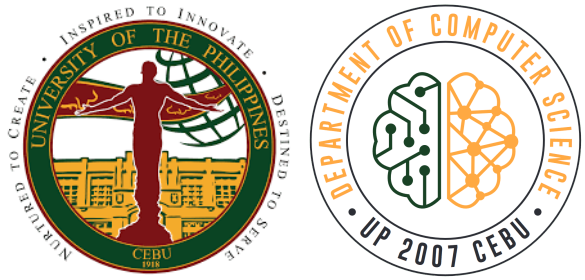

Research Brief

Name	Oscar Vian L. Valles
Student ID number	2018–06491
Project Title	Development of a touch typing trainer with an emphasis on finger and wrist positions
Project No.	9
Name of Supervisor	Dhong Fhel K. Gom-os

Contents

1.1 Background of the Study

There are a lot of educational typing tests available that help people learn touch typing, including Monkeytype, TypeRacer, or Keybr. These typing tests list out words that are then typed out. The inputted keys are then compared to check if the user has typed the expected letter. At the end of the test, the time taken is calculated and certain metrics are given. These metrics include words per minute (WPM) and accuracy (Bartnik, 2021).

However, this method of examination leaves out a crucial part of typing — ergonomics. Ergonomic typing prevents a lot of health issues in the future like repetitive strain injury or carpal tunnel. One important factor that affects ergonomics is the typing procedure and posture. This means the proper placement of the wrist, hands, and hitting the keys using the right finger that is assigned to the key.

Correct finger placement is usually taught at the beginning using a diagram, with each key being associated with a specific finger. For instance, the letter Q in a QWERTY layout should be hit using the fifth digit of the left hand, and this is shown by coloring the fifth digit and the key Q with the same color or by placing the letters directly on the fingers (Dobson, 2009).

Incorrect finger placement may cause these hand and wrist positions: ulnar deviation, forearm pronation, and wrist extension (Serina et al., 1999). These three are hand and wrist positions that are common in all activities, however, prolonged periods in these positions may cause injuries such as Carpal tunnel syndrome (CTS) (Toosi et al., 2015)

In addition, this type of typing is frequently taught in the beginner level (Donica et al., 2018). This means that there is a need to weed out bad habits that may develop, like using the index finger for pressing the spacebar or backspace. However, it is impractical for an educator to check each student if they are not performing these movements as these may only show for a small period which may not be caught in time.

Thus, there is a need for automatically detecting which finger is used during typing, and for the position of the wrist in relation to the arm. One way to do this is through finger and hand tracking. One solution for tracking is by using image processing and machine learning. An example of this is MediaPipe by Lugaresi et al., 2019.

MediaPipe allows for various applications for machine learning in the field of image processing. This includes, hand tracking, pose estimation, object detection, and others. Another example of a library that allows for hand and finger tracking is OpenCV by Bradski, 2000. This is a tool that simplifies computer vision and image processing. Machine learning can also be used with OpenCV.

1.2 Research Objectives

1.2.1 General Objectives

To create a touch typing trainer that corrects poor finger placement and hand position to develop better typing habits and healthier typing ergonomics.

1.2.2 Specific Objectives

- To develop a program that tracks fingers and hand positions while typing
- To create a subroutine that ascertains which finger was used to type a key
- To detect if incorrect fingers were used to press a key or if the position of the hand in relation to the wrist is problematic
- To assess the accuracy and performance of the developed program's ability to perform the previously stated objectives
- To develop a user-friendly interface for users to train touch typing using the developed program
- To generate key statistics of a user's touch typing performance

1.3 Scope and Limitation

This research will focus on typing on a 60% keyboard. This type of keyboard only has the alphanumeric part of the keyboard. This limits the number of keys to be checked and the expected movement of the hand. Furthermore, The keycaps will also be of a light color, while the surface that the keyboard rests upon will be of a dark color.

In addition, the keyboard layout will be ANSI. This layout is described by the American National Standards Institute (ANSI INCITS 154-1988, 1999). This is the most common layout in the United States. However, it is also used in numerous English-speaking countries such as the Philippines, Malaysia, and India.

The program will expect the that user has all ten digits and has no hand, finger, or wrist deformities. In addition, only the placement of the hands, fingers, and wrists will be taken into account when determining if the ergonomics of the user while typing is healthy. The program will not check seating position, angle of elbows, and other metrics for an ergonomic typing posture while typing.

Capturing of the video to be analyzed by the program would be limited to a single 1080p webcam that is capturing in 60 frames per second. The camera will be pointed downwards facing the keyboard and the hand. This means that the vertical angle of the wrist may not be accurate.

1.4 Significance of the Research

This research is beneficial for all users of physical keyboards. These include a vast majority of the population as there are a lot of professions that heavily rely on keyboards. Examples include developers, physicians, educators, accountants. By having better ergonomics while typing, wrist injuries can be prevented, and typing speed may be increased

This research also helps educators, especially early educators teaching beginner typers. By automatically checking for ergonomics, posture, and correct technique, the burden of checking each student is lessened, and directed interventions for bad habits can be easily created as students with these bad habits are easily identified

This research has a direct impact on people that has hand or wrist injuries that are caused by poor typing habits. By correcting these poor habits, pain from these injuries will be lessened, and even be prevented from occurring in the first place. A specific example of this is by reducing ulnar deviation which affects the nerve that is indicative of CTS (Toosi et al., 2015).

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