Technical Disclosure Commons

Defensive Publications Series

January 08, 2015

ADAPTIVE USER INTERFACE BASED ON EYE TRACKING

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ABSTRACT

An adaptive user interface system can be used to dynamically adapt a graphical user interface (GUI) for a user. The system is based on the observed ability of the user to focus on various GUI elements presented on the interface. The system is comprised of two subsystems, an eye tracking module and an interface adapter. The eye tracking module captures successive images of user's eye focus locations on the interface over a predefined time period. The module then determines a set of interface locations most focussed on by the user and transmits them to the interface adapter. The interface adapter adapts or realigns the graphical user interface according to the received focussed locations.

PROBLEM STATEMENT

While viewing a user interface on a display screen, a user usually focuses on only certain important visual elements. The graphical user interface can be a web page, gaming screen, login page, document etc. A user's focus is primarily on those areas of the interface which have the highest importance to the user. For example, on a web page, a user generally focuses on the main content portion instead of areas such as side bars and suggested content. Eye tracking and user gaze detection technologies associated with electronic display devices, such as a front facing camera, can be used to determine the user's focus on the display. These technologies are helpful in estimating the degree of executive control or potential attention deficit possessed by a user to focus saccadic eye movement on fixed targets on a display screen.

An adaptive user interface system that dynamically adapts a user interface (currently being viewed by a user) according to where the user focuses his gaze is disclosed.

ADAPTIVE USER INTERFACE SYSTEM

The systems and techniques described here relate to an adaptive user interface system. The adaptive user interface system can be implemented for use in an Internet, an Intranet, or another client and server environment. The system can be implemented locally on a client device or implemented across a client device and server environment. The client device can be any electronic device, e.g., a laptop, mobile phone, computer, tablet, wearable, etc.

FIG. 1 illustrates an example method for dynamically adapting a graphical user interface according to where a user focuses his eyes on the interface. The method can be performed by a system that adapts a user interface according to the user's eye gaze, for example, the adaptive user interface system.

The system comprises an eye tracking module that captures successive images of user's eye focus location on a user interface over a predetermined time period (Block 102). The eye tracking module tracks the user's gaze using technologies such as IR sensors along with front facing camera modules. The module may gauge both user attention deficit and user focus locations on a display screen. The eye tracking module helps in determining the user focus on the areas on a display screen of "highest meaning." A user's eyes usually dart back and forth between these areas of importance, tracing a characteristic path for a given type of image. These areas of importance on the display screen may reflect graphical user interface elements such as an image, soft button, text field, etc.

The system then determines a set of target locations most focussed on by the user during the predetermined time period based on the successive captured user interface locations (Block 104). In order to determine this, the system creates a histogram which depicts the distribution of time that the user's eyes focus on the different focus target locations (graphical/visual elements). The eye tracking module may also be capable of calculating ballistic trajectories, as well as identifying specific fixation points.

The eye tracking module then transmits the top-most user focus locations to an interface adapter in the adaptive user interface system. The interface adapter adapts the user interface visual elements according to the top most focussed locations (Block 106). The system may create a modification action for the user interface elements. This includes aligning visual elements in the user interface so that elements that are receiving the highest amount of attention line-up accordingly to the user's focus locations. In some cases, fewer or more elements can be presented to the user according to their estimated attention deficit or focus control.

For example, on GUI for a social networking application, a user's eyes focus on his/her "news feed." Other elements, e.g., profile, the settings menu, and advertisements, receive much less focus from the user. The system may modify the presented GUI by reducing or even hiding some of the lesser focussed GUI elements so that the "news feed" element remains front and center for the user. This optimizes the readability of the interface. In some instances, a user interface may assign predefined focus thresholds to certain GUI elements. These focus thresholds require a minimum amount of the user's eye focus before the system can realign and be presented more prominently to the user. For example, an email client may annotate that its sidebar requires 30% focus time before it can be realigned in the user interface. If the user's eye focus on the sidebar is greater than 30% of the time, then the system optimizes the alignment of the sidebar in the user interface.

FIG. 2a illustrates a graphical user interface 200 of a login screen currently being viewed by a user. The eye tracking module tracks the user’s eye focus locations. The focus locations may include the visual graphical elements on the login screen, such as “Captcha” 202, “  ” 206, “Continue” 208, “Reload” 210 etc. The eye tracking module captures successive images of the user’s focus target locations on the GUI 200.

After tracking the user’s eyes focus locations on the GUI, the system identifies the GUI element that the user focused on for the most amount of time. FIG. 2b depicts a histogram, generated by the eye tracking module, which shows a hypothetical distribution of focus times for each of the GUI elements. If the system determines that the user’s eye focus on the GUI element 206 satisfies a predefined threshold of time, the system authenticates the user. This predetermined threshold may be expressed in percentage of overall focus time. As an example, the limit specifies that the user’s eyes focus time must be at least 70 % on the GUI element 206. If the user focuses on the GUI element 206 for at least 70% of the time when on the authentication screen, the system confirms that a valid user is present in front of the login screen and authenticates and logs in the user and transitions the interface to the next page. As shown in FIG. 2b, the element 206 receives the highest amount (80 %) of the user’s focus among all the GUI elements present on the interface. The interface adapter receives the focus time values from the eye tracking module. The adapter then authenticates and logs in the user and transitions the interface to the next page.

FIG. 3a illustrates a graphical user interface 300 of an email client currently being viewed by a user on a display screen of an electronic device. The interface has four major GUI elements: To field 302, Cc field 304, Subject field 306, and Text field 308. The eye tracking module tracks the user's eye focus locations on these GUI elements by capturing successive images of the user's focus target locations. After tracking the user's focus locations on the GUI elements, the eye tracking module creates a histogram depicting the distribution of time the user focused on the various GUI elements.

FIG. 3b illustrates the histogram generated by the eye tracking module that depicts the percentage distribution of the user's focus on each of the GUI elements. As shown, Text Field 308 has the highest amount of focus time from the user (80%). These GUI elements may be annotated with pre-defined user eye focus times. For example, the user interface element Text field 308 may have a pre defined "user focus threshold" of 60% of the overall focus, over a predefined time period. The eye tracking module sends the determined focus values to the interface adapter. If the user's gaze at the text field fulfills the criteria, the interface adapter causes the user interface to realign.

FIG. 4 depicts the re-aligned user interface where the text field 408 is expanded, optimizing the visual element that the user focused on the most. Similarly To field 420, Cc field 404, and Subject field 406, have been reduced in size to make room for the increase in size of the text field 408.

The adaptive user interface system can also be implemented in the field of video games. The eye tracking module can identify which points in a video game scene users focus upon the least (focus attention deficit). This information can be utilized to embed enemies or obstacles in those locations to create a more stimulating gameplay.

The subject matter described in this disclosure can be implemented in software and/or hardware (for example, computers, circuits, or processors). The subject matter can be implemented on a single device or across multiple devices (for example, a client device and a server device). Devices implementing the subject matter can be connected through a wired and/or wireless network. Such devices can receive inputs from a user (for example, from a mouse, keyboard, or touchscreen) and produce an output to a user (for example, through a display). Specific examples disclosed are provided for illustrative purposes and do not limit the scope of the disclosure.

FIGURES

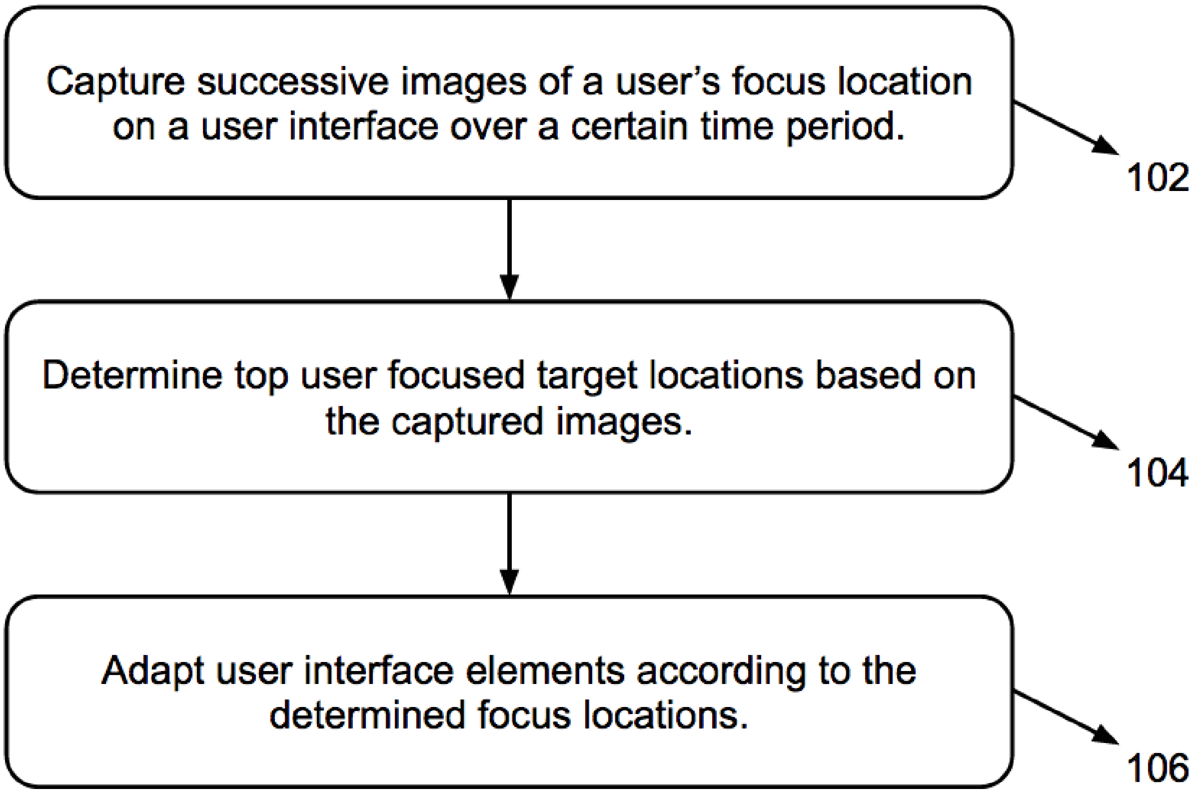
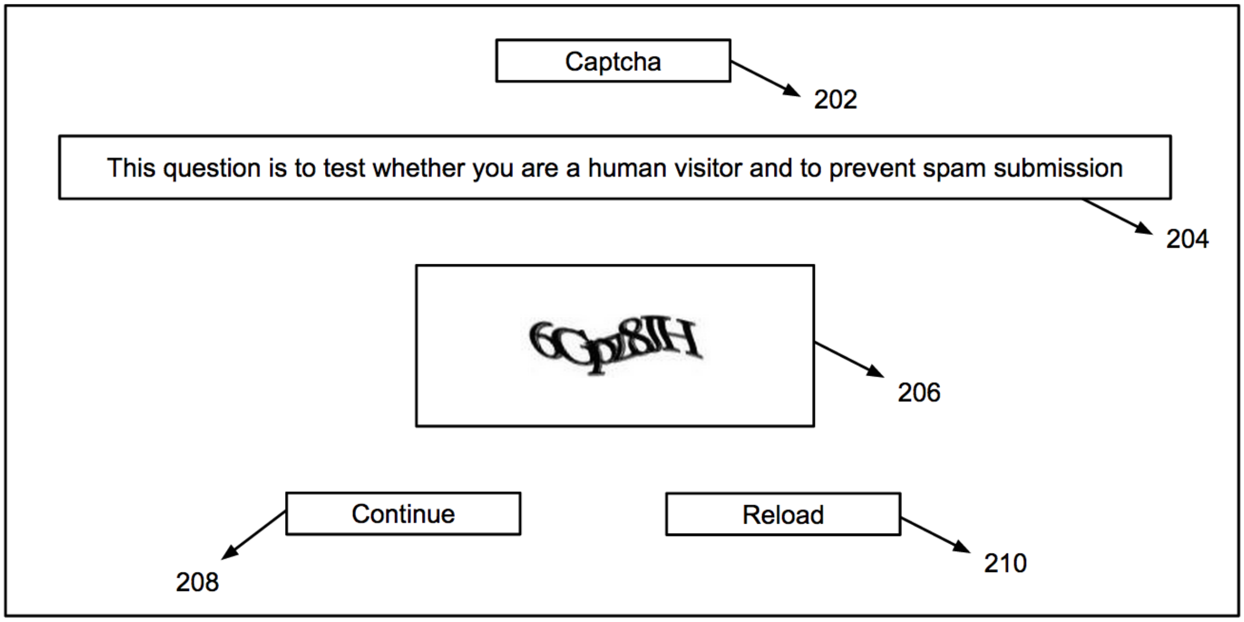


Figure 1



200

Figure 2a

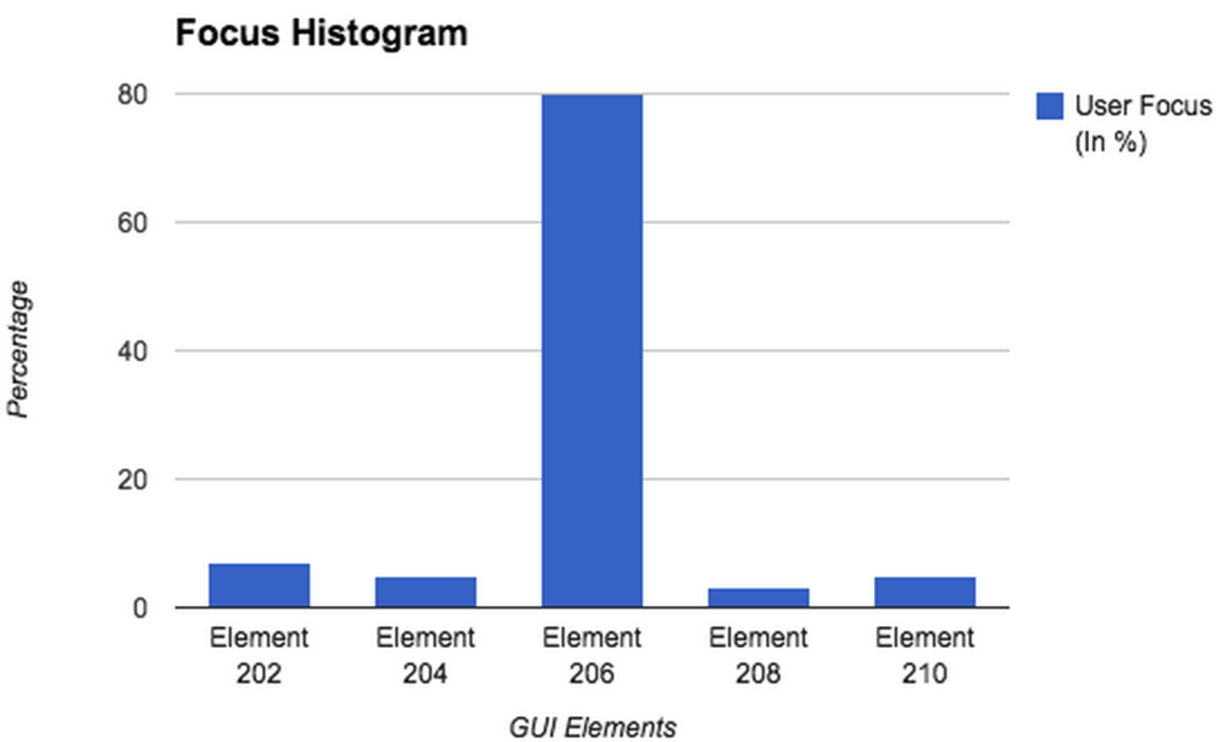


Figure 2b

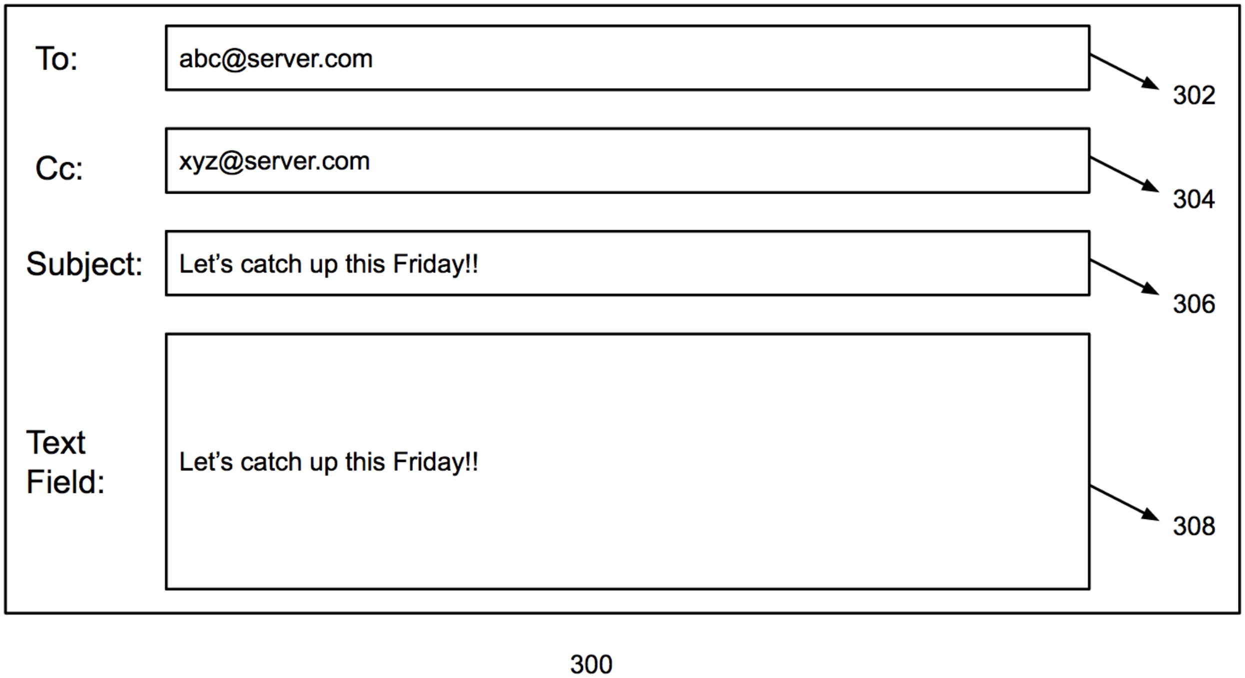


Figure 3a

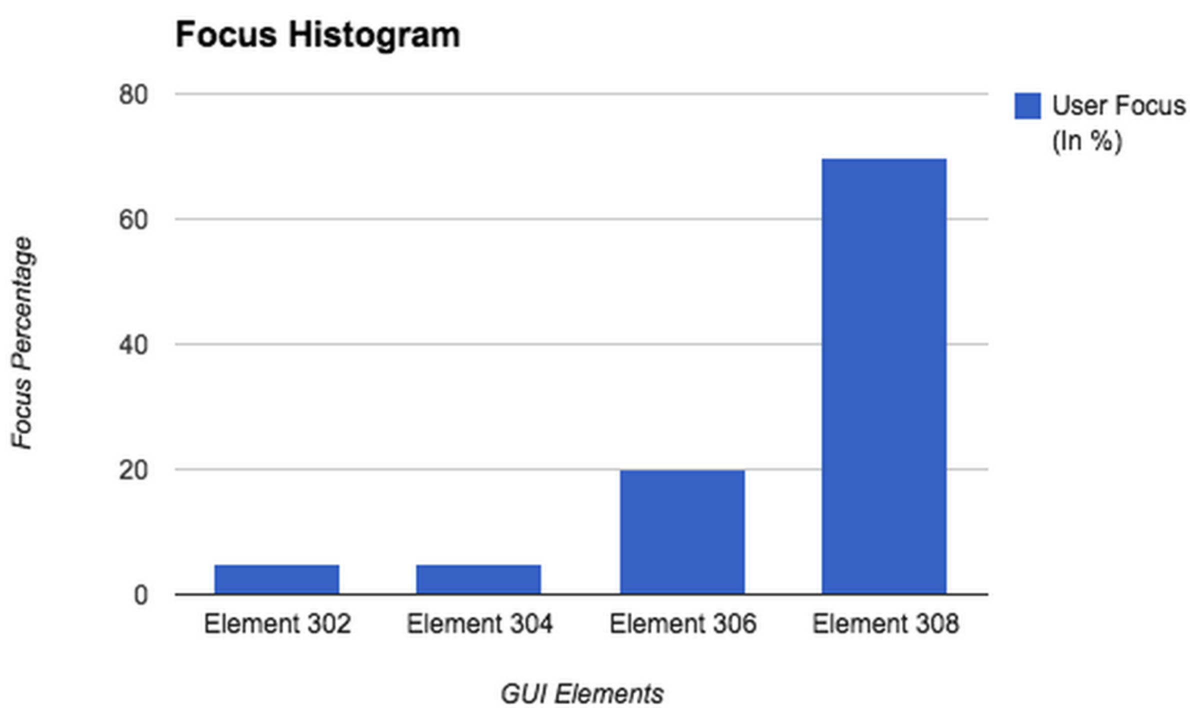


Figure 3b

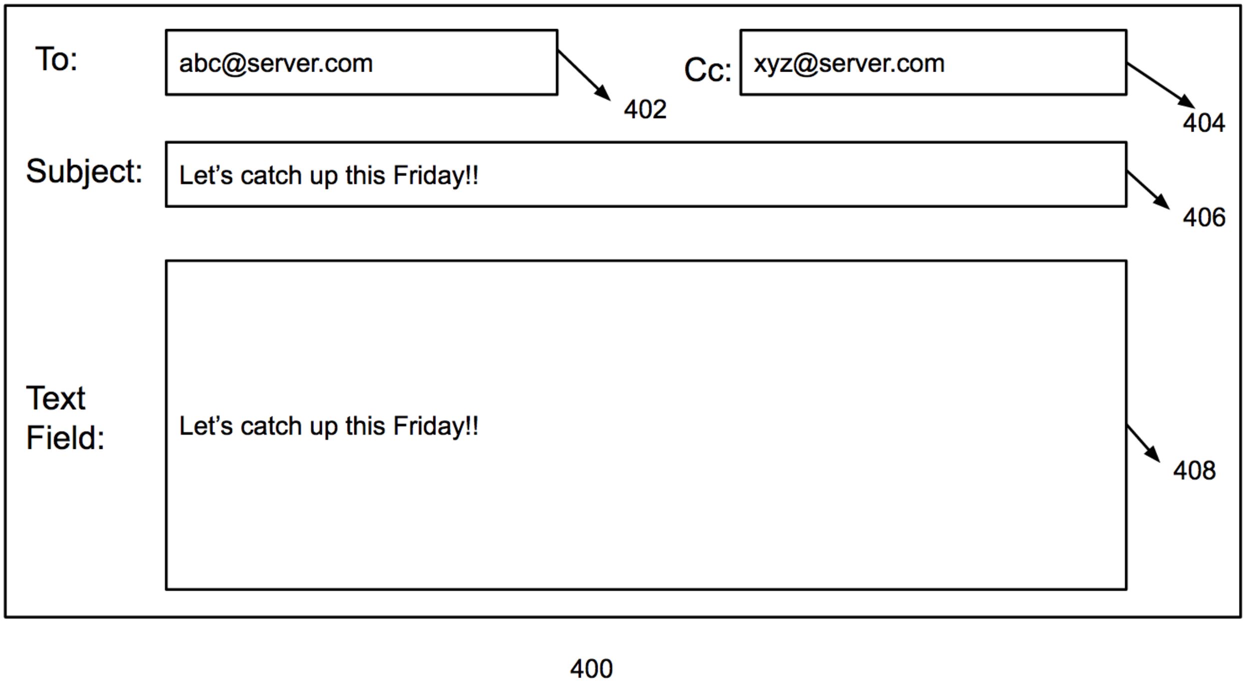

To:
abc@server.com
402
Cc:
xyz@server.com
404
Subject:
Let’s catch up this Friday!!
406
Text
Field:
Let’s catch up this Friday!!
408
400

Figure 4