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Constructing a Bi-Lingual Virtual Keyboard for English and Igbo Languages to Counter Keyloggers

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Abstract
This research work produces a virtual keyboard that incorporates the alphabets of both English and Igbo languages on the same platform. Igbo is one of the indigenous languages widely spoken in Nigeria. Its alphabets consist of some accent characters that differ from the English alphabets; as a result, cannot be found on a standard computer keyboard. To make things easy for multi-lingual users, some application programming interface methods provided by Windows operating system were used to acquire the features of an actual keyboard to implement the English alphabets on the virtual keyboard. For the Igbo accent alphabets, usually printed by a combination of the alt key and some numeric keys on a conventional keyboard, this design bundled them into a single button and then used the sendkeys class to send message to the operating system which decomposes the combination and prints the accent character when the key is clicked. The idea to produce the virtual keyboard is borne from the desire to localize information technology to Nigeria, given that a virtual keyboard that could be used to type text in a local language is constructed. The keyboard will also serve as a counter measure to keystroke logging when Igbo accents provided by the keyboard are used as part of user password characters.

Keywords
Windows, Keyboards, Igbo language, Application Programming Interface, Igbo Keyboard

I. Introduction

Igbo is one of the three major languages of Nigeria [3] aside Hausa and Yoruba. Its alphabets are similar to those of English, except the accents: Ị, ị, Ọ, ọ, Ụ, ụ, Ṅ, and ṅ which are not found on any existing keyboard. A user must combine the alt key and four numeric keys to type the accents on a conventional keyboard.

Existing virtual keyboards that attempt to implement Igbo accents have limitations. A good example is Babylon9, an onscreen keyboard produced by Gate2Home.com that can be used to type in both English and Igbo languages [2]. The major limitation, among others, is that a user must click three different keys before an Igbo accent is printed. This is, unarguably, not a user-friendly arrangement.

In this work, we have bundled the required combinations that print each Igbo accent into one key, and then used the SendKeys class to send the keys once such that a single click can print the Igbo characters.

This paper is organized as follows: Section 1 introduces the topical issue, and reviews related literature, Section 2 presents the English/Igbo keyboard model, Section 3 discusses the results, while Section 4 draws conclusion on the subject matter.

Related Works

The Igbo alphabet consists of a number of accent characters that cannot be typed easily on a keyboard, for instance, the QWERTY keyboard [3]. A user must make use of the "Alt Codes" to type the accents. Alt Codes are a combination of the alt key and a sequence of four numeric characters from the numeric keypad that produce the Igbo accents. They are: ALT+7882 for Ị, ALT+7883 for ị, ALT+7884 for Ọ, ALT+7885 for ọ, ALT+7908 for Ụ, ALT+7909 for ụ, ALT+7748 for Ṅ, and ALT+ 7749 for ṅ.

Some existing virtual keyboards have actually attempted to implement the Igbo accents but with flaws. For instance, Babylon9 is an online, on-screen keyboard produced by Gate2Home.com [1]. To type Igbo accents on this keyboard, a user must click three different keys. For example, to type accent "ị", one must first click the normal 'i", then secondly click "alt"; then a screen would appear containing the accent dots, and thirdly, click the dot to print it beneath the "i" to make it an Igbo accent character. The process is same for the other characters as well.

Another on-screen keyboard that can be used to type in Igbo is Free Online Igbo Keyboard, produced by [2].With this keyboard, to type Igbo accent "ị", you have to click i+[, while to type ọ and ụ, you have to click o+[and u+[respectively. To type ṅ, you have to click n +\.

Though, these two virtual keyboards have partially solved the issue of providing a platform for users to type in Igbo language, there are a number of limitations. For instance, a user must click a number of keys before an Igbo accent is printed, which is tedious. Users are required to have a prior knowledge of the various combinations that make the Igbo accents which make the keyboards user-unfriendly. Another flaw is that a user will have to type in the text boxes provided as part of the keyboards before copying and pasting in another application. No other application can accept input directly from these keyboards; as a result, the keyboards could not be used to create login passwords to include Igbo accents as a countermeasure to keyloggers. Lastly, these keyboards are found online and could not be installed on any other machine.

To solve these limitations, a virtual keyboard would be constructed in such a way that the Alt Codes that make up the Igbo accents are bundled into one key. With this provision, a single click will send the required keys to print an Igbo accent. We will use some Application Programming Interface (API) methods to make any currently selected Window or page to receive input from the keyboard. With this, the keyboard can be used as a countermeasure to keyloggers if the Igbo accents are included in user passwords. The keyboard can also be used on any machine running on Windows Operating System.

II. English/Igbo Virtual Keyboard Model

Unified Modeling Language (UML) notations will be used in the design of the virtual keyboard. Modeling in software design, is aimed at solving a problem by focusing on only the relevant details

and ignoring other things. Below is the diagram that describes the virtual keyboard in terms of objects, attributes, associations and operations.

The class diagram in Figure 1 depicts that when a user clicks a key on the keyboard, the device driver tracks the key and sends a message to the operating system which in turn passes the keyboard data on to the current application.

The flow chart for the virtual keyboard is shown in Figure 2.

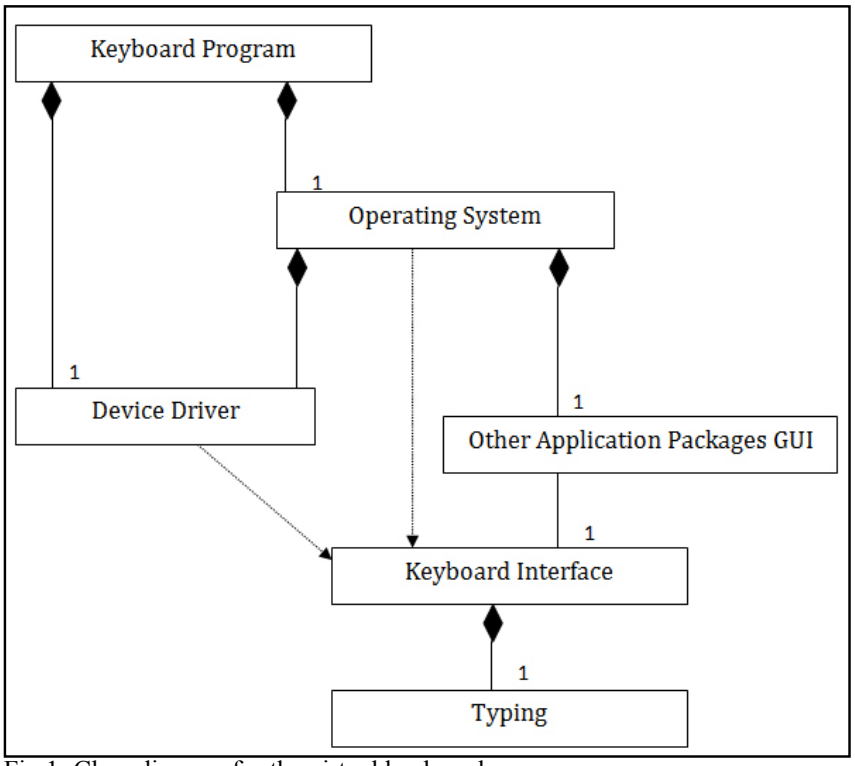

Fig.1: Class diagram for the virtual keyboard

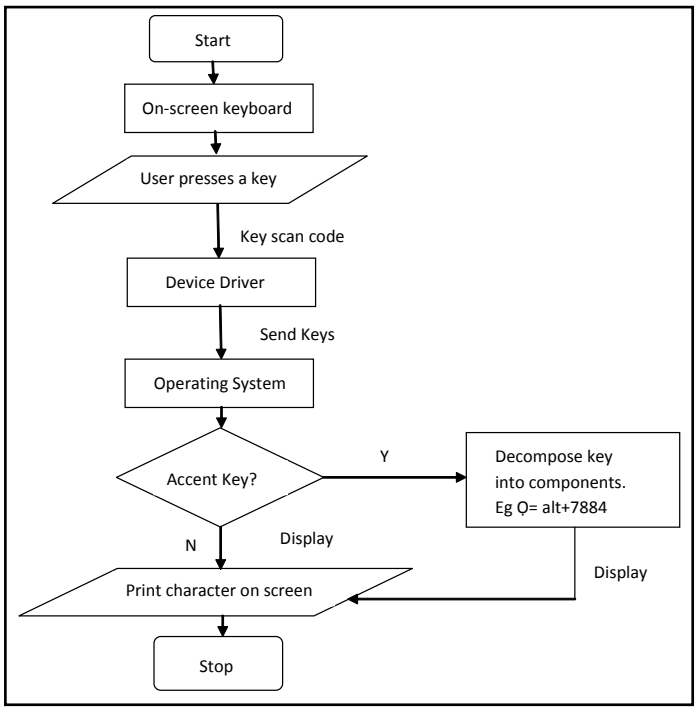

Fig. 2 : Is omitted.

If the clicked key is not an Igbo accent, the operating system simply sends the character to the current application to be displayed on the screen. However, if the key is an Igbo accent, the operating system resolves the key into the corresponding alt code before displaying on the screen.

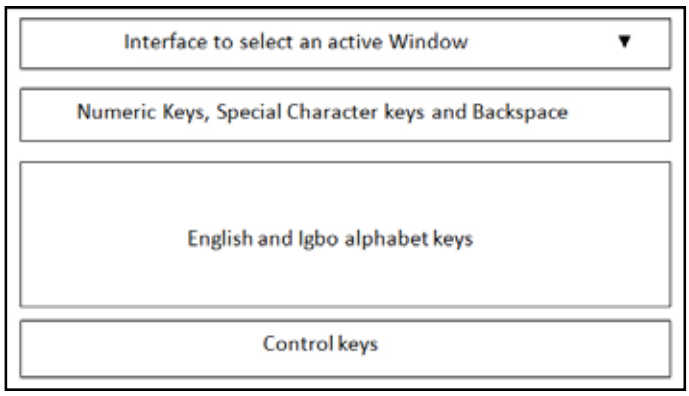

Fig. 3: The Virtual keyboard interface

The keyboard will provide a combo box that would populate all currently active windows or pages. Users can select, from the list, the window or page that should receive input from the keyboard. Aside the combo box, the keyboard will provide various keys similar to what obtains with a QWERTY keyboard. In addition, Igbo accent characters will also form part of the keyboard. As earlier mentioned, if a user clicks any English, numeric, control or special character keys, we would use Windows API calls to generate same events as a

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```
If user clicks Ị Then
        SendKeys.Send ({alt}+{7}+{8}+{8}+{2})
End If
If user clicks Ọ Then
        SendKeys.Send ({alt}+{7}+{8}+{8}+{4})
End If
and so on…
```

Algorithm 1: Keys sent when Igbo accents are Clicked.

normal keyboard; so that the characters would be printed on the screen. However, as for the Igbo accent alphabets, this is not feasible. This is because the accent alphabets can only be printed by a combination of the control key and four numbers from the numeric keypad.

We intend to achieve this by using Windows SendKeys class such that a single keystroke would generate numerous keystrokes which would be sent to the active application. Algorithm 1 gives you an idea of what happens.

III. Results And Discussion

To implement the virtual keyboard, Visual Basic.Net programming language was used. This language was chosen because it has inbuilt methods that make it possible to make use of Windows APIs needed to get the keyboard function. The declarations shown in Listing 1 were made to implement the keyboard keys when the program is run:

```
' Declarations
PrivateRowOneAsString() = {"`", "1", "2", "3", "4", "5", "6",
"7", "8", "9", "0", "-", "="}
PrivateRowTwoAsString() = {"q", "w", "e", "r", "t", "y", "u",
"i", "ị", "o", "ọ", "p", "[", "]"}
PrivateRowThreeAsString() = {"a", "s", "d", "f", "g", "h", "j",
"k", "l", "ụ", ";", "'", "#"}
PrivateRowFourAsString() = {"\", "z", "x", "c", "v", "b", "n",
"ṅ", "m", ",", ".", "/"}
PrivateCapsLockAsNewCheckBox
Private Key, Special AsString
Private Windows AsNewArrayList
Private Window AsIntPtr
```

Listing 1: Declarations for Igbo and English virtual keyboard keys

We created an array that assigned sizes and positions to the keys above on the English and Igbo virtual keyboard at the Load Event of the form when the program is run as shown in Listing 2.

```
PrivateSubfrmMain_Load(ByVal sender AsSystem.Object, _
ByVal e AsSystem.EventArgs) _
HandlesMyBase.Load
Dim Col AsInteger
' Row One                    'Calls the KeyboardButton Proce-
dure to implement button sizes and relative positions
For Col = 0 To 12
KeyboardButton(25, 25, 40, Col * 25 + 4, _
RowOne(Col), RowOne(Col))
Next
KeyboardButton(50, 25, 40, Col * 25 + 4, "BkSp", "{BACK-
SPACE}")
' Row Two
KeyboardButton(36, 25, 66, 4, "Tab", "{TAB}")
For Col = 0 To 13
KeyboardButton(25, 25, 66, Col * 25 + 40, _
UCase(RowTwo(Col)), RowTwo(Col))
Next
KeyboardButton(39, 25, 66, 36 + Col * 25 + 4, "↵", "{EN-
TER}")
' Row Three
CapsLock.Appearance = Appearance.Button'Customizes
the capslock button
CapsLock.Size = NewSize(48, 25)
CapsLock.Location = NewPoint(4, 92)
CapsLock.Text = "Caps"
Controls.Add(CapsLock)
For Col = 0 To 12
KeyboardButton(25, 25, 92, Col * 25 + 52, _
UCase(RowThree(Col)), RowThree(Col))
Next
KeyboardButton(27, 25, 92, 48 + Col * 25 + 4, "", "{EN-
TER}")
' Row Four
KeyboardButton(38, 25, 118, 4, "Shift", "+", True)
For Col = 0 To 11
KeyboardButton(25, 25, 118, Col * 25 + 42, _
UCase(RowFour(Col)), RowFour(Col))
Next
KeyboardButton(62, 25, 118, Col * 25 + 42, "Shift", "+",
True)
' Row Five
KeyboardButton(50, 25, 144, 4, "Ctrl", "^", True)
KeyboardButton(50, 25, 144, 54, "Alt", "%", True)
KeyboardButton(154, 25, 144, 104, "Space", "{SPACE}")
KeyboardButton(44, 25, 144, 258, "Home", "{HOME}")
KeyboardButton(44, 25, 144, 302, "End", "{END}")
KeyboardButton(33, 25, 144, 346, "Del", "{DEL}")
EndSub
```

Listing 2: Implementation of English and Igbo virtual keyboard keys

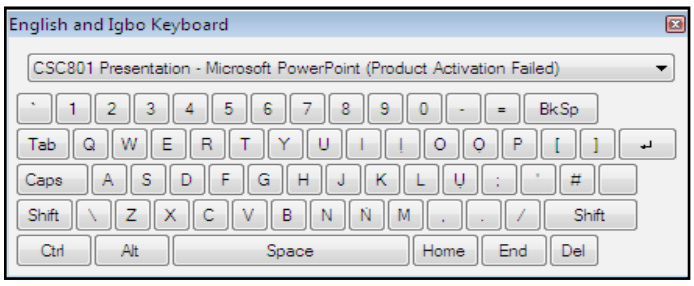

Fig. 4: English and Igbo virtual keyboard

The screen shot in Figure 4 shows the fully implemented virtual keyboard. Observe the Combo Box at the top of the keys. As mentioned earlier, its purpose is to populate all currently running applications on the computer. When any of the Windows is selected, it is this Window that will receive input from the keyboard.

With this keyboard, a user can input text into any application unlike the existing keyboards earlier reviewed. Additionally, a single click will print the Igbo accents directly as opposed to the other keyboards where a number of key combinations are required. In this arrangement, a user can make use of the keyboard to create login passwords that include Igbo characters which can

circumvent keyloggers.

IV. Conclusion

As a counter-measure to the menace of keyloggers, we recommend organizations that transact in highly sensitive data to employ the use of this virtual keyboard in creating login passwords. If a login password contains at least one Igbo accent character, for instance "ị" as in "uwadịa", even if a keylogger succeeds in logging the password; in order to re-type it on another computer, the perpetrator has to type **"uwadaltl7883a".** This certainly does not match the original password and thus, would be rejected. The reason is that to type Igbo letter "ị" on a conventional keyboard, you must combine alt and 7883.

Information Technology has spread to almost all parts of the world as of today. However, some individuals in Nigeria still feel adamant in tapping the advantages that come with it. This is largely because they tend to look at I.T as a Western affair. This on-screen keyboar d has customized an important input device to include alphabets of an indigenous language. It is expected that this will further encourage more indigenes to tap the benefits of Information Technology by using this keyboard.

References

[1] iRazoo, n.d.Igbo keyboard. [online]. Gate2Home.com. Available at:http://gate2home.com/Igbo-Keyboard/Babylon[Accessed 7 March 2012].

[2] Learn Igbo Now, 2011. Free online Igbo keyboard. [online]. Available at: <http://www.learnigbonow.com/free-igbo-keyboard> [Accessed 7 March 2012].

[3] Omniglot, 2012. Igbo.[online]. Available at: <http://www.omniglot.com/writing/igbo.htm> [Accessed 7 March 012].