

## **Re-Layout Qwerty Keyboard for Typing Indonesian with Keyboard Layout Analyzer**

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**Abstract:** The use of computers at work is increasing rapidly both in education and other fields of work. Even though touchscreen technology is now known in almost all parts of the world, physical keyboards still have their own place for computer users. Computer use at work includes typing position and duration of computer use. Typing activities for a long duration and the wrong position when typing can risk developing diseases of the fingers and wrists. This research aims to determine the increase in speed and accuracy of 10-finger typing using a QWERTY keyboard for students at SMK N 1 Pedan Klaten. The data collection method was carried out by observation, tests and documentation with data analysis techniques using the descriptive percentage method. The research results show that by using the proposed keyboard there is a difference in the speed of typing Indonesian text where using the proposed keyboard the average typing time for respondents increases by 2.3 minutes. Loading on the big finger where the frequency of the letter 'a' on the little finger is transferred to the stronger finger, namely the middle finger. From these results, using the proposed keyboard is considered faster and has less burden for typing Indonesian.

**Keywords:** QWERTY keyboard, fast typing, keyboard layout analyzer

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### **1. Introduction**

*The keyboard is one of the important devices in the computer world. The keyboard is a device used to enter input in the form of text into the processor.*[1] There are various types of keyboards used in the world today. Each country uses different keyboards according to the language used. The differences in each keyboard can be seen physically and in terms of the layout of the buttons used.[2] Even though touchscreen technology is now known in almost all parts of the world, physical keyboards still have their own place among computer technology users as evidenced by the existence of many external keyboards.[3] This is because the keyboard on the touchscreen screen is difficult to use for fast typing.[4] The QWERTY keyboard is considered unsuitable for typing Indonesian text. The arrangement of the keys on this keyboard has not changed since it was first discovered. The arrangement of letters must also be adjusted to the intensity of use, where letters with high intensity will be placed closer together.[5] *Letter Frequency is the most important aspect in analyzing a keyboard layout.*[6] You will see letters that appear frequently and those that rarely appear, letters that rarely appear should be placed in the most difficult position that can be reached by the finger and positions that are easy to reach should be occupied by letters that appear frequently. The probability that the characters A, N and E in Indonesian text are the letters that appear most often in Indonesian typing. and the probability that the character E in English texts for formal and

non-formallanguages appears more often than other characters.[7]

Ten-finger system typing is a very effective technique for using a computer keyboard efficiently.[8][9] With some practice and correct finger position, you can type without needing to look at the keyboard. The increasingly rapid development of office technology inevitably requires workers who have abilities and skills, are creative, responsive and intelligent in carrying out office tasks.

Nowadays there are various kinds of keyboard products available which are intended to make typing comfortable for long periods of time but until now there has been no keyboard manufacturer that accommodates adjusting the arrangement of keys on a keyboard that is adapted for typing in Indonesian. Computer users are at high risk of experiencing work-related upper musculoskeletal disorders, which are influenced by years of activity. Several etiological factors, such as age, gender, including wrist trauma, typing that does not pay attention to the ergonomic position of the wrist when using a keyboard and mouse has a risk of developing Carpal tunnel syndrome.[10] Complaints that arise include tingling in the fourth finger of the palm, numbness, pain and muscle weakness. [11] Even though the QWERTY layout is very widely used, it has several weaknesses and is less efficient. When using a QWERTY keyboard, many people complain of pain in the left hand because the left hand's fingers are overloaded when typing.[12] The position of each finger when typing with the ten finger system can be seen in Figure 1.1.



**Gambar 1.1** Position of Each Finger on the QWERTY Keyboard (Sumber; [https://www.academia.edu/39670515/Mengetik\\_10\\_Jari](https://www.academia.edu/39670515/Mengetik_10_Jari))

A. Left hand

Left pinky ( 1,q,a,z )

Left ring ( 2,w,s,x ),

Left middle ( 3 e d c )

Left index ( 4 5 r t f g v b )

B. Right hand

Right lipinky ( 0 p ; / )

Right ring ( 9 o l . )

Right middle ( 8 l k , )

Right index ( 6 7 y u h j n m )

For good typing, each finger is allocated to access certain keys, generally ten fingers work while the thumb allocation is used to type spaces.

Some people consider the current keyboard design to be unergonomic.[13] Complaints that arise occur in several parts of the fingers that often carry out typing activities. The frequently used letter keys are placed far from each other and there is difficulty in using the fingers to press the keys. Apart from that, if the body position is directly in front of the keyboard, the user's hands will often bend towards the left, because the keyboard has 2 parts, namely the alphabet part on the left and the numeric part on the right. Solving problems that arise from injury or excessive load on the fingers, and reducing problems with each finger on the right and left hand.

Indonesia, with the 4th largest population in the world and more than 50% of its population is connected to the internet, and more than 35% of its population uses computers and is forced to use a QWERTY keyboard which is designed in English. The probability of characters that frequently appear in Indonesian is different from English. The problem that occurs with the majority of existing keyboard layouts is the uneven distribution of finger load. This happens because the layout is designed in English characters so it is necessary to research the optimal

keyboard layout for typing Indonesian. This research will provide an ergonomic description of the location of the keys or letters that are often used in Indonesian typing, the probability that the letter that is often used is the letter 'A' where when using tenfinger typing the position of the letter 'A' is on the little finger. In this way, we can change the position or location of the letters that are placed on the part of the finger that has less load.

## 2. Material and method

### Research methods

This research was conducted at SMK Negeri 1 Pedan, Klaten, Central Java. The research subjects were 15 students in class XI of the Office Management and Business Services Program, semester I of the 2022/2023 academic year. The research was carried out in 2 cycles. One cycle consists of 4 meetings. The keyboard layout study was carried out to find out more details about the type of keyboard layout that will be tested, namely QWERTY. Several things are known about each keyboard layout, including the mapping of letters on the keyboard layout, and how the keyboard works. Data collection methods are carried out by observation, tests and documentation. From this study, a guide was produced that will be used for training in using the keyboard layout. The drill method (ready practice) is applied to train students to master the material and be skilled. The data analysis technique uses the descriptive percentage method. The percentage descriptive analysis method was used to examine 10-finger typing skills. Research support tools used in studies and testing in research are:

- a) Personal Computer/Laptop Hardware, used by participants to carry out the typing process
- b) Keyboard Layout Analyzer (KLA) Website Used to determine letter frequency calculations
- c) The Microsoft Keyboard Layout Creator (MKLC) software is used to implement the design layout. This software can be downloaded on the Microsoft Website

### Research stages

Data collection and processing is carried out both directly and indirectly. Directly by conducting interviews with students who do work with computers, especially typing. Observe typing activities using the QWERTY keyboard which is commonly used in Indonesia using a tenfinger typing system. It is necessary to observe typing activities in Indonesian at this stage. Literature studies are carried out to obtain a comprehensive understanding of the problems discussed. Direct observation and literature studies can provide precise problem information, thereby obtaining appropriate methods for solving general typing problems. The questions asked include whether there are complaints about the limbs, especially the wrists and fingers, after using the keyboard to type, which part of the hand often hurts from typing

#### 1. Typing Test

In terms of implementation 15 students are first equipped with sufficient theoretical knowledge and then the students are instructed to practice so that they become proficient and skilled. Testing participants will be given a synopsis text of an Indonesian novel with a total of 2,871 letters/499 words from a text excerpt on the first page of the novel entitled 'Pulang' by Tere Liye in 2015. Students are assigned to retype the given text using a QWERTY keyboard until the time to complete the text is calculated and recorded. The results of respondents' typing speed can be seen in table 1.1.

Responden	Waktu	HURUF/MENIT	KATA/MENIT
responden 1	20.48	140	24.3

responden 2	22.47	127.7	22.2
responden 3	23.18	123.8	21.5
responden 4	25.32	113.3	19.7
responden 5	24.11	119	20.6
responden 6	23.25	123.4	21.4
responden 7	22.35	128.4	22.3
responden 8	23.45	122.4	21.2
responden 9	24.19	118.6	20.6
responden 10	22.21	129.2	22.4
responden 11	25.16	114.1	19.8
responden 12	25.58	112.2	19.5
responden 13	21.53	133.4	23.1
responden 14	24.39	117.7	20.4
responden 15	23.54	121.9	21.1

**Tabel 1.1** Results of the speed of typing Indonesian text

## 2. Letter frequency

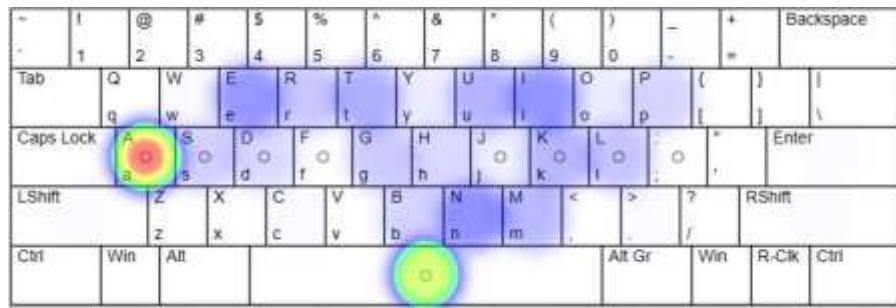
Parameter data for complaints and uneven loading on the fingers caused by the typing process using the ten finger method was obtained from the results of the frequency of appearance of letters in Indonesian text. Text character frequency data includes the appearance of letters in Indonesian text obtained using the Keyboard Layout Analyzer website. The following are the results of the frequency of appearance of text letters that the researcher created, seen in table 1.2.

No	Huruf	Frekuensi	No	Huruf	Frekuensi
1	a	561	14	n	245
2	b	94	15	o	45
3	c	10	16	p	94
4	d	81	17	q	0
5	e	228	18	r	121
6	f	1	19	s	103
7	g	112	20	t	173
8	h	82	21	u	169
9	i	228	22	v	0
10	j	32	23	w	12
11	k	155	24	x	0
12	l	125	25	y	41
13	m	153	26	z	0

**Tabel 1.2** Results of Indonesian text letter frequencies

## 3. Heat Maps

From the results of the frequency of appearance of Indonesian text letters, it will then be mapped on the QWERTY keyboard. The results of mapping the letters frequently used to type Indonesian text were obtained using the keyboard layout analyzer website, seen in Figure 1.2.



**Gambar 1.2.** HeatMaps results for typing Indonesian text

#### 4. Use of fingers

From the results of the frequency of letter appearance and letter mapping on the QWERTY keyboard, the distribution of finger use when typing with the ten finger system is known. Identification of potential complaints, possible consequences, and possible causes of problems need to be mapped by analyzing the recorded letter probability data and finger usage allocation. The distribution of loads on the fingers can be seen in Figure 1.3



**Gambar 1.3.** Pie chart of finger usage for typing Indonesian text

#### 5. Proposed keyboard design

By using the data that has been obtained and from literature studies, at this stage a new keyboard layout design will be created that is suitable for Indonesian typing and an ergonomic keyboard design. From this analysis, it will be known which keyboard characteristics are desired by the respondent and which have ergonomic value. The initial design was created using Microsoft Layout Keyboard Creator software. The placement of the layout design on the keyboard refers to the placement of fingers in the ten finger typing method where the frequency of occurrence of letters with a greater load will be placed on the fingers with greater strength. Meanwhile, the frequency of letters appearing and the small load will be adjusted to the finger with the smallest strength. In this design, the researcher moved the position of the letter 'a' to where the letter was rated as having the highest frequency of appearance and loading. The results of the layout design can be seen in Figure 1.4.



**Gambar 1.4.** Proposed keyboard layout design for typing Indonesian text

#### 6. Implement the proposed keyboard layout

At this stage, the layout that has been created will be implemented using a commonly used keyboard, namely the QWERTY keyboard, by moving the key of the letter 'a' to the location of the key of the letter 'd' in accordance with the layout design that the researcher created. The QWERTY keyboard was chosen to implement the layout design results because it is familiar with its layout and position of use. The results of implementing the proposed keyboard layout can be seen in Figure 1.5.



**Gambar 1.5.** Implementation of the proposed keyboard layout

#### Analysis Results and Discussion

At this stage, 15 respondents to the typing test using a QWERTY keyboard were selected. 5 participants were selected with the fastest typing ability to complete the given text. The results of the respondent's typing speed with the fastest time can be seen in table 1.3.

Responden	Waktu	HURUF/MENIT	KATA/MENIT
responden 1	20.48	140	24.3
responden 2	22.21	129.2	22.4
responden 3	23.18	123.8	21.5
responden 4	22.35	128.4	22.3

responden 5	21.53	133.4	23.1
Rata-rata	21.95	130.96	22.72

**Tabel 1.3.** Speed results for typing Indonesian text with a QWERTY keyboard

Next, the five selected respondents will be asked to quickly type the text provided with the 'proposed' keyboard using a ten-finger typing system. In terms of implementation, the five respondents were first provided with sufficient theoretical knowledge and then the students were instructed to practice so that they became proficient and skilled. The typing speed results using the proposed keyboard will be recorded. The achievements of respondents when typing using the proposed keyboard can be seen in table 1.4.

Responden	Waktu	HURUF/MENIT	KATA/MENIT
responden 1	19.26	149	25.9
responden 2	20.23	141.9	24.6
responden 3	19.14	150	26
responden 4	20.19	142.1	24.3
responden 5	19.10	150.3	26.1
Rata-rata	19.58	146.66	25.38

**Tabel 1.4.** Speed results for typing Indonesian text with the proposed keyboard

From the results of testing the proposed keyboard, it is known that there is a difference in the speed of typing Indonesian text with the tenfinger system, where using the proposed keyboard the average time achieved in completing the text is 19.58 minutes. This proves that using the proposed keyboard the respondent's typing speed increased by 2. 3 minutes. For the load on the fingers using the keyboard, the proposal is considered to be smaller, where the letter 'a' has the highest frequency value and the load is transferred to the stronger finger, namely the middle finger. This is in line with the results of previous research by Fadhilah, 2016, which states that the problemthat occurs with the majority of existing keyboard layouts is the uneven distribution of finger loads. This happens because the layout is designed for English, so it seems a special layout is needed for typing in Indonesian.

### 3. Conclusion

The research results show that by using the proposed keyboard there is a difference in typing speed with the ten finger system for the speed of typing the given text. The load on the fingers is considered smaller where the frequency of the letter 'a' and the load on the little finger is transferred to the stronger finger, namely the middle finger. From these results, using the proposed keyboard is considered more effective and faster for typing Indonesian.

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