of these applications relies on technical factors such as availability of mobile and GPS satellite coverage. Many of these applications are also linked to local authorities such as the police, making the usage of them reactive - only to be activated when users are already in danger.

There is a lack of mobile applications that features instructions that can be taken to keep oneself more prepared for danger. Currently, to be informed of proactive actions that can be taken in dangerous situations, a search engine query must be conducted. However, feelings of anxiety and fear that are associated with panic may be felt when one is in danger [15], making the process of finding the right information a challenge. Therefore, this paper documents the development of a proactive women safety application using the user interaction technique of Direct Combination,

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which among others has the features of narrowing the scope of results based on users' needs. This may be helpful in helping women in panicky situations find their needed information faster.

2. Literature Review

This research uses Direct Combination, a user interaction (UI) technique that was first proposed by Simon Holland and Daniel Oppenheim in 2002 [8] as a means of extending the capabilities of Direct Manipulation. The development of the application also includes decisions on the types and designs of icons to represent dangerous situations that may be faced. Similar mobile applications and other works on women safety were also reviewed for an insight on situations and actions that can be taken.

Direct Combination

In Direct Manipulation, users manipulate objects such as buttons and menus to execute the operation that they want. Direct Combination as an extension to this user interaction technique focus not on a single interaction object, but on pairs of interaction objects [9]. Direct Combination employs the technique of drag and drop with the item being dragged referred to as "visitor" and the item it is being dropped on called as "target". In a Direct Combination environment, another tool called a toolglass is also employed where this tool is sandwiched between the visitor and the target and as a result will list down available operations relevant to the two objects [9].

Direct Combination offers advantages such as presenting to users only relevant options to choose from, instead of unrestricted space of commands [8]. In a situation where users know what objects they want to use (for example a printer), but are not sure what operations can be done with it, Direct Combination can help list down only the available operations that can be done, promoting recognition rather than recall [8].

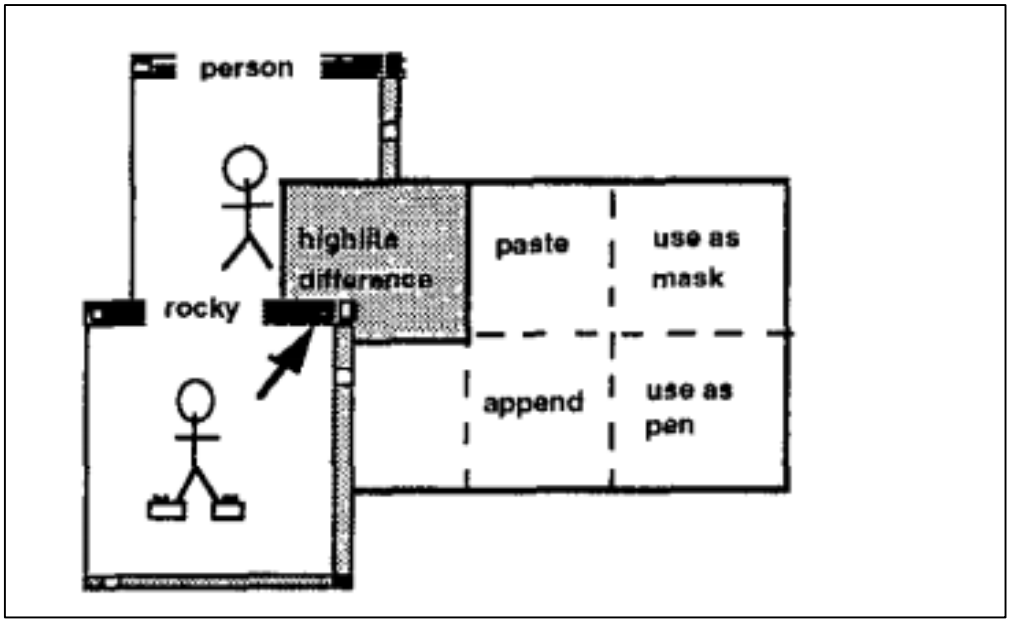

Fig. 1. Implementation of Direct Combination with the *toolglass* showing list of available options [9]

Icons

Icons can be defined as small pictures on the computer screen to represent objects, operations or a collection of files [4]. Icons can introduce aesthetic values to software and promote curiosity [7]. Interface via icons can also communicate ideas and actions to users in a limited visual space [6].

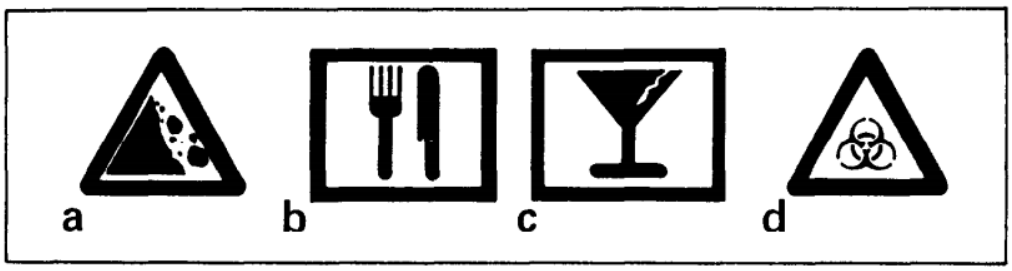

Fig. 2. Resemblance (a), exemplar (b), symbolic (c) and arbitrary icons (d) [14]

There are attempts to categorize icons based on their functions and forms. Among the earliest was a work by Rogers in 1989 which categorized icons into four categories namely *resemblance*, *exemplar*, *symbolic* and *arbitrary* [14]. Resemblance icons show the concept it is painting through a similar image, for example, the road sign used for "rocks falling" [14]. Exemplar icons on the other hand focus on the prominent characteristics of the referent as evidenced by having a fork and knife as symbols for "restaurants" [12]. Symbolic icons refer to a higher level of abstraction than the image used, example being a broken glass image to imply "fragile" [17] and finally arbitrary icons just like the name implies are arbitrarily chosen images such as the radioactive sign [17].

Advantages of using icons have been documented in many kinds of literature. Wiedenbeck in her 1999 paper highlighted that icons can lead to faster recognition, allow users to devote more attention to their primary tasks and may aid the learning of a system [18]. As icons are inherently pictures, they are easier to recognize and process as compared to words, and they are also easier to recall [3]. Horton in his book [10] as cited by Siau, [16] also mentioned that icons enhance productivity and reliability, can speed search, reduce the necessity of reading and are more internationally recognizable among others.

Related Works on Personal Safety

Mobile applications developed for personal safety mostly share similar characteristics; they allow users to set a list of emergency contacts and come equipped with a panic button. Clicking on the button will send alerts to the specified contacts, together with a GPS-tracked current users locations [2]. There are also some applications with more features such as an app called "Companion" that can detect when a headphone is yanked out of a phone or the phone falls to the ground or the user starts running. It will then check in with the user whether they are in danger where a failure to answer will trigger alert messages to assigned contacts [11]. Some applications also have features of contacting the authorities when the panic button is pressed.

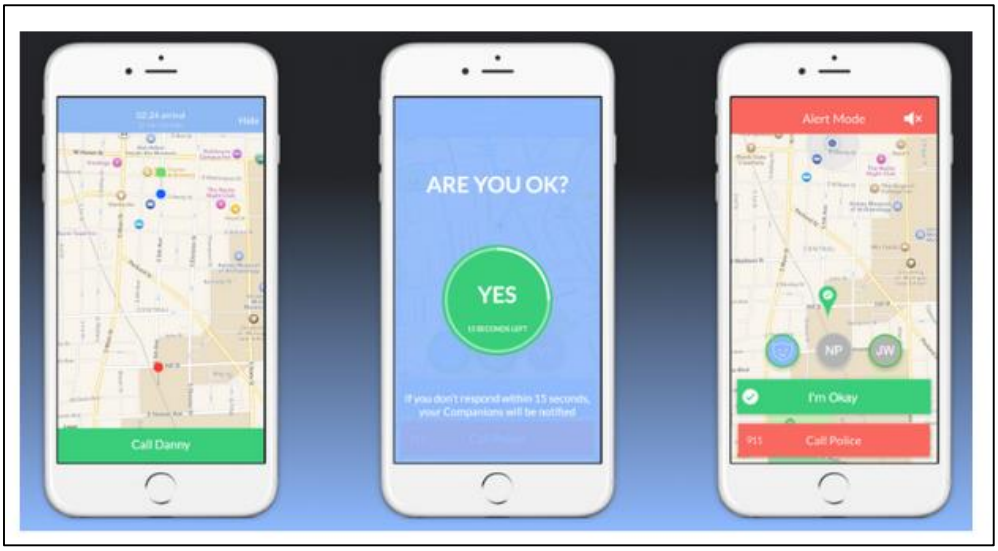

Fig. 3. Screenshots of Companion application [11]

While the list of mobile applications that have been reviewed in this research is not exhaustive, a theme can be discovered whereby the applications focus on contacting predetermined contacts or the authorities during emergencies, therefore, relying on technical factors such as availability of network and GPS coverage. These applications are also reactive - the panic buttons are meant to be used when users are already in danger.

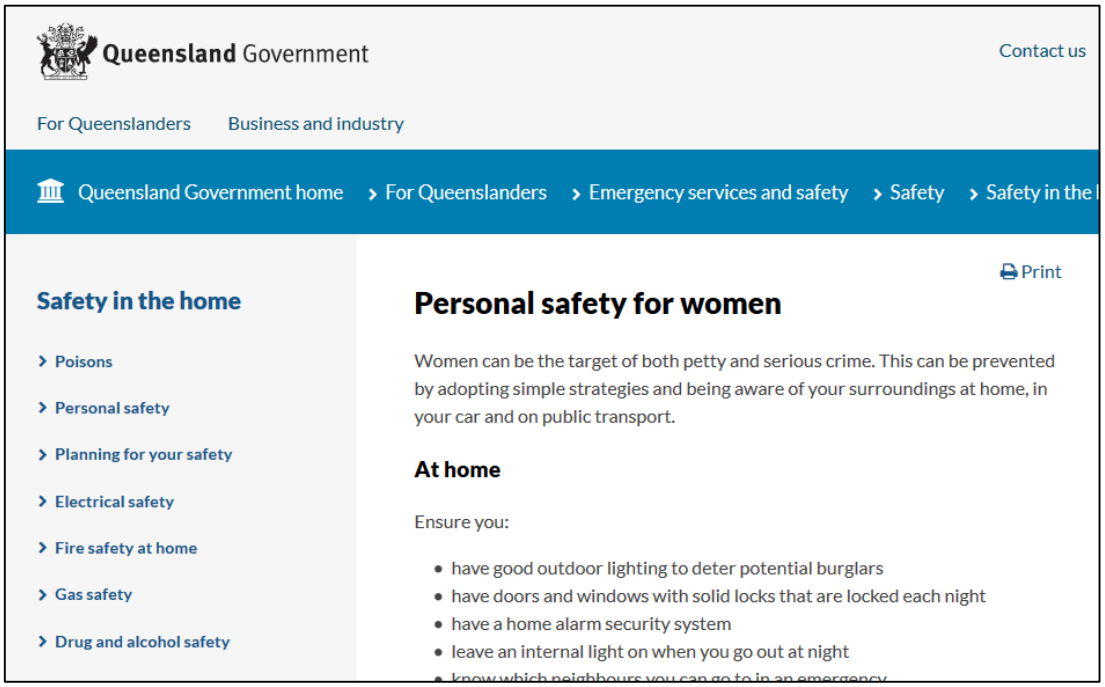

Fig. 4. Personal safety tips for women on Australia's Queensland Government website [13]

Proactive safety tips that are practical can be found online by searching on search engines. For example, an article published by Cosmopolitan magazine and available on the web listed down 21 safety tips for women including for places such as hotel rooms and car parks [1]. Other websites and even local governments have also listed some personal safety tips to be followed and they are available online (Figure 4). Some of these materials, however, are not sorted according to situations,

and browsing web pages are also reliant on the availability of network and users being composed enough in potentially dangerous situations to do search engine queries.

3. Findings

Based on the readings of common dangerous situations that may be faced by women and the tips that can be taken when facing them, eleven situations have been recognized. Table 1 shows the list of identified situations. From the list of situations, four categories of situations were determined. Each situation may have more than one categories applied to them. In the process of designing the application, up to nine categories were first considered but finally, only four were selected to lessen the burden of choice on users. These four categories were then assigned an icon each.

Table 1
Dangerous Situations for Women and its Categories

Situations	Categories
Car broke down	car
Car accident	car, danger
Being followed by a car	car, criminal
At the parking	car, alone
Being followed	alone
Snatch theft	criminal, danger, alone
Molestation	criminal
Sexual harassment	criminal, alone
Kidnapping risk	alone, danger
Walking alone	alone
In the elevator	alone

Icons for all four categories were adapted from files downloaded through a popular icon search engine and marketplace, *Iconfinder*. These icons were edited to have contrasting background colours with each other and to contrast against a light-coloured mobile application background. Figure 5 shows the pictures of the four icons. The categories of 'car' and 'criminal' are represented by resemblance type icons with the two icons depicting the images of a car and a criminal respectively. Meanwhile, the more abstract categories of 'alone' and 'danger' are represented with symbolic type icons - an exclamation mark icon is paired with 'danger' while a single person icon is associated with 'alone'.

Fig. 5. Categories of dangerous situations and its icons

Figure 6 (left) shows the main page screen of the application. Clicking on any of the icons will bring users to the list of situations related to the icon's category. As an example, Figure 6 (centre) shows the screen that is displayed to users that click on the 'alone' icon and Figure 6 (right) shows the instructions given when clicking on "Walking Alone" situation.

Fig. 6. Screencaps of the application

In line with the Direct Combination user interaction technique in which users can combine a pair of items together to get more context-sensitive results, a combination of two icons in this application narrows the list of situations presented to users. A user can drag any of the icons on the screen (visitor) and drop it to any of the remaining three icons (targets). While this is a different implementation than using a *toolglass* as recommended by the original Direct Combination paper, it is still an equivalent execution of the user interaction technique.

Table 2 shows the list of icons combinations and the situations associated with them with Figure 7 showing the screen shown to users that drag and drop the icons of 'car' and 'criminal'. The background colour of this screen is changed to light pink as compared to the default light blue background of the application. This is to distinguish to users the results between a select operation (clicking on an icon) and combine operation (dragging an icon over another icon).

The application was developed through Unity software with some image editing completed using Adobe Photoshop. The application was then exported into .apk format and was successfully launched using an Android phone with the technical specifications listed in Table 3.

Table 2
Combination of Two Icons and its Situations

Combinations	Situations
alone + danger	Snatch theft
	Kidnapping risk
alone + car	At the parking
	Being followed by a car
alone + criminal	Snatch theft
	Being followed by a car
	Molestation
	Kidnapping risk
	Sexual harassment
danger + car	Car accident
danger + criminal	Sexual harassment
	Snatch theft
car + danger	Car accident
car + criminal	Being followed by a car

Table 3
Technical Specifications of Android Phone Used

Category	Specification
Model	Vivo
Android Version	7.1.2
Processor	1.8GHz Snapdragon
RAM	4GB

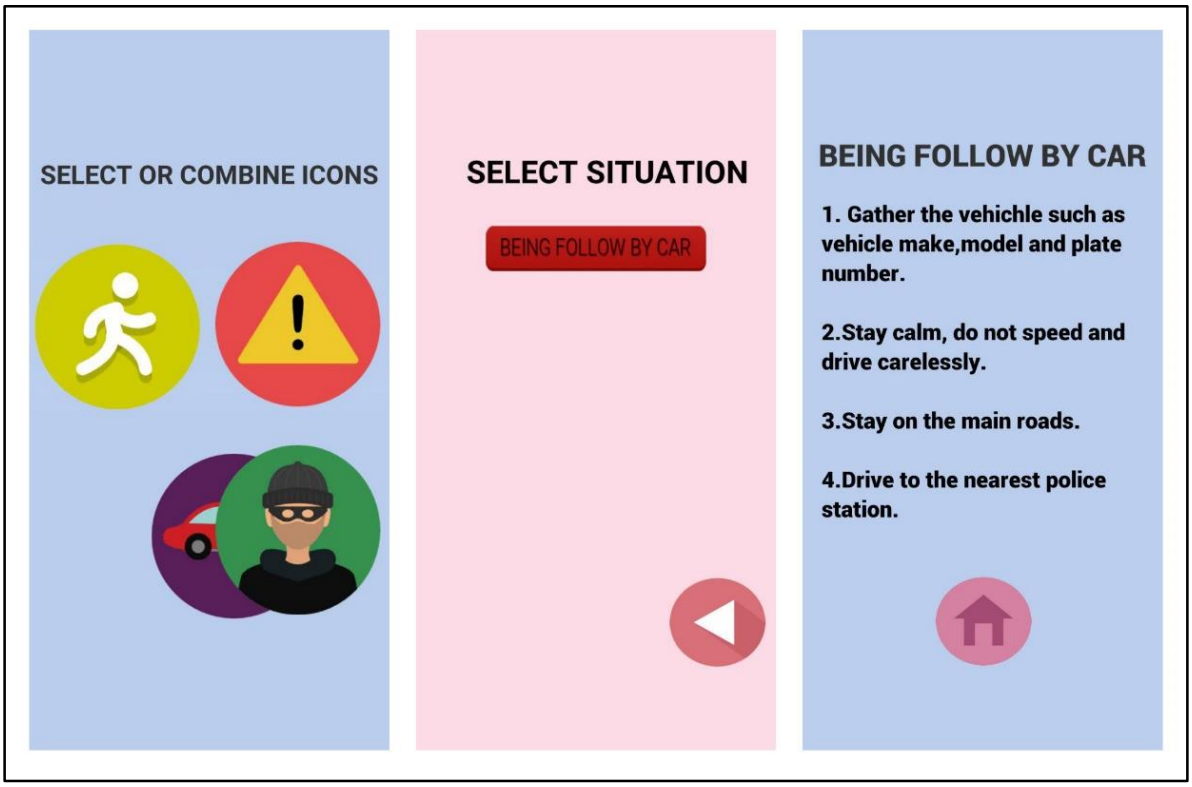

Fig. 7. Results of combining car and alone icons

4. Conclusion

This paper documents the development of a mobile application for a proactive women safety application using Direct Combination user interaction technique. It allows users to view a list of recommended actions that can be taken in precarious situations. From the list of twelve risky situations that have been identified, four overlapping categories were determined namely 'car', 'criminal', 'alone' and 'danger'. Four icons were then chosen to represent the respecting categories. The use of icons, as opposed to menus, may help users to recognize (rather than recall).

The user interaction design of the application allows users to manipulate it in two ways, clicking on an icon to list all related situations or combining two icons via drag and drop for a tailored down view of situations relevant to the two chosen icons. This demonstrates the implementation of Direct Combination, and it may help users experiencing panic in dangerous situations to quickly view the list of recommended actions that can be proactively taken to keep them safe. In the future, the addition of reactive features that are common in 'panic button' apps such as sending alert messages and location to predefined contacts or the authorities when two icons are combined may be valuable, allowing users to have a more comprehensive personal safety options in one single application.

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