EE2703 : Applied Programming Lab
Assignment 4 - Keyboard Analysis

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EE23B002

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1 Approach followed

- Firstly, a keyboard layout is created from the `qwerty_layout` in the file as in the keyboard heatmap programming quiz.
- The keyboard layout is generated using matplotlib rectangles in the function `genKeyboardLayout`.
- The heatmap is a pixel grid of `58 * 16` pixels in `x, y` coordinates.
- Takes in an input string from the user.
- Then two arrays x, y each containing `x, y` coordinate of each key pressed is generated. For example:
  - if I press 'a' which has coordinates `(1.75, 2)`, 1.75 gets appended to x and 2 gets appended to y
  - This keeps track of the frequencies with which each coordinate in the keyboard has been pressed.
- Then the `calculate_key_travel` function is called, which calculates the total distance travelled for typing the entire text. It follows the following logic:
  - for each character c in the `input_string` it checks the corresponding keys to be pressed, and adds the distance to each of those keys onto `sum`.
  - it does this by going to the `characters` dictionary, which contains a tuple consisting of each key to be pressed for achieving a particular character.
  - For example, say we want to type 'A', the `characters` dictionary will have a key `A` with the element `('Shift_R', 'a')`, so it adds the distance for going to both $right\ shift$ and a.
  - returns `sum`.
- if `-a` flag is passed using the command line, generates animation, else saves `heatmap.png`.
- `-a` flags creates animation, although it takes time for longer text samples.

- `-a` calls the `plot` function (for animation) and otherwise calls the `plot1` function (without animation).
- The `plot` function works as follows:
    1. Consists of the heatmap array, containing an element for each pixel.
    2. Contains X, Y arrays which are 2D arrays constructed using `np.meshgrip`.
    3. For each letter, the corresponding values in the heatmap array is updated, (inside a circle of radius `0.6` units) multiplied with a function that has decreasing values going away from the center of the key, to create a gradient effect.
    4. A custom colormap is defined for the heatmap in a blue to red spectrum and use `plt.imshow` function to create the heatmap and save it to `heatmap.png`.
    5. If the `plot` function is used with the `-a` flag for animation, a function `update` is created, which gradually increments the heatmap array, updates the artist object, which in turn is used as an argument to `FuncAnimation` function from numpy, and saves it as `animation.gif`.

2 The QWERTY Layout format

- I follow the same layout format given in the programming quiz, the layout has two dictionaries:
    1. `keys` which contains a key for each key in the dictionary, and the value is a dictionary of the format `{'pos': (x,y), 'start':'home_row_key'}` where the `pos` is the coordinate of the given key and `start` is the home row key to be used while typing that key.
    2. `characters` which contains a character as key in the dictionary, and each character corresponds to a tuple of individual keys that have to be pressed for typing that key for example. to obtain 'A', we have to press both $right\ shift$ and a.

3 Results

Sample Text 1 : The environment is a vital part of our planet, providing the resources we need to live and thrive. It encompasses everything from forests and oceans to the air we breathe and the ecosystems that sustain biodiversity. Protecting the environment is crucial for maintaining the balance of nature and ensuring a healthy future for all living organisms. Human activities like pollution, deforestation, and climate change are threatening this delicate balance, making it imperative for us to take action. By adopting

sustainable practices, conserving natural resources, and reducing our carbon footprint, we can preserve the environment for future generations.

```
Distance travelled for qwerty layout = 483.68 units
```

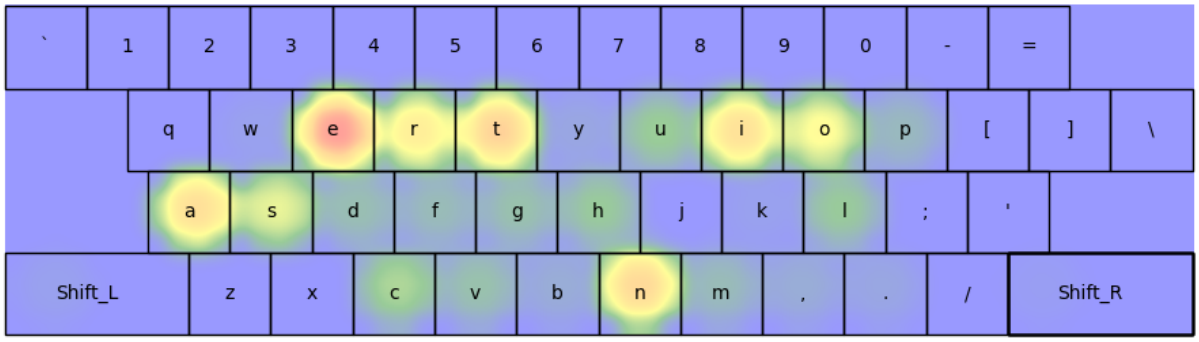

Figure 1: Heatmap for qwerty

```
Distance travelled for dvorak layout = 295.28 units
```

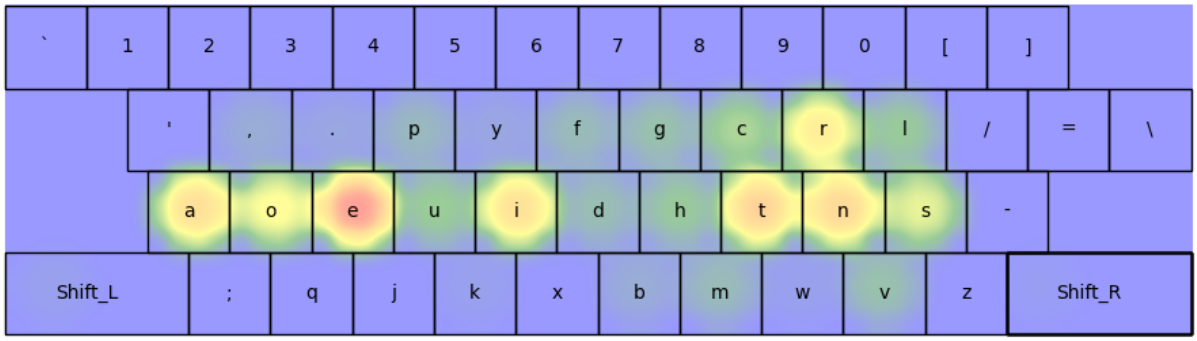

Figure 2: Heatmap for dvorak

```
Distance travelled for colemak layout = 208.830 units
```

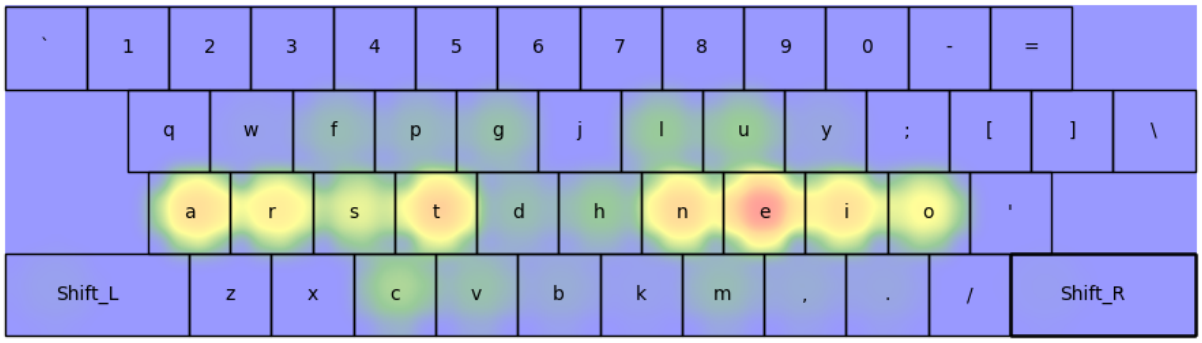

Figure 3: Heatmap for colemak

Sample text 2 : Programming is the art of crafting solutions through code, transforming ideas into functional applications that drive modern technology. It involves writing instructions in various languages like Python, Java, or C++ to communicate with computers and automate tasks. Programmers solve complex problems by breaking them down into manageable steps, creating efficient and scalable systems. The process fosters logical thinking, creativity, and persistence as developers debug and optimize their code. From websites and apps to artificial intelligence and data processing, programming powers innovation and shapes the digital landscape, making it an essential skill in today's rapidly evolving world.

```
Distance travelled for qwerty layout = 506.98 units
Distance travelled for dvorak layout = 373.016 units
Distance travelled for colemak layout = 269.971 units
```

4 Steps to test code with different layouts

- All the layout files have to be **imported** eg `import qwerty_layout` or `import dvorak_layout`

  all the layouts have been uploaded in the zip file.

  in the `main` block, update the layout used in the line `layout = qwerty_layout`

5 Notes

- All the code is in `ee23b002.py`, the `_layout.py` are the layout files.
- All the `layout.py` has to be in the same directory as the script.py, if default analysis keyboard needs to be changed, change the `layout` to the required `layout`
- Space key has not been included in either the heatmap generation or the distance calculation as, in heatmap generation it skews the result as space is typed a large number of times, and in distance key calculation it is assumed that the thumb finger is always on space.