

Kinetic Touch-Screen GUI Specifications

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**Prepared By
*Diversified Software Industries, Inc.***



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Version Table

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1 Introduction

The intention of this document is to provide developers with guidelines to follow during creation of the Kinetic PC/Piranha touch-screen GUI (graphical user-interface). In some instances, a design issue may arise that is not covered in this document. In these cases, the developer should discuss the problem with the user-interface designer. During development, the user-interface designer should periodically examine each screen *and the flow between screens* to ensure effective design.

Touch screens can be a very effective interface because of their durability in adverse environments, the intuitiveness of touch, and the high speed of selecting large targets. However, as touch-targets (i.e. buttons) get smaller, speed and accuracy decline rapidly. Fitt's Law states that touch times increase as target size decreases and target distance increases. This occurs because the user must make more time-consuming corrective motions with smaller targets. The number of errors, especially during touch-screen typing, is a major concern in the design of interface. The design problem is to create an intuitive interface with maximal target size (thus increasing speed and reducing errors) while still fitting all the elements into the available screen space.

2 Display Characteristics

The display measures 480 pixels wide by 320 pixels high with a screen resolution of approximately 105 dots per inch, resulting in a 4.58" by 3.05" display. The display is monochrome - black on a grayish-greenish background.

3 User Profile

3.1 Occupation

Truck drivers will be the primary users of the system.

3.2 Experience

Most users will have very little experience using this type of messaging system, and some probably have experience using a Windows-based computer. It is likely that few users know how to "touch-type" on a QWERTY keyboard. Touch-typing requires the user to know (without looking) where each key is on the keyboard. Users who don't touch-type



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use the “hunt and peck” method of typing, in which they look for the letter on the keyboard, then touch the letter once it’s found.

3.3 Physical Characteristics

The drivers may be male or female, with body dimensions spanning the range of the overall American population. The width of the tip of the index finger of the 95th percentile male is 2.0 cm (83 pixels). Studies have shown that users typically touch slightly to the lower-left of a target’s center.

4 Environment

The unit will be placed inside the truck. It will rest in the center of the cab (to the right of the driver’s seat) on top of a pole coming from the floor. The user will be able to rotate the unit, thus positioning the display so that it faces the user. The height of the unit will vary, though I am assuming it will be at approximately shoulder-level. Because the unit faces the user and is placed below eye-level, the user’s arm and finger will obstruct only the elements below and to the right of the targets.

Although Kinetic will explicitly instruct users not to use the device while driving, it is expected that some users will violate this. If so, placement of the unit is very important. Although a lower position (e.g. hip level) would exhibit less strain on the shoulder during use, the lower position would take the user’s eyes further from the road. To minimize the risks associated with driving while operating the device, the unit should be located at about dash-height and just to the right of the truck’s instrument panel. This positioning will allow the road to remain in the user’s peripheral view while he or she focuses on the display.

5 Screen Text

All text on the screen should be 14-point Arial Narrow. Arial Narrow was chosen because it is a highly readable yet compact screen font. 14-point-size was chosen because it is the smallest Arial Narrow with 2-pixel letter thickness, which looks dramatically better than 1-pixel thickness, especially when viewing while driving or when glare is present.

THIS IS 14-POINT ARIAL NARROW. 1 2 3 4 5 6 7 8 9 0



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6 Touch Interaction and Feedback

6.1 Lift-Off Selection

The system will utilize “lift-off selection,” which has been found to reduce the number of errors. Lift-off selection means that the selected area will be the screen area that was covered by the finger when the finger was lifted off the screen. It also eliminates any problem with users touching the screen for too long, so that the screen changes while the finger still rests on the screen.

6.2 Feedback

Upon touching a linked element, the element must immediately change. This informs the user of exactly which element he or she is touching. For text selections (i.e. not graphical elements), the text should be reversed upon touching. For graphical elements, the black background of the image-link will turn to gray, and the text will reverse.

7 Button/Link Guidelines

7.1 Consistency (Image Links)

Links must be easily and reliably identified as touchable buttons. To ensure this, all graphical links, such as buttons, will have a black background and a 3-pixel gray border (the gray is a checkerboard pattern of black and background color). The buttons will look like similar to the image shown below with the label on top and an icon in the middle. The label is on top so that when being clicked, the user’s finger and hand will not obstruct the user’s view of the label. When the button is being touched, the image on the right will be shown.



Figure 1: Example buttons (right one represents “pushed” state).



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In some cases, these buttons will be too big. If a smaller button is required, a “short button” can be used. However, the smaller “short” button will induce more errors, so it should be used as sparingly as possible.



Figure 2: Example of a "short" button.

The tabbed menu items along the top of the page will cover the entire width of the page. The “open” item (i.e. the section that the user is currently in) will be shown in white and will have an open bottom to give the impression of tabbed pages. The tab buttons were made to be tall enough so that the user need not contend with the top edge of the display, which can provide physical obstruction from touching the top edge.



Figure 3: Tab menu along the top of the screen.

7.2 Appearance

The buttons were given a rounded look to produce a “friendly” feel, unlike the hardness of rectangular buttons. A friendly feel is often reassuring to an intimidated user, making the system appear easy to use (even if it’s not). The roundness also fits the roundness of a fingertip, suggesting that the image is appropriate to touch. Icons are added to the buttons to provide an additional cue to their function, and also to improve the overall appearance of the system.

7.3 Text in Image Links

The text on these buttons is 14-point Arial Narrow, for reasons discussed above in “Screen Text.”

7.4 Size and Spacing

Ideally, any touchable link should be at least 83 x 83 pixels (2 x 2 cm). The buttons shown above are 89 x 89 pixels, and each tab button is 120 x 70 pixels. If the buttons are



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this large, only a few pixels of spacing are necessary between buttons. In the case of smaller buttons, increased spacing must be provided to avoid increasing errors. To figure out spacing requirements, assume that the user's finger is 83 x 83 pixels, then make sure that each touchable area is at least that size.

7.5 Text Links

In some cases, such as in viewing messages, a line of text may serve as a link. This can be problematic because single lines of text are not tall enough to provide an adequate target size. Therefore, linked text lines should be three lines tall, with one line break before the title and two line breaks after the title. For example, a list of touchable messages would look something like this:

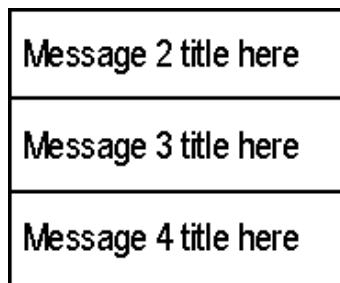


Figure 4: Example of a touchable list of messages.

Unfortunately, this takes up a lot of vertical screen space. Another alternative is not to have touchable text, but instead scroll up and down the list with scroll buttons, then click "View" to see the selected message. This would allow each message title to be only one line, thus conserving space. I would recommend this method.

8 Text Entry/Editing

Text will be entered and edited using a simulated keyboard (see section on keyboard below). The keyboard will not be displayed all the time, because it is not used frequently enough to warrant it. The user will be able to display the keyboard by touching the text field (or its associated label) in which the text will be entered. All empty text fields will contain the text: (touch here to enter/edit text). After text has been entered into a field, the instructional message will not be shown. However, from previous reading(s) of the message, users should learn quickly that a text field is edited by touching it. It might also be a good idea to put an item in the preferences that allows users to turn off the "(touch here...)" text. By default, the instructional text would be shown to decrease the learning



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curve. Text fields would end up looking like the image shown below, with both the label and the entry field as a touchable region.

Engine Faults: **(touch here to enter/edit text)**

Figure 5: Text Field when no text has been entered.

9 Keyboard

9.1 Design Discussion

A touch-screen keyboard on a screen of this size is a surmountable design challenge. If a traditional QWERTY keyboard is scaled down to fit the 480 x 320 screen, each key (or “target”) would be about 42 x 42 pixels, which is about half of the recommended 83 x 83 pixels (2 cm). The traditional QWERTY key layout, which typists are familiar with, was abandoned for several reasons:

- Touch-typing on the keyboard is impossible because it is too small and it is positioned in a near-vertical plane.
- Few of our users know the location of keys on a QWERTY layout, so a QWERTY layout would not help them find each key any faster.
- Travel distance is an important determinant in touch-typing speed. Because QWERTY is meant for use with ten fingers (unlike the “one-finger” typing done on a touch-screen), it was not designed to minimize the distance between frequently occurring keystrokes.

The Kinetic keyboard has three different key sizes, with key placements different from QWERTY’s. These changes were made to increase typing speed and reduce errors. These effects will occur because:

- If typing in English, about 70% of the keystrokes occur on the nine large keys on the right. According to Fitt’s Law, this will increase typing speed and decrease errors by reducing fine-tuning adjustments.
- Because the most frequently used keys are bigger, users will be able to find them quicker (reduced “search time”), thus increasing typing speed.
- Letters that most frequently occur together in English (e.g. TH, HE, AN, IN, ER, RE, etc.) are located very close together on the keyboard. This will increase typing speed by reducing the travel distance between frequent letter sequences.



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- The user will usually use the device while seated in the driver's seat. He or she will probably touch the screen with his right index or middle finger, thus obscuring his view of the screen that lies to the lower right of his fingertip. For this reason, the more frequently used keys are placed toward the bottom right of the screen. This places the user's hand on the lower right of the screen most of the time, which doesn't block the view of the screen. This allows the user to begin searching for the next key while touching another key, thus decreasing search time and increasing typing speed.
- Keys that often occur in consecutive order were placed so that the key that is typed second is not placed to the lower right of the first key, thus decreasing search time because the hand doesn't block the view of the next key.

These ideas led to this keyboard design:

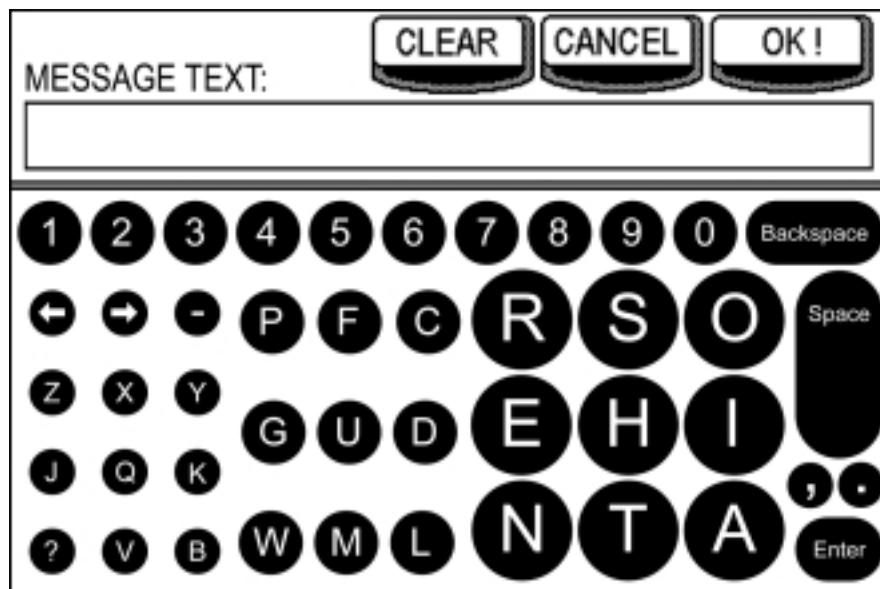


Figure 6: Keyboard design with sample text-entry field above the keyboard.

9.2 Text-Entry Mode

When the user brings up the keyboard, the screen will look similar to the image shown above. The text field that the user touched to open the keyboard (for example, the message field) will be shown above the keyboard. This field will scroll if necessary. The user cannot tab to any other fields on the page. This was done for two reasons:

1. Very few screens will have more than one text field



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2. There's not much room for a tab button (although it can be done if necessary)

Above the text field are three buttons:

- **CLEAR:** This clears any text out of the field. This is useful for editing a field, since the user cannot just double-click the text and hit the delete key.
- **CANCEL:** This button leaves the text field as it was before the user touched it.
- **OK:** This submits the new text and closes the keyboard. The user is taken back to the page in which he touched the text field. The “Enter” button on the keyboard does the exact same thing.

Note that the OK button duplicates the “Enter” button on the keyboard. This is convenient for users, but if any buttons must be added to the keyboard (a colon, for example, for entering times), the Enter button is the first to go. Two small buttons could be placed where the Enter button is.



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