Assignment 4 Report

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1 Introduction

This report outlines the methodology employed to develop a keyboard layout visualization tool and to calculate finger travel distances while typing. The approach encompasses various keyboard layouts, analyzes key press frequencies, generates a corresponding heat map, and quantifies finger travel based on character input.

2 Approach

2.1 Keyboard Layout Selection

First input is taken to select the desired keyboard layout. Depending on the layout chosen, the keys in all rows are initialized as empty strings. Subsequently, the variables `row1_keys`, `row2_keys`, `row3_keys`, and `row4_keys` are populated with the characters present on the keyboard, deliberately excluding special characters such as `Enter`, `Shift`, and others.

2.2 Special Character Handling

Following this, a comprehensive list of special characters is compiled to capture the names of these keys, including `Tab`, `CapsLock`, `Enter`, and `Shift`. A `keyboard_layout` is then constructed, using a standard keyboard as a reference. The widths of the keys are determined through a process of trial and error, ensuring a visually accurate representation of the keyboard layout.

2.3 Layout Compatibility

It is observed that for different keyboard layouts, such as `QWERTY`, `Dvorak`, and `Colemak`, the primary distinction lies in the arrangement of characters. The layout and special characters remain constant, which guarantees compatibility across all three layouts.

2.4 Shift Key Activation

To ascertain which `Shift` key should be pressed, a dictionary is established that maps each key on the keyboard to its respective special character. A function is implemented to determine the appropriate `Shift` key: if the x-coordinate of the key is less than half the total keyboard width, the right `Shift` will be engaged; otherwise, the left `Shift` will be activated. This design choice is made based on the intuitive assumption that it minimizes finger travel distance.

2.5 Key Press Counting

A dictionary is created to track the number of times each key on the keyboard is pressed. Utilizing the values recorded in this dictionary, a heat map is generated to visualize key usage.

2.6 Heat Map Generation

The heat map generation process involves plotting rectangles that correspond to the layout of the keyboard. Each rectangle's color is determined by normalizing the count of key presses (by dividing with the maximum value), with the resulting color filled into the respective rectangle. This creates a vivid visual representation of key usage across the keyboard.

2.7 Finger Travel Distance Calculation

To compute the total finger travel distance, specific home row indices are designated (0, 1, 2, 3, 6, 7, 8, 9). The home keys comprise the letters located in row 3 corresponding to these indices. For any character input, the nearest home key is identified by checking for the first home key within a specified range of 1.5 units along the x-axis.

If the key belongs to the home row, the finger travel distance is recorded as zero. Otherwise, the distance between the character and the nearest home key is calculated and accumulated in the total distance, which was initialized at the outset to monitor finger travel. This distance is subsequently multiplied by two, based on the assumption that the finger returns to the home key after typing each character.

3 Test Case 1

3.1 Text Entered

```
Enter a string:  Hello!!  good morning, have a nice day:)
```

3.2 Frequency Dictionary

The following frequency dictionary shows the number of times each key was pressed:

```
{'lshift': 3, 'shift': 5, 'h': 2, 'e': 3, 'l': 2, 'o': 4, 'rshift': 2,
'1': 2, 'spacebar': 7, 'g': 2, 'd': 2, 'm': 1, 'r': 1, 'n': 3, 'i': 2,
',': 1, 'a': 3, 'v': 1, 'c': 1, 'y': 1, ';': 1, '0': 1}
```

3.3 Heat Map Visualization

The heat map shows the intensity of key usage based on the values above after normalizing. A higher intensity indicates a higher frequency of key presses.

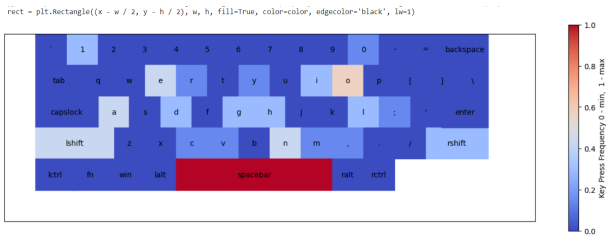

Figure 1: Heat map for Test Case 1

3.4 Finger Travel Distance

The total finger travel distance, calculated based on the input string, is:

72.16766515910885 units

4 Test Case 2

4.1 Text Entered

```
Enter a string:  129ewud JVBK^&* EW!@$# fVcs eg123
```

4.2 Frequency Dictionary

The following frequency dictionary shows the number of times each key was pressed:

```
{'1': 3, '2': 3, '9': 1, 'e': 3, 'w': 2, 'u': 1, 'd': 1, 'spacebar': 4,
'lshift': 6, 'shift': 14, 'j': 1, 'rshift': 8, 'v': 2, 'b': 1, 'k': 1,
'6': 1, '7': 1, '8': 1, '4': 1, '3': 2, 'f': 1, 'c': 1, 's': 1, 'g': 1}
```

4.3 Heat Map Visualization

The heat map shows the intensity of key usage based on the values above after normalizing. A higher intensity indicates a higher frequency of key presses.

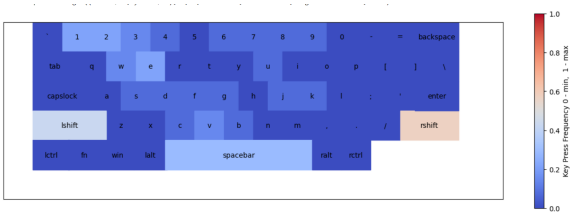

Figure 2: Heat map for Test Case 2

4.4 Finger Travel Distance

The total finger travel distance, calculated based on the input string, is:

99.30021556025854 units

5 Test Case 3

5.1 Keyboard Layout

The Dvorak keyboard layout is used for this test case.

5.2 Text Entered

```
Enter a string:  some Example TEXT %^#$%#^
```

5.3 Frequency Dictionary

The following frequency dictionary shows the number of times each key was pressed:

```
{'s': 1, 'o': 1, 'm': 2, 'e': 4, 'spacebar': 3, 'rshift': 8, 'shift': 12,
'x': 2, 'a': 1, 'p': 1, 'l': 1, 'lshift': 4, 't': 2, '5': 2, '6': 2, '3': 2, '4': 1}
```

5.4 Heat Map Visualization

The heat map shows the intensity of key usage based on the values above after normalizing. A higher intensity indicates a higher frequency of key presses.

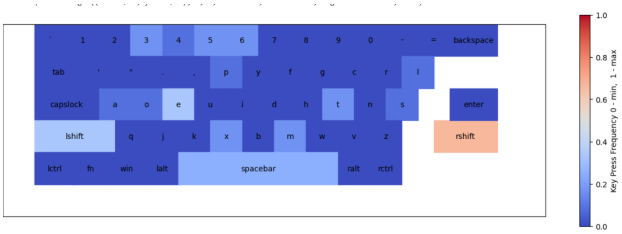

Figure 3: Heat map for Test Case 3 (Dvorak Keyboard Layout)

5.5 Finger Travel Distance

The total finger travel distance, calculated based on the input string, is:

55.166928249863595 units