

# NON-EXAM ASSESSMENT

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TYPING GAME

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# Analysis

## Introduction

A web-based application where typing skill is improved through entertainment. I believe typing is a skill that every individual must master. I have seen people that type on their laptop as if they have never typed on their laptop. If you spend 2 hours per workday typing and you type 40 WPM this means you are spending 500 hours typing. However, if you invest some time to double your typing speed to 80 WPM, this means you are either saving 250 hours per year or you are doubling the output this will automatically make you more valuable.

## Problem description

Currently the world is revolving around computers where we do most of our work. We spend a lot of time typing on our computers, so it is essential that we have good typing skills as productivity is important when doing work. But unfortunately, most people spend a great amount of time typing and fixing mistakes, so they have less time to think of what they are actually writing. Most people prefer to do work on their computers, but their typing speed is a limiting factor. Nowadays even the students do their exams on their computers, so a student with fast typing speed has more advantage than a student with slower typing speed, this will limit his success just because of his typing skills. When a company is hiring, they expect you to be able to type at a certain speed as they do not want a slow-paced employer. Not only do we need to practise typing, it is also important that we track our progress when learning any skills because the rate of improvement increases. Few of my friends have been practising typing for a long time but they don't know whether they have improved their typing so as a result there hasn't been much improvement.

## Stakeholders

My target audience will be those who are learning how to type and would like to improve their typing skills. Any age group will be welcome to use my websites but I believe it is more suited for younger people as they have more time to spend developing such skills.

My main stakeholder is a year 12 student named Saad, who does English and sociology for his A-levels. He writes many essays on his computer and finds himself spending too much time typing. He is a capable student but always complains that he cannot get his work done on time. He told me that he has been practising typing recently but there has been no improvement. And I believe tracking his progress is the best solution. Throughout the project, he will be constantly updating and informing me with the development of the website. I'll ensure that I get his approval for every iteration and for the development of the website I will have to make sure that he is happy with every feature that I create for the website.

## Computational Methods

This problem is a computation problem because it requires algorithms that are run every second updating the count, words per minute and writing in the database. Also, the only way to type is by using a computer. It is possible to make hardware that is dedicated only for typing but I don't see the reason why would anyone buy another piece of hardware when a computer has these functionalities in it. The calculations can be done instantly when

calculating words per minute, the computer is more efficient when sorting large amounts of data as sorting is needed when doing a leaderboard. Managing users' accounts and their progress will be much easier by using databases.

## Abstraction

Only the essential details are provided to the user, so it improves the maintainability of my code. To make best use of hardware resources, we must not include any features that are not essential to the program, and I need to make sure extra code is not run in the background unnecessarily.

- I will focus less on the design and the structure of the web pages instead I will focus on the main typing game, but I need to make sure the web page is presentable.
- In the sign in and sign-up process the user will be asked to input only the necessary information to make sure their account is safe.
- Functions, procedures and OOP will be used to provide functional abstraction, procedural abstraction and encapsulation when coding the IDE.
- I will use the routes files to create request URLs for my web pages and define a controller method which will have “CRUD” functionalities when working with the database.
- When displaying the progress of the user, the graph and the data will be simplified so it can be understood by any type of user.
- I will be using the echo function to reduce lines of codes instead of creating a new page when something is changed in the page.

## Decomposition

This game can be broken down into 3 main components: front page, typing game, and other features.

- When making my website I need to first structure the website, then style it and then make the website interactive so it can perform certain actions. Each page will have 3 different components but it will be shown as one page to the end user.
- The front page will consist of sign in and sign-up buttons, and images, videos or animation to make the website appealing. The front will give an insight of what the website is for.
- The sign in and sign-up page will allow the user to create an account and log in the future. It is important that the game allows users to create an account and login because the program will have a progress tracker for each user so the program must recognize each individual.
- There will be a default typing game with specific settings such as the user has to type the entire paragraph correctly and has unlimited time.
- I am not sure what features to include in my website until I interview my stakeholders, however I know that each feature can be broken down into sub problems.

## Thinking ahead

- I will be using PHP for my sign in and sign-up process because it provides functions that make communicating with MySQL extremely simple. However, I will be using

JavaScript for my typing game and progress tracker. JavaScript requires a runtime environment called node.js in order to communicate with MySQL.

- The inputs of the game will most definitely be the keyboard and mouse. The keyboard will be used to its entirety. I need to make sure certain keys are disabled during the game, for example the enter button to prevent them making new paragraphs unnecessarily.
- The website must be secure which is why I will be using PHP because PHP is more secure than JavaScript, as the code itself is not visible in the browser. JavaScript code is comparatively more vulnerable.

### Thinking logically

- The typing game will be making decisions all the time, because the program will be deciding whether to apply the colour green, red or no colour on the text depending on what the user has typed.
- If statements will be used for validation when creating an account and validation is required to make the system robust and secure.
- Decisions will also be made when displaying the leaderboard because it should only display them in the leaderboard if they play a certain mode.

### Thinking concurrently

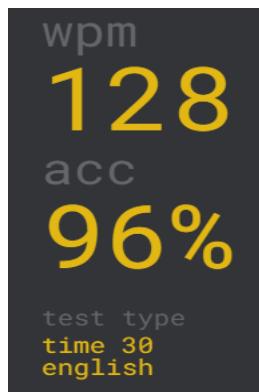
- Multiple users will be able to access play at the same time therefore the website must be able to recognise everyone that is on the website as a different user. Additionally, each user is likely to be using the website differently so multiple processes will be running simultaneously.
- The leaderboard will be updated live while they are in a game, so as soon as the user gets a higher wpm than the user on the leaderboard, they will be placed on top of the leaderboard instantly. This is thinking concurrently as the program is running two processes simultaneously which increases the games effectiveness to provide a good experience for the target audience.

## Interview

### Purpose of the interview

It is necessary that my stakeholders are asked about their preference and how they would like to use the website so that the end program meets their needs. However, the stakeholder may not know their full requirements at the beginning of the project which is why I will be getting feedback throughout the development of the project. For my stakeholder I have chosen two individuals, Wasi who is the fastest typist that I know and Saad who is the slowest typist that I know. I will be using email to communicate and interview my stakeholders because email is the most formal way to communicate and the stakeholders are more likely to answer my questions more seriously and honestly.

Here is Wasi taking a typing speed test:



Here is Saad taking a typing speed test:

You just typed a quote from the book:

The Fault in Our Stars by John Green	
	Your speed: <b>20 wpm</b>
	Time: <b>0:59</b>
	Accuracy: <b>87.6%</b>
	Points: <b>7</b>
<a href="#"> Try again?</a>	

We can see from the screenshots that there is a big difference between Saad and Wasi in typing speed. One of the reasons why Saad has a low typing speed is because of the number of mistakes he makes while he types. I will be interviewing Mohsin, who was a slow typist however he has been practising since last year.

## Life effect

### Question

1. Are you a student, if yes what do you study?
2. How much of your work is done on paper and how much of your work is done digitally and does it involve writing?
3. Does your typing speed affect your work efficiency and achieving your best as most of your work is done digitally.

### Justification

1. I want to know in which field they are studying so I will have a better idea of which field is in need of my website.
2. I want to know how useful my website will be. The more work is done digitally instead of paper the more important it is to have good typing skill.
3. I want to see the difference in their achievement because one of my stakeholders is the fastest typist and the other is the slowest typist.

## Answer

1. [Saad]- Yes, I am a year 13 A-level student and I study English, sociology and economics.  
 [Wasi]- Yes, I am a year 12 A-level student and I study geography, maths and physics.  
 [Mohsin]- No, I am a junior software developer and have been working there for a year.
2. [Saad]- I write most of my essays on my computer because it is easier to share and store for future use.  
 [Wasi]- I take my physics notes on paper because it involves calculation. I also do my maths calculation on paper as well but half of my geography work is done digitally and half is done on paper.  
 [Mohsin]- As a software engineer I mostly code on my computer, there is hardly any work done on paper except when we are in meetings and we try to share ideas. Even when we are presenting to a group of people, we use PowerPoint presentations.
3. [Saad]- I spend a lot of time doing my homework, I remember most of my GCSE exams were done online. Doing my tests online was much harder for me and I was always the last one to submit my test.  
 [Wasi]- I just feel like I have an advantage over the other students in my class and most of the time I finish my work before everyone.  
 [Mohsin]- I started practising typing last year and it helped me a lot when I was applying for jobs.

## What I have learned

1. We can see that they are all in different fields, we can learn more from the interview because they have very different experiences. We can also see that they are in different age groups.
2. We can see even the youth are doing most of their work on their computer, we can tell the teachers prefer to do their work on their computer, this means we have a wider audience that requires good typing skills.
3. They all agree that today such skill is very important to have, and it could prevent anyone achieving their best as all applications are done online.

## Website requirements interview

### Question

1. Do you think a typing game will benefit you, if yes how will it benefit you?
2. What kind of features would you like to see on the website, so it meets your needs?
3. How much focus should there be on the design of the website?

### Justification

1. I want to know if the website will benefit even people with good typing skills and maybe find out if the website has more than one purpose. It would also tell me whether I should add different features for more skilled typists. This question is targeted to Wasi and Mohsin as Saad is my main stakeholder.
2. I must specifically know which features are the most important to include.
3. I want to know if they have a specific website design that they have seen in other websites which improve website usability.

## Answer

1. [Wasi]- I think I can practise typing for fun, just to get a high score.  
 [Mohsin]- I still practise typing during my free time because I am not satisfied with my typing speed yet.
2. [Saad]- I need a section that shows what are the words that I get wrong because I think I am able to type fast but keep making mistakes.  
 [Wasi]- I would like to see a leaderboard on the website so I can be on top of the leaderboard all the time.  
 [Mohsin]- In the last few months I feel like I haven't seen any improvement, so I feel like a progress tracker will be very useful for me.
3. [Saad]- I don't really care how the website looks, I will be happy with a website where I can just practise my typing.  
 [Wasi]- I think including the main functionality is more important than the design, however the design makes the website more appealing for other people to use.  
 [Mohsin]- You don't really need to focus on the design but make sure the colours and the fonts are appropriate so the buttons and the important information are visible.

## What I have learned

1. So my typing game can be used for fun and improvement. This means I should add extra features for different purposes.
2. The main features that my stakeholders want to see on my website is a leaderboard, progress tracker and the common mistakes.
3. I will not focus on the website design, however I will listen to Mohsin's advice because he built a few websites before. For example displaying error messages red and success message green which is part of design.

## Specific interview

I will be interviewing Saad individually because he struggles the most when typing.

### Question

1. Should there be multiple levels of difficulty?
2. In which device are you most likely to use the website and which browsers do you use?
3. You said before that you want to just practise typing. What can I add on the website so that it is easy for you to use?
4. How do you want the progress tracker to look like and what information should it include?

### Justification

1. I need to find out if my main stakeholder is interested in being challenged from the start of the learning process.
2. I need to know which device my stakeholder prefers to use so I will develop the website based on his preference.
3. Any extra features that I need to add to improve the usability of the website for my stakeholder.
4. I asked my stakeholder Saad before if he wants a progress tracker on the website and he said yes. I need to know what information would be useful to include in the progress tracker.

## Answer

1. [Saad]- It is better for me to practise typing instead of trying multiple levels. You could add different modes, so in the future when I am confident with my typing skills I could try them.
2. [Saad]- I will use my laptop and I will use chrome as my default browser.
3. [Saad]- I would like to jump on the website and start practising without doing anything else.
4. [Saad]- I want to see how my average typing speed changes over a month or a year and the words that I mostly get wrong.

## What I have learned

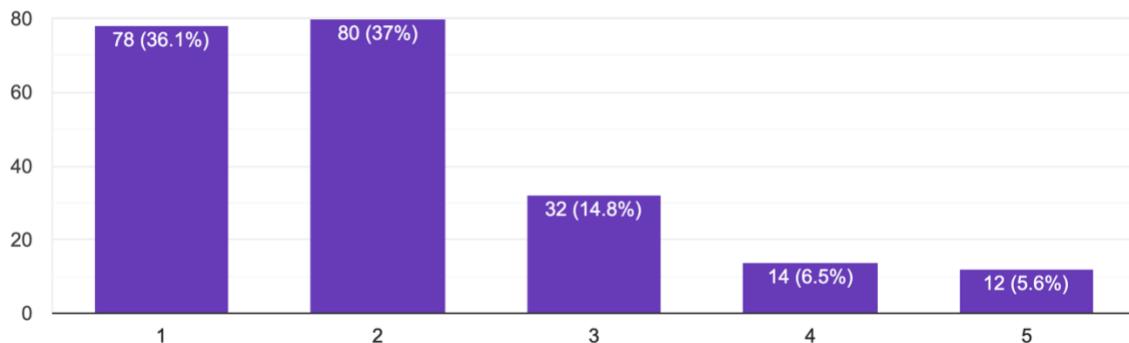
1. Adding different modes is an optional requirement, but it would be a good feature for many people.
2. I don't need to make my website responsive. Responsive website means when a website is resized to a smaller screen size the website will adjust itself so that the information is contained, and the website is still usable. I will focus less on making a cross browser website.
3. I was thinking that everyone must sign up and login in order to play, but just to meet the stakeholder's needs I will add guest mode.
4. I guess it is up to me how I will display this information and I will probably use a graph instead of a table so it is easy to understand.

## Survey

I distributed my survey to a wider range of people, to get a better idea of how I should develop my website. I did a google form with multiple choice questions instead of open questions, so the people do not have to spend a long time filling in my form. I distributed my form to a variety of online communities to get a fair result.

### Do you think is important to have strong typing skills in 2022?

216 responses

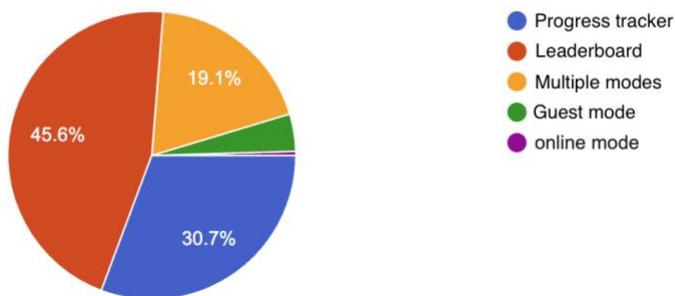


Most people agree that It is important to have strong typing skills. This means my website will be useful. This question confirms the initial problem presented and we should all spend time developing typing skills.

Which feature is the most important to include in a typing game?

 Copy

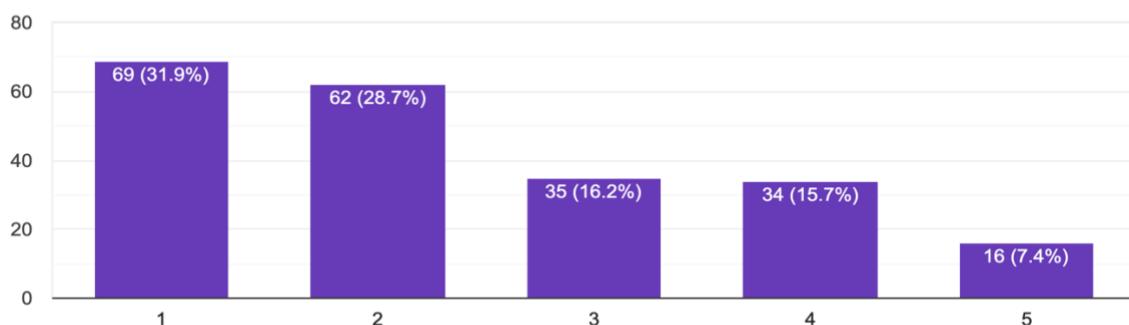
215 responses



Most people want to see a leaderboard and a progress tracker on the website, which is not what my stakeholder wants. I put another option, if the people had any other feature in their mind they could type it in. As we can see a small percentage of people suggested online mode which is a feature I did not have in mind.

Typing without looking at the keyboard is easy for me.

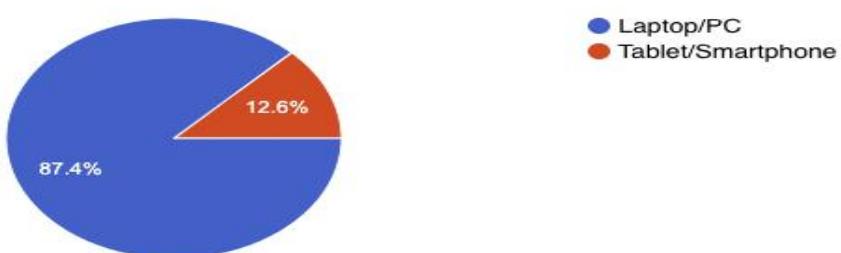
216 responses



Most people said it is easy for them to type without looking; this suggests that it is not necessary to include anything that teaches them how to type from the start.

On what device would you use the typing game website on?

214 responses



I am certain that I will develop my website for a large screen size instead of making a responsive website as most of my users will be using a laptop.

## Conclusion

The main features that I would include is a leaderboard, guest mode and progress tracker. And online mode and multiple modes on the optional requirement list. I need to make sure that users can sign up and log in so that they are recognised in order to display their progress. Most people will find my website useful no matter what they are studying. The game does appeal to many age ranges and the website would now have more than one purpose by adding the features listed above. Most users also wanted the game to function on a desktop PC, giving an indication of what platform this solution should be developed for.

## Research

### Example 1 (<https://play.typeracer.com/>)

Overview of the website

This is what the front page of type racer looks like.

The website has an online mode where you can compete with random players, and you can also practise by yourself as well.

Get matched up with online opponents  
Enter a Typing Race

Improve your typing skills on your own  
Practice Yourself

Race up to 200 friends in your own racetrack  
Race Your Friends

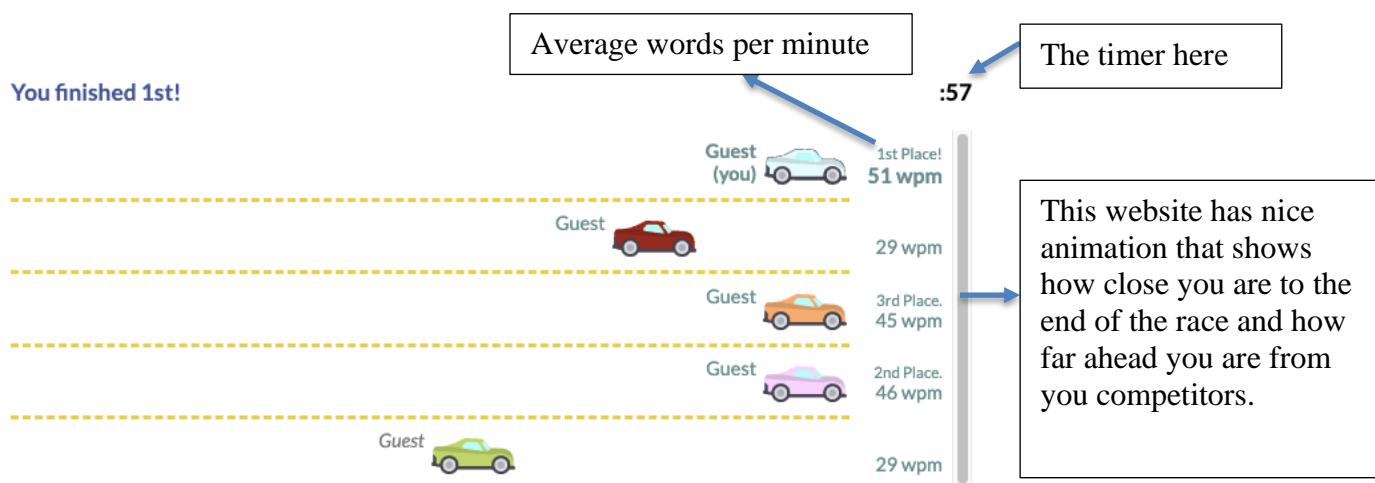
TypeRacer Universes

Dictionary	Anime	Português TypeRacer
Randomly generated top English words! 9331 Races Today	何ですか？！ Type content from Tokyo Ghoul to Attack on Titan. 3652 Races Today	Você pode vencer os mais rápidos digitadores do Brasil? 2248 Races Today

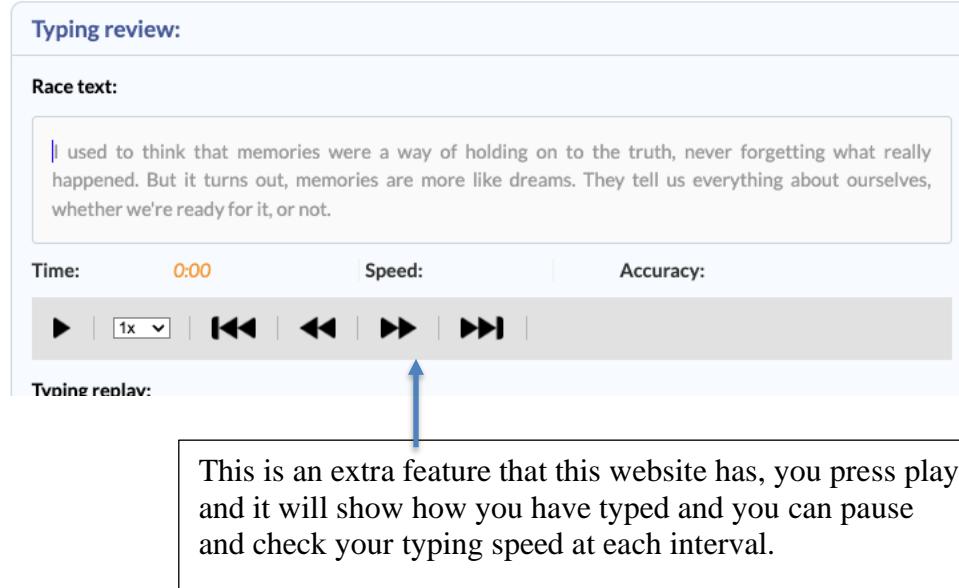
Latest High Scores

Name	Speed	Time
1 keegant	221 wpm	23 seconds ago
2 flaneur	216 wpm	15 minutes ago
3 mt one-trick (tempaccount_1)	173 wpm	28 minutes ago
4 Black Rose (rosewolf)	171 wpm	20 minutes ago
5 xvi (mrasianboy)	170 wpm	54 minutes ago
6 Emanuela (emanuel01)	125 wpm	40 minutes ago

The leaderboard is on the first page which shows their rank, username, best speed and how long ago they got their best speed.



[Main menu \(leave race\)](#) [Race again](#)



This website is for entertainment purposes but can be used to practise. You need to buy a premium to be in the leaderboard of that website. There is only one mode which has specific settings; the entire quote has to be correct in order to finish, there is a time limit, you are allowed to get six mistakes in a row before the keyboard is disabled etc.

What can I take from this

I will make sure that the leaderboard is on the front page, this will encourage users to sign up and participate and practise. The website does not require you to make an account before you practise, and this is what the quest mode will look like on my website with similar settings. I am not really sure what they use to generate the quotes and much information of the development approach that they used to create such a website but all I know is that they have used JavaScript as their programming language.

What will be different

I will make sure the user gets a personalised experience when using my website. I will provide users with in-depth analysis of their typing performance.

Example 2 (<https://10fastfingers.com/typing-test/english>)

Overview of the website

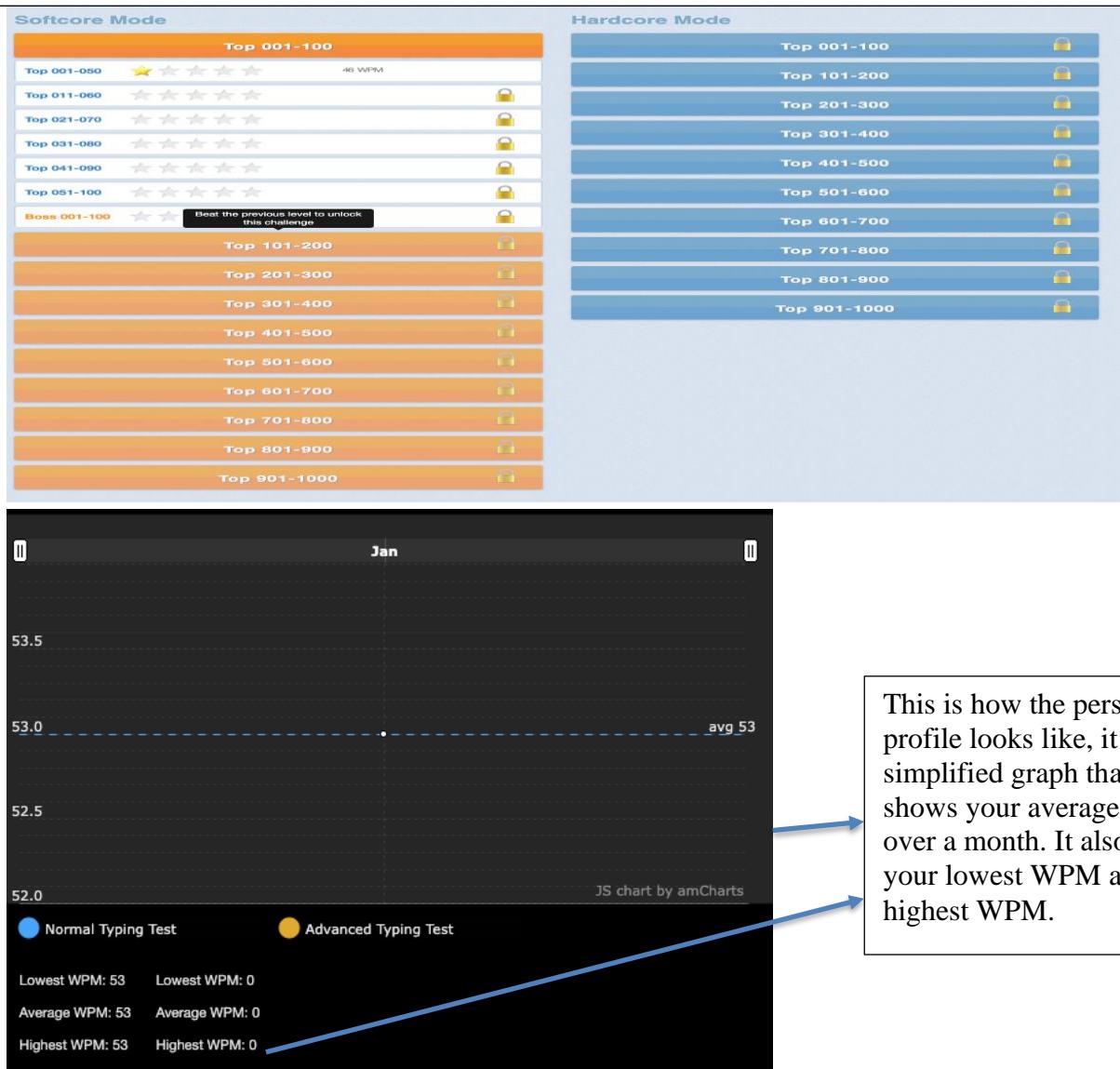
The screenshot shows a typing test interface. At the top, there is a text box containing random words: "young page than word young but might you house people soon should enough so his four on old through city such if next his". Below this is a blue header bar with a white input field on the left, a "1:00" timer in the middle, and a refresh/circular arrow icon on the right. A blue arrow points down from the timer area to a text box on the right which reads: "You have a minute timer and you have to type the random words that are shown in the box". On the left, there is a "Result Screenshot" section with a large green "53 WPM" (words per minute) displayed prominently. Below this, a table provides detailed stats: Keystrokes (263 | 14) 277, Accuracy 91.96%, Correct words 53, and Wrong words 3. A blue arrow points from the "Wrong words" row to a callout box on the right that explains the accuracy calculation: "This is how the stats are shown, it calculates accuracy different to example one. The number of words you type divided by the number of wrong words you get.".

Result Screenshot	
<b>53 WPM</b> (words per minute)	
Keystrokes	(263   14) 277
Accuracy	91.96%
Correct words	53
Wrong words	3

You have a minute timer and you have to type the random words that are shown in the box

This is how the stats are shown, it calculates accuracy different to example one. The number of words you type divided by the number of wrong words you get.

This is one of the extra features that this website has, there are multiple challenges with the same setting, and you earn stars and points as you complete them. These tests includes a variety of text of different length and difficulty levels. To achieve the stars, you must type the paragraph in each level under certain amount of time.



This website has two main modes: random words and quotes. You can sign up and log in to access your personal profile. Your profile shows your achievements earned by completing the challenges.

Text Practice Mode		language filter:	All languages		
		New			
State	Title	Rating	Textlength	completed	Age
public	<a href="#">Poskytování informací o trestním řízení a osobách na něm zúčastněných</a> Poskytování informací o trestním řízení a osobách na něm zúčastněných	0 votes	987 words 6641 characters	0	0 Today 04:54
public	<a href="#">National Tourism for Integrated Society vs. Consequences of Criminal Actions...</a> National tourism should have a major thrust in the development of an integrated	1 votes	261 words 1493 characters	56	Today 03:46
public	<a href="#">Luyện gõ 02</a> má ban ché gi cõ ché bang chí ché thi thám thang ám áp thi hoé	1 votes	55 words 227 characters	1	97 Today 02:02
public	<a href="#">My typing practice text</a> The quick brown fox jumps over the lazy dog. This sentence is commonly used to s	1 votes	75 words 454 characters	1	270 Today 11:54
public	<a href="#">Kinh tế chính trị</a> Trình bày khái niệm tư bản bất biến tư bản khả biến Bô phđ	1 votes	344 words 1522 characters	1	34 Today 09:10
public	<a href="#">The Jat Regiment</a> When the finance minister began speaking at the Indo-US joint business meeting i	1 votes	627 words 3953 characters	0	78 Today 07:35
public	<a href="#">The Idea of a University Defined and Illustrated by John Henry Newman Pt. 100</a>		765 words	0	20 Today

This is the text practice mode. This feature allows you to select the paragraph that you want to type instead of typing a random quote or words. It also allows you to create your own quote. This feature is useful if you want to practise typing a specific paragraph that you may have to type somewhere else. The website also supports multiple languages, including English, German, French, Spanish, and many others.

#### UI features

1. The website has a clean and simple user interface, with a white background and black text.
2. The typing test is displayed in the centre of the screen, with a countdown timer at the top and the user's typing progress at the bottom.
3. The website uses a large and clear font for the text, making it easy to read.
4. As the user types, the website highlights any errors in red, making it easy to see where mistakes have been made.
5. The leaderboard is displayed on the right-hand side of the screen, showing the top 100 fastest typists.
6. The website uses a green colour to indicate correct keystrokes, and a red colour to indicate incorrect keystrokes.
7. The website has a responsive design, meaning that it can be used on a variety of devices and screen sizes.
8. The website uses animation to provide visual feedback, such as when the user completes a typing test.

#### What can I take from this

The leaderboard of this website is on the front page, I will make sure the leaderboard is on my front page as well. I will be using similar graphs for my progress tracker feature. The settings that are used on this website could be used for one of the modes on my website where you type random words.

## What I will do different

My website will have multiple graphs for different time periods and modes. While I will not include fun challenges for now, it is a good feature for entertainment. My website will not support multiple languages because it will be developed for stakeholders who are fluent in English.

## Website developing languages and methods

Method	Purpose	Advantage	Disadvantage	Chosen
HTML5 and CSS	To structure the webpage and style it. These are not coding languages.	<ul style="list-style-type: none"> <li>Allows you to deploy content</li> <li>Easy to develop and design GUI</li> <li>Can embed with other scripting languages</li> <li>Cross platform</li> </ul>	<ul style="list-style-type: none"> <li>Limited functionality, can make it interactive</li> <li>Requires access to the internet</li> </ul>	
JavaScript	Programming language for web application	<ul style="list-style-type: none"> <li>Rapid development</li> <li>Client-side execution</li> <li>User Interface Interactivity</li> <li>Make XMLHttpRequest() Object</li> </ul>	<ul style="list-style-type: none"> <li>Code always visible</li> <li>Different browsers may interpret the code differently.</li> </ul>	
PHP	It is a dynamic and general-purpose language that is used in development of server-side applications	<ul style="list-style-type: none"> <li>Offers plenty framework</li> <li>Has the Xdebug extension that provides great debugging</li> <li>Supports functional and object-oriented programming paradigms.</li> </ul>	<ul style="list-style-type: none"> <li>Building a web page using only PHP can be slower when compared to other languages.</li> </ul>	
Java	It is a versatile OOP language that is sometime used for backend web development	<ul style="list-style-type: none"> <li>large set of APIs, tools, and implementations of commonly used security algorithms, mechanisms, and protocols.</li> <li>large number of Java libraries of different purposes for example:</li> </ul>	<ul style="list-style-type: none"> <li>Java is slow and has poor performance. Java is memory-consuming and significantly slower than native languages such as C or C++. ...</li> <li>Java provides a not so attractive</li> </ul>	

		HTML parsing libraries	look and feel of the GUI.	
Framework (Angular)	It offers more practical solutions for the front end.	<ul style="list-style-type: none"> <li>Ensures that developers can build websites with minimum coding</li> <li>Saves time</li> <li>Framework has been tested many times to ensure full functionality</li> </ul>	<ul style="list-style-type: none"> <li>Lack performance</li> <li>Difficult to learn</li> <li>You need to invest time and learn this language completely before building a web page</li> </ul>	
Python	Its duty is sending data to and from servers, processing data and communicating with databases, URL routing, and ensuring security.	<ul style="list-style-type: none"> <li>Allows you to easily scale even complex web applications</li> <li>Offer flask and Django framework</li> <li>Python used for web scraping meaning extracting date.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>	
Website builder	It is an alternative to web development.	<ul style="list-style-type: none"> <li>Doesn't require any coding experience</li> <li>Easy to develop</li> </ul>	<ul style="list-style-type: none"> <li>Can't customise the design</li> <li>No source code</li> </ul>	

## Conclusion from research

Both solutions to similar problems I researched used JavaScript, because it offers extended functionalities and there are many JS frameworks. These websites gave me an idea of what information the leaderboard should include and what information I should include in the progress tracker and how the graph should look. The modes are very simple and basic, but it can help to start developing the website.

## Proposed Solution

Initially I did not have any specific feature in my mind, so these were the features that my targeted stakeholder wanted to see and use on my website, so it meets their needs. Once I interviewed my stakeholder, I asked a wider audience for their preferences and needs. The wider audience was more interested in the features that my stakeholders have proposed than the other features. My stakeholders have very little knowledge in the technology world, which means that they may be limiting their ideas because they do not know what is possible to do and what is not. However I will be updating my stakeholders throughout the development process for additional information.

## Must

The first and most important feature would be the Typing Test. This would be the user typing out an extract in the program. When the word inputted by the user is correct and corresponds to the extract, the program moves on to the next word. The test will not continue unless the word typed is correct and no mistakes are in the input. The solutions I have researched vary on how errors made by the user are tackled.

The main features that I will prioritise and make sure to include in my website after I have done the interview and research are leaderboard, progress tracker and guest mode. Wasi, who mastered typing, wanted to see a leaderboard on my website. So this feature is more for entertainment, for people that are experts and want to challenge each other. I will only be displaying the top 10 typists and will make the table abstract by displaying the necessary information. This feature unlocks a new purpose and audience to the website and it allows me to call it a typing game. Databases will come in handy when making a leaderboard, each user's highest typing speed will be written on the database and a function will be run to read, sort and display the data into a table. Mohsin and Saad wanted to see a progress tracker on the website, which I believe is a good feature for Saad especially because he will see a greater improvement when his typing skill is tracked. Thanks to this feature the users can easily notice whether the user is taking the right approach to improve their skill for example touch typing. I have chosen to display the progress using graphs instead of tables so it is easy to visualise and understandable by most users. It will consist of the 2 main graphs, one of the graphs showing their typing speed performance and their accuracy over a period. There will be a different table summarising your performance. This feature can get complicated if many modes are added into the game. My main stakeholder did not want to log in each time in order to use my website, so I believe guest mode is the best feature for him. It is a good feature for random users because most users will not be willing to sign up to play and type. However his progress will not be tracked. The guest mode will be a general typing game and will not have access to different modes and they cannot be displayed on the leaderboard.

## Optional

The online mode is a feature that was proposed by a wider audience. It is a feature that will allow multiple users to play against each other and see who can type faster. This feature will bring in a lot of young users as they like competition and could be played as a game during their free time. I believe the demand for this feature is very low and will not benefit any of my stakeholders in any way. It will involve using a platform like Ably real-time to give the user a synchronised digital experience in real-time. I will also require to have a good understanding of networking and have good knowledge on server-side scripts. It can be very hard to maintain the synchronisation between all the users which could be very time consuming so for now it is on the optional feature.

## Extra

The learner mode would be a targeted feature, it would teach people how to type from scratch. I believe in this modern time most people have used a computer before. The user will be able to choose a username of their choice, and I could have a feature where they can add a profile picture and change their username. A scoring system could be added to the typing game where the user will be awarded with points based on their typing performance. These are extra cool features because the website will be fully functional and would fulfil my stakeholders needs without these features.

## Limitations

One of the biggest limitations is that only users that understand English and type in English will be able to use my website. My website will not have any auto translate feature, and even if it did it must translate the quote fetched from the API. My stakeholders are fluent in English therefore it is not necessary to translate the website's content to a different language. Another limitation is that the website won't support text to speech. This would help visually impaired users to use the website since the text to speech will automatically be able to read what the user needs to type.

Due to time constraints, I will not be able to develop all the features mentioned above. However, I will make sure I have the features that will benefit my stakeholder and the wider audience the most. So if I can't add the profile feature the user will not be able to change their username and customise his profile. I am aware that the last two generations (Gen Z and Millennials) use mostly mobile devices, however most people said they are more likely to use my website on a laptop or pc. So I will ignore the mobile phone users for now and focus on the fundamental features.

Another limitation even though it is not much of a problem today is that the user must have an internet connection to access my website. Meaning it cannot be accessed offline. It could be run on a local computer with XAMPP installed but the user must have the source code on their computer as well.

## Requirements

### Software

<b>Software</b>	<b>Justification and purpose</b>
Visual Studio Code	It is an IDE which has many tools. For example it will allow me to make changes on the website and view those changes live. And node.js development workload is available with visual studio code
XAMPP	I need to use a localhost to run PHP whilst I am developing the website and I also need it to communicate with MySQL.
XDebug	This will allow me to debug when coding in PHP. It will allow me to set breakpoints and inspect all the variables in scope.
API	I need an API which will generate random quotes or words for the users to type.
Node.js	It is a runtime environment that will allow me run my JavaScript on a server which will be helpful to communicate with MySQL database
Chart.js	It is a JavaScript library which will allow me create graphs
Secondary API	I will try to put a back API, I need to make sure my website is still running even if the first API server is down.
GitHub Pages	It is a site hosting service, this will allow me to host the website for free for other online users to access my website.
phpMyAdmin	It is a software tool which handles administration of MySQL database servers. This is where I will be storing the user's login information and progress information.

Browser	A browser is needed because I will be making a website, it doesn't really matter which browser I use to view my website. I will be using Chrome because it is the most popular browser, you can also view it in other browsers as they read HTML and CSS the same way.
Any OS	Any OS which is able to run a web browser and execute code from VS studio
Bootstrap	This is a framework that will allow my website to be responsive and usable on different devices.

## Design

<b>Design</b>	<b>Justification and purpose</b>
A consistent colour scheme.	The colours of my website must match the colours required by my stakeholder.
A consistent font.	Font will have to match stakeholder's request in order to make my website custom and to give a personalised touch.

## Hardware

<b>Hardware</b>	<b>Justification and purpose</b>
PC	I will be using my personal computer to execute the code and test my code.
Keyboard	A keyboard is required for the user to play the game, log in and sign up.
Mouse	A mouse is required for the user to navigate through my website.
Monitor	Allows the user to view the website.

## Languages

<b>Languages</b>	<b>Justification and purpose</b>
HTML and CSS(not a programming language, it is a markup language)	It is used by all the websites to structure and design the website. Every single web page will consist of HTML and CSS with another programming language. For example I will use HTML to make my buttons, table, background image and CSS to add colour and position the elements listed above.
PHP	I will be using PHP for login and sign up process because it is more secure than JavaScript. It allows connection to almost any type of database.
JavaScript	I will be using JavaScript to develop my typing game and the features because it is beginner friendly and it is very popular with lots of resources.
Node.js (not a programming language, it is a runtime environment)	It allows JavaScript to connect with databases. I will be creating, reading, updating and deleting data and using databases for leaderboard and progress tracker.

## Success criteria (Fast)

Criteria	What and Justification	Met
<b>Front page</b>		
Front page leaderboard	The leaderboard must be on the front page, this is a feature taken from type racer. It will encourage more people to participate and be on the leaderboard	<input type="checkbox"/>
<b>Sign up</b>		
Username and password validation	The username and password must be in a certain format so that username is something reasonable and the password is secure.	<input type="checkbox"/>
Success message and error message	If the requirements are not met it must output an error message. If the requirements are met it outputs a success message.	<input type="checkbox"/>
Password hashed	The password used to sign up must be hashed before it is written in the database. So that the account cannot be accessed even if they have the database.	<input type="checkbox"/>
Username used already	The program must check against the database if the username is already used to make sure the username is unique.	<input type="checkbox"/>
Account made already	The program must check against the database if the email is already in the database.	<input type="checkbox"/>
Verification email	A random 6-digit number will be generated and will be sent to the email provided. So that a valid email is used and can access the account later.	<input type="checkbox"/>
Send verification email	If the user forgot to verify their account, they can send another email to verify it. As the verification code would expire.	<input type="checkbox"/>
Update verification status	When the user successfully created an account, it must update that the user has verified their email.	<input type="checkbox"/>
<b>Log in</b>		
Correct Username and password	The user should not be able to access their account without the correct username and password.	<input type="checkbox"/>
Forgot password	If they have forgotten their password, they will be able to send a link to their email to reset the password so that their account will not be lost.	<input type="checkbox"/>
Forgot password link expiry	The link sent when the password is forgotten must have an expiry time, so it makes sure that anyone else does not access the link.	<input type="checkbox"/>

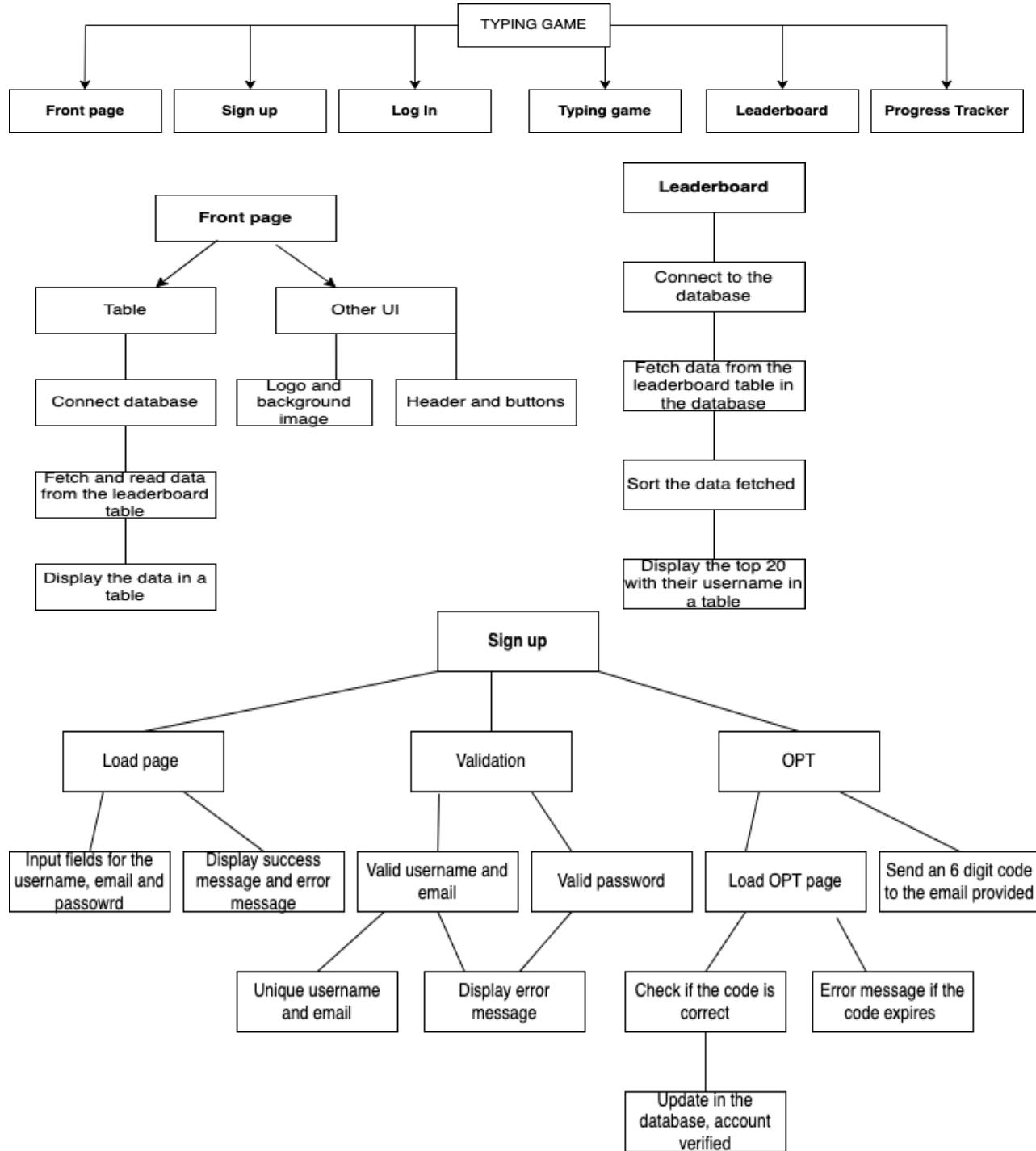
Update database password	The database must be updated with the new password when the password is changed so that the user can log in next time with the new password.	<input type="checkbox"/>
<b>Typing game</b>		
Create a table	When the user takes the first typing test, it must create a table in the database with their username which will then later be used for the progress tracker.	<input type="checkbox"/>
Random paragraph generator	It must generate a random quote for the user to replicate and type.	<input type="checkbox"/>
Timer	The user must type the paragraph generated within a fixed period. The timer should start when the user starts typing and it should reset when the user generates a new quote.	<input type="checkbox"/>
Mistake	It must show how many times the user has typed an incorrect letter, so the user can see their accuracy.	<input type="checkbox"/>
WPM	The program will perform a calculation and it will display how fast the user is typing(Words per minute) which is a standard measure of typing speed.	<input type="checkbox"/>
CPM	WPM will not be as accurate as characters per minute because we assume every word is 5 characters long which is not true all the time. CPM is used if they want an accurate measurement.	<input type="checkbox"/>
Prevent copy and paste	The user should not be able to copy and paste in the text area to prevent any cheating.	<input type="checkbox"/>
Write in the database	After every test the time taken, WPM and mistakes must be written in the database with the current time and the date. This will be useful later when showing their progress.	<input type="checkbox"/>
<b>Guest Mode</b>		
Typing game	The user will be able to play and take a typing test without logging in.	<input type="checkbox"/>
<b>Leaderboard</b>		
Table	There should be a table with top 10 faster typists.	<input type="checkbox"/>
Live update	The table must be updated instantly if the user manages to get a higher speed than the people in the database	<input type="checkbox"/>
<b>Progress tracker</b>		
WPM graph	The user should be able to see their change in typing speed over a period of time.	<input type="checkbox"/>
Accuracy graph	There will be a table showing their change in accuracy speed over the last month or year. By looking at this graph they can conclude whether they have worked on their accuracy.	<input type="checkbox"/>

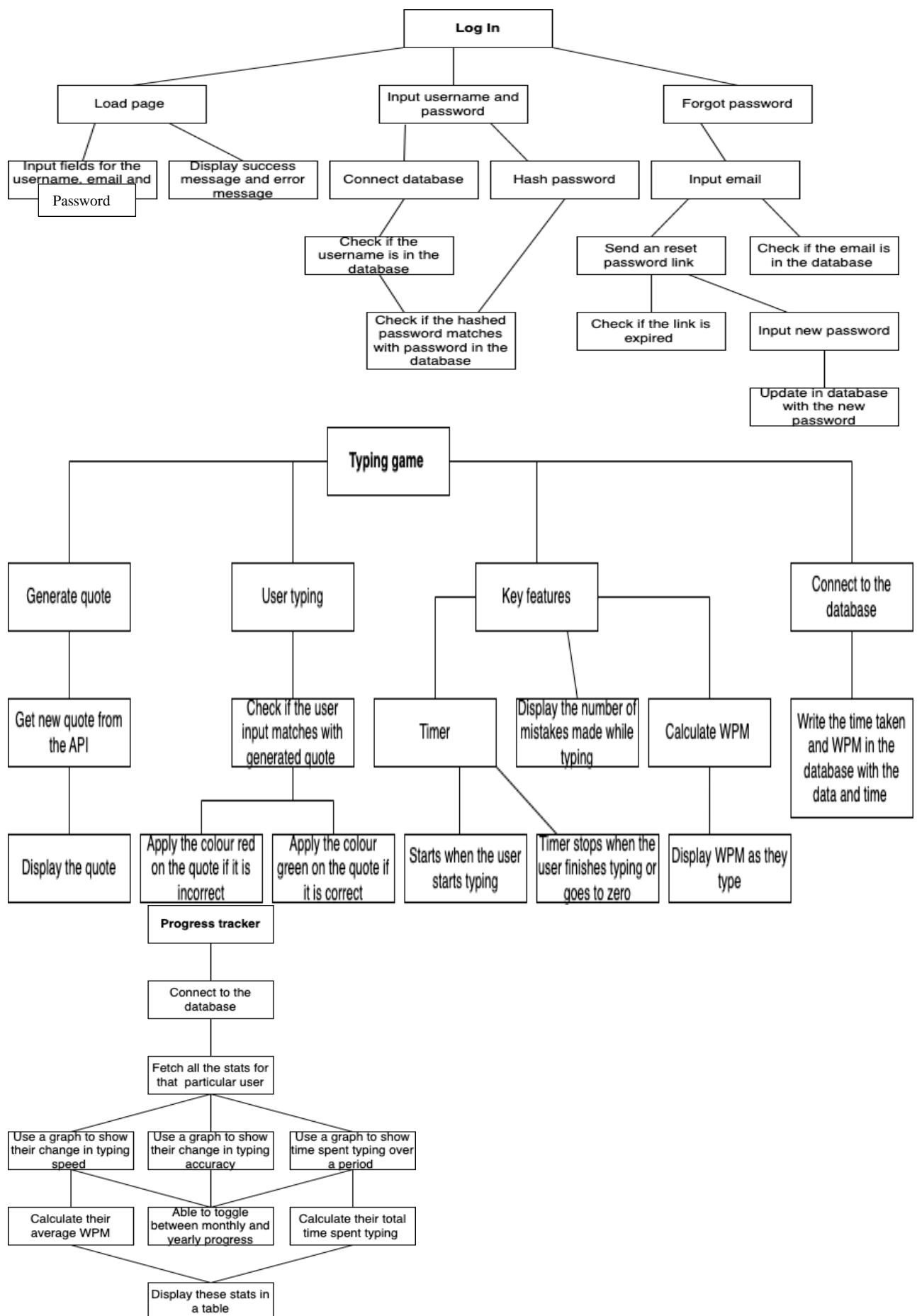
Extra stats	This will summarise their performance and they do not have to look at the graphs. This will have the time spent typing and their average WPM.	<input type="checkbox"/>
<b>Design</b>		
Simple design	Most websites are crazy looking with nice animation and the website changes its format if you move your cursor and so on. But I keep my design simple and easy to use for my stakeholder as I am not advertising anything.	<input type="checkbox"/>
SQL injection	The program should be able to protect itself from SQL injection.	

# Design

## Decomposition of problem

### System diagram



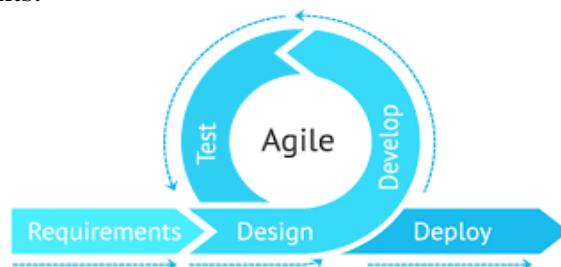


The easiest way for me to break down my problem was to decompose the problem by features. As shown above these features can be broken down even further into sub-tasks and I will develop them part by part making it easy to follow and solvable using computational methods. I did not add guest-mode even though I mentioned it in my success criteria because the guest-mode has the same processes as typing game without the process of writing the values into the database.

### Software development life cycle (SDLC)

Type	Advantages	Disadvantages	Chosen
Waterfall Model	<ul style="list-style-type: none"> <li>Easy to understand and follow</li> <li>Suited for projects in which the requirements are known.</li> <li>Stages and activities are well defined</li> </ul>	<ul style="list-style-type: none"> <li>Too rigid if I make changes to the requirements, I would have to start again which is a waste of time.</li> <li>Difficult to backtracking</li> </ul>	<input type="checkbox"/>
Agile development	<ul style="list-style-type: none"> <li>The requirements can be changed and added after each iteration.</li> <li>Face to face communication</li> <li>Result is high quality</li> </ul>	<ul style="list-style-type: none"> <li>If the requirement is unclear, then the end product will not be what was desired.</li> <li>Requires consistent interaction between user and programmer</li> </ul>	<input checked="" type="checkbox"/>
Spiral Method	<ul style="list-style-type: none"> <li>Produces prototypes throughout</li> <li>- Thorough risk-analysis and mitigation</li> </ul>	<ul style="list-style-type: none"> <li>Lack of focus on code efficiency</li> <li>Making prototypes may be a waste of time.</li> </ul>	<input type="checkbox"/>
V-Shaped Model	<ul style="list-style-type: none"> <li>Development of test plans are done early</li> <li>Works well for simple requirements</li> </ul>	<ul style="list-style-type: none"> <li>Model doesn't provide a clear path for problems found during testing phase</li> <li>Not flexible</li> </ul>	<input type="checkbox"/>

I have decided to use agile development to develop my website because I will continuously take feedback from my stakeholders for the design and the usability of my website. I will not finish everything all in one go so agile will allow me the flexibility of going back and changing any requirements.

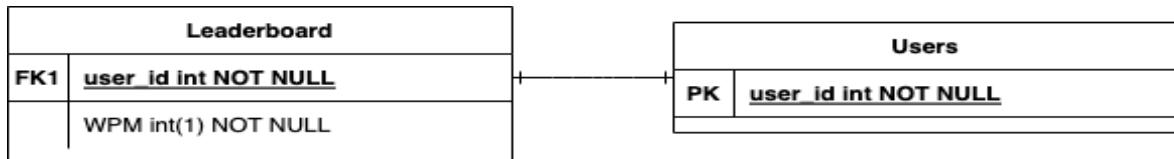


### Front page

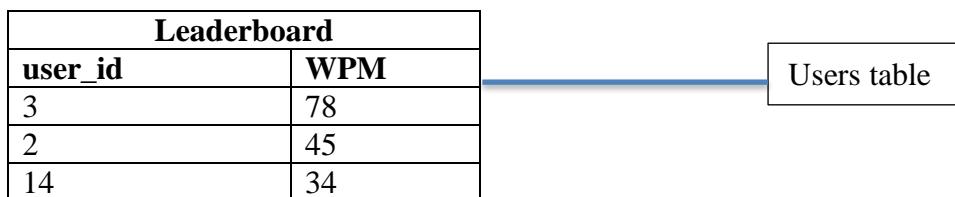
For a website I thought it would be important to have a front page where they get an insight of what the website is about and from there, they can navigate to different web pages.

## Database

I will be having a separate table in my database called leaderboard so that any calculation or sorting will not be performed on this page. The leaderboard will be ready, and this page will have to read the database and fetch its corresponding username from another table.



user\_id will act as foreign key in the leaderboard table and it is a one-to-one relationship because not all users will be in the leaderboard and only their best speed will be written in the leaderboard table.



## Key variables/function

Name	Purpose
<b>Variables</b>	
username_array	array This will store the usernames fetched from the leaderboard table in array
WPM_array	array This will store the speed of each user in the leaderboard database
<b>Function</b>	
table	This function will loop through the array and put these values into a table
fetch_leaderboard	The function will perform a read operation and will fetch the username and the speed from the leaderboard

## Pseudocode

```

Function fetch_leaderboard()
    database= require"dbh.file"
    leaderboard_value=database.execute("
        SELECT username, WPM
        FROM users
        JOIN Leaderboard
        users.user_id= leaderboard.user_id")
        ORDER BY WPM ASC
    return leaderboard_value
endFunction
  
```

To perform a read operation, we must connect to the database first (line 2). We are performing an inner join when it only returns connected, matching rows as every user\_id is

not in the leaderboard table. Returning the values from highest typing speed to the lowest so that I do not need to sort it again to display the leaderboard.

```

1 procedure table (username_array, WPM_array):
2     for i in range 0 to len(username_array) Then
3         <tr>
4             <td>username_array[i]</td>
5             <td>WPM_array[i]</td>
6         </tr>
7     next i
8 endprocedure

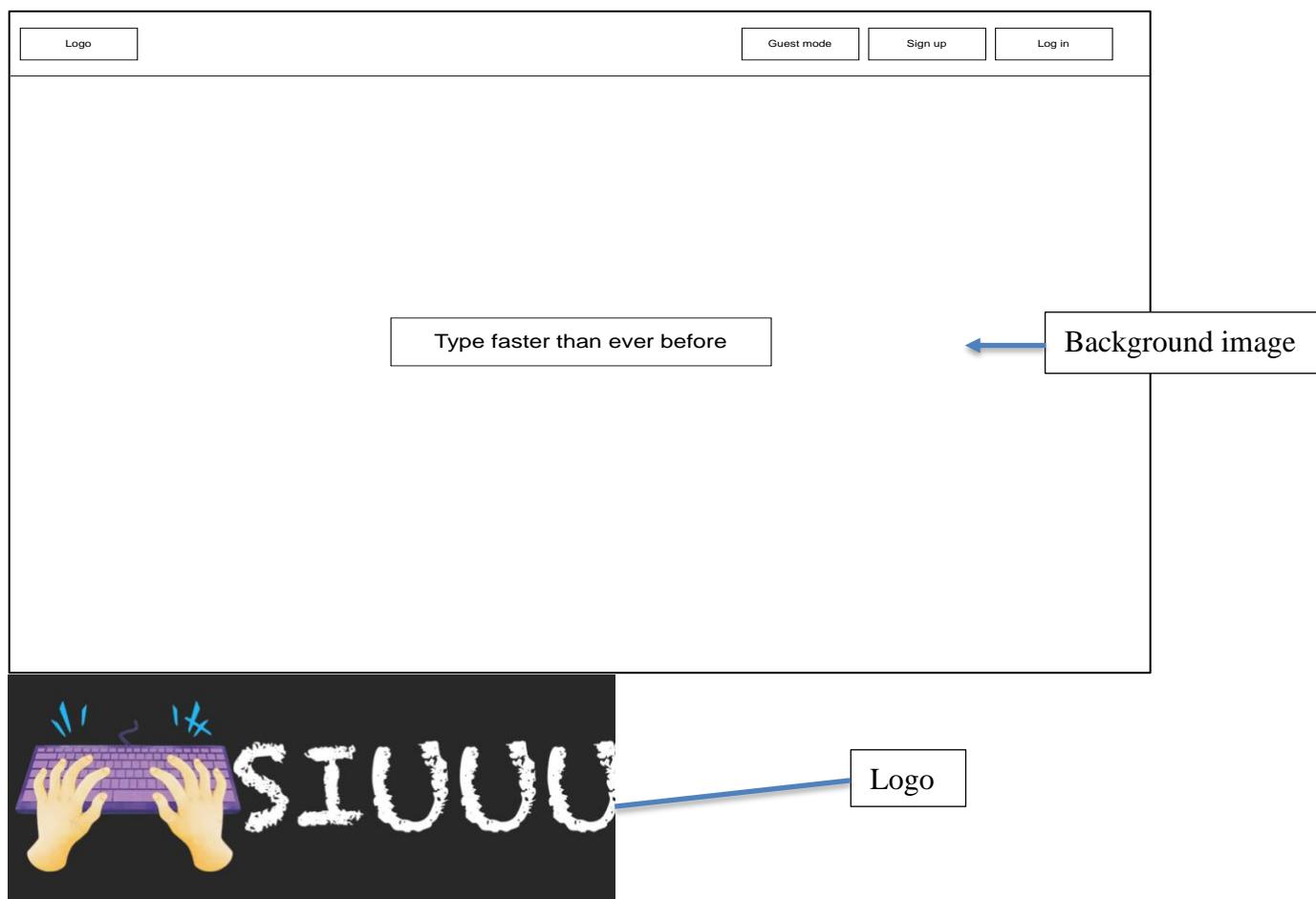
```

I am passing username\_array and WPM\_array as parameters and looping through the array and displaying every username and its corresponding speed in a new row.

### IPSO table

Input	Process	Storages	Output
Log in button	Check if the button is pressed.		Redirect to the log in web page
Sign up button	Check if the button is pressed.		Redirect to the sign up web page.
Guest mode button	Check if the button is pressed.		Redirect to the sign up web page.

### Design/usability feature



Simple design with a logo on the top left. I will have this quote in the middle giving an insight that this website is something to do with typing. Not sure which background image I will use, maybe I will put a video of someone typing. The buttons are self-explanatory when the buttons are pressed, they will be directed to the right page.

Leaderboard		
Rank	Username	Speed/WPM
1	Wasi	129
2	Mohsin	72
3	Saad	35

Home	II	Services	II	Terms	II	Policy
------	----	----------	----	-------	----	--------

When you scroll down the user will be able to see the leaderboard and add a footer just to look like a website.

## Feedback

### What do you think about the design for the front page?

[Mohsin]- I like the fact that you kept it simple and did not use bright colours.

[Saad]- It would be nice to add some animation, for example when you scroll down the leaderboard pops out instead of just being there.

## Test plan

Test_id	Description	Type	Test data	Expected result
1	Check if the fetch_leaderboard returns an array of objects in ascending order.	Normal	Use a leaderboard table with dummy data	Leaderboard_value=[{Username:saad WPM:107} {username:Mohsin WPM:87}]
2	Test if the leaderboard table is shown the right order with the right username and rank.	Normal	Use a leaderboard table with dummy data	A table with the top 10 users should be in the table with their username and speed.

## Sign up

The user will be directed here if they want to create an account. The user must input a valid username, email and password. An email will be sent to the email provided with a random six-digit number so that they can verify their account by entering the code received in my website.

## Database

When the user successfully signs up their username, password and email will be written in the database and they will have a user\_id as a reference.

Users	
PK	<u>user_id int NOT NULL</u>
	username TEXT NOT NULL email TINYTEXT NOT NULL password LONGTEXT NOT NULL status int(1) NOT NULL

I will set the password to longtext because the longer the password is the safer it is, so I do not want to put a restriction on the user. The user\_id will be the primary key and this will be helpful when creating other tables. The status will be 0 if the user didn't verify their account and it would be 1 if they have verified it.

Users				
user_id	username	email	password	status
1	Saad123	Saad.saad@gmail.com	Sfdfd”323”!\$!”!£	0
2	Mohsin123	Mohsin.mohsin@gmail.com	FSDFS@:SDS{£\$	0
3	Wasi123	Wasi.wasi@gmail.com	SFDFERFSDFssff\$”@	1

## Key variables/function

Name	Purpose
Variables	
username	string
password	string
repeat_password	string
email	string
unique_check	boolean
code	integer
status	integer
Function	
valid_username	This function will make sure the username is not too short or long and it is something reasonable.
valid_email	This function will make sure the email entered has the right format.
valid_password	This will make sure the password is 8 characters long and has a number. It will make sure that both passwords entered are equal.
verification_email	When the valid username and password is entered a verification email will be sent.
write_new_user	The details will be written in the database with a status of 0.

otp_check	This will check whether the otp entered matches with the otp generated.
update_status	This will update the status to 1 if the user verifies their account.

## Pseudocode

```

1 Function valid_username (username)
2     if len(username) >=4 and len(username) <20 then
3         if match(["A-Z,a-z,_,."], username) then
4             return True
5         else
6             output("The username must be 4-19 characters long and can
contain _ or ..")

```

This is the validation for the username, passing username as a parameter. The username must be between 4 characters and 19 characters long because the username will be shown in the leaderboard so it cannot be extremely long or 1 character long. The username cannot have weird symbols, (line 4) I am checking if the username contains only a to z alphabetic letters and can have underscore or dot in their username because having “£\$£”%”%”% in the leaderboard is meaningless.

```

1 Function valid_email (email)
2     if email is valid then
3         return True
4     else
5         return False

```

This is the validation for email, passing email as a parameter. Most languages have internal functions that can be used to validate email. If the programming language that I will be using doesn't have an internal function for emails that I will be using an array [a-z,@,1-9] to validate the email. We do not want to get errors later when sending emails for verification.

```

Function valid_password (password, repeat_password)
1     if password==repeat_password Then
2         if len(password) >=8 Then
3             if match ([!, £, $, %, ^, &, *, (,), [<;<', @<~<>, ?<<-` , ]],
4 password) then
5                 return True
6             else
7                 output("The password must be 8 char long, must contain a special
char or a number")

```

This is the validation for password, passing password and repeat\_password as parameters. (line 2) I am checking if both passwords entered match. (line 3)The password must be at least 8 characters long and (line 4) must contain a special character. If the password does not meet the requirement, then an error message is displayed. I am just using the typical validation that is used in most websites and making sure the user has a strong password.

```

1 Function verification_email (email)
2     code=RANDOM(6)
3     To email
4     Subject: verification code
5     output (" Your verification code is "+ code)
6     send_email()

```

```
7 endFunction
```

This will generate a random 6 digit number(line 2) and it will send an email to the email provided making sure that the email used is their email.

```
1 procedure write_new_user (username,email,password)
2   database= require"dbh.file"
3   status=0
4   database.execute("
5     INSERT INTO users
6       (username,email,password, status)
7     VALUES (username, email, password, status)
8   ");
9 end procedure
```

After sending the email to the user, it will connect to the database and will write the details into the database by performing a write operation. Passwords must be hashed before writing into the database, do need the user\_id as it is auto increment.

```
1 Function otp_check (otp, otp_input)
2   if otp==otp_input Then
3     return True
4   else
5     output("Incorrect otp")
6 endFunction
```

This function will check whether the code entered matches with the code generated by the verification\_email function. It will output a message if it is incorrect.

```
1 procedure update_status (email)
2   database=require"database.file"
3   database.execute("
4     UPDATE users
5       SET status=1
6       WHERE email=email;
7   ");
8 end procedure
```

When the function otp\_check returns true, it will update the database that the email is Verified by performing an update operation and the status will be set to 1. This will be used later when the user wants to verify their account.

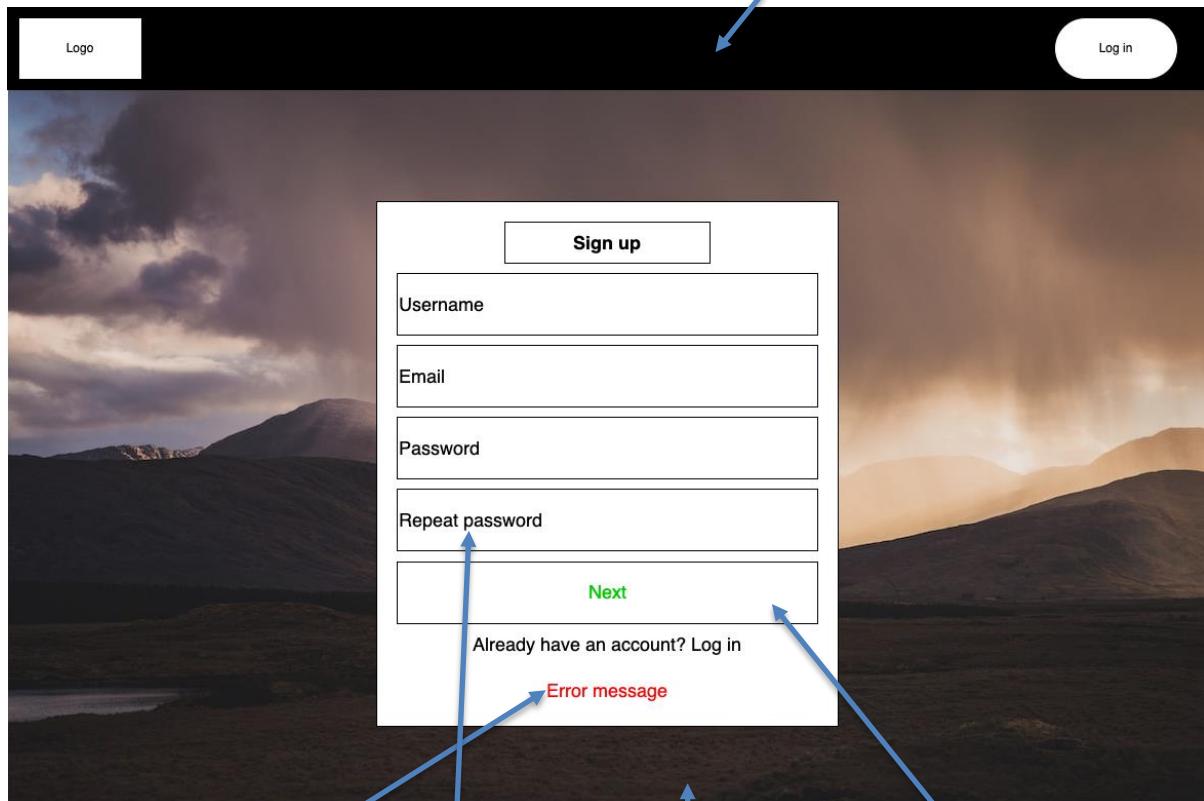
## IPSO table

Input	Process	Storages	Output
Username	Validate the username	After validation store it in the users table	If not valid: username can only contain _ or .
Email	Validate email/ send an email to a 6 digit code	Store it in the users table	If not valid: enter a valid email
Password	Validate the password and hash it	Store the hashed password in the users table.	If not valid: Password must be 8 char long and must contain special char
Already have an account/Log in	Check if it is pressed		Redirect the user to the log in web page

Next button pressed	Run all the function on the background	Stores all the details entered into the database.	Error message or success message
Verify	Check if the code entered matches with code generated		Incorrect code
Logo	Check if the logo is pressed		Redirect the user to the front page.

## Design/usability feature

I have decided to go with a black header, and I will use a bright colour for the buttons so it is contrasting, and it will make the buttons nice and visible.

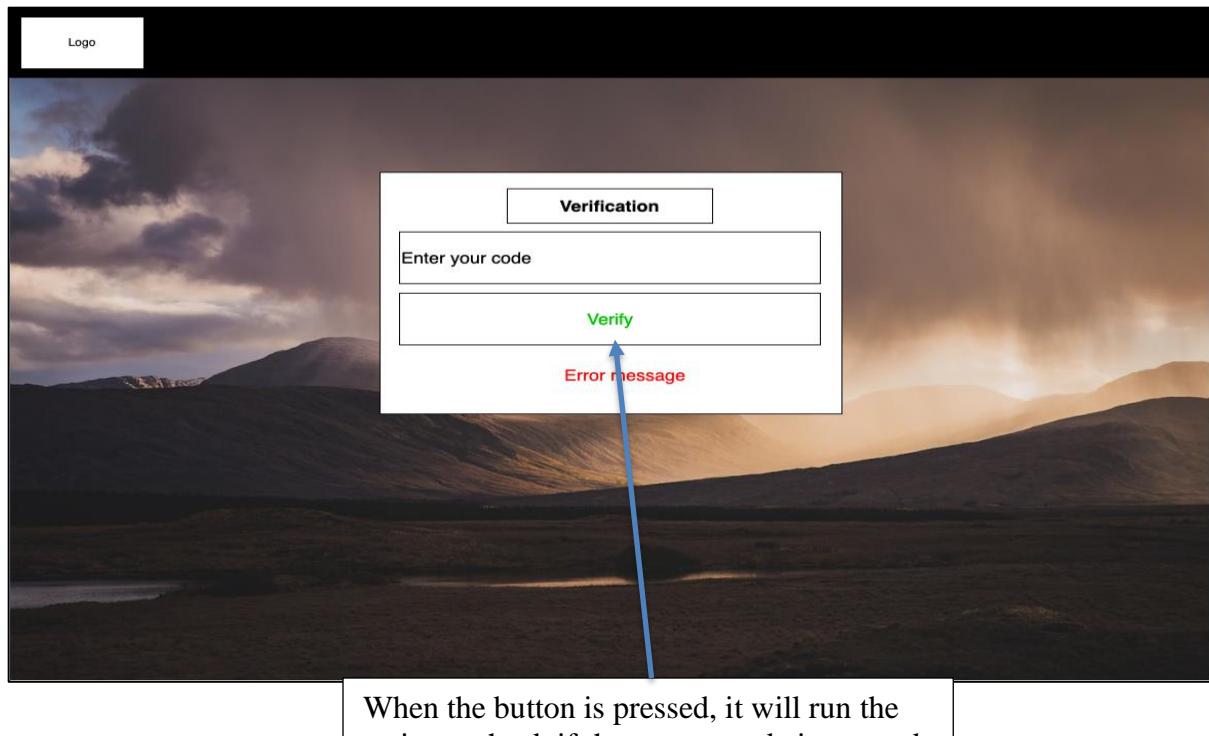


The colour red means it needs attention, this message will be shown if invalid username, email and password is entered.

Showing what needs to be entered in each field make it clear and easy for the user to use

Button runs validation scripts and then records details in database and sends verification email

Background image



Feedback

When the button is pressed, it will run the script to check if the correct code is entered.

### What do you think about the design for the sign up page?

[Wasi]- I like the background image, make sure to add colours in the form as well, white doesn't really look nice.

### Test plan

Test_id	Description	Type	Test data	Expected result
3	Check if invalid usernames are not accepted.	Erroneous	R “\$”\$”\$”\$£	The username must be at least 4 char and can only contain. or _.
4	Check if valid username is accepted	Normal	Saad123	The username should be accepted
5	Check if invalid email is not accepted.	Erroneous	Saad saad@ @ @dfd	Invalid email
6	Check if invalid password is not accepted.	Erroneous	£\$”££”\$”£\$”£\$ 212 mohsinsaad	The password must be at least 8 char long and should contain a special char or a number.
7	Check if valid password is accepted	Normal	Mohsin!23	Valid password.

8	Check if the username, email and password is written in the database.	Normal	Mohsin123 <a href="mailto:mohsin@gmail.com">mohsin@gmail.com</a> Mohsin!23	These values will be written in the database.
9	Check if the user receives an email with a code	Normal	Taher.ahmed2004@Hotmail.com	The user should receive an email with a code.
10	Check if the email is sent to all type of emails	Boundary	Business email and School email.	The email should be sent to all types of emails.
11	Check if incorrect code is not accepted	Erroneous	Code!= code_entered	Incorrect code.
12	Check if the database is updated with the new status	Normal	Code==code_entered	Accounts should be verified and the user can play and their progress will be tracked.
13	The user cannot use the same email to make other accounts.	Normal	Use the same email to sign up twice.	Looks like you already have an account.

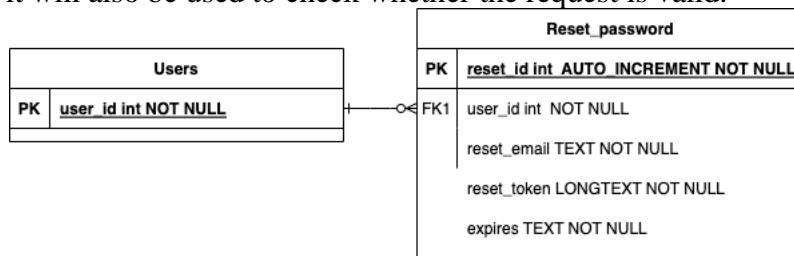
## Log in

This is where the user can come back and get access to their account. They can also verify their account if they have not verified it before by sending an email with a code. They can also reset their password if they have forgotten their password.

There are multiple ways of resetting the password. Some of the ways are: when the user resets the password, the program can read the password from the database and send the password to the user. This is not safe because the information in the database is not protected. Another way is to create a new password and send it my email, this will leave the user with a random email or they have to contact me to change it. And the last method which is the safest is to send a reset link where they can reset their password.

## Database

I will be having a separate table in my database to track who requested to reset their password. And it will also be used to check whether the request is valid.



user\_id will act as a foreign key in the reset\_password table. It is a one to many relationship because one user can have multiple reset requests. This may not be the case if I delete their reset\_id after. The reset\_token will be used to check if the right user is resetting the password.

Reset_password				
reset_id	user_id	reset_email	reset_token	expires
1	4	Saad.saad@gmail.com	Fds4324\$""£\$	124483034
2	10	Mohsin.mohsin@gmail.com	"\$"£\$fds2342	230484032
3	8	Wasi.wasi@gmail.com	SFF\$"\$£324	303939484

## Key variables/function

Name	Purpose	Variables
<b>Function</b>		
match_password	Check if the password fetched matches with the password entered.	
account_exist	Check if the account with the email entered when resetting the password exists in the database.	
write_reset_password	Write the email, token and expires into the reset_password table if the account exists.	
send_reset_link	This function will send a link to the email provided.	
valid_password	This will make sure the password is 8 characters long and has a number. It will make sure that both passwords entered are equal.	
validate_token	This will check if the token that the user has matches with the token in the database.	
update_password	Update the password in the database with the new password.	

## Pseudocode

```

1 function empty_username_email(username_email, password)
2     if username_email==" " or password==" " then
3         output("Empty fields")
4     else
5         return true
6     end if

```

```
7 end function
```

Passing username\_email and password as parameters and then checking if both username\_email and password are empty meaning that nothing was entered in the input fields.

```
1 function read_password(username_email)
2   database=require"database.file"
3   read_password=database.execute("SELECT password
4     FROM users
5     WHERE username=username_email OR email=username_email
6   ")
7   return read_password
8 end function
```

Passing username\_email as a parameter and connecting to the database first. Performing a read operation and returning the password stored in the database for that user.

```
1 function match_password(password, read_password)
2   if password==read_password then
3     return true
4   else
5     output ("incorrect username or password")
6   end if
7 end function
```

Passing password and read\_password as parameters, if the password entered matches with the password stored in the database the user can successfully log in. I need to hash the password before they are compared.

```
1 function account_exist(email)
2   database=connect("database.file")
3   account_check=database.execute(
4     "SELECT email
5       FROM users
6       WHERE email=email
7   ")
8   if account_check=="" then
9     output ("Account doesn't exist")
10  end if
11 end function
```

Checking first if the account exists before sending a link to their email. The program should not send a reset link to an email that does not have an account. The user must sign up first before they can reset their password. It will connect to the database first then check if the email provided exists in the database. If it doesn't, an error message is displayed.

```
1 function write_reset_password(reset_user_id,email)
2   token=random.bytes(128)
3   reset_expires=current.date.time+1
4   database=connect("database.file")
5   insert=database.execute(
6     "INSERT INTO reset_password
7       (user_id, reset_email, reset_token, expires)
8       VALUES (reset_user_id, email, token, reset_expires)
9   ")
10 end function
```

The token will be random 128 bytes which will make it impossible to replicate and the user\_id, email, token and current data and time will be written in the Reset\_password table for later use.

```

1 function send_reset_link(email, token)
2     URL= https://resetpassword.co.uk?token=token
3     To email
4     Subject: Reset password
5     output (" Your link to reset your password is"+ URL)
6     send_email()
7 end function
```

Making a URL with the right domain and attaching the token with it. Sending the URL to the email provided.

(valid\_password)The next function will be the same function used in sign up.

```

1 function validate_token(URL)
2     user_token=get[URL].token
3     database=connect("database.file")
4     current=current.date.time
5     token_expires=database.execute("
6         SELECT *
7         FROM Reset_password
8         WHERE reset_token=user_token AND expires >=current
9     ")
10    if token_expires=="" then
11        output("Request invalid or expired")
12    else
13        return true
14    end if
15 end function
```

First get the token that the user has in the URL(line 2), then it will connect to the database. It will perform a read operation, it returns the values that have the same token and its expiry date is greater than the current date. If it returns nothing this means the token doesn't match or the request is expired.

```

1 function update_password(password, email)
2     database=connect("database.file")
3     update=database.execute("
4         UPDATE users
5             SET password=password
6             WHERE email=email
7     ")
8 end function
```

This will update the user table with the new password after validation.

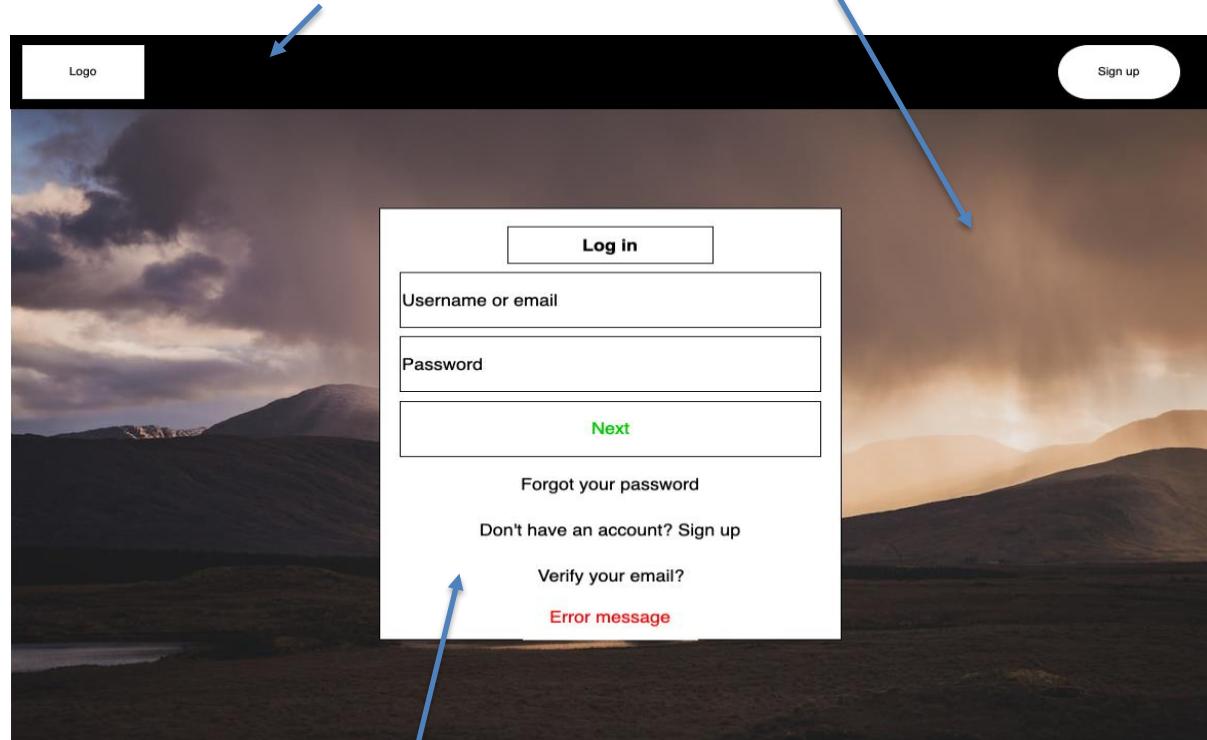
## ISPO table

<b>Input</b>	<b>Process</b>	<b>Storages</b>	<b>Output</b>
Username	Check if it is in the database and read the password.		If it doesn't exist in the database, output "incorrect username or password."

Email	Send a link to this email or send a code to verify.		If not valid: don't have an account
Password	The password will be hashed again and will check if matches		Incorrect username or password
Forgot your password?	Check if the link is pressed.		Redirect the user to that page.
Verify your email?	Check if the link is pressed		Redirect the user to that page.
Next log in page	Check if the username and password are correct.		Incorrect username and password.
Reset my password button	Check if the user has an account.	Store the email and token in the Reset_password table.	Don't have an account or send a link to their email.
Next reset my password	Check if a valid password is used.		Passwords must be 8 char and have a special char or success.

## Design/usability feature

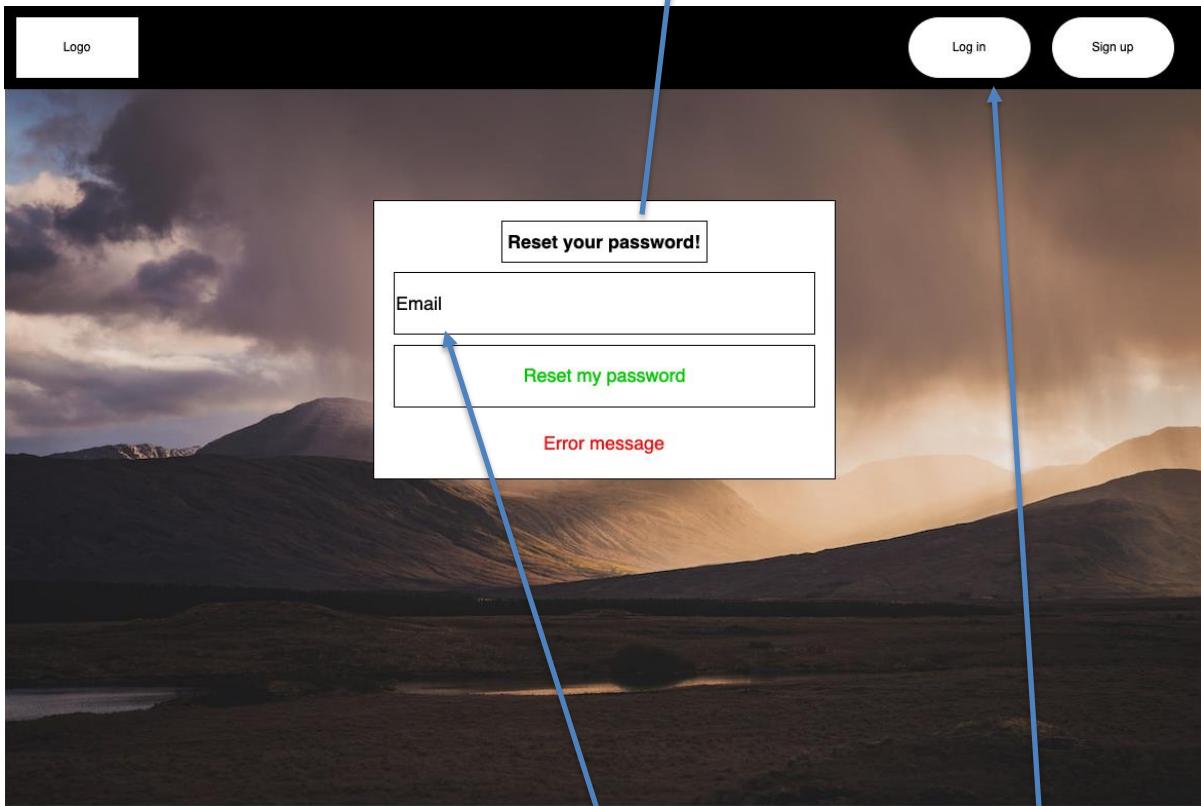
Using the same header and background, keeping the design consistent so users don't get confused or disoriented when navigating the site.



These are all the possible options which would help the user to get access to their account, and it is stated clearly what each option does.

This button is to confirm if they want to reset their password.

41



## Feedback

### What do you think about the design for the Log in page?

[Mohsin]- I like the fact that the design for your sign up and log in page are the same. I personally don't like a new design every single time I change a web page. Everything seems to be clear.

## Test plan

Test_id	Description	Type	Test data	Expected result
15	Accounts verified already cannot be verified again.	Erroneous	Use an email that is already verified	Account verified already.
16	Check if the user can log in with either their username or email.	Normal	For the same user use their username and email	Log in successful
17	Users cannot log in with an incorrect password.	Erroneous	Password!=password_entered	Incorrect username or password.
18	Users cannot reset their password, if they do not have an account.	Erroneous	Enter an email that is not in the database.	Don't have an account.
20	Check if the new password is updated in the database	Normal	Password=Mohsin!2	Update database
21	Check if the token and the email is written in the reset	Normal	Enter an email in the database.	Write database.

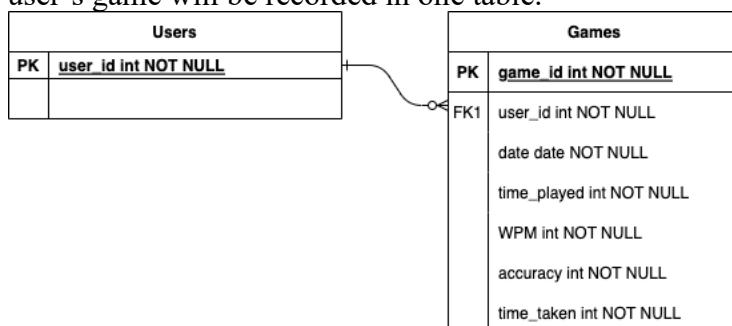
	password table when the user requests to reset			
22	The user cannot reset their password if the request expires	Erroneous	CurrentTime > expires	Invalid request

## Typing game

This is the main part of the game. It will generate a random quote using the API and the user will have 60 seconds to type the quote that was generated. At the end of the game the user will be able to see how long they took and how fast they typed. By pressing a button, you will be able to generate a new quote and start again. It will write in the database every single game that they played and it will check every time if they have beaten anyone in the leaderboard.

## Database

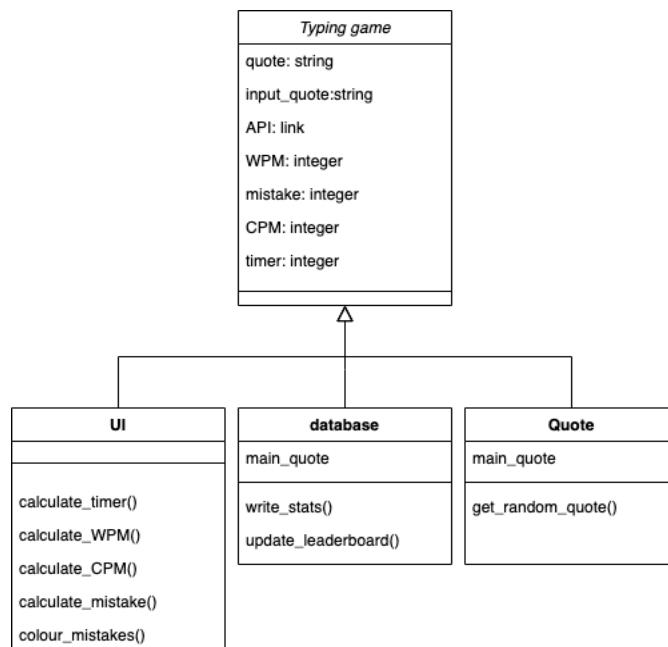
I will have a separate table in my database to store the statistics after every single game. At the start I thought about creating a new table each time a new user starts playing. This means the program should be able to drop and create tables and columns at runtime, this will affect the performance of the game and slow down database queries. This will be very hard to maintain, it will also experience database scalability issues. So I have decided to create a new table where every user's game will be recorded in one table.



We have a composite key game\_id and user\_id. It is a one to many relationship because one user can play multiple games. I have realised that user\_id is being used as a foreign key in multiple places. This is not a problem as the foreign key is unique and each table needs the use of foreign key because we need to know which user has played the game.

Games						
game_id	user_id	date	time_played	WPM	accuracy	time_taken
1	1	26/07/21	16:00	67	89	29
2	2	11/12/21	12:23	23	78	49
3	1	13/09/22	2:45	112	97	45

## Class diagram



The typing game will be the parent class and it will have the constructor method with those attributes. I may be adding other attributes later while coding. All the methods in the UI class will be performing mathematical calculations to calculate the typing speed of the user. I will inherit from the parent class. The quote class will render a new quote. The database class will write the speed and the time into the database.

Formula to calculate WPM: I have calculated it using ratios if the user typed 15 words in 20 seconds we want to work out how many words the user would have typed in 1 min.

$15 : 20 = x : 60$  or  $20/60=1/3\text{min}$  this means  $15:1/3=x:1$  so the user has typed 15 words in  $1/3$  minutes, I want to work out how many words will the user type in 1 min. So  
 $((\text{words typed}) / (\text{timer}/60))$

## Pseudocode

```

1  class typing_game
2    constructor(quote, input_quote, API, WPM, mistake, CPM, timer)
3      set quote attribute to quote
4      set input_quote attribute to input_quote
5      set API attribute to API
6      set WPM attribute to WPM
7      set mistake attribute to mistake
8      set CPM attribute to CPM
9      set timer attribute to timer
10
11   get quote()
12     return quote attribute
13   set quote(newQuote)
14     set quote attribute to newQuote
15   get input_quote()
16     return input_quote attribute
17
18   set input_quote(newInputQuote)
  
```

```

19     set input_quote attribute to newInputQuote
20
21     get API()
22         return API attribute
23
24     set API(newAPI)
25         set API attribute to newAPI
26
27     get WPM()
28         return WPM attribute
29
30     set WPM(newWPM)
31         set WPM attribute to newWPM
32
33     get mistake()
34         return mistake attribute
35
36     set mistake(newMistake)
37         set mistake attribute to newMistake
38
39     get CPM()
40         return CPM attribute
41
42     set CPM(newCPM)
43         set CPM attribute to newCPM
44
45     get timer()
46         return timer attribute
47
48     set timer(newTimer)
49         set timer attribute to newTimer
50 end class

```

This is the typing\_game class with setters and getters.

```

1 class UI inherit from typing_game
2     constructor(quote, input_quote, API, WPM, mistake, CPM, timer)
3     super.new(quote, input_quote, API, WPM, mistake, CPM, timer)

```

Inheriting from typing\_game class.

```

1 start()
2     set startTime attribute to currentTime()
3 calculate_timer(timeLimit)
4
5     if currentTime() - startTime >= timeLimit
6         return true
7     else
8         return False

```

If you set the timeLimit to 60 then this will return true after 60 seconds. When this method is called the current time is recorded and will be passed as parameters. After it will if the time passed is greater than the timeLimit.

```

1 calculate_WPM()
2     word_typed=get input_quote().split into words (" ")
3     return len(word_type/(timer/60))

```

Splitting the paragraph, the was entered by the user into individual words to check how many words were typed by the user. And use the formula to calculate words per minute.

```

1 calculate_CPM()
2     char_typed=input_quote.get_input_quote.split into char ("")
3     return len(char_type/(timer/60))

```

Splitting the paragraph, the was entered by the user into individual words to check how many characters were typed by the user. And use the formula to calculate character per minute.

```

1 colour_mistake()
2     count=0
3     for i in range len(get input_quote()) to 0 Then
4         if get input_quote()[i]== get quote()[i] Then
5             apply colour green
6         else
7             apply colour red
8             count++;
9         end if
10    next i
11    return count

```

Checking if the character in the specific position that the user has typed matches with the character in the same position in the quote. If it does match then apply the colour green or apply the colour red meaning the user has typed it incorrectly. I have combined two of the methods, this will also return the number of mistakes that the user has made. If the colour is red the user has made a mistake.

```

1 write_stats(WPM, accuracy, timer, user_id)
2     database=connect("database.file")
3     database.execute(
4         INSERT INTO Games
5             (user_id,date, time_played, WPM, accuracy, time_taken)
6             VALUES (user_id, currentDate(), currentTime(),WPM, accuracy, timer)
7         )

```

This is the database class. Writing all the details into the database. It will know which user has played at the beginning of the game. It will connect to the database first. Then it will perform a write operation. The accuracy will be calculated outside the method. **Accuracy formula= 100-(number of mistakes/number of characters)**.

```

1 update_leaderboard(WPM, user_id)
2     database=connect("database.file")
3     leaderboard=database.execute(
4         SELECT * FROM leaderboard
5         ORDER BY WPM ASC
6     )
7     lowest_speed=leaderboard[40]
8     if lowest_speed<WPM Then
9         database.execute(
10            INSERT INTO leaderboard(user_id, WPM)
11            VALUES (user_id, WPM)
12        )
13     end if

```

Performing a read operation first and returning the values in ascending order. This means the last value would be 40 because only the top 10 users will be in the leaderboard table.

Checking if the last value in the leaderboard is less than or equal to the speed that was achieved by the user this time. If yes then perform an update operation and put the user into the database.

```
1 class quote inherit from typing_game
2     constructor(quote, input_quote, API, WPM, mistake, CPM, timer,
3 main_quote)
4     super.new(quote, input_quote, API, WPM, mistake, CPM, timer,
5 main_quote)
6     set main_quote attribute to main_quote
```

This is the quote class and it has its own attribute main\_quote.

```
1 get_new_quote(API)
2     return newquote.API()
```

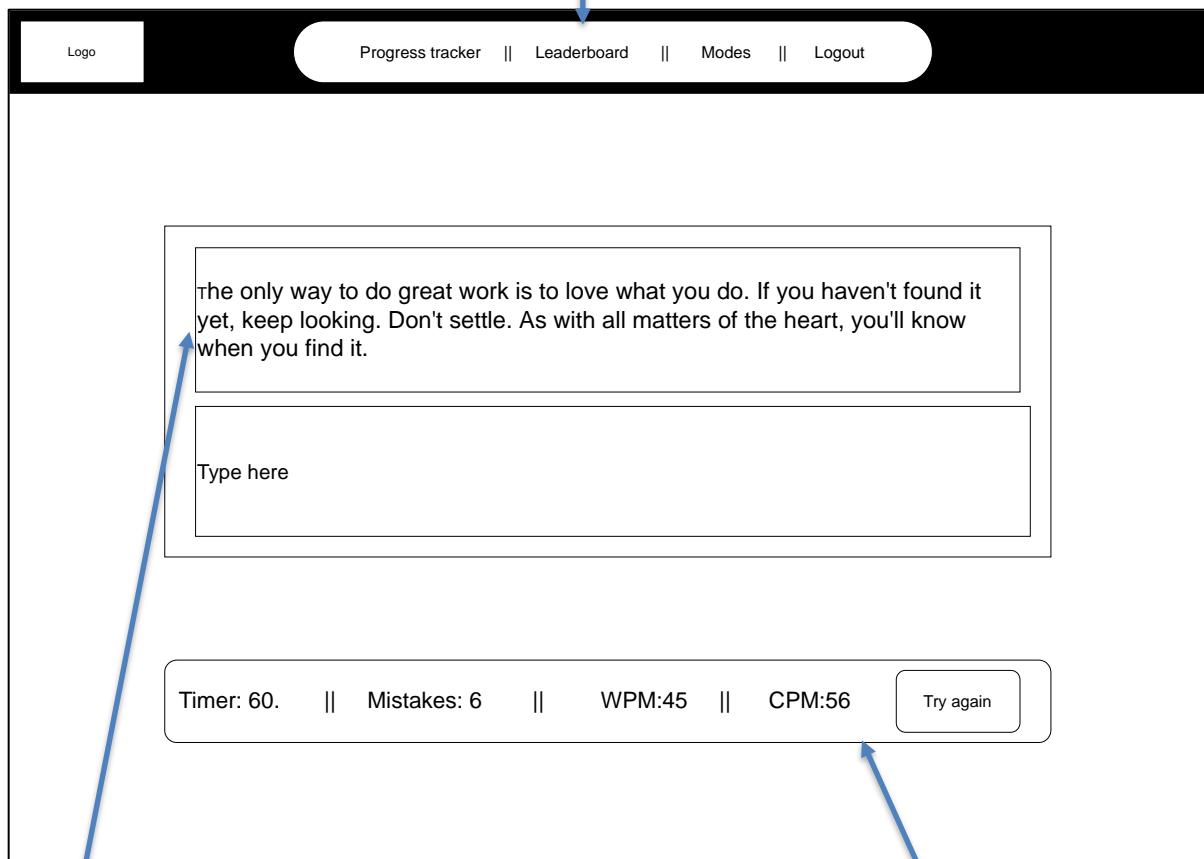
This will fetch the quote from the API that I will be using and will return a new quote each time the method is called.

### IPSO table

Input	Process	Storages	Output
User typing	Check if the user started typing and run the script		Show timer, speed and mistakes.
WPM	Calculate WPM	Store the WPM at the end of the game	Show as they type
Mistakes	Check how many characters were typed incorrectly	Store the accuracy of the user.	Show mistakes as they type
Try again button	Check if the button is pressed		Generate new quote
Timer	Check for how long the user has been typing that quote for.	Store how long it took to type that quote.	Show timer as they type.
Logout button	Check if the button is pressed		Redirect the user to front page
Progress tracker	Check if the button is pressed		Redirect the user to progress tracker page

### Design/usability feature

The user can navigate from here to different features, it is at the top so the user can find the feature that they are looking for easily and quickly. I included modes even though it isn't in the essential feature list.



The quote will be displayed here, it has a large font, so it is clear and readable.

The speed, timer and number of mistakes are shown here, the user doesn't have to switch web pages or look around to find this information.

Everything is in different sections, the navigation bar is at the top, the quote and the typing area is separated by boxes. And typing performance is also separated. I will make sure the quote and type area are aligned so that the user doesn't have to look in different places to type.

#### Feedback

Getting feedback from all three stakeholders because this is the main part of the software.

#### What do you think about the design for the typing game page?

[Saad]-It looks very simple and there is a lot of information in one place and guessing everything there is necessary, but I don't understand what CPM is.

[me]-CPM is characters per minute, it is a more accurate way of calculating how fast the user is typing but most people use words per minute, I have this just for extra information.

[Mohsin]- Your layout is solid, but I would like you to make the quote and the input area different so I can distinguish the difference between the two.

[Me]- No, problem.

[Wasi]-This is a banger, let me know when you add colours to each component.

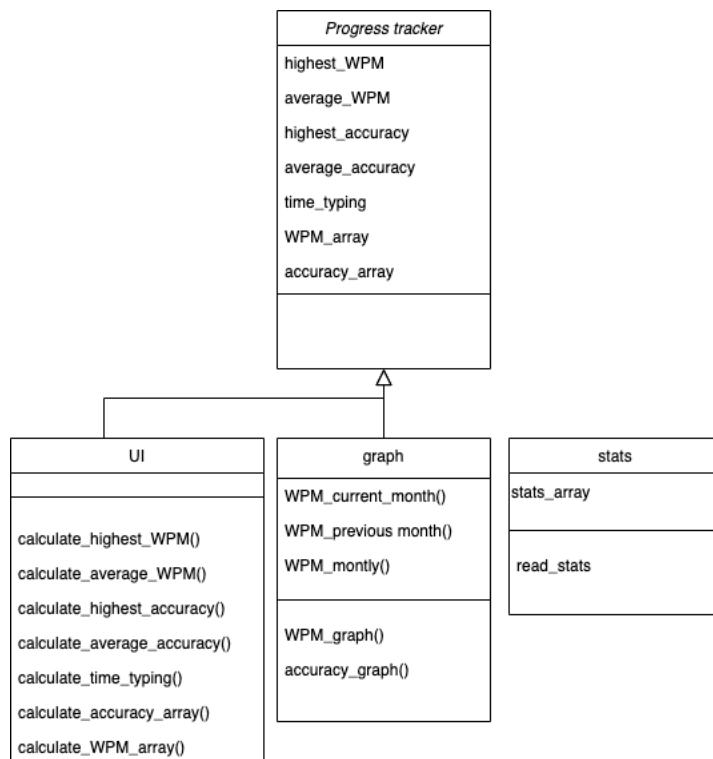
## Test plan

Test_id	Description	Type	Test data	Expected result
24	The timer should stop, when it reaches zero or the user finishes typing.	Normal	Wait until the timer reaches zero.	Timer=0
25	The timer should start as soon as the user starts typing.	Normal	Sfsdfs in the input field.	Start timer
26	The timer should reset when the reset button is pressed.	Normal	Press “try again” button	Timer=60
27	The number of mistakes will not go down.	Erroneous	Press backspace key	Mistakes are constant.
28	Prevent copy and paste.	Erroneous	Try copy and paste the quote	Error
29	Words per minute should not include words that are typed incorrectly	Erroneous	Incorrect words	Should not include the incorrect words.
30	API should generate a new quote each time	Normal	Render new quote 5 times	5 different quotes
31	Incorrect characters typed should be coloured red and correct characters should be coloured green.	Normal	Type 1 matching character and 1 not matching character.	The Typed: Tre
32	Check if the leaderboard table in the database is updated, if higher speed is achieved.	Normal	WPM> leaderboard WPM	Update leaderboard
33	Check if the data, WPM and accuracy is written into the database.	Normal	Date:12/04/23 Accuracy:98 WPM:70	Write these values in the database.
34	Check if the timer and WPM and mistakes work even if the user types everything wrong.	Boundary	Type random characters.	Working timer, WPM and mistakes counter

## Progress tracker

Here the user will be able to see their change in typing speed and accuracy over the last three months by dates and over the last year by months. They will also be able to see their highest WPM, average WPM, highest accuracy, average accuracy and time typing.

## Class diagram



I forgot to add The `read_stats` method will return all the information about the games that user has played. The **UI** class will sort the `stats_array` for the graph and search the array for the highest value.

## Pseudocode

```

1  CLASS ProgressTracker
2    CONSTRUCTOR(highest_WPM, average_WPM, highest_accuracy,
3      average_accuracy, time_typing, stats_array, WPM_array, accuracy_array)
4      SET this.highest_WPM to highest_WPM
5      SET this.average_WPM to average_WPM
6      SET this.highest_accuracy to highest_accuracy
7      SET this.average_accuracy to average_accuracy
8      SET this.time_typing to time_typing
9      SET this.WPM_array to WPM_array
10     SET this.accuracy_array to accuracy_array
11 END CONSTRUCTOR
12 GET highest_WPM()
13   RETURN this.highest_WPM
14 END GET
15 SET highest_WPM(value)
16   SET this.highest_WPM to value
17 END SET
18 GET average_WPM()
19   RETURN this.average_WPM
20 END GET
21 SET average_WPM(value)
22   SET this.average_WPM to value
23 END SET
24 GET highest_accuracy()
25   RETURN this.highest_accuracy
  
```

```

26 END GET
27 SET highest_accuracy(value)
28   SET this.highest_accuracy to value
29 END SET
30 GET average_accuracy()
31   RETURN this.average_accuracy
32 END GET
33 SET average_accuracy(value)
34   SET this.average_accuracy to value
35 END SET
36 GET time_typing()
37   RETURN this.time_typing
38 END GET
39 SET time_typing(value)
40   SET this.time_typing to value
41 END SET
42 GET WPM_array()
43   RETURN this.WPM_array
44 END GET
45 SET WPM_array(value)
46   SET this.WPM_array to value
47 END SET
48 GET accuracy_array()
49   RETURN this.accuracy_array
50 END GET
51 SET accuracy_array(value)
52   SET this.accuracy_array to value
53 END SET

```

This is the constructor method with these attributes.

```

1 class stats
2   constructor(stats)
3     SET this.stats_array to stats_array
4   END CONSTRUCTOR

```

This is the constructor method of the stats class with stats\_array attributes.

```

1 read_stats()
2   database=connect("database.file")
3   stats_array=database.execute(
4     SELECT * FROM Games
5     WHERE user_id= user_id
6   )
7   return stats_array

```

This method in the stats class will return an array of objects of all the games information that the user has played since the beginning from the games table.

```

1 CLASS UI EXTENDS ProgressTracker
2   CONSTRUCTOR()
3     SUPER(highest_WPM, average_WPM, highest_accuracy, average_accuracy,
4 time_typing, stats_array, WPM_array, accuracy_array)
5   END CONSTRUCTOR

```

The UI class inherits from the progressTracker class.

```

1 calculate_highest_WPM()

```

```

2     this.highest_WPM=0
3     for i in range 0 to len(this.stats_array) Then
4         if this.stats_array[i].WPM>this.highest_WPM Then
5             this.highest_WPM=this.stats_array[i].WPM
6         end if
7     next i
8     return this.highest_WPM

```

This method will loop through the stats array and will check which game had the highest words per minute.

```

1 calculate_highest_accuracy()
2     this.highest_accuracy=0
3     for i in range 0 to len(this.stats_array) Then
4         if this.stats_array[i].accuracy>this.highest_accuracy Then
5             this.highest_accuracy=this.stats_array[i].accuracy
6         end if
7     next i
8     return this.highest_accuracy

```

This method will loop through the stats array and will check which game had the accuracy.

```

1 calculate_average_WPM()
2     this.average_WPM=0
3     for i in range 0 to len(this.stats_array) Then
4         this.average_WPM=this.average_WPM+this.stats_array[i].WPM
5     next i
6     return this.average_WPM/len(this.stats_array)

```

This method will add up all the speeds recorded for each game and divide by the number of games that were played.

```

1 calculate_average_accuracy()
2     this.average_accuracy=0
3     for i in range 0 to len(this.stats_array) Then
4         this.average_accuracy=this.average_accuracy+this.stats_array[i].accuracy
5     next i
6     return this.average_accuracy/len(this.stats_array)

```

This method will add up all the accuracy recorded for each game and divide by the number of games that were played.

```

1 calculate_time_typing()
2     this.time_typing=0
3     for i in range 0 to len(this.stats_array) Then
4         this.time_typing=this.time_typing+this.stats_array[i].time_taken
5     next i
6     return this.time_typing

```

The time it took for the user to type a quote will be recorded in the database after each game. So this method will add up all these values.

```

1 calculate_WPM_array()
2     for i in range 0 to len(this.stats_array) Then
3         if stats_array[i].date> (current.year-1)
4             this.WPM_array.push(WPM:stats_array[i].WPM,
5 date:stats_array[i].date)
6     end if

```

```

7     next i
8     return this.WPM_array

```

This method will return the date and the speed of all the games that were played in the last year which will be used for the graphs.

```

1 calculate_accuracy_array()
2     for i in range 0 to len(this.stats_array) Then
3         if stats_array[i].date > (current.year-1)
4             this.WPM_array.push(accuracy:stats_array[i].accuracy,
5 date:stats_array[i].date)
6         end if
7     next i
8     return this.accuracy_array

```

This method will return the date and the accuracy of all the games that were played in the last year which will be used for the graphs.

```

CLASS graph EXTENDS ProgressTracker
1   CONSTRUCTOR()
2       SUPER(highest_WPM, average_WPM, highest_accuracy, average_accuracy,
3 time_ttyping, stats_array, WPM_array, accuracy_array)
4   END CONSTRUCTOR

```

The graph class inherits from the progressTracker class. It will also have its own attribute.

```

WPM_graph()
1     for i in range 0 to len(this.stats_array) Then
2         if this.stats_array[i].date > 1,current.month Then
3             WPM_current_month.push(WPM:this.stats_array[i].WPM,
4 date:this.stats_array[i].date)
5         else if this.stats_array[i].date > 1,current.month-1 Then
6             WPM_previous_month.push(WPM:this.stats_array[i].WPM,
7 date:this.stats_array[i].date)
8         end if
9     next i

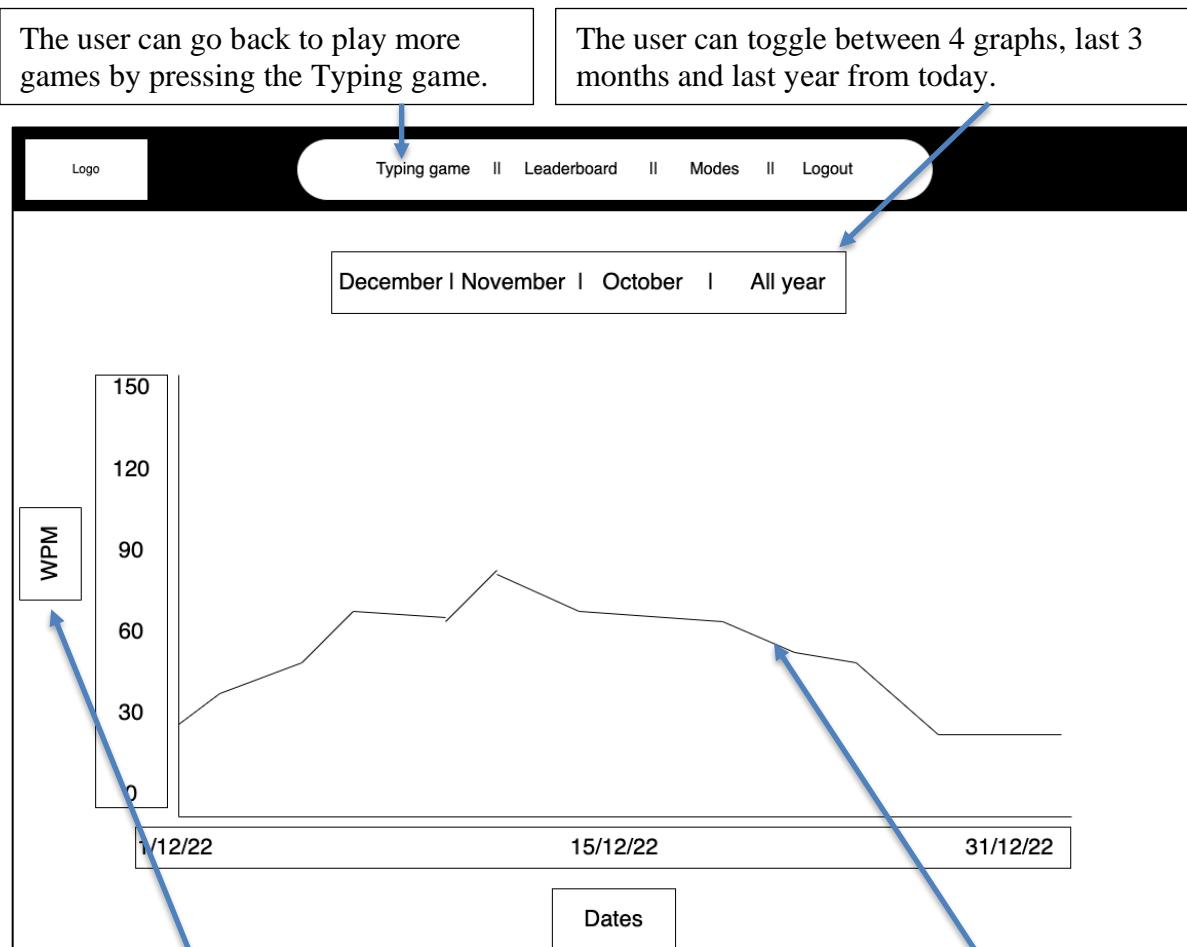
```

This method will separate the games into months. It will loop through the stats\_array and if the date in that array is greater than the last three months then write the speed of those games into the WPM\_current\_month and WPM\_previous\_month. Once the program has the arrays and values for the x-axis and y-axis, this method will loop through the graph again and generate graphs. This is not shown here as it is part of the user interface.

## IPSO table

<b>Input</b>	<b>Process</b>	<b>Storages</b>	<b>Output</b>
Typing game button	Check if the button is clicked		Redirect the user to the main page.
Logout	Check if the button is clicked		Redirect the user to the front page.
Months and year button	Check which month is clicked and generate the graph for that month or year		Show the graph.
	Calculate their average speed and accuracy.		Display their average speed and accuracy.

## Design/usability feature



Labelling the axis, the range is between 0-150 as most users will be between that speed. All dates in that month are labelled but they are not shown because it will become so messy.

Using a line graph because it is easier to read and we can see the performance increased in the middle of the month and decreased by the end of the month.

Highest WPM	Average WPM	Highest Accuracy	Average accuracy	Time typing
106	87	100	98	24:8:45

All the essential information about a user's typing performance are summarised here. How long they have been typing, what was their best speed and what is their average speed.

## Feedback

**What do you think about the design for the progress tracker page?**

[Saad]- I love it. It is very simple. Will there be only one graph showing only the previous month?

[me]- No, you can toggle between 4 different graphs showing the performance at 4 different times. Maybe I need to make it clear you can switch to a different graph.

[Mohsin]- I think you should use a bar chart instead of a line graph, if the values are missing and you connect the points it shows an incorrect trend.

[me]- I have used a line graph for simplicity, I may use a bar chart.

## Test plan

Test_id	Description	Type	Test data	Expected result
35	The average WPM should be equal to the highest WPM if they played one game.	Normal	Stats_array=[ {WPM:50} ] Only one game played	Average WPM=highest WPM
36	If the user didn't play in that month, it shouldn't generate a graph.	Erroneous	WPM_array=[“”]	No graph generated.
37	The program should calculate the average WPM if more than one game is played per day.	Boundary	Stats_array=[ {date:20/12/21 WPM:34} {date:20/12/21 WPM:67}]	WPM for that day is 50.5

## Post development test plan

Once I have developed all the components mentioned in my success criteria I will run these tests with my stakeholders and other students to make sure the program works without any errors as a whole. These tests will possibly help to reassure myself that there aren't any syntax and logical errors in the entire program.

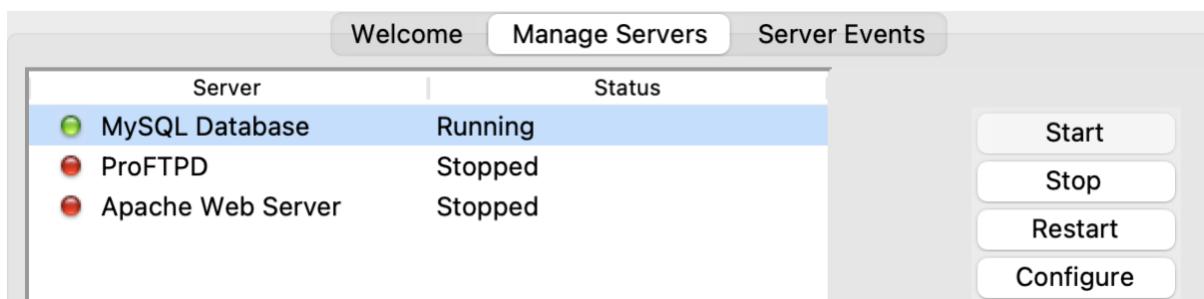
Test id	Description	How to test?
1	Check if the logo and background image and the table in the first page loads with no problem.	Load the page multiple times, check if anything breaks.
2	Check if many new users can create an account.	Get multiple people to create an account with valid username, email and password
3	Check if the right messages are shown when necessary.	User inputs invalid username, email and password.
4	Users cannot use their username.	Ask users to use the same username.
5	Check if users can follow the steps to verify their account without any assistance.	Get multiple people to create an account with a valid username, email and password.
6	The program should defend itself from SQL injection	Test data: " , = , == , SELECT 1,1,1,1,1,1 Saad" DROP ALL DATABASES

7	Check if a new quote is generated every time.	Complete the game 10 times.
8	Check if the user can log back in.	Create an account and try to log in the next day.
9	Check if users can check how long they took to type a paragraph.	Use a timer while the user types and check if the timer matches with the timer on my website.
10	Check if the typing speed is shown to the user while the user types	The user will type and see the typing speed changes.
11	Check if the user can view their progress over the last 3 months and over the last year.	Ask the user to play for a month and check if all games are registered and shown in the progress tracker.
12	Check if coping and pasting is disabled.	Ask the user to attempt to copy and paste the quote.
13	Check if the new users are added to the leaderboard when they get a higher typing speed than someone in the leaderboard.	The best typist should play the game.
14	Check if the user can see their best typing speed, best accuracy and time typing.	The user should play a few games and should record their best typing speed and check if the recorded speed matches.
15	Check if the user can navigate between the webpages (leaderboard, typing game, progress tracker)	Ask the user to navigate without any assistance.
16	Check if the user can log out without any problems.	User logging out.
17	Check if the guest mode can be played without logging in.	Play guest mode.
18	Check if user can reset their password.	Ask the user to reset their password.

# Development

## Database

To begin any development, the first thing that needs to be set up is the database. I will be developing the website at home. I have chosen MySQL as my database management system because it can be used to perform complex data analysis and manipulation tasks. This can be useful for future development and will be able to handle complex queries. The database will be accessed through the browser by using XAMPP phpMyAdmin which is a free and open-source software that lets you handle the administration of MySQL. I will not use MySQL WorkBench because it is not beginner friendly and it needs to be installed on your local computer.



Once we have XAMPP installed on my local computer, I can start the MySQL server by pressing the start button.

We can now access the database through the browser. Type in “localhost/phpMyAdmin/” in the search bar. I can CRUD from here. I will not be creating any accounts or giving any privileges unless the website is being published. I will set up the database as mentioned in the design section. So I will create a database first called “TYPING-GAME” manually.

I will set the table by following my design.

### Users table

```
1 CREATE TABLE Users (
2     user_id INT(11) PRIMARY KEY AUTO_INCREMENT,
```

```

3   username TEXT NOT NULL,
4   email TINYTEXT NOT NULL,
5   password LONGTEXT NOT NULL,
6   status INT(1) NOT NULL
7 );

```

#	Name	Type	Collation	Attributes	Null	Default
1	user_id	int(11)			No	None
2	username	text	utf8mb4_general_ci		No	None
3	email	tinytext	utf8mb4_general_ci		No	None
4	password	longtext	utf8mb4_general_ci		No	None
5	status	int(1)			No	None

Created a table called “Users” with user\_id as a primary key. This table will be used to store sign in information so that the user can access the account.

### Reset\_password table

```

1 CREATE TABLE Reset_password (
2   reset_id INT(11) PRIMARY KEY AUTO_INCREMENT NOT NULL,
3   user_id INT(11),
4   reset_email TEXT NOT NULL,
5   reset_token LONGTEXT NOT NULL,
6   expires TEXT NOT NULL,
7   FOREIGN KEY (user_id) REFERENCES Users(user_id)
8 );

```

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	reset_id	int(11)			No	None		AUTO_INCREMENT
2	user_id	int(11)			Yes	NULL		
3	reset_email	text	utf8mb4_general_ci		No	None		
4	reset_token	longtext	utf8mb4_general_ci		No	None		
5	expires	text	utf8mb4_general_ci		No	None		

Created a table called “Reset-password” with reset\_id as a primary key and user\_id as a foreign key from the Users table. This table will be used if the user forgets their password and wants to reset their password.

### Leaderboard table

```

1 CREATE TABLE Leaderboard (
2   user_id INT(11),
3   WPM INT(11) NOT NULL,
4   FOREIGN KEY (user_id) REFERENCES Users(user_id)
5 );

```

#	Name	Type	Collation	Attributes	Null	Default
1	user_id	int(11)			No	None
2	WPM	int(11)			No	None

Created a table called leaderboard with user\_id, as a foreign key from the Users table. This table will be used to store the top 10 typists.

## Games table

```
1 CREATE TABLE Games (
2     game_id INT NOT NULL PRIMARY KEY,
3     user_id INT(11),
4     date DATE NOT NULL,
5     WPM INT NOT NULL,
6     accuracy INT NOT NULL,
7     time_taken INT NOT NULL,
8     FOREIGN KEY (user_id) REFERENCES Users(user_id)
9 );
```

#	Name	Type	Collation	Attributes	Null	Default
1	game_id	int(11)			No	None
2	user_id	int(11)			Yes	NULL
3	date	date			Yes	NULL
4	WPM	int(11)			Yes	NULL
5	accuracy	int(11)			Yes	NULL
6	time_taken	int(11)			Yes	NULL

Created a table called “Games” with game\_id as a primary key and the user\_id as the foreign key from the user stable. This table will store every single game played by every single user and this table will be used for the progress tracker. I have mentioned in the design section that I will be storing the time it was played. But I have realised it is not necessary because I will show the monthly progress not daily progress because your typing does not improve over a day.

## IDE

I will be using visual studio code to write, debug and test my code. VS code is great for web development. It supports a wide range of programming languages including HTML, CSS, JavaScript and PHP. It has an extension that allows you see the changes made on the website instantly while developing. It has an integrated terminal which will be helpful to run node.js script, to install node packages and getting the server running. There is an extension that allows you to debug PHP code without leaving the IDE. VS code has built-in Git support, making it easy to manage version control directly within the editor. It also has many features built-in that will aid me throughout the development process.

## Log in system

### PHP

I will be using PHP for my log in system. PHP is a server-side programming language used for creating dynamic web pages and web applications. It can connect to MySQL easily without the need of any external run-time environment. I will use an Apache web server to execute PHP code so I will install XAMPP that has an interpreter installed as well. PHP source code is not visible making it slightly more secure than JavaScript for a login system. PHP code can be written in vs code and xdebug can be used to debug the script. The local server needs to be running all the time to see the web page on the browser.



The screenshot shows a browser window with the URL `localhost/typing-game-php/test.php`. The page content is:

```

<!DOCTYPE html>
<body>
| <h1>CODING IN PHP</h1>
</body>
</html>

```

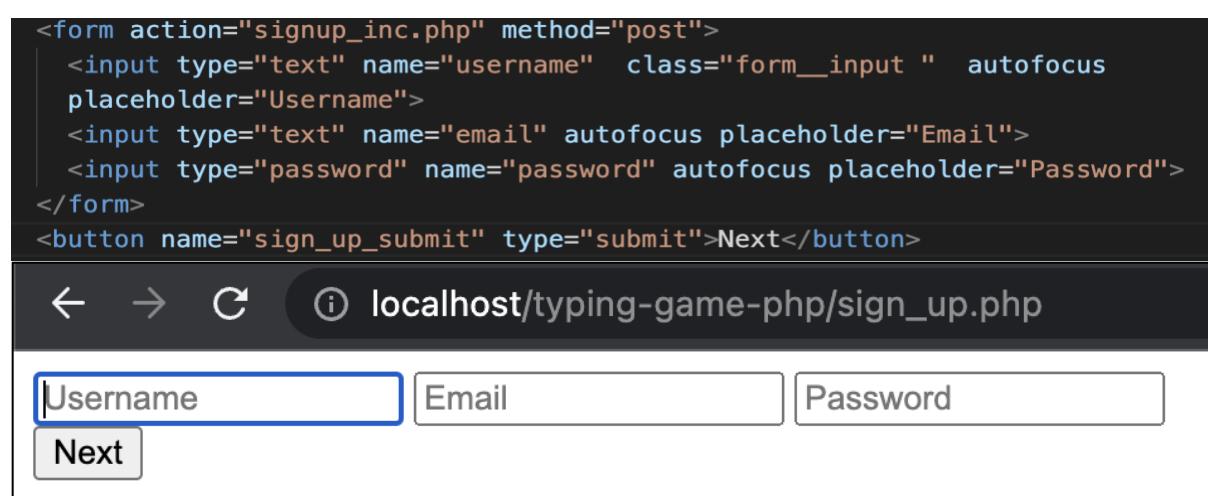
A callout box points to the URL in the address bar with the text "Specifying the directory and the file name."

All the files need to be in the htdocs directory by default but can be configured later.

### Sign-up

First iteration (1<sup>st</sup> iteration)

This is my first implementation for sign up without GUI and any validation.



The screenshot shows a browser window with the URL `localhost/typing-game-php/sign_up.php`. The page contains a form:

```

<form action="signup_inc.php" method="post">
<input type="text" name="username" class="form__input" autofocus placeholder="Username">
<input type="text" name="email" autofocus placeholder="Email">
<input type="password" name="password" autofocus placeholder="Password">
</form>
<button name="sign_up_submit" type="submit">Next</button>

```

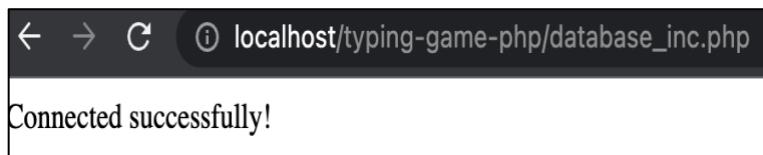
We have 3 input fields here, with a button that will run the PHP script. For clarity the input fields are named using placeholders. I do not have the 4<sup>th</sup> input field “Repeat password” for testing purposes.

```
PHP > dbh.inc.php
1 ?php
2 // connect with the database
3 $server_name="localhost";
4 $database_username = "root";
5 $database_password = "";
6 $database_name="typing_game_database";
7 $conn = mysqli_connect ($server_name, $database_username, $database_password, $database_name);
8 // if the connection fails
9 if (!$conn){
10     die("Connection failed:".mysqli_connect_error());
11 }
```

I will name all the files that have PHP script with inc. It is not really an extension file but it is just to distinguish the HTML.php.

I am connecting to a MySQL database using the mysqli extension. The server's name, username and password are set as default because I did not create any new users and did not add any privileges to any users.

Test			Result	
Description	Type	Code	Expected	Actual
Database connection	Normal	if (!\$conn)	Connected successfully	<input checked="" type="checkbox"/> Connected successfully



## write\_new\_user

```

❷ sign_up_inc.php
1  <?php
2  function write_new_user($username, $email, $password, $status) {
3
4      require 'database_inc.php';
5      // writing the values in the database
6      $sql = "INSERT INTO Userss (username, email, password, status) VALUES (?, ?, ?, ?);";
7      $stmt = mysqli_stmt_init($conn); // initialize statement
8      if (!mysqli_stmt_prepare($stmt, $sql)){
9          mysqli_stmt_close($stmt); // close statement
10         mysqli_close($conn); // close connection
11         return false;
12     }
13     else {
14         $email = strtolower($email);
15         mysqli_stmt_bind_param($stmt, "ssss", $username, $email, $password, $status);
16         mysqli_stmt_execute($stmt);
17         mysqli_stmt_close($stmt); // close statement
18         mysqli_close($conn); // close connection
19         return true;
20     }
21 }
22
23 // checking if the button is pressed
24 if (isset($_POST['sign_up_submit'])) {
25     // getting the values from the input fields
26     $username = $_POST['username'];
27     $email = $_POST['email'];
28     $password = $_POST['password'];
29     $status = 0;
30
31     // write new user to the database
32     $result = write_new_user($username, $email, $password, $status);
}

```

When the button “Next” is pressed, this script will run which will add the username, email and password to the database. I have used prepared statements (line 6) to prevent any SQL injection. The field password and status are keywords in PHP (line 6), but it was not a problem. I may need to change the column name in the database if I encounter any errors in the future.

Test\_id 8

Using the test data specified in the design section.

	user_id	username	email	password	status
❸	1	Mohsin123	mohsin@gmail.com	Mohsin!23	0

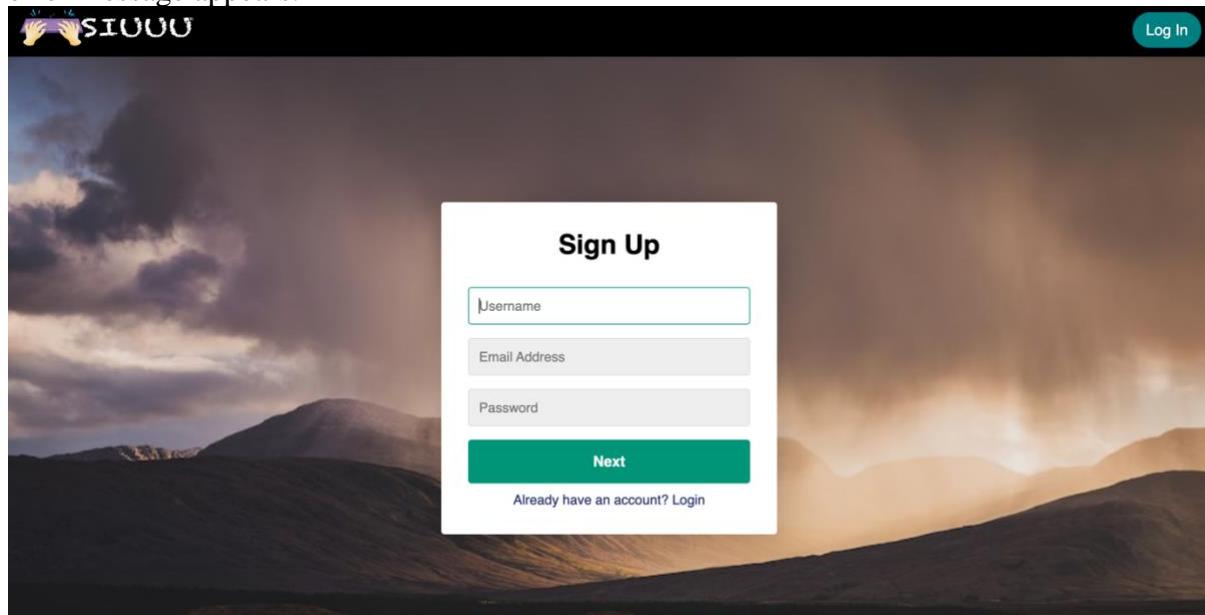
The username, email and password has successfully been added to the “Users” table in the database.

## Review

Test	
Test_id	Passed or failed
8	Passed

Second iteration (2<sup>nd</sup> iteration)

I will add the GUI first before adding any validation. This is because I want to see how the error message appears.



I have removed the repeat password input fields because they will be able to reset their password later. And it is only a typing game, so it does not need to be very secure. I have created a separate CSS file with all the styles and linked it to your HTML document using the "link" tag.

```
<link rel="stylesheet" href="style.css">
```

Thanks to id and class attribute I was able to customise each element.

## Feedback

### What do you think about the design for the sign up page?

[Wasi] – It is user friendly, it looks simple and the input fields stand out. May you want to change the next button to a confirm button or sign up button so that the user knows that their email and password is being stored.

I will validate the inputs: username, password and email before being used in the SQL statement because it could lead to security vulnerabilities such as SQL injection attacks.

```
31 if (empty ($username) || empty($email) || empty ($password)){
32     header ("Location: sign_up.php?error=emptyfields&username=$username&email=$email");
33     exit();
34 }
```

I must check whether all the input fields are filled in before running any validation or any code. The error will be passed as a query parameter in the URL (line 32), along with the values that the user entered in the form for the 'username' and email fields. The username and email will be returned so that the user does not need to fill in the input fields every single time.

Test			Result	
Description	Type	Code	Expected	Actual
Returning error if the input fields are empty	Erroneous	<pre>if (empty (\$username))</pre>	All fields are required!	<input checked="" type="checkbox"/> All fields are required!




All fields required!

#### valid\_username

```

21 function valid_username($username) {
22     if (strlen($username)< 4 || strlen($username)>20){
23         header("Location: sign_up.php?error=username_length&email=$email");
24         exit();
25     }
26     else if (is_numeric($username)){
27         header ("Location: sign_up.php?error=username_num&email=$email");
28         exit();
29     }
30     else if (!preg_match("/^a-zA-Z0-9._]*$/", $username)){
31         header("Location: sign_up.php?error=username_char&email=$email");
32         exit();
33     }
34     else if (!preg_match('/^(?![_.]).*[_]{2}+(?![_.])$/', $username)){
35         header("Location: sign_up.php?error=username_format&email=$email");
36         exit();
}

```

These are the validation that I have added for the username. The username must be between 4 characters and 20, cannot contain only numbers, cannot contain any special character except \_ and .. The username cannot contain \_ or . at the end or at the beginning of the username. The preg\_match() function is a PHP function that performs a regular expression match.

Test			Result	
Description	Type	Code	Expected	Actual
Username cannot contain only numbers	Erroneous	Line 30	Username cannot contain only numbers!	<input checked="" type="checkbox"/> Username cannot contain only numbers!

12345

hello

.....

**Username can not contain only numbers!**

Test\_id 3

R

hello

.....

**Username must contain 4-20 charecters!**

The username “R” is only one character, so it throws an error.

\$\$ \$\$ \$£

hello

.....

**Username can only contain letters, numbers, . and \_**

**Next**

The username ““\$”\$”\$”\$£” only contains a special character, so it throws an error. The username can contain . and \_.

Test\_id 4

Saad123

hello

.....

**Username cannot contain . or \_ at the start or end!**

I have entered a valid username, but I am still getting an error. I have realised that line 34 is only checking whether the username contains . or \_ at the start or end and is checking whether it contains 2 underscore or dot consecutively. But it is not checking whether it contains the alphabetic characters or numbers in the username. s

Improvement

```
34 | else if (!preg_match('/^(?![_.]) (?!.{2}_[_.]) [a-zA-Z0-9._]+(?<![_.])$/ ', $username)){
```

Now it is also checking whether the username contains A-Z,0-9. Line 30 is not necessary because line 34 is doing the same job but I will keep them so that I can print different error messages accordingly.

Saad123

hello

.....

Valid username

Valid\_email

```
40 ~ function valid_email($email){ // checking if email is valid
41 ~ ~ if (!filter_var($email, FILTER_VALIDATE_EMAIL)){
42 ~ ~ ~ header ("Location: sign_up.php?error=email&username=$username")
43 ~ ~ }
```

The FILTER\_VALIDATE\_EMAIL filter is a built-in PHP filter that validates an email address. The ! negates the result of the filter. So, if the email is not valid, the user is sent back to sign\_up.php page with an error.

Test			Result	
Description	Type	Code	Expected	Actual
Checking if special email is accepted	Boundary	line 41	Valid email.	<input checked="" type="checkbox"/> Valid email.
Checking if valid email is accepted	Normal	Line 41	Valid email.	Valid email.

Saad123

sales@yourbusiness.com

..

**Valid email.**

I am not sure whether this business email exists or not but it is a valid email.

Saad123

saad@school21.org.uk

....

**Valid email.**

This is my stakeholder's school email.

Test\_id 5

Saad123

Saad

.....

**Invalid email!**

The email address “Saad” is invalid.

saad@ @ @dfd

.....|

**Invalid email!**

The email address “Saad” is invalid.

The user should not be able to make an account again with the same email. So, the programme needs to check in the database if the user was already used.

```

64 function unique_username_email($username, $email){
65     // Prepare SQL statements to check for username and email
66     $sql= "SELECT username FROM Users WHERE username=?";
67     $sql1= "SELECT email FROM Users WHERE email=?";
68     $stmt = mysqli_stmt_init($conn);
69     $stmt1= mysqli_stmt_init($conn);
70     // Handle error if SQL statements fail
71     if (!mysqli_stmt_prepare($stmt, $sql)|| !mysqli_stmt_prepare($stmt1, $sql1)){
72         header("Location: signup.php?error=sqllerror");
73         exit();
74     }
75     else { // Bind parameters and execute SQL statements to check for username and email
76         mysqli_stmt_bind_param($stmt, "s", $username);
77         mysqli_stmt_execute($stmt);
78         mysqli_stmt_store_result($stmt);
79         $resultCheck = mysqli_stmt_num_rows($stmt);

80         mysqli_stmt_bind_param($stmt1, "s", $email);
81         mysqli_stmt_execute($stmt1);
82         mysqli_stmt_store_result($stmt1);
83         $resultCheck1= mysqli_stmt_num_rows($stmt1);
84         // If username or email already exists, redirect with error message
85         if ($resultCheck >0){
86             header("Location: sign_up.php?error=username_taken&email=$email");
87             exit();
88         }
89         else if ($resultCheck1>0){
90             header("Location: sign_up.php?error=already_have_an_account&username=$username");
91             exit();
92         }
}

```

Line 83 returns the number of rows in the database that contains the same username or email.

Test\_id 13

Mohsin123											
mmpack@kitchen-tvs.ru											
Mohsin!23	<table border="1"> <thead> <tr> <th>user_id</th><th>username</th><th>email</th><th>password</th><th>status</th></tr> </thead> <tbody> <tr> <td>1</td><td>Mohsin123</td><td>mohsin@gmail.com</td><td>Mohsin!23</td><td>0</td></tr> </tbody> </table>	user_id	username	email	password	status	1	Mohsin123	mohsin@gmail.com	Mohsin!23	0
user_id	username	email	password	status							
1	Mohsin123	mohsin@gmail.com	Mohsin!23	0							
<b>Username has been taken!</b>											

The username “Mohsin123” is in the database already so it returns an error.

mohsin@gmail.com
Mohsin!23

**Looks like you already have an account!** The email address “mohsin@gmail.com” is already in the database so it throws an error.

Valid\_password

```

46 function valid_password($password){
47     // Password must be at least 8 characters
48     if (strlen($password) < 8) {
49         header("Location: sign_up.php?error=password_length&username=$username&email=$email");
50         exit();
51     }
52     // checking if it contains A-Z or 0-9
53     if (!preg_match('@[A-Za-z0-9]@', $password)) {
54         header("Location: sign_up.php?error=password_char&username=$username&email=$email");
55         exit();
56     }
57     // checking if it contains a special character
58     if (!preg_match('@[\^\\w]@', $password)) {
59         header("Location: sign_up.php?error=password_special&username=$username&email=$email");
60         exit();
}

```

These are the validation that I have added for the password. The password must be at least 8 characters, must contain alphabetic characters or numbers and must contain a special character. The character class [^w] includes most of the special characters: punctuation, brackets, mathematical symbols, currency symbols and other miscellaneous symbols. If the user decides to use a special character that is not included in that class, the program will throw an error. It is not possible for me to include all possible special characters.

I will be hashing the password as well by using a PHP's built-in password hashing function.

```
62 $hashed_password = password_hash($password, PASSWORD_DEFAULT);
```

The password\_hash() function generates a random salt and combines it with the password to produce a unique hash that is resistant to various types of attacks, including dictionary attacks and brute force attacks. I have used the bcrypt algorithm which has a cost factor of 10 which is the number of iterations used to generate the hash.

```
1 <?php
2 $password="hello123";
3 $hashed_password = password_hash($password, PASSWORD_DEFAULT);
4 echo $hashed_password;
```

\$2y\$10\$5hR7UPaDK95T1OJwbIJhNubN71QWiMwHB5XBhtSafWIHrYMSFqNbS

This is what the hash value is when the password is hello123.

Test\_id 6

I will make the password visible for testing purposes.

Saad123

taher.ahmed2004@hotmail.com

£\$\$££"\$\$£\$\$£\$

**Password must contain alphabetic letters!**

The password “£\$\$££” only contains special characters so it does not match with the pattern in line 53 so it throws an error.

Saad123

taher.ahmed2004@hotmail.com

212

**Password must be atleast 8 characters!**

The password “212” is only 3 characters long and it does not contain any special character but the exit() function terminates the script execution before checking whether it contains a special character so that it does not throw two errors at the same time.

Saad123
taher.ahmed2004@hotmail.com
mohsinsaad

Password must contain atleast one special character!

The password “mohsinsaad” contains only alphabetic characters and it does not contain any special character so it throws an error.

Test\_id 7

Saad123
taher.ahmed2004@hotmail.com
Mohsin!23

**Valid password!**

The password “Mohsin!23” is a valid password because it is 9 characters long with a special character.

verification\_email

When the user enters valid username, password and email the program should send an email with a random generated. The email will be short and it will just contain the verification code. I have decided to use PHPMailer which is an email sending library for PHP. And I will be using Gmail SMTP to send emails from PHPMailer.

<https://github.com/anicetkeric/phpSendMail.git>

This is the GitHub repository for that library. I must download the files and save it in the same file where I have all the PHP script.

```

96 function verification_email($email){
97     session_start();
98     $code= rand(100000,999999); //generate a random 6 digit number
99     $_SESSION['code'] = $code;
100    require "Mail/phpmailer/PHPMailerAutoload.php";
101    $mail = new PHPMailer(); // Create a new PHPMailer instance
102    $mail->isSMTP();
103    $mail->Host='smtp.gmail.com'; // Set the SMTP host name
104    $mail->Port=587; // Set the SMTP port number - 587 for authenticated TLS SMTP submission
105    $mail->SMTPAuth=true; // Set the SMTP authentication mechanism
106    $mail->SMTPSecure='tls'; // Set the encryption system to use - ssl (deprecated) or tls
107    // my school gmail account
108    $mail->Username='taher.ahmed@school21.org.uk';
109    $mail->Password='[REDACTED]';
110    // sent from email
111    $mail->setFrom('taher.ahmed@school21.org.uk', 'Verificaton code');
112    // get email address from input
113    $mail->addAddress($_POST[$email]);
114    // HTML body
115    $mail->isHTML(true);
116    $mail->Subject="Verification code";
117    $mail->Body=<b>Dear User</b>
118    <p>Your verificaton code is:<br>
119    <p>$code</p>
120    <p>With regards,</p>
121    <b>Programming with siuuu</b>";
122    if(!$mail->send()){
123        header("Location: sign_up.php.php?error=email_not_send");
124    }
125    header("Location: otp.php?error=succes&email=$email");
126    exit();

```

I have not used the GET or POST parameters this time because I do not want the code to be visible in the URL. Instead I have used sessions instead which is a way to store and share data across multiple pages.

#### Test\_id 9

I did not receive any email because I have used the incorrect password. The password was changed recently, so I had to update it with the new password.

**Looks like you already have an account!** I am expecting to receive an email in that email address.

**VC** Verificaton code <taher.ahmed@school21.org.uk>

**Dear User**

Your verificaton code is:

597585

With regads,

**Programming with siuuu**

This is the email that I received in my personal email for “taher.ahmed@school21.org.uk” instantly with a random 6-digit number.

#### Test\_id 10

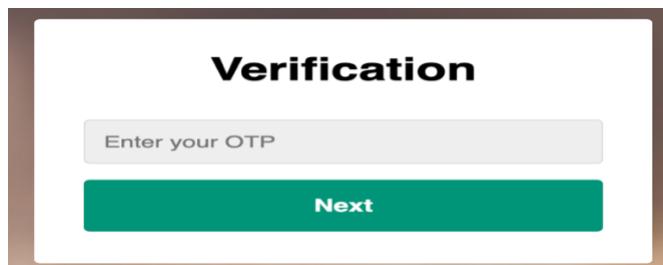
Saad's school email has a special domain.

The email was successfully sent to Saad.

I will not be testing it with any business email for now.

#### Otp\_check

Once the email has been sent to the user it will be directed to a different page where the user can enter their verification code.



```

158 function otp_check() {
159     if (isset($_POST['otp-submit'])) {
160         session_start();
161         $otp = $_POST['otp'];
162         $code = $_SESSION['code'];
163         $otp_int = intval($otp);
164         $codeint = intval($code);
165
166         $email = $_POST['email'];
167
168         if (empty($otp)) {
169             header("Location: otp.php?error=empty_fields&otp=$code");
170             exit();
171         }
172         if ($otp_int !== $code_int) {
173             header("Location: otp.php?error=wrong_otp");
174             exit();
175         }
176         else{
177             echo "Welcome";
}

```

To access the code that was generated previously, I need to use sessions line 162. Line 172 is checking whether the code entered matches with the code generated.

Test\_11



Verificaton code <taher.ahmed@school21.org.uk>

**Dear User**

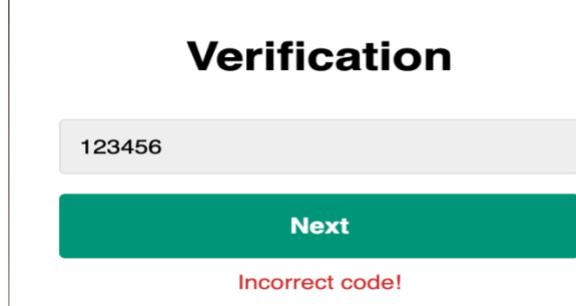
Your verificaton code is:

597585

With regrads,

**Programming with siuuu**

The code that was sent by the email was 597585.



The code entered '123456' is not equal to 597585, which is why it throws an error.

## Update\_status

```

151 function update_status($email){
152     // Get the email and status value from the request.
153     $email = $_POST['email'];
154     $status = 1; // one means verified
155     $sql = "UPDATE Users SET status=? WHERE email=?"; // Prepare the SQL query and statement.
156     $stmt = mysqli_stmt_init($conn);
157     if (!mysqli_stmt_prepare($stmt, $sql)) {
158         header("Location: otp.php?error=mysql_error"); // If there is an error, redirect to the OTP page with an error
159         message.
160         exit();
161     }
162     //bind the parameters and execute the query.
163     mysqli_stmt_bind_param($stmt, "ss", $status, $email);
164     mysqli_stmt_execute($stmt);
165     header("Location: main.html");
166     exit();

```

This will set the status of the user in the database to 1, meaning that the user has verified the account. Then the user will be redirected to the main page where the user can practise his typing.

## Test\_id 12

The status was not updating in the database. I have done a few trials with the same email address, each time I had to remove the email from the database so that I would not get an error saying I already have an account. No error was showing in my debugger. After I have realised that I was binding an integer value, but I was specifying that I am binding two string value line 163.

## Improvement

**163 | mysqli\_stmt\_bind\_param(\$stmt, "is", \$status, \$email);**

Now I am indicating that I will bind an integer value followed by a string value.

## Verification

597585

Next

I have entered the code that I received through my email.

user_id	username	email	password	status
1	Mohsin123	mohsin@gmail.com	Mohsin!23	0
2	T_eight211	taher.ahmed2004@hotmail.com	\$2y\$10\$CLvovcB8Ow1pkobCQ95Z8evJ2lCEENCAzMfFZgLT36SS...	1

The status in the database has been updated now.

## Review

Any user can now create an account and can verify their account.

Success criteria	
<b>Criteria</b>	<b>Met?</b>
Username and password validation	Met
Success message and error message	Met
Username used already	Met
Account made already	Met
Verification email	Met

Update verification status	Met
<b>Test</b>	
<b>Test_id</b>	<b>Passed or failed?</b>
3	Passed
4	Failed see page 61
5	Passed
6	Passed
7	Passed
8	Failed see page 65
9	Passed
10	Passed
11	Passed
12	Failed see page 68
13	Passed

## Log in

First iteration (3<sup>rd</sup> iteration)

This is my first implementation for log in without GUI and any validation. In this iteration the user will be able to log in with the username and password that were stored in the database.

```

10 <form action="log_in_inc.php" method="post">
11 | <!--Input fields-->
12 | <input type="text" name="username_email" class="form_input" autofocus placeholder="Username or
13 | email">
14 | <input type="password" name="password" autofocus placeholder="Password">
15 | <!--Button to run the script-->
| <button name="log_in_submit" type="submit">Next</button>
```

The program needs to be connected to the database, so that the program can read the username, email and password from the database and can compare the values.

```
require 'database_inc.php';|
```

This is an external file with reusable code which establishes a database connection.

## Match\_password

```

2  function match_password($username_email, $password) {
3      require 'database_inc.php'; //connecting with the database
4      // Prepare a SQL statement to retrieve the user data
5      $sql = "SELECT * FROM Users WHERE username = ? OR email = ?";
6      $stmt = mysqli_stmt_init($conn);
7      // Check if the SQL statement is valid
8      if (!mysqli_stmt_prepare($stmt, $sql)) {
9          header("Location: log_in.php?error=sql_error");
10         exit();
11     }
12     else {
13         mysqli_stmt_bind_param($stmt, "ss", $username_email, $username_email);
14         mysqli_stmt_execute($stmt);
15         $result = mysqli_stmt_get_result($stmt);
16
17         // Check if user exists
18         if ($row = mysqli_fetch_assoc($result)) {
19             // Check if user account is verified
20             if ($row['status'] == 1) {
21                 // Check if password matches
22                 if ($password !== $row['password']) {
23                     header("Location: log_in.php?error=wrong_password");
24                     exit();
25                 } else if ($password == $row['password']) {
26                     header("Location: main.html");
27                     exit();
28                 }
29             }
30             else {
31                 header("Location: log_in.php?error=account_not_verified");
32                 exit();
33             }
34         }
35         else {
36             header("Location: log_in.php?error=user_not_found");
}

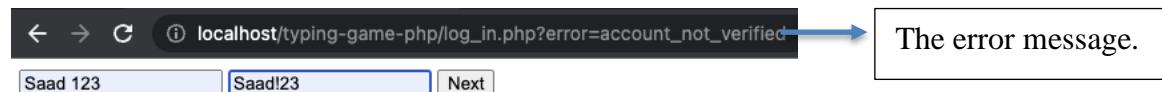
```

This function checks if the user exists first in the database, then it checks if the user is verified and then it checks if the password entered by the user matches with the password in the database. The function mysqli\_stmt\_get\_result(\$stmt) is used to retrieve the result set from the executed statement.

Test			Result	
Description	Type	Code	Expected	Actual
Not verified accounts should not be able to log in	Erroneous	line 20	Account not verified!	<input checked="" type="checkbox"/> Account not verified!

I have manually added another user in the database that is not verified.

3 saad 123	saad@gmail.com	Saad!23	0
------------	----------------	---------	---



Test\_id 17

mohsin@gmail.com Saad123 Next

I have entered an incorrect password. The actual password stored in the database is “Mohsin!23”.

mohsin@gmail.com Saad123  
Incorrect username or password!  
Next

I also need to test if the user can log in with the correct password.

mohsin@gmail.com Mohsin!23  
Incorrect username or password!  
Next

user_id	username	email	password	status
1	Mohsin123	mohsin@gmail.com	\$2y\$10\$CLvovcB8Ow1pkobCQ95Z8evJ2ICENCAzMfFZgLT36SS...	1

Improvement

I will use the same hashing function that I have used before.

```
$hashed_password = password_hash($password, PASSWORD_DEFAULT);
```

I have hashed the password entered before comparing. I still got the same message. After some research I found this built-in function “password\_verify()”, which verifies if the hashed password matches the hashed password stored in the database.

```
21 | $password_check = password_verify($password, $row['password']);
```

This function returns true if it matches.

mohsin@gmail.com Mohsin!23 Success message  
Next

Test\_id 16

This will test whether the user can log in with either their username or email.

Mohsin123 Mohsin!23 Success message  
Next

I tried to log in with his username and as you can see in the URL “success=welcome”. I have tested it with his email before.

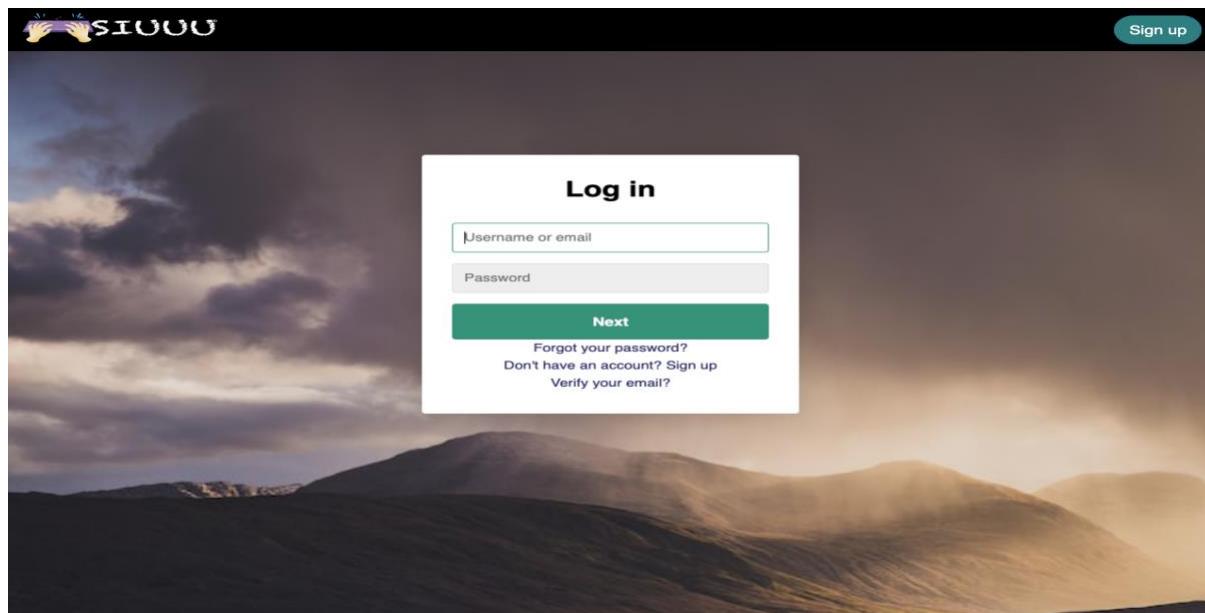
#### Review

The user can successfully log in if they have verified their account.

Success criteria	
Criteria	Met?
Correct username and password	Met
Test	
Test_id	Passed or failed?
17	Failed

Second iteration (4<sup>th</sup> iteration)

I will add the GUI first before adding any other features. I will use the same design that I have used for the sign up page.



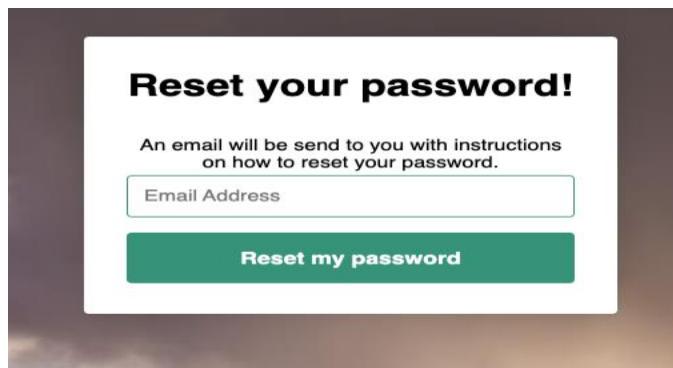
#### Feedback

##### What do you think about the design for the sign up page?

[Wasi] – The design is very clear and it follows the typical design of a website. How would I navigate to the if there is one? And you said you will add a guest mode.

[me] – The guest mode has not been added yet, but there will be a button on the header that will direct you to the guest mode page. My pressing the logo will be able to go to the home page which has not been added yet.

I have to add another page where the user can enter their email so that the user can reset their password.



Account\_exist

```
reset_request_inc.php
1 <?php
2 function account_exist ($email){
3     $sql = "SELECT * FROM Users WHERE email = ?";
4     $stmt = mysqli_stmt_init($conn);
5     // Check if the SQL statement is valid
6     if (!mysqli_stmt_prepare($stmt, $sql)) {
7         header("Location: log_in.php?error$sql_error");
8         exit();
9     }
10    else {
11        mysqli_stmt_bind_param($stmt, "s", $email);
12        mysqli_stmt_execute($stmt);
13        $result = mysqli_stmt_get_result($stmt);
14        // Check if user exists
15        if ($row = mysqli_fetch_assoc($result)) {
16            header("Location: log_in.php?error=user_found");
17            exit();
18        }
19        else {
20            header("Location: log_in.php?error=user_not_found");
21            exit();
22        }
23    }
24}
```

This function will check if the user made an account and has their email, username and password stored in the database. Line 13 assigns the result of the prepared statement (line 3). Line 15 checks if there is a row returned from the query.

Test\_id 18

## Reset your password!

An email will be send to you with instructions  
on how to reset your password.

wasi@gmail.com

You do not have an account!

I have used an email that is not in the database so the program outputs “Do not have an account!”

## Write\_reset\_password

```

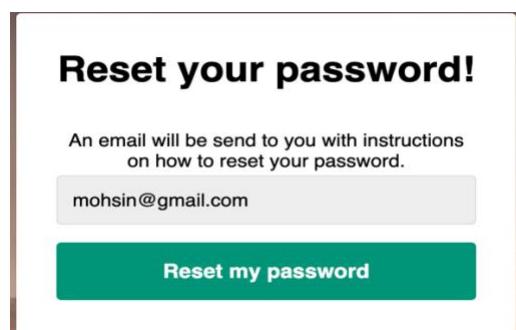
108 function write_reset_password ($email){
109     // converting these binary values into hex so it can be inserted in the URL
110     $token = bin2hex(random_bytes(32));
111     // this is the URL is included in the reset email
112     $url = "localhost/typing-game-php/reset_password.php?token=$token" ;
113     // setting for how long this email request will be valid for
114     $expires = date("U") + 1800;
115     $sql = "INSERT INTO Reset_password (reset_email, reset_token, expires) VALUES (?, ?, ?);";
116     $stmt =mysqli_stmt_init($conn);
117     if (!mysqli_stmt_prepare($stmt, $sql)){
118         header( "Location: reset_request.php?error=sql_error");
119         exit();
120     }
121     else {
122         //passing the values
123         mysqli_stmt_bind_param($stmt, "sss", $email, $token, $expires );
124         mysqli_stmt_execute($stmt);

```

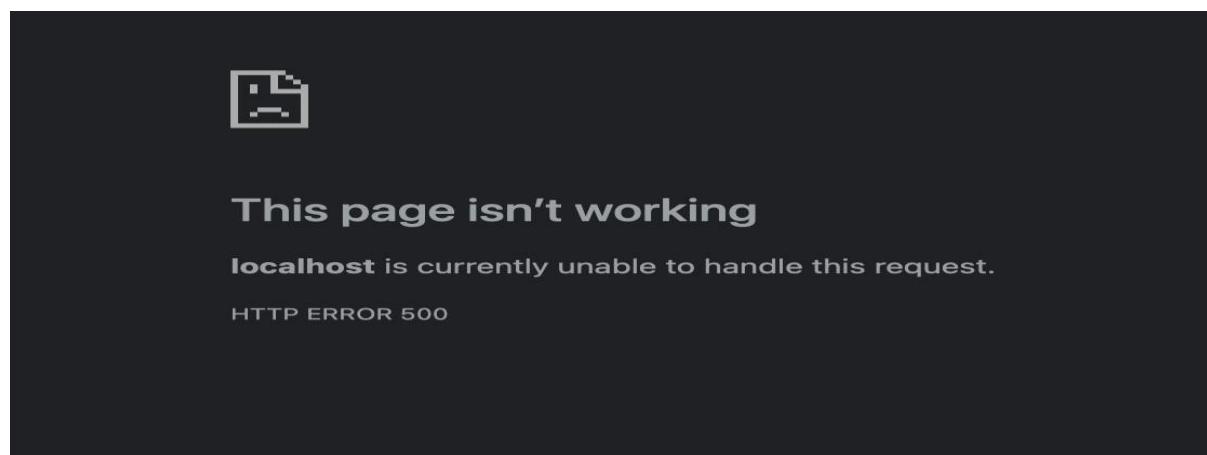
The token variable is a random 32-bytes string which is then converted to a hexadecimal character. I will pass the token through the URL so that the token can be validated later. If the token was in binary, it would make the URL extremely long. The expires variable adds 30 minutes to the current time which will be used to check if the link has expired or not. The program then will store these values to that database so that I can be validated when resetting the password.

## Test\_id 21

I will test if the token and URL generated are being written in the database in “Reset\_password”.



I have entered an email address that has created an account before.



I got this error. There are 5 columns in the “Reset\_password” table, one of them being auto incremented and I am passing one of 3 values. I am missing the user\_id of the user which needs to be stored in the database as a foreign key.

## Improvements

```

59  function fetch_user_id($email){
60      require "database_inc.php";
61      $sql= "SELECT user_id FROM Users WHERE email=?";
62      $stmt = mysqli_stmt_init($conn);
63      if (!mysqli_stmt_prepare($stmt, $sql)){
64          header("Location: reset_request.php?error=sql_error");
65          exit();
66      }
67      else {
68          mysqli_stmt_bind_param($stmt, "s", $email);
69          mysqli_stmt_execute($stmt);
70          $result = mysqli_stmt_get_result($stmt);
71          $row = mysqli_fetch_assoc($result);
72          echo "Your user_id is ".$row['user_id'];
73      }
74  }
75  $email="saad@gmail.com";
76  fetch_user_id($email);

```

This function will now fetch the user\_id of that user. Line 73 outputs the user\_id.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the correct user_id is fetched	Normal	line 61	Your user_id is 3	<input checked="" type="checkbox"/> Your user_id is 3.



Saad is assigned with a user\_id of 3 and the program printed 3.

I have to pass these values in the prepared statement. And I need to make sure I am passing the values as an integer.

```

32  $sql = "INSERT INTO Reset_password (user_id, reset_email, reset_token, expires) VALUES
(?, ?, ?, ?);";

```

reset_id	user_id	reset_email	reset_token	expires
1	2	taher.ahmed2004@hotmail.com	b9160ce9cca3c2078763bf82f4c04ef3decbd4bb74cea52d2d...	1678370529

The user\_id, reset\_email, reset\_token and expires have been successfully inserted in the Reset\_password table.

## Send\_reset\_link

I will use the same library “PHPMailer” that I have used to send the verification code in the sign-up process.

```

80  function send_reset_link($URL, $email){
81      require "Mail/phpmailer/PHPMailerAutoload.php";
82      $mail = new PHPMailer;
83      $mail->isSMTP();
84      $mail->Host='smtp.gmail.com';
85      $mail->Port=587;
86      $mail->SMTPAuth=true;
87      $mail->SMTPSecure='tls';
88      $mail->Username='taher.ahmed@school21.org.uk';
89      $mail->Password=      ;
90      $mail->setFrom('taher.ahmed@school21.org.uk', 'Reset password');
91      // get email from input
92      $mail->addAddress($email);
93      // HTML body
94      $mail->isHTML(true);
95      $mail->Subject="Recover your password";
96      $mail->Body="Dear User
97      <h3>We received a request to reset your password.</h3>
98      <p>Kindly click the below link to reset your password</p>
99      <p>Here is your password reset link:<br>
100     <a href=". $URL .">$URL</a></p>
101     <p>With regards,</p>
102     <b>Programming with siuuu</b>";
103     if(!$mail->send()){
104         header("Location: reset_request.php?error=email_not_send");
105     }
106     header("Location: reset_request.php?success=success");
107 }
```

The URL and email are passed as parameters. The URL which contains the token, and the location will be sent in the email.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the URL has been sent through email.	Normal	80-106	Check your email!	<input checked="" type="checkbox"/> Check your email!

I have removed the reset\_email and the reset\_token from the Reset\_password table so that the email is sent when these values are written in the database.

## Reset your password!

An email will be send to you with instructions on how to reset your password.

taher.ahmed2004@hotmail.com|

Check your email!

**Reset my password**

The program will redirect the user to the same page “reset\_request” and it will print this message because in the URL it says success.

TA Taher Ahmed <taher.ahmed@school21.org.uk> 

**Dear User**  
**We received a request to reset your password.**

Kindly click the below link to reset your password

[www.localhost/typing-game-php/reset\\_password.php?](http://www.localhost/typing-game-php/reset_password.php?token=ef7bd9cc5a33ab50a516070fc6ec1ae6c4a3e482fead0b68e29ead241d30ab7c)  
[token=ef7bd9cc5a33ab50a516070fc6ec1ae6c4a3e482fead0b68e29ead241d30ab7c](http://www.localhost/typing-game-php/reset_password.php?token=ef7bd9cc5a33ab50a516070fc6ec1ae6c4a3e482fead0b68e29ead241d30ab7c)

With regards,

**Programming with siuuu**

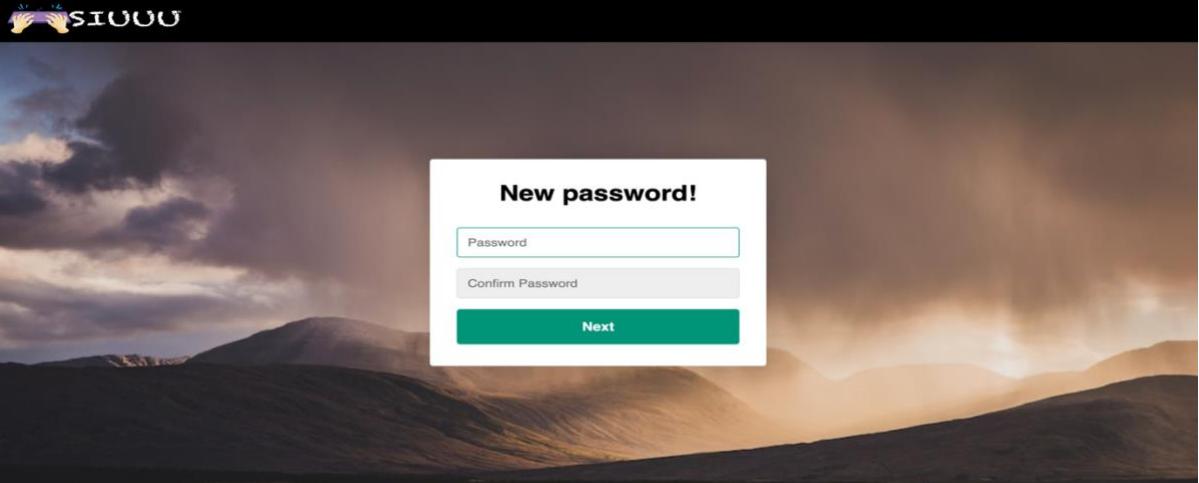
I received this email in my personal email with this URL.

I have to make another web page where the user can enter their new password.

```

19 |     <h1 class="form_title">New password!</h1>
20 |     <div class="form_input_group">
21 |         <input type="password" name="password" class="form_input" autofocus
22 |             placeholder="Password">
23 |     </div>
24 |     <div class="form_input_group">
25 |         <input type="password" name="password-repeat" class="form_input" autofocus
26 |             placeholder="Confirm Password">
27 |     </div>
    <button class="form_button" name="reset_password_submit" type="submit"> Next</button>

```



The user cannot go to any other pages from here. I have two input fields here for the password so that the user does not forget the password again.

Valid\_password

I will use the same function with the same validation that has been used in the sign-up process.

```

3 |     if ($password != $repeat_password) {
4 |         header ("Location:reset_password.php?error=password_match&token=$token");
5 |         exit();
6 |

```

This if statement has been added to the function, which checks if both of the password entered matches. And I am passing the token through the URL so that the URL is still valid.

Test			Result	
Description	Type	Code	Expected	Actual

Not matching password should be rejected	Erroneous	3	Password does not match!	<input checked="" type="checkbox"/> Password does not match!
--	-----------	---	--------------------------	--

## New password!

Mohsin!23

Hello!23

Password does not match!

**Next**

The password “Mohsin!23” and “Hello!23” are not equal so the program outputs this message.

### Validate\_token

In this function I will check if the request has expired and will check if the token in the URL matches with the token in the database.

```

8   function validate_token($token){ // It takes a token string as input
9     $current_date = date("U"); // Get the current date in Unix timestamp format
10    require 'database_inc.php'; // Include the database connection file
11    // Prepare the SQL query to select the reset token from the database
12    // that matches the token from the URL and has not expired yet
13    $sql = "SELECT * FROM Reset_password WHERE reset_token=? AND expires >= ?";
14    $stmt = mysqli_stmt_init($conn);
15    if (!mysqli_stmt_prepare($stmt, $sql)){
16      header( "Location: reset_password.php?error=sql_error");
17      exit();
18    }
19    else{
20      mysqli_stmt_bind_param($stmt, "ss", $token, $current_date);
21      mysqli_stmt_execute($stmt);
22      $result = mysqli_stmt_get_result($stmt); // Get the result set from the executed statement
23      if (!$row = mysqli_fetch_assoc($result)){
24        // If no row is returned, redirect to the password reset page with an error message
25        header( "Location:reset_password.php?error=resubmit_request");
26        exit();
27      }
28      else{
29        // The token in the url matches with token in the database and the link has not expired yet
30        header("Location:reset_password.php?success=valid");
}

```

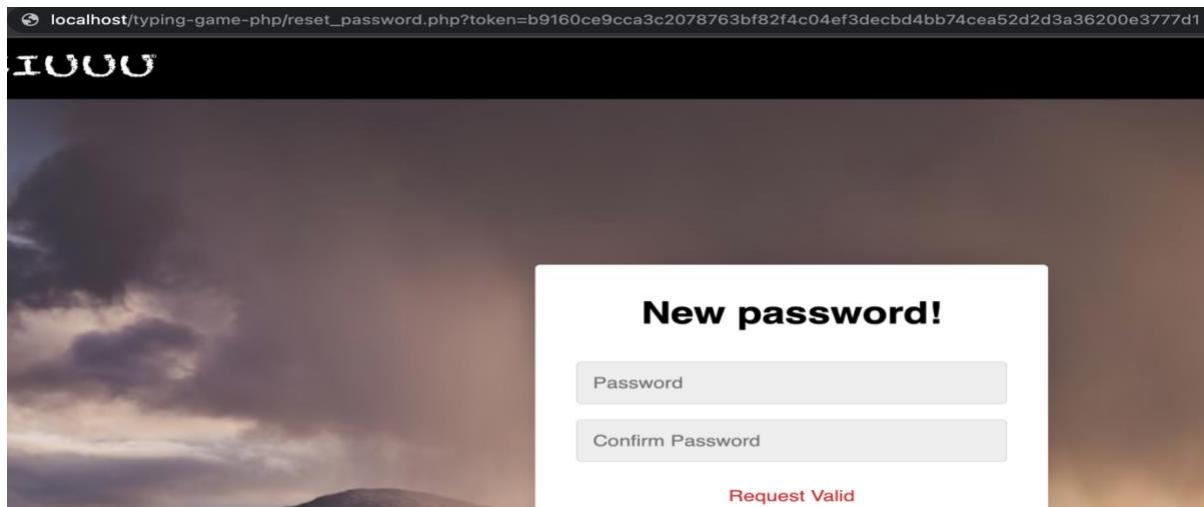
This function checks if any row in the database has the same token that is in the URL and the current time is less than the expiry time.

Test			Result	
Description	Type	Code	Expected	Actual
Check if valid request is valid	Normal	Line 8-30	Request valid.	<input checked="" type="checkbox"/> Request valid.

I have copied the token from the database and passed it in the validate\_token function.

reset_id	user_id	reset_email	reset_token	expires
1	2	taher.ahmed2004@hotmail.com	b9160ce9cca3c2078763bf82f4c04ef3decb4bb74cea52d2d...	1678386096

The current date and time in Unix timestamp format is 1678377334 which is less than the date and time in the database 1678386096.



After running the script, as you can see the token in the URL is the same token in the database and I have shown that the request has not expired yet because 30 minutes has been added to time in the database.

Test\_id 22

I have waited 30 minutes and the current date and time is 1678386658 which should be greater than the expiry date and time.

The program printed this error message as 1678386658 is this greater than 1678386096.

Update\_password

After checking if the request is valid and validating the password, the password can be updated with a new password entered.

```

34 function update_password($password, $email){
35     require "database_inc.php";
36     $sql ="UPDATE Users SET password=? WHERE email=?";
37     $stmt =mysqli_stmt_init($conn);
38     if (!mysqli_stmt_prepare($stmt, $sql)){
39         header( "Location: reset_password.php?error=sql_error");
40         exit();
41     }
42     else{
43         // hashing the password before writing the password
44         $hashed_password = password_hash($password, PASSWORD_DEFAULT);
45         mysqli_stmt_bind_param($stmt, "ss", $hashed_password, $email);
46         mysqli_stmt_execute($stmt);

47         $sql ="DELETE FROM Reset_password WHERE reset_email=?";
48         $stmt =mysqli_stmt_init($conn);
49         if (!mysqli_stmt_prepare($stmt, $sql)){
50             header( "Location: Location:reset_password.php?error=sql_error");
51             exit();
52         }
53         else{
54             mysqli_stmt_bind_param($stmt, "s", $email);
55             mysqli_stmt_execute($stmt);
56             header("Location: reset_password.php?success=success");
57         }
58     }
59 }

```

This function will hash the password and update the database with the new password. I have also decided to remove the email, token and expires from the reset\_password table so that there aren't multiple reset requests at the same time.

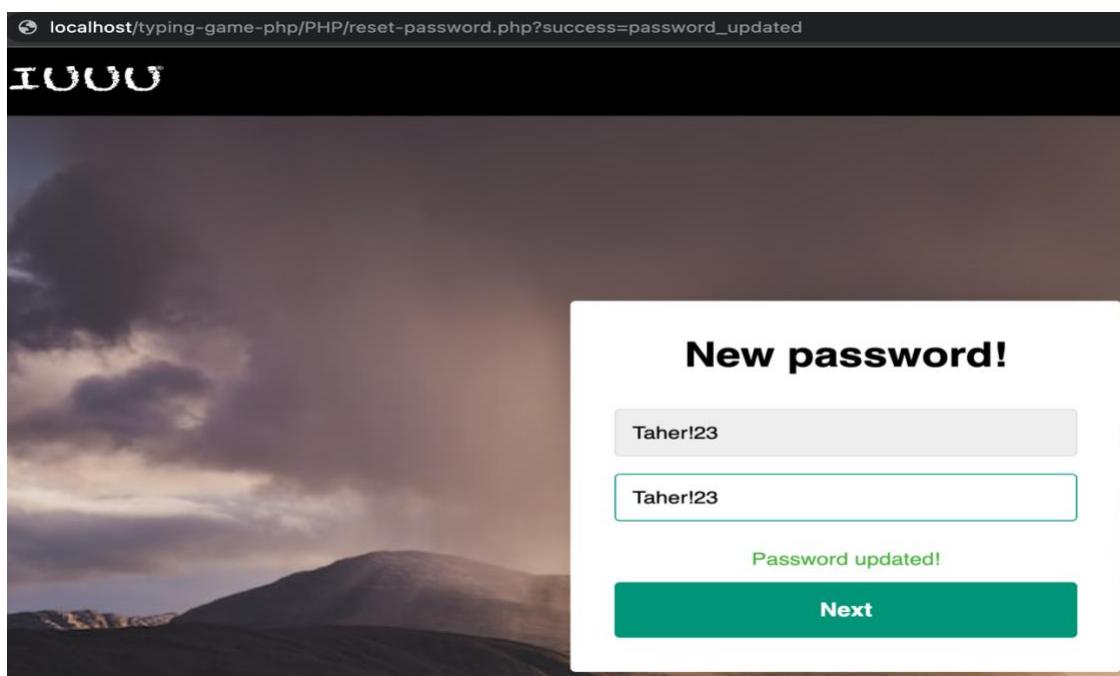
Test\_id 20

I will not hash the password so that it is obvious if the password has changed or not.

2 T\_eight211 taher.ahmed2004@hotmail.com Hello!23

1

I have changed the password to “Hello!23”. I have then sent a reset password request.



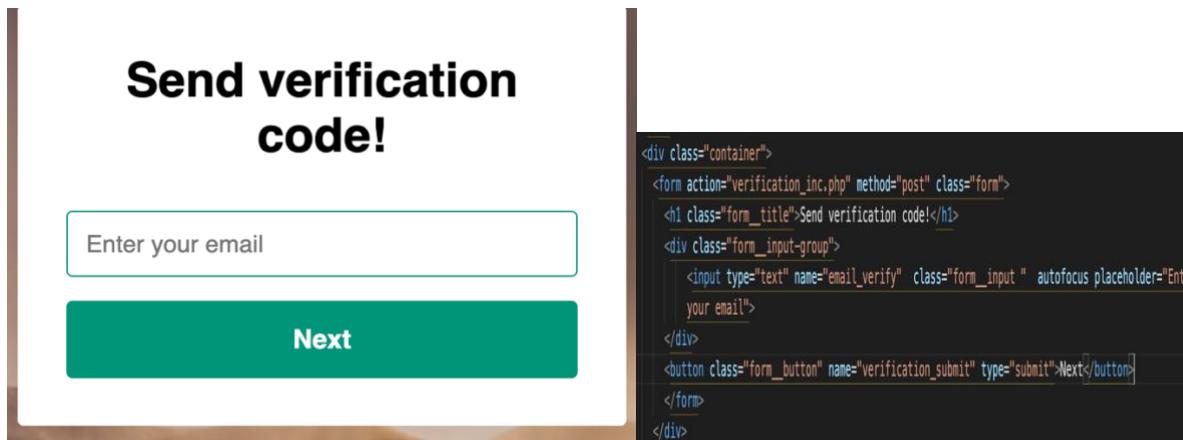
I was redirected on the same page with a success message. This means the password was updated in the database.

user_id	username	email	password	status
1	Mohsin123	mohsin@gmail.com	Mohsin!23	1
2	T_eight211	taher.ahmed2004@hotmail.com	Taher!23	1
3	saad 123	saad@gmail.com	Saad!23	0

The password has been successfully updated in the database to “Taher!23”.

### Verification

Users can verify their account if they have not verified their account previously, if they have closed the web page where the verification code is entered they will not have access to the web page again. So they need to send the verification code again. In this section I will make another page where the user can enter their email to send a verification email.



```


<form action="verification_inc.php" method="post" class="form">
<h1 class="form_title">Send verification code!</h1>
<div class="form_input-group">
<input type="text" name="email_verify" class="form_input" autofocus placeholder="Enter your email">
</div>
<button class="form_button" name="verification_submit" type="submit">Next</button>
</form>


```

This page will follow the same design as the other input forms. Each element has their own class so that I can change the colour and position each element.

### Verified\_already

I must check if the user has verified their account already or not. There is no point in sending a verification code through email if they have verified their account already.

```

2 function verified_already($email){
3     require 'database_inc.php';//connecting with the database
4     // Prepare a SQL statement to retrieve the user data
5     $sql = "SELECT * FROM Users WHERE email = ?";
6     $stmt = mysqli_stmt_init($conn);
7     // Check if the SQL statement is valid
8     if (!mysqli_stmt_prepare($stmt, $sql)) {
9         header("Location: log_in.php?error=mysql_error");
10        exit();
11    }
12    else {
13        mysqli_stmt_bind_param($stmt, "ss", $email);
14        mysqli_stmt_execute($stmt);
15        $result = mysqli_stmt_get_result($stmt);
16        // Check if user exists
17        if ($row = mysqli_fetch_assoc($result)) {
18            // Check if user account is verified
19            if ($row['status'] == 1) {
20                header("Location: log_in.php?error=account_verified_already");
21                exit();
22            }
23            else {
24                //send verification code
25            }
26        }
27        else {
28            header("Location: log_in.php?error=user_not_found");
29            exit();
}

```

When the email is entered, it retrieves all the user data from the “Users” table. It then checks if any data has been returned or not. It then checks if the status is 0 or 1 meaning verified or not. If the account is not verified it follows the same steps as the sign-up page.

Test\_id 15

user_id	username	email	password	status
1	Mohsin123	mohsin@gmail.com	Mohsin!23	1

[mohsin@gmail.com](mailto:mohsin@gmail.com) is verified already so I will enter this in the input fields.

## Send verification code!

Account verified already!

[Next](#)

It prints this message as this email is verified already.

## Review

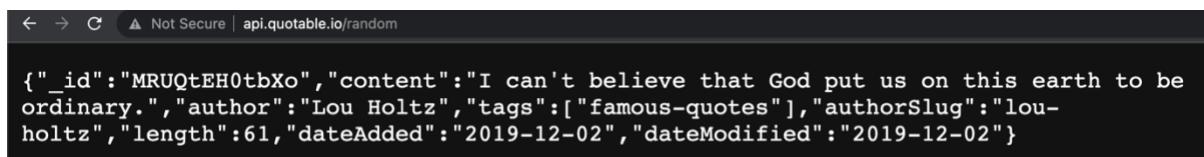
The user can now successfully log in, reset their password and verify their account if they have not verified their account before. My GUI looks very similar to the GUI of design, there have been small changes on the colour choices of the buttons and input fields. I have also added another page where the user can enter their email address to verify their account.

Success criteria	
Criteria	Met?
Correct Username and password	Met
Forgot password	Met
Forgot password link expiry	Met
Update database password	Met
Test	
Test_id	Passed or failed?
18	Passed
21	Failed
22	Passed
20	Passed
15	Passed

## Typing game

### First iteration (5<sup>th</sup> iteration)

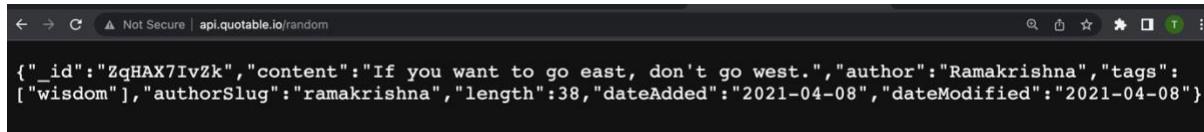
In this iteration I will fetch a random quote from an API, and display it. I have used <http://api.quotable.io/random> which is a REST API that provides a random quote when requested. REST stands for Representational State Transfer, and it is an architectural style for building web services. This API returns a JSON object that contains a randomly generated quote, along with other details such as the author and length of the quote. I will also make an input field where the user can type.



```
{"_id": "MRUQtEH0tbXo", "content": "I can't believe that God put us on this earth to be ordinary.", "author": "Lou Holtz", "tags": ["famous-quotes"], "authorSlug": "lou-holtz", "length": 61, "dateAdded": "2019-12-02", "dateModified": "2019-12-02"}
```

I have entered the URL in the search bar and this is the quote it fetched this time. It also shows the author name and the number of characters in this quote, which will be helpful when calculating the CPM.

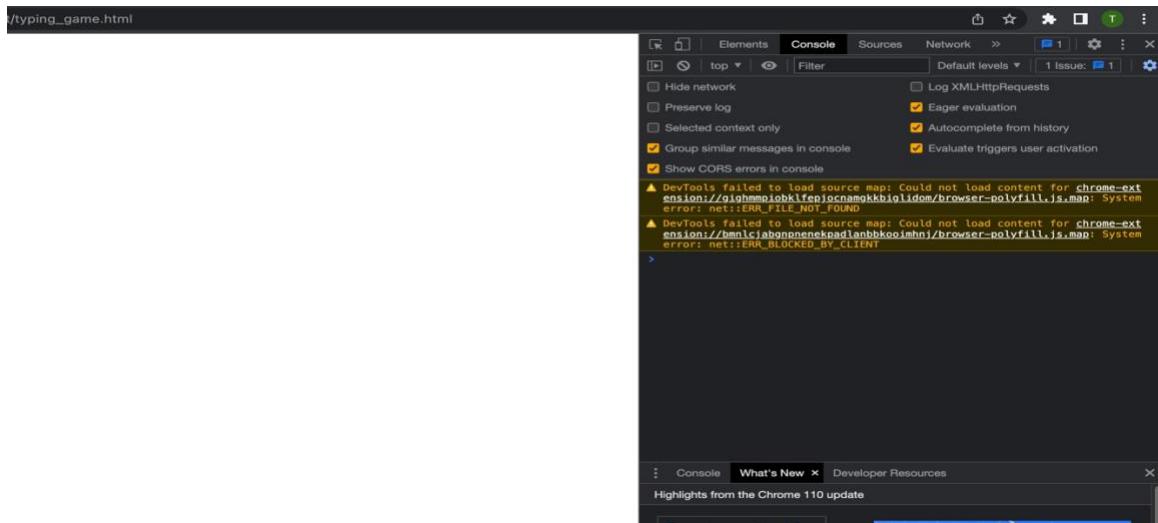
If I were to refresh.



```
{"_id": "ZqHAX7IvZk", "content": "If you want to go east, don't go west.", "author": "Ramakrishna", "tags": ["wisdom"], "authorSlug": "ramakrishna", "length": 38, "dateAdded": "2021-04-08", "dateModified": "2021-04-08"}
```

We have a different quote now.

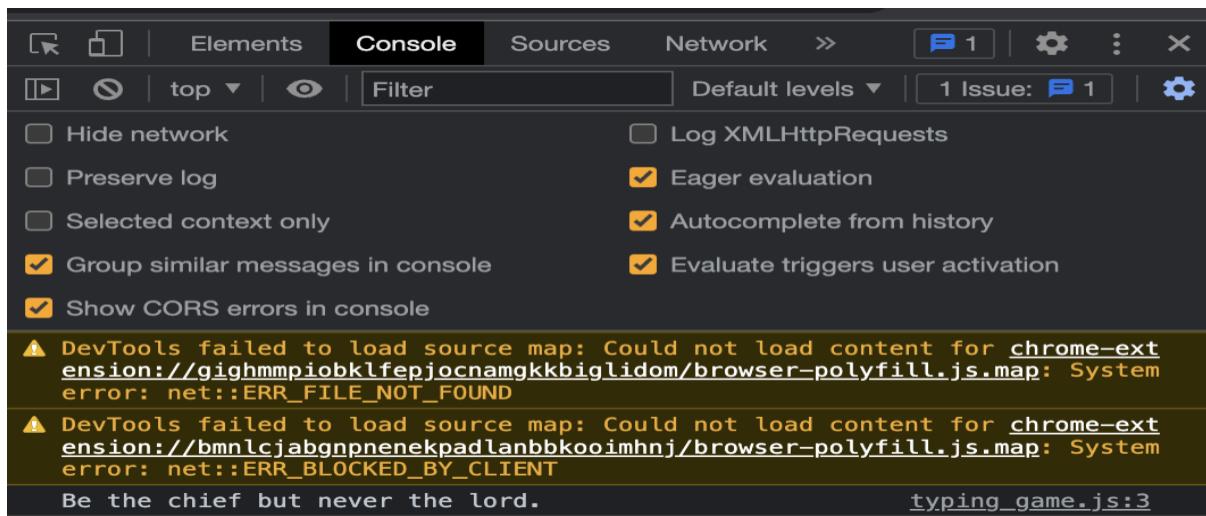
I will test now, if I can print out the code on my website.



I have created an empty HTML web page and I have opened the console. I am using JavaScript to code the typing game. The console will be very helpful throughout the development process. It can be used to log messages, debug JavaScript code. The console also provides a command-line interface where I can enter JavaScript code and execute it directly into the browser.

```
1 fetch('http://api.quotable.io/random')
2   .then(response => response.json())
3   .then(data => console.log(data.content))
4   .catch(error => console.error(error));
```

It fetches a random quote from the API, and it extracts the quote using the json() method and then it prints it using console.log().



The quote has been successfully fetched and logged into the console.

```
<body>
  <div id="quote_display" >Quote</div>
  <textarea type="text"></textarea>
</body>
```

## Quote

The quote will be displayed on top of the textarea. And the textarea will be used for the user to type.

### Quote

```

1 // The Quote class fetches a random quote from an API and returns it.
2 class Quote {
3   constructor(api_url) {
4     this._apiUrl = api_url;
5   }
6   async _getRandomQuote() {
7     const response = await fetch(this._apiUrl);
8     const data = await response.json();
9     return data.content;
10 }
11 async getNextQuote() {
12   const quote = await this._getRandomQuote();
13   return quote;
14 }
15 }
16 // The QuoteRenderer class takes a quote and renders it on the screen.
17 class QuoteRenderer {
18   constructor(displayElement, inputElement) {
19     this._displayElement = document.getElementById(displayElement);
20     this._inputElement = document.getElementById(inputElement);
21   }
22   render(quote) {
23     // Clear the display element of any previous quote.
24     this._displayElement.innerText = '';
25     // Iterate over each character in the quote.
26     quote.split('').forEach((character) => {
27       // Create a new span element for the character and set its text.
28       const characterSpan = document.createElement('span');
29       characterSpan.innerText = character;
30
31       // Add the span element to the display element.
32       this._displayElement.appendChild(characterSpan);
33     });
34     // Reset the input element's value to null.
35     this._inputElement = null;
36   }
37 }
```

I have added another class just to separate the functionality for now. This quote class will fetch the quote from the REST API and the QuoteRenderer will display the quote in the web page. I have also splitted each character into individual span elements which will be useful to colour each character to show if the user has typed it correctly or incorrectly.

```
46 class TypingGame {
47   constructor(api_url, displayElement, inputElement, mistakeElement, timerElement) {
48     // Create a new Quote instance to fetch quotes.
49     this._quote = new Quote(api_url);
50
51     // Create a new QuoteRenderer instance to render quotes.
52     this._renderer = new QuoteRenderer(displayElement, inputElement);
```

This is the class where I will manage all the logic of the game and create instances of the other classes so that I can use the methods of those classes.

You got to be careful if you don't know where you're going, because you might not get there.

Test id 30

I will refresh the tap 5 to see if all the quotes are different.

## Quote 1

**Whoever is happy will make others happy, too.**

### Quote 2

**Knowing is not enough; we must apply. Willing is not enough; we must do.**

### Quote 3

**One who gains strength by overcoming obstacles possesses the only strength which can overcome adversity.**

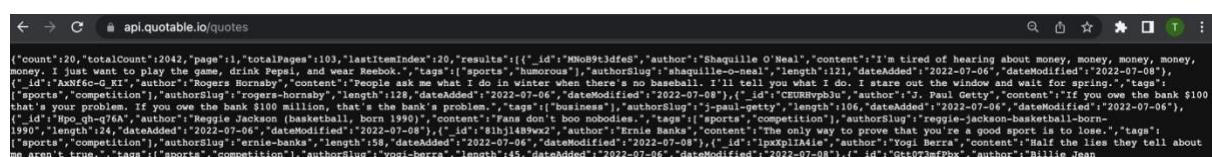
#### Quote 4

In dwelling, live close to the ground. In thinking, keep to the simple. In conflict, be fair and generous. In governing, don't try to control. In work, do what you enjoy. In family life, be completely present.

## Quote 5

In order to win, you must expect to win.

All these quotes are different, to get a more accurate result I need to refresh many times. It would be a waste of time because I can see the total number of quotes at any given time.



The `totalCount` property in the response tells you the total number of quotes in the database. So there are 2042 different quotes in the database.

## colourMistakes

```

57  colourMistakes() {
58    const arrayQuote = this._renderer._displayElement.querySelectorAll('span');
59    const arrayValue = this._renderer._inputElement.value.split(' ');
60    arrayQuote.forEach((characterSpan, index) => {
61      const character = arrayValue[index];
62
63      if (character == null) {
64        characterSpan.classList.remove('correct');
65        characterSpan.classList.remove('incorrect');
66      } else if (character === characterSpan.innerText) {
67        characterSpan.classList.add('correct');
68        characterSpan.classList.remove('incorrect');
69      } else {
70        characterSpan.classList.remove('correct');
71        characterSpan.classList.add('incorrect');

```

This method colours the characters based on whether they are correct or incorrect. It splits the input into an array of characters so that each character can be compared. If the character in a specific position match, then the correct class is applied which coloured green. I have used a count controlled loop ‘forEach’ to compare each element.

```

85  this._renderer._inputElement.addEventListener('input', () => {
86    // Colour the characters based on whether they are correct or incorrect.
87    this.colourMistakes();
88  });

```

I have used the addEventListener method, in this case it listens for the input fields to change. The ‘colourMistakes’ method is called every single time the user types something.

Test\_id 31

---

All of All of our technology is completely unnecessary to a happy life.

A All

When I have typed the first character correctly, it coloured the matching correct in that position green. But when I typed the rest of the word correctly, it was not registering.

I have decided to log both variables that are being compared.

```

▼ (2) [ 'If', "you're" ] ⓘ
  0: "If"
  1: "you're"
  length: 2
  ► [[Prototype]]: Array(0)

```

I have realised the input is being split into an array of words instead of characters.

Improvements

```

59  const arrayValue = this._renderer._inputElement.value.split('');

```

I have removed the space in the brackets which gave me a logic error.

---

Our lives are a sum total of the choices we have made.

Orr lives are dsfkl

The first character matches so it is coloured green the second character doesn’t match so it is coloured red.

## Review

I have changed most of the class names and attributes names. I have used underscore in my class diagram to name the attributes and method, but I have used camelCase in my code because it is not a good practice to use underscore in JavaScript and underscore is used at the start of the attribute to make it private for encapsulation. The user can now type in the text area and the user can see whether they are typing correctly or incorrectly.

<b>Success criteria</b>	
<b>Criteria</b>	<b>Met?</b>
Random paragraph generator.	Met
Forgot password	Met
Forgot password link expiry	Met
Update database password	Met
<b>Test</b>	
<b>Test_id</b>	<b>Passed or failed?</b>
30	Passed
31	Failed

## Second iteration (6<sup>th</sup> iteration)

In this iteration I will add GUI, a timer, mistake counter and WPM calculator. I will add the design before any further development and testing so I can see how the features will look to the end user.

```

12 <header>
13   <a href="#" class="logo1"></a>
14   <ul class="navigation1">
15     <li><a href="#">My progress</a></li>
16     <li><a href="#">Leaderboard</a></li>
17     <li><a href="#">Modes</a></li>
18     <li><a href="../Front-page/front-page.html">Logout</a></li>
19   </ul>
20   <a href="#" class="image1"></a>
21 </header>
22
23 <div class="container1">
24   <div class="quote-display" id="quoteDisplay" >Quote</div>
25   <textarea class="quote-input" id="quoteInput" type="text">Quote</textarea>
26 </div>
27 <div class="wrapper">
28   <div class="content-box">
29     <div class="content">
30       <ul class="result-details">
31         <li class="time">
32           <p>Time Left:</p>
33           <span><b>60</b>s</span>
34         </li>
35         <li class="mistake">
36           <p>Mistakes:</p>
37           <span>0</span>
38         </li>
39         <li class="wpm">
40           <p>WPM:</p>
41           <span>0</span>
42         </li>
43         <li class="cpm">
44           <p>CPM:</p>
45           <span>0</span>
46         </li>
47       </ul>
48       <button name="clicked" id='tryAgain'>Try Again</button>

```

The screenshot shows the application's interface. At the top is a dark header bar with a logo on the left and navigation links: 'My progress', 'Leaderboard', 'Modes', and 'Logout'. Below the header is a light-colored container. Inside the container, there's a 'quote-display' box containing the word 'Quote' and a 'quote-input' text area below it. Below the input area is a 'content-box' containing a list of performance metrics: Time Left (60s), Mistakes (0), WPM (0), and CPM (0). A 'Try Again' button is at the bottom of the list.



I have decided to keep the same header format with the logo on the left. I have used a list instead of a button. I have a “Try again” button which will generate a new quote when the user has finished typing. The class is used for CSS and the id will be used to specify the element in JavaScript. The wrapper section has all the information related to the user’s performance. I have separated the quote, input section and the result section so that the user

does not get distracted while typing. I have a profile picture on the right of the header, the user will not be able to change their profile picture but it is a feature that could be added in the future.

## Feedback

### **What do you think about the design for the typing game page?**

[Wasi] - I really like the colour scheme and layout of the website, it's very visually appealing. I do not think anyone is interested in how many characters they can type in a minute. I think it would not mean anything to most users because the standard measure for typing is words per minute.

[me] – I have added CPM as it is a more accurate measure of their typing speed. I will probably remove it.

[Saad] – I like how you have separated different sections. The quote seems to be a bit small, it would be better if you would use a bigger font.

[me] – I am currently using 16px, I will probably make it bigger and use 20px.

## Updated design



## Calculate\_mistakes

The mistake counter must be added first because to calculate words per minute we need to know how long it took for the user to type and how many of the words have been typed correctly. I have mentioned in my design that I will have a method that will change the mistake element but I have realised that the method colourMistake() is iterating over each character and comparing each character. So I will add the code under the if statement where the characters do not match.

```

53  // Initialize the mistakes array.
54  this._mistakesArray = [];
55
56  // Get the mistake element from the DOM.
57  this._mistakeElement = document.querySelector(mistakeElement);
58
59 }
```

```

61 // This method colors the characters based on whether they are correct or incorrect.
62 colourMistakes() {
63   const arrayQuote = this._renderer._displayElement.querySelectorAll('span');
64   const arrayValue = this._renderer._inputElement.value.split('');
65
66   arrayQuote.forEach((characterSpan, index) => {
67     const character = arrayValue[index];
68
69     if (character == null) {
70       characterSpan.classList.remove('correct');
71       characterSpan.classList.remove('incorrect');
72     } else if (character === characterSpan.innerText) {
73       characterSpan.classList.add('correct');
74       characterSpan.classList.remove('incorrect');
75     } else {
76       characterSpan.classList.remove('correct');
77       characterSpan.classList.add('incorrect');
78       if (!this._mistakesArray.includes(index)) {
79         this._mistakesArray.push(index);
80       }
81       this._mistakeElement.textContent = this._mistakesArray.length;
82     }
83   });
84 }

```

I have used an array which is initialised in the constructor with an empty array (line 54). I have used the included method that checks whether the “mistakeArray” includes the value referred by the index. If not, the value is added to the array. The length of the array is the number of mistakes.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the mistake counter updates correctly.	Normal	Line 78	The count should go up when the user types incorrectly.	<input checked="" type="checkbox"/> Count updated.

**Bad things are not the worst thing  
worst thing that can happen to us**

Bed fdsags

Time Left: 60s | Mistakes: 5

The characters typed incorrectly were ‘a’, ‘t’, ‘h’, ‘i’, ‘n’. The count has been updated with 5.

Test\_id 27

**Bad things are not the worst things  
worst thing that can happen to us!**

Bad thi

**Time Left: 60s | Mistakes: 5 |**

I have cleared the input field and then typed some of the characters correctly. The mistake count is still 5.

calculate\_timer

I need to make a timer so that I know how long the user took to type n number of words. This is my first attempt at making a timer that counts down from 60 to 0.

```

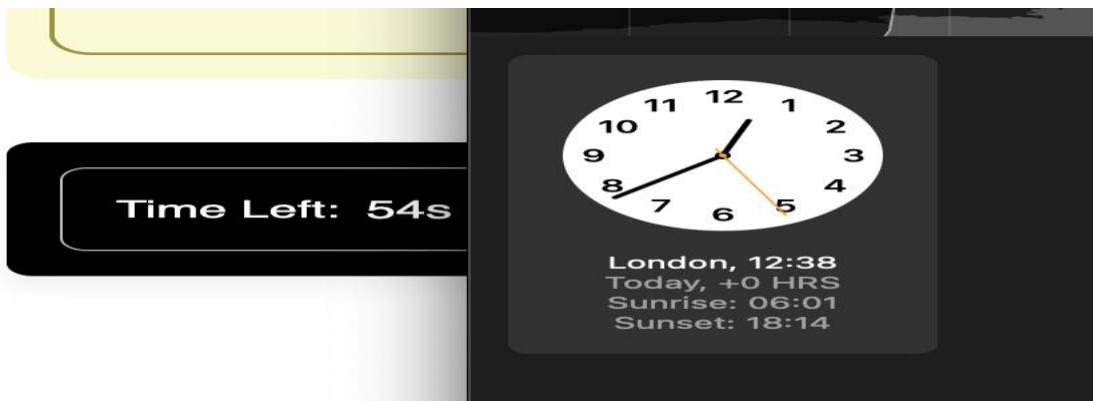
85  timer() {
86    const startTime = new Date();
87    this._timerElement.innerText = 60;
88    const startTimer = setInterval(() => {
89      this._timerElement.innerText = this.getTimerTime(startTime);
90    }, 1000);
91  }
92
93  // This method calculates the remaining time.
94  getTimerTime(startTime) {
95    return Math.max(0, 60 - Math.floor((new Date() - startTime) / 1000));
96  }

```

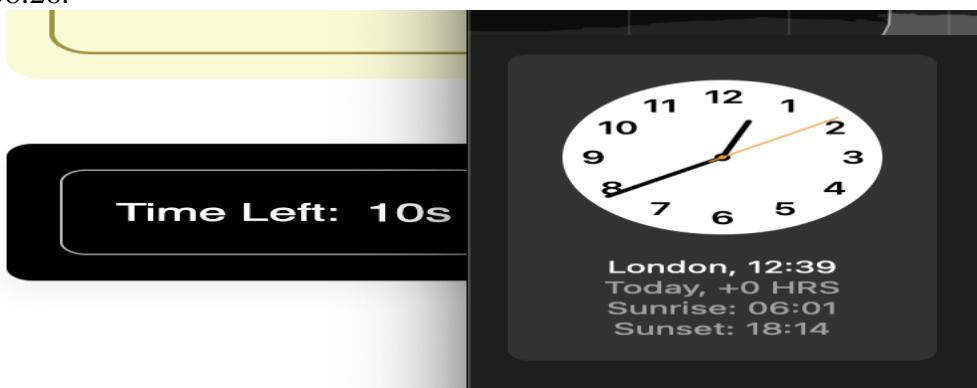
This code defines a timer() function and a helper function getTimertime(startTime) that together create a countdown timer that runs for 60 seconds. I have created a date object which stores the time when the timer method is called (line 86). The “setInterval” method (line 88) will update the timer element in html every 1000 milliseconds. So the method will call itself every second automatically. The “getTimertime” method subtracts the current time with the time recorded initially when the method was called to find the difference in time.

“Math.max” method is used to ensure that the timer never displays a negative value. And the “Math.floor” is used to round down the number to the nearest integer so that the timer is not a decimal.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the timer is working.	Normal	Line 97	Timer counting down and whole positive.	<input checked="" type="checkbox"/> Timer counting down and whole positive.



I have placed a real time clock next to my timer. When the timer is at 54 the real time is 12:38:26.



When the timer is 10, the real time is 12:39:09. So the time difference between the screenshot is  $12:39:09 - 12:38:26 = 43$  and the time difference between the timer is  $54-10=44$ . There is a second difference probably because the timer is rounded down.

```
• 89 const startTimer = setInterval(() => {
  90   this._timerElement.innerText = this.getTimerTime(startTime);
  91   if (this._timerElement.innerText == 0) {
  92     clearInterval(startTimer);
  93   }
  94 }, 1000);
```

The clearInterval method stops the timer when the value of the timer is 0. The timer should also stop when the user types all the entire quote displayed correctly.

```
140 checkMatch() {
141   const quote = this._renderer._displayElement.innerText.trim();
142   const input = this._renderer._inputElement.value.trim();
143
144   if (quote === input) {
145     clearInterval(this._timerInterval);
146     return true;
147   } else {
148     return false;
149   }
150 }
120   if (this.checkMatch()) {
121     console.log('Match!');
122 }
```

I have added another method where it will compare the text content of the quote display element and the input element. And if the quote element and the input element match then the timer is stopped. The if statement (line 120) is in the event listener so that it checks every single time the user types something in the input field.

test\_id 24

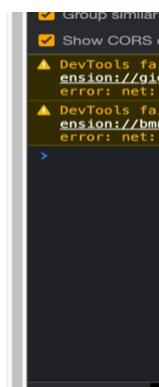
An optimist is a person who sees a green light everywhere, while the pessimist sees only the red spotlight... The truly wise person is color-blind.

Time Left: 0s | Mistakes: 0 | WPM: 0 | CPM: 0 Try Again

I have not typed anything in the input field and the timer stopped when it reached zero.

Fine words and an insinuating appearance are seldom associated with true virtue

Fine words and an insinuating appearance are seldom associated with true virtue



Time Left: 14s | Mistakes: 0 | WPM: 0 | CPM: 0 Try again

Even though I had typed the entire quote correctly, the timer did not stop and nothing appeared in the console.

### Improvements

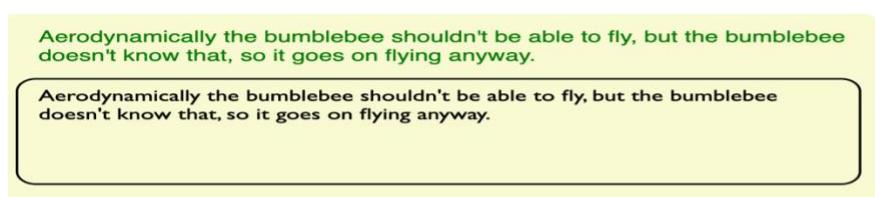
I have decided to remove the if statement in the “checkMatch()” and return a Boolean value if the display element matches with the input element.

```

103 |   checkMatch() {
104 |     const quote = this._renderer._displayElement.innerText.trim();
105 |     const input = this._renderer._inputElement.value.trim();
106 |     return quote === input;
107 |
91 |     if (this._timerElement.innerText == '') || this.checkMatch()) {
92 |       console.log("Match!")
93 |       clearInterval(startTimer);
94 |     }
95 |   }, 1000);

```

I have put the condition in the “timer” method (line 91) because this piece of code is repeatedly executed every second. If the “checkMatch()” returns true then the timer will be stopped and output “Match!”.



I have once again typed the entire quote correctly; the timer has stopped and “Match!” has been outputted to the console.

The timer now starts when the page loads but should start as soon as the user starts typing.

```
114  this._renderer._InputElement.addEventListener('input', () => {
115    // Colour the characters based on whether they are correct or incorrect.
116    this.colourMistakes();
117    if (!this._mainTimer) {
118      this._mainTimer = this.timer();
119    }
120  });

```

The if statement (line 117) is checking if the “\_mainTimer” variable is null or undefined meaning the timer has not been started yet. This is in the event listener so whenever the user types a character, it checks if the timer has been started or not.

test\_id 25

I will test if the timer starts when the user starts typing.

**The eye sees only what the mind is prepared to comprehend.**



The timer did not start automatically.

The eye sees only what the mind is prepared to comprehend.

The eye sees only |

Time Left: 54s | Mistakes: 3 | WPM: 0 | CPM: 0

[Try again](#)

The timer did start when I started typing but the timer started overlapping and going crazy. Maybe because the timer started multiple times.

### Improvements

```

58     this._timer = null;
59     this._isTimerRunning = false;
60   }
61   timer() {
62     const startTime = new Date();
63     this._timerElement.innerText = 60;
64     this._isTimerRunning = true;
65
66     this._timer = setInterval(() => {
67       this._timerElement.innerText = this.getTimerTime(startTime);
68       if (this._timerElement.innerText == 0 || this.checkMatch()) {
69         this.endTimer();
70       }
71     }, 1000);
72   }
73
74   endTimer() {
75     clearInterval(this._timer);
76     this._isTimerRunning = false; // Reset the timer running flag.
77   }
78
79   // Listen for input events on the input element.
80   this._renderer._inputElement.addEventListener('input', () => {
81     // Colour the characters based on whether they are correct or incorrect.
82     this.colourMistakes();
83     // Start the timer if it's not already running.
84     if (!this._isTimerRunning) {
85       this.timer();
86     }
87   });
88 
```

I am using a flag which is initially set to false (line 59). The timer starts and the flag is set to true. If a condition is met where either the timer reaches zero or the quote element matches the input element, then the timer is stopped and the flag is set to false again. (line 125) is checking if the flag is false when the user starts typing.

Either you run the day or the day runs you.

E

Time Left: 46s | Mistakes: 0 | WPM: 0 | CPM: 0

Try again

The timer started when I started typing.

Either you run the day or the day runs you.

Either you run the day or the day runs you.

Time Left: 38s | Mistakes: 0 | WPM: 0 | CPM: 0

Try again

And the timer stopped when I had typed the entire quote correctly.

The timer should reset itself when I generate a new quote. And a new quote is generated by pressing the “Try again” button.

```
148 | game._tryAgainButton.addEventListener('click', () => {
149 |   game.start();
150 | });


```

I have added an event listener to the “tryAgain” button element which will call the “start()” when the button is pressed. I have also made sure the timer is set back to 60 when the button is pressed.

```
116 |   async start() {
117 |     // Fetch a new quote from the Quote instance.
118 |     const mainQuote = await this._quote.getNextQuote();
119 |     // Render the quote using the QuoteRenderer instance.
120 |     this._renderer.render(mainQuote);
121 |     this._mistakesElement.textContent= 0;
122 |     this._timerElement.innerText=60;
123 |     // Listen for input events on the input element.
124 |     this._renderer._inputElement.addEventListener('input', () => {
125 |       // Colour the characters based on whether they are correct or incorrect.
126 |       this.colourMistakes();
127 |       // Start the timer if it's not already running.
128 |       if (!this._isTimerRunning) {
129 |         this.timer();
130 |       }
131 |     });
132 |   }
133 | }


```

I am setting the timerElement to 60 and the mistakesElement to 0 when the button is pressed. This is an async method which allows me to handle asynchronous operations by implicitly returning a Promise. Meaning it allows me to use the await keyword which allows the code to make an HTTP request to fetch from an API when the “\_getRandomQuote()” method is called without blocking the main thread.

test\_id 26

**Change your thoughts and you change your world.**

**Change your thoughts and you change your world.**

Time Left: 49s

Mistakes: 1

WPM: 0

Try again

The timer stopped at 49 seconds and I have made 1 mistake.

**Don't settle for a relationship that won't let you be yourself.**

Time Left: 60s

Mistakes: 0

WPM: 0

Try again

When the button is pressed a new quote is generated, the timer is set back to 60 and the mistakes element is set to zero.

calculateWPM

I have a working timer so now I can calculate words per minute. I will be using ratios as I mentioned in my design. I have to check how many words have been typed correctly at any given time first so that I can update wpm while the user types.

```

91 | compareWords(){
92 |   const arrayQuoteWords = this._renderer._displayElement.innerText.split(" ");
93 |   const arrayInputWords = this._renderer._inputElement.value.split(" ");
94 |   var count=0;
95 |   arrayInputWords.forEach((answer, i) => {
96 |     if (answer === arrayQuoteWords[i]) {
97 |       count++;
98 |     }
99 |   });
100 |   return count;
101 |

```

I have added a new method. This method will check how many words in the input element match with the quote element. I am splitting the quote and the input into an array of words by using the split function and I am looping through the array to check how many items match.

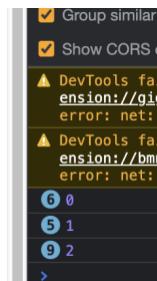
Test		Result		
Description	Type	Code	Expected	Actual

Check if the count is being incremented based on what I type.	Normal/erroneous	Line 95-96.	Count incremented by one if the word matches.	<input checked="" type="checkbox"/> Timer counting down and whole positive.
---	------------------	-------------	---	---

I will log the count variable to see if the count is being incremented.

Wisdom, compassion, and courage are the three universally recognized moral qualities of men.

Wisdom, compassion, lkdfjlj



I have typed two words correctly and two words incorrectly, so the console outputs 2. I can now calculate words per minute. If for example 24 words are typed in the 20s, I need to calculate how many words would be typed in 60s.  $24:20=60=X$ .

```

103 |
104 |     calculateWPM(){|
105 |         // Get the remaining time from the timer element, subtract it from 60 to get the time elapsed|
106 |         const getTimer=60-this._timerElement.innerText;|
107 |         const wordCount=this.compareWords();|
108 |         // Calculate the WPM value by dividing the word count by the time elapsed (in minutes), and|
109 |         // rounding to the nearest integer|
110 |         const wpmValue=Math.round((wordCount/(getTimer/60)));|
111 |         // Set the WPM element's text to the calculated WPM value|
112 |         this._wpmElement.innerText=wpmValue;

```

I am using the “compareWords()” method which returns the count. By using the example above “getTimer”= 20, “wordCount”=24 and “wpmValue” = 60.

Test			Result	
Description	Type	Code	Expected	Actual
Testing wpm calculator.	Normal	Line 109.	The faster the user types the higher the wpm	<input checked="" type="checkbox"/> Timer counting down and whole positive.

Be as you wish to seem.

Be as you wish to seem.|

Time Left: 52s

Mistakes: 0

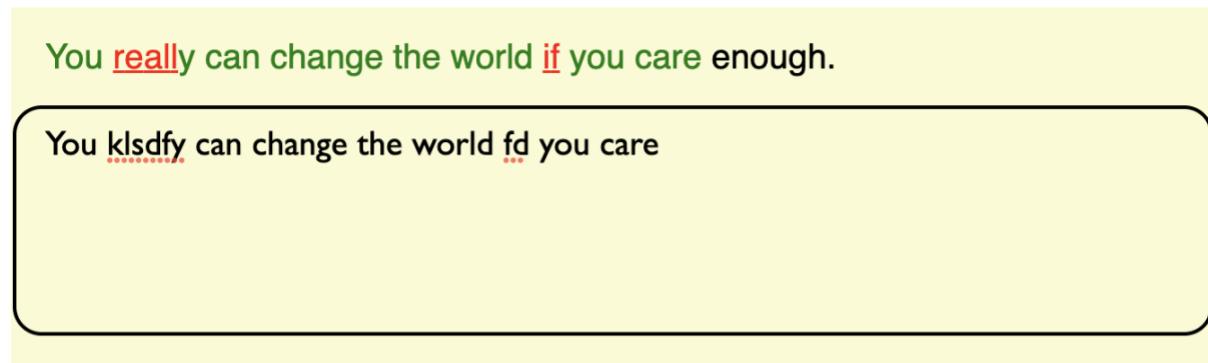
WPM: 45

Try again

I have typed 6 words in 8 seconds.  $8/60=0.133333$ .  $6/0.133333=45.000001$  which rounds down to 45.

test\_id 29

I will test whether the wpm is being updated live and if incorrect words are included or not.



I have typed 7 words in 24s. So  $24/60=0.4$  and  $7/0.4=17.5$  which rounds up to 18. The wpm calculator works even in the middle of the game. I have typed 2 words incorrectly and these words were not included in the calculation because  $9/0.4=22.5$ .

I have mentioned that users would not be able to copy and paste in this game.

```
24 | <textarea class="quote-input" id="quoteInput" type="text" onpaste="return false;"  
25 | ondrop="return false;" autocomplete="off" onKeyDown="{}(e) => e.preventDefault()" autofocus>  
26 | quote</textarea>
```

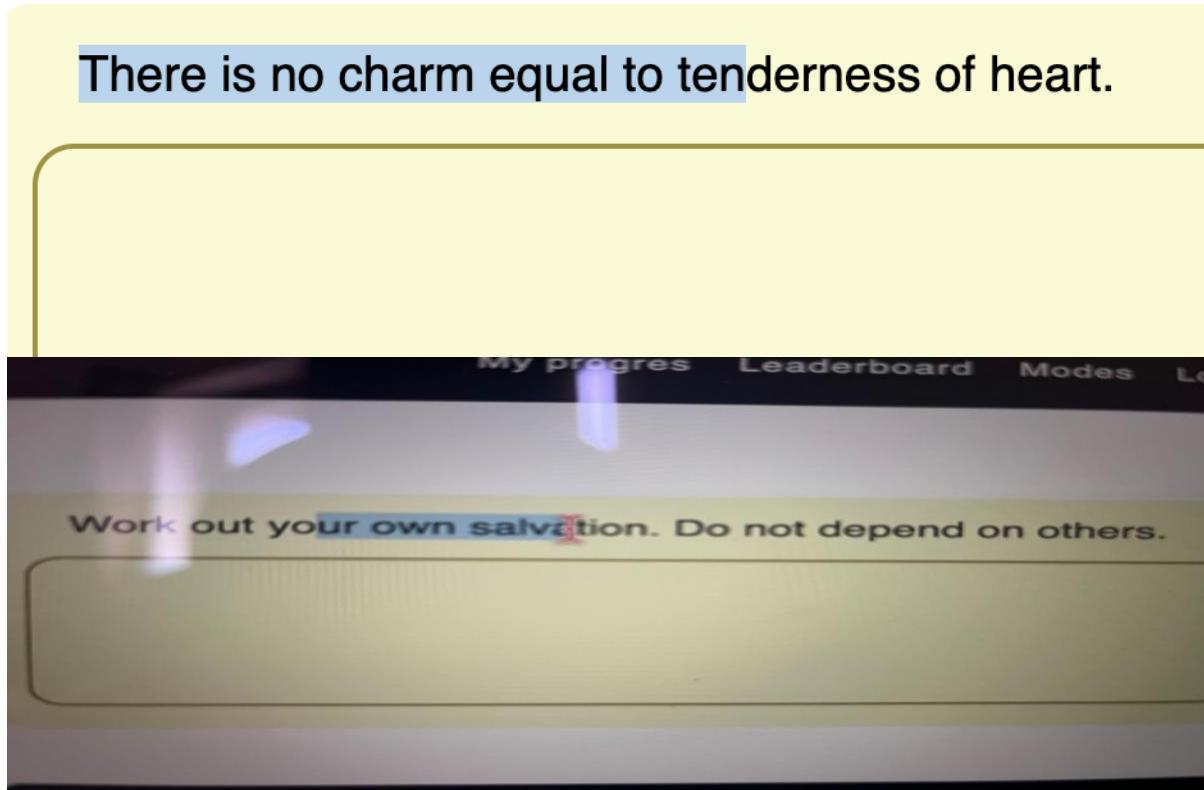
To prevent pasting in the text area I have used 3 attributes. “onpaste="return false;” This attribute prevents the user from pasting text into the text area either using the keyboard shortcut or right-click then paste. “ondrop="return false;” This attribute prevents the user from dragging and dropping text into the textarea. autocomplete="off": This attribute disables the browser's autocomplete feature for the textarea. I have also added this attribute, onKeyDown="{}(e) => e.preventDefault()": This adds an event listener to the textarea for the "keydown" event, and calls a function that prevents the default behaviour of that event. This prevents the user making a new paragraph in the textarea.

```
90 .quote-display{  
91   margin-bottom: 1rem;  
92   font-size: 1.2rem;  
93   margin-left: calc(1rem + 2px);  
94   margin-right: calc(1rem + 2px);  
95   -webkit-user-select: none; /* Disable text selection for Chrome, Safari, and Opera */  
96   -moz-user-select: none; /* Disable text selection for Firefox */  
97   -ms-user-select: none; /* Disable text selection for Internet Explorer and Edge */  
98   user-select: none; /* Disable text selection for all browsers */  
99 }
```

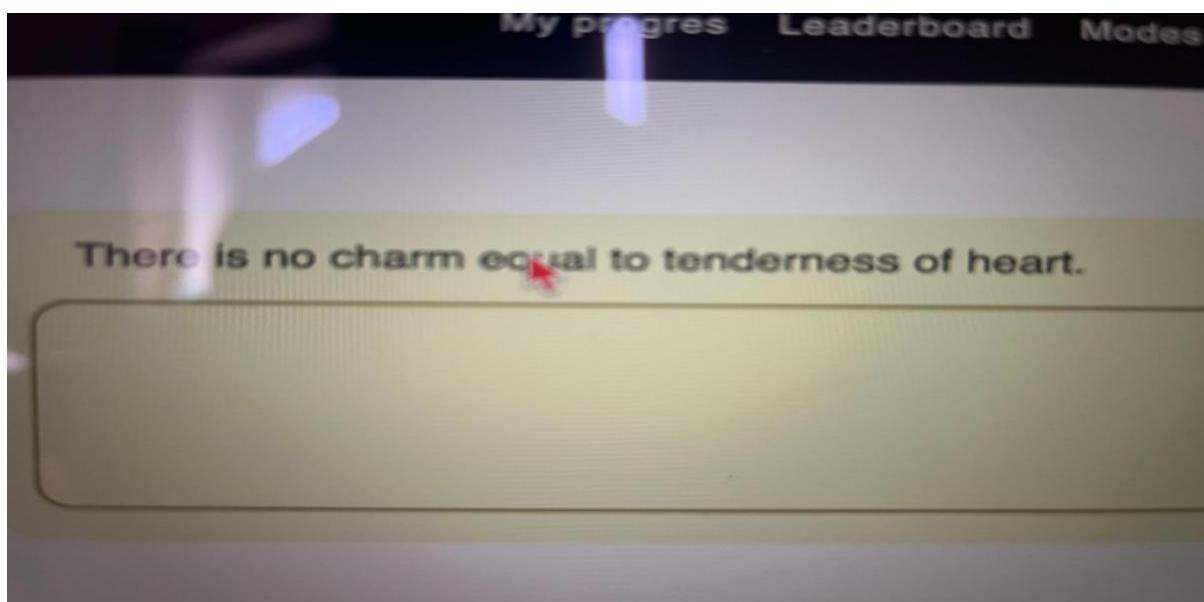
To prevent copying I have used CSS class selectors to set the ‘user-select’ property to ‘none’ for the ‘.quote-display’ element. This prevents users from selecting and copying any text

within that element. I have disabled it for most of the browsers that are commonly used today.

Test\_id 28



This is before adding the CSS properties to the ‘quote-display’. I could select the quote and copy.



This is after adding the CSS properties to the ‘quote-display’ class. The cursor does not change to select mode when I hover over the text.

The truth is not for all men, but only for those who seek it.

The truth is not for all men, but only for those who seek it.

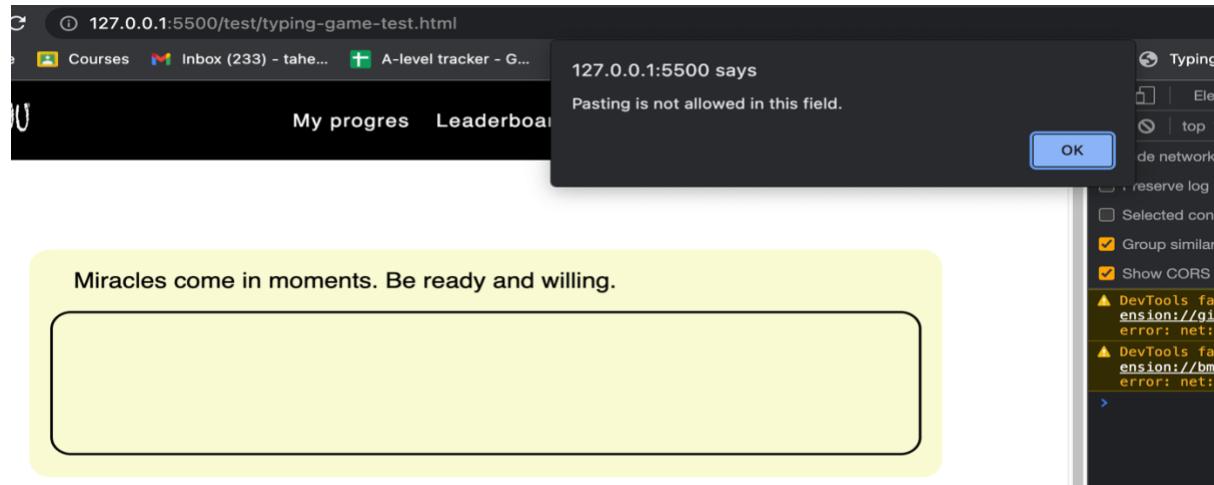
Time Left: 59s | Mistakes: 0 | WPM: 840 | Try again

This is before adding the html attributes to the textarea. I have completed the game within one second and this is only possible by copying and pasting.

```

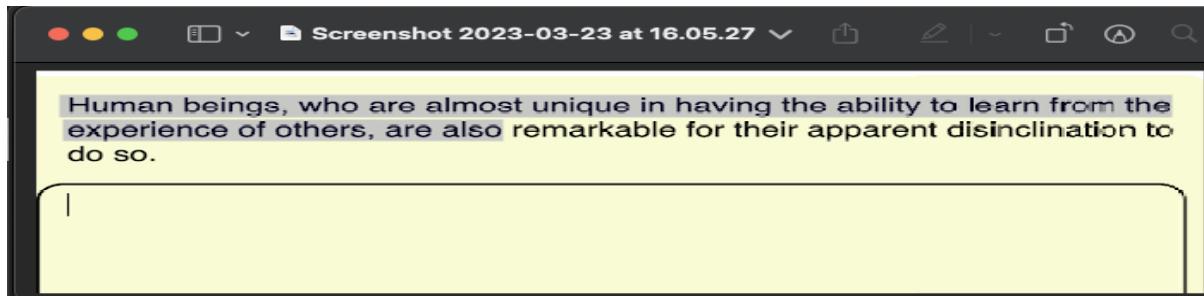
23 <div class="quote-display" id="quoteDisplay" ></div>
24 <textarea class="quote-input" id="quoteInput" type="text" onpaste="handlePaste(event)"
25 ondrop="return false;" autocomplete="off" onKeyDown="{}(e) => e.preventDefault()"
26 autofocus>quote</textarea>
27 <script>
28   function handlePaste(event) {
29     event.preventDefault();
30     alert('Pasting is not allowed in this field.');
31   }
32 </script>
```

I have added a function ‘handlePaste’ which will display an error message using the ‘alert’ method if the user tries to paste in the text area.



I have tried to paste in textarea and the ‘handlePaste’ was called which outputted this message.

The user can still copy and paste by using screenshots and OCR copying.



I took a screenshot of the quote and I am able to copy the quote now. But as far as I am aware the user would not be able to paste the quote in the textarea. So I would pass this test because I do not want to add anything if possible that prevents users from taking a screenshot or using any other type of software.

**Miracles come in moments. Be ready and willing.**

|

The event listener to the textarea for the "keydown" event is not working. It is still allowing me to add a new line by pressing enter. And the reason why it is not working is because the content in that element is not a string.

#### Improvements

```

156 |     this._renderer._inputElement.addEventListener("keypress", function(event) {
157 |       if (event.key === "Enter") {
158 |         event.preventDefault();
159 |         alert("Error: Enter key is disabled.");
160 |       }
161 |     });

```

I added an event listener in the script file which listens for a “keypress” event. In this case the enter key, if the enter key is pressed then ‘event.preventDefault()’ method is called which prevents the default behaviour of the “Enter” key in the input field.

Test\_id 34

**Friendship improves happiness and abates misery, by the doubling of our joy and the dividing of our grief.**

Ikjasdljlkdfsjlsdilkjsdlk;kljlidsfjlkdsflkdflkdklds

Time Left: 50s

Mistakes: 49

WPM: 0

Try again

I have typed random characters in the textarea. The timer is counting down, the mistakes have been counted and wpm is zero as everything has been typed incorrectly.

#### Review

The user can now play the typing game. The character per minute feature was removed because it was an unpopular typing speed measurement. I have mentioned in my analysis that I will make a new table for each user but this will lead to several problems. I have instead written all the info in one table with the user\_id and game\_id. I have not used any static methods which do not require you to create an instance of the class to call the method. This is because static methods can make it more difficult to test and maintain the code and you cannot override the method on a specific instance of the class. It also becomes more difficult to reason about the behaviour of the code as they do not have access to the instance state of an object. There has been a change in how I named the variable, class and method names compared to PHP. This is because JavaScript does not have true private attributes and the only way to indicate it is a private attribute by using an underscore before the variable names. I have used camelCase for attributes and method names and PascalCase for class names to distinguish between the classes.

Regarding the efficiency of the code, I have implemented four event listeners which I initially thought might be resource-intensive. However, these listeners only execute when their corresponding events occur, so they do not significantly impact performance since they do not involve polling data. On the other hand, the setInterval() functions are set to execute every second, which could be more resource-intensive, but it is not significant enough to cause the user to wait.

Success criteria	
Criteria	Met?
Random paragraph generator	Met
Timer	Met
Mistake	Met
WPM	Met
CPM	Dropped
Prevent copy and paste	Met
Create a table	Dropped

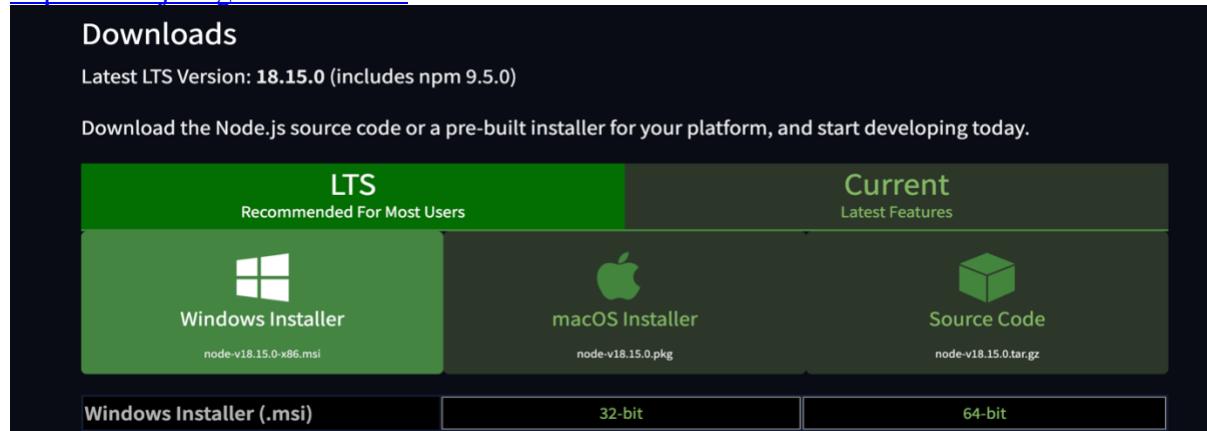
Test	
Test_id	Passed or failed?
27	Passed
24	Failed
25	Failed
26	Passed
29	Passed
28	Failed
34	Passed

### Third iteration (7<sup>th</sup> iteration)

In this iteration, I will insert the wpm, accuracy of the game and date when the game was played to the games table. This table will later be used to display the progress of the user. I will also update the leaderboard table.

#### Node.js

I have mentioned in my analysis that I will be using node.js to set up a web server and run JavaScript on the server so that I can connect to mysql database. I will install the node.js first. <https://nodejs.org/en/download/>



I have installed node.js and now I will run a few commands in the terminal.

```

The default interactive shell is Follow link (cmd + click) /bin/zsh.
To update your account to use z, please visit https://support.apple.com/kb/HT208050.
For more details, please visit https://support.apple.com/kb/HT208050.
Tahers-MacBook-Air:test-test-server taher.ahmed$ npm init
This utility will walk you through creating a package.json file.
It only covers the most common items, and tries to guess sensible defaults.

See `npm help init` for definitive documentation on these fields
and exactly what they do.

Use `npm install <pkg>` afterwards to install a package and
save it as a dependency in the package.json file.
  
```

npm init: Initialises a new Node.js project by creating a package.json file that describes the project and its dependencies. And now I have a package.json file.

● Tahers-MacBook-Air:test-test-server taher.ahmed\$ npm i express nodemon mysql

I am installing 3 packages: express, nodemon and mysql. Express is a web application framework for Node.js. It will provide some extra features and tools for example, it would allow to map HTTP requests to specific functions or handlers. 'nodemon' will automatically

restart the server when changes are made.

```

1  const express = require("express");
~/Documents/test-test-server/app.js
2  const app = express();
3  const port = 3004
4
5
6  app.get("/", (req, res) => {
7
8  });
9  //create server
10 app.listen(port, (err) => {
11   if (err)
12     throw err
13   else
14     console.log("Server is running at port %d:", port);
15 });

```

Now we can get the server running by typing ‘npm start’ in the terminal. I have an app.js file, this file will contain the logic for starting the application and defining routes.

```

Node.js v18.12.1
💡 Tahers-MacBook-Air:test-test-server taher.ahmed$ node app
server running on port number 3005:

```

The server is now running so I can now establish the database connection.

```

JS database-inc.js > [1] con
1  const mysql = require("mysql");
2
3  const con = mysql.createConnection([
4    host: "localhost",
5    user: "root",
6    password: "",
7    database: "typing_game_database",
8    port: 3306
9  ]);
10
11 con.connect((err) => {
12   if (err) {
13     console.error("Error connecting to database:", err);
14     return;
15   }
16
17   console.log("Database connection successful.");
18 });
19
20 module.exports.con = con;

```

I am using the ‘mysql’ module so that I can use the MySQL functionality in Node.js. I am connecting with the same username and password that I have used in PHP.

```

💡 Tahers-MacBook-Air:test-test-server taher.ahmed$ node database-inc
Database connection successful.

```

I am connected to the server now.

```

6  //configuration
7  app.set("view engine", "hbs");
8  app.set("views", "./view")
9  app.use(express.static(__dirname + "/public"))
10 app.use(express.json());
11 //routing
12 app.get("/", (req, res) => {
13   res.render("typing-game")
14 });
15 app.get('/typing-game.js', (req, res) => {
16   res.set('Content-Type', 'text/javascript');
17   res.sendFile(__dirname + '/typing-game.js');
18 });

```

As I am using express, I need to set up the configuration and routes for each file. I am using 'hbs' as my templating engine because it allows me to create reusable HTML templates. I don't think I will be using any features of hbs so I would just write in html but the file type will be hbs. In the public directory I will have all the images and the css files. For example line 12 sets up a route for the homepage ("/") that renders the "typing-game" view using the handlebars templating engine. And line 15 sets up a route for the "typing-game.js" file and serves it as a JavaScript file.

writeStats

```

175 class Database {
176   constructor() {
177     this._user_id = 1;
178     const today = new Date();
179     this._formattedDate = today.toISOString().slice(0, 10);
180   }
181
182   writeStats(displayElement, mistakesElement, timerElement,
183   wpmElement) {
184     this._accuracy = Math.round(100 - (mistakesElement.textContent/
185     displayElement.innerText.length)*100);
186     this._timeTaken = 60 - timerElement.innerText;
187     const url = '/writeStats';
188     const options = {
189       method: 'POST',
190       headers: { 'Content-Type': 'application/json' },
191       body: JSON.stringify({
192         user_id: this._user_id,
193         date: this._formattedDate,
194         wpm: wpmElement.innerText,
195         accuracy: this._accuracy,
196         timer_taken: this._timeTaken
197       })
198     };
199     fetch(url, options)
200       .then(response => {
201         if (!response.ok) {
202           throw new Error('Error adding game data to database!');
203         }
204         return response.text();
205       })
206       .then(data => {
207         console.log(data);
208       })
209       .catch(error => {
210         console.log(error);
211       });
212   }

```

I have created a new class 'Database' which has a 'writeStats' method. (Line 178-179) creating a date object which returns the current date and time. I am then formatting the date

so that it can be written in the database. I have created a POST request to send the game statistics to the server via the '/writeStats' route.

```

54 | const { con } = require("./database-inc")
55 | app.post('/writeStats', (req, res) => {
56 |   const { user_id, date, wpm, accuracy, timer_taken } = req.body;
57 |
58 |   const query = 'INSERT INTO games (user_id, date, wpm, accuracy,
59 |   time_taken) VALUES (?, ?, ?, ?, ?)';
60 |   const values = [user_id, date, wpm, accuracy, timer_taken];
61 |
62 |   con.query(query, values, (error, results, fields) => {
63 |     if (error) {
64 |       console.log(error);
65 |       res.status(500).send('Error adding game data to database!');
66 |     } else {
67 |       res.send('Game data added successfully');
68 |     }
69 |   });
70 | });

```

I must import the con object from the database-inc file before performing any database queries. As I have mentioned before all the route handler function will be written in a separate file app.js. This is the route handler function from the POST request that I have created in the main file. It then extracts the values from the request body. It then inserts the game statistics in the games table.

Test\_id 33

I will play a normal game and see if the values are inserted in the games table.

If you must tell me your opinions, tell me what you believe in. I have plenty of doubts of my own.

If you must tell me your opinions, tell me what you believe in. I have plenty of doubts of my own.

Game Statistics					
Time Left:	36s	Mistakes:	4	WPM:	53
Try again					

game_id	user_id	date	wpm	accuracy	time_taken
1		2023-04-01	53	96	24

The wpm and time\_taken match. Accuracy =  $(1-4/98)*100=95.91$  which rounds 96%.

UpdateLeaderboard

As I have mentioned in my design, the leaderboard table will have 10 dummy accounts at the start and will be updated later as new accounts are created. Each user will have a unique user\_id. After each game, the program will check if the user\_id is already in the leaderboard, it will then check if the user beat his own wpm in the leaderboard, it will update the leaderboard accordingly. If the user\_id is not yet in the leaderboard, it will check if this new user achieved a higher wpm than the user with the lowest wpm in the leaderboard. And it will update the leaderboard accordingly.

```

66 // Check if the user's score is higher than any score in the leaderboard
67 const leaderboardQuery = 'SELECT user_id, wpm FROM leaderboard ORDER BY wpm DESC LIMIT 10';
68 con.query(leaderboardQuery, (leaderboardError, leaderboardResults, leaderboardFields) => {
69   if (leaderboardError) {
70     console.log(leaderboardError);
71     res.status(500).send('Error getting leaderboard data from database!');
72   } else {
73     let userInLeaderboard = false;
74     let lowestWpm = Number.MAX_SAFE_INTEGER;
75     let lowestWpmUserId = null;
76
77     for (const row of leaderboardResults) {
78       if (row.user_id === user_id) {
79         userInLeaderboard = true;
80         if (wpm > row.wpm) {
81           const updateQuery = 'UPDATE leaderboard SET wpm = ? WHERE user_id = ?';
82           const updateValues = [wpm, user_id];
83           con.query(updateQuery, updateValues, (updateError, updateResults, updateFields) => {
84             if (updateError) {
85               console.log(updateError);
86               res.status(500).send('Error updating leaderboard data in database!');
87             } else {
88               res.send('Game data added successfully and leaderboard updated!');
89             }
90           });
91         } else {
92           res.send('Game data added successfully but score not higher than existing score in leaderboard!');
93         }
94         break;
95       }
96       if (row.wpm < lowestWpm) {
97         lowestWpm = row.wpm;
98         lowestWpmUserId = row.user_id;
99       }
100     }
101
102     if (!userInLeaderboard && wpm > lowestWpm) {
103       const updateQuery = 'UPDATE leaderboard SET user_id = ?, wpm = ? WHERE user_id = ?';
104       const updateValues = [user_id, wpm, lowestWpmUserId];
105       con.query(updateQuery, updateValues, (updateError, updateResults, updateFields) => {
106         if (updateError) {
107           console.log(updateError);
108           res.status(500).send('Error updating leaderboard data in database!');
109         } else {
110           res.send('Game data added successfully and leaderboard updated!');
111         }
112       });
113     } else if (!userInLeaderboard) {
114       res.send('Game data added successfully but score not higher than lowest score in leaderboard!');
}

```

Instead of creating a different route I have included the logic for the leaderboard in the '/writeStats' route, so I do not have to create a different post request in the main file. I have thought of retrieving the entire leaderboard table every time and overwriting the sorted leaderboard data but this would cause unnecessary database writes and impact performance. So instead I am just changing the value of 2 records.

Test\_id 32

user_id	WPM
72	620
42	89
40	65
6	60
5	90
43	216
50	69
49	208
3	266
1	20

This is what the leaderboard table looks like with 10 random users.

```
constructor() {
    this._user_id = 1;
```

I have set the user\_id to 1 and that user is already in the leaderboard table.

Obstacles are those frightful things you see when you take your eyes off your goal.

Obstacles are those frightful things you see when you take your eyes off your goal.

Time Left: 44s	Mistakes: 1	WPM: 56	Try again
----------------	-------------	---------	-----------

The user is already in the leaderboard table and achieves a higher wpm. The wpm in the leaderboard was 20 and I have achieved a wpm of 56 so the leaderboard table should be updated with new wpm.

user_id	WPM
72	620
42	89
40	65
6	60
5	90
43	216
50	69
49	208
3	266
1	56

The wpm in the leaderboard for that user matches with wpm of the game.

A wise man can learn more from a foolish question than a fool can learn from a wise answer.

A wise man can learn more from a foolish question than a fool can learn from a wise answer.

Time Left: 32s	Mistakes: 9	WPM: 41	Try again
----------------	-------------	---------	-----------

I have played another game but did not achieve a higher wpm. So the leaderboard table should be updated.

user_id	WPM
72	620
42	89
40	65
6	60
5	90
43	216
50	69
49	208
3	266
1	56

```
constructor() {
    this._user_id = 2
```

I have set the user\_id to 2, this user is not in the leaderboard table.

Happiness cannot be travelled to, owned, earned, worn or consumed.  
 Happiness is the spiritual experience of living every minute with love, grace and gratitude.

Happiness cannot be travelled to, owned, earned, worn or consumed. Happiness is the spiritual experience of living every minute with love, grace and gratitude.

Time Left: 38s

Mistakes: 1

WPM: 65

Try again

User\_id 2 achieved a higher wpm than the lowest ranked user in the leaderboard. The lowest ranked user in the leaderboard is user\_id=1 with a wpm of 56.

user_id	WPM
72	620
42	89
40	65
6	60
5	90
43	216
50	69
49	208
3	266
2	65

So user\_id 1 was replaced with user\_id 2.

```
^  constructor() {
    this._user_id = 4
```

I have set the user\_id to 4, this user is not in the leaderboard.

**People may doubt what you say, but they will believe what you do.**

**People may doubt what you say, but they will believe what you do.**

Time Left: 31s

Mistakes: 0

WPM: 27

Try again

I have played a game and did not achieve a higher wpm than the lowest wpm in the leaderboard. So I am expecting the leaderboard table to stay the same.

user_id	WPM
72	620
42	89
40	65
6	60
5	90
43	216
50	69
49	208
3	266
2	65

User\_id was not added to the leaderboard table.

### Review

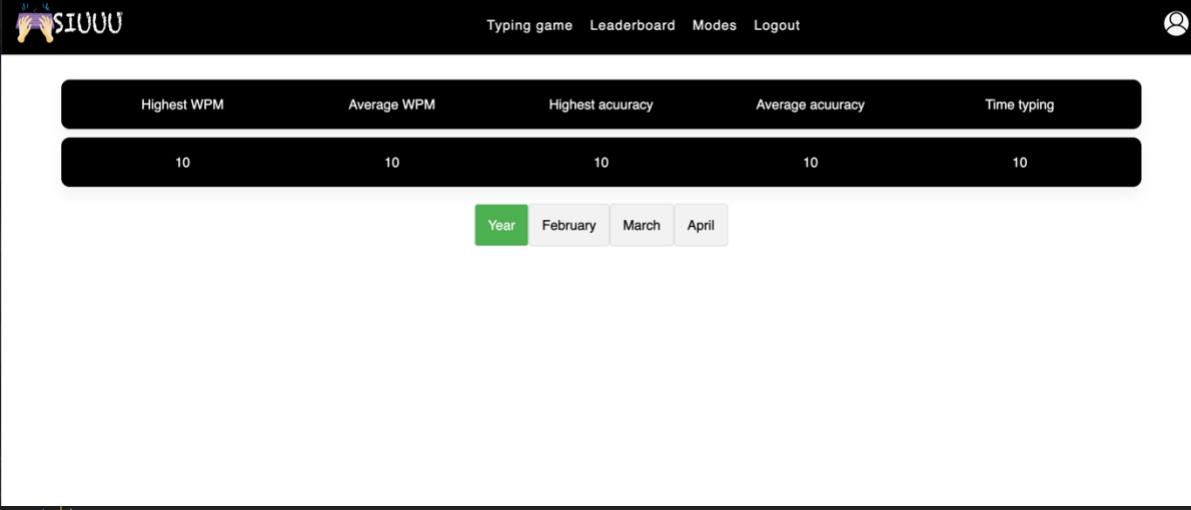
The game statistics will be recorded in the database after every game now, and the leaderboard table will be updated accordingly. I have tested all possible combinations of how the leaderboard table could be updated.

Success criteria	
Criteria	Met?
Write in the database	Met
Test	
Test_id	Passed or failed?
33	Passed
32	Failed

## Progress tracker

### 1st iteration (8th iteration)

In this iteration I will fetch all statistics of all the games that have been played so far by the user. And render the information into meaningful tables. I need to first create the HTML structure where the table and statistics will be shown.



The screenshot shows a web application interface. At the top, there is a navigation bar with links: 'Typing game', 'Leaderboard', 'Modes', and 'Logout'. On the right side of the top bar is a user profile icon. Below the navigation bar, there is a row of five performance metrics, each with a value of '10': 'Highest WPM', 'Average WPM', 'Highest accuracy', 'Average accuracy', and 'Time typing'. Underneath these metrics is a horizontal navigation bar with four buttons: 'Year' (highlighted in green), 'February', 'March', and 'April'. The main content area below the navigation bar is currently empty, suggesting a placeholder or a loading state.

```

134 | const currentDate = new Date(); // Get the current date
135 | const currentMonth = currentDate.getMonth(); // Get the current month (0-indexed)
136 | // Define an array of month names
137 | const monthNames = ['January', 'February', 'March', 'April', 'May', 'June', 'July', 'August', 'September', 'October',
138 |   'November', 'December'];
139 |
140 | // Compute the index of the last month (0-indexed)
141 | let lastMonth = currentMonth - 1;
142 | if (lastMonth < 0) {
143 |   lastMonth = 11; // If the current month is January, set the last month to December
144 | }
145 | // Compute the index of the month before the last month (0-indexed)
146 | let lastLastMonth = lastMonth - 1;
147 | if (lastLastMonth < 0) {
148 |   lastLastMonth = 11; // If the last month is January, set the month before it to December
149 | }
150 | // Set the text content of the HTML elements with the corresponding month names
151 | document.getElementById("currentMonth").innerHTML = monthNames[currentMonth];
152 | document.getElementById("lastMonth").innerHTML = monthNames[lastMonth];
153 | document.getElementById("lastLastMonth").innerHTML = monthNames[lastLastMonth];

```

The user will be able to see the summarised performance on the top and will be able to toggle between the graphs where it says the name of the months. By using the date object I am able to display to the user current month, previous month and the month before and using an array to show the corresponding month instead of numbers.

### Feedback

#### **What do you think about the design for the progress tracker page?**

[Saad] – It looks very clean and understandable. The information is well structured and displayed. What would the graph look like?

[me] – I am not able to display the graph yet, you can have another look when I finish the development for generating the graphs.

## readStats

```

1 class Stats {
2   static readStats() {
3     const url = '/fetch-progress-tracker';
4     const options = {
5       method: 'POST',
6       headers: { 'Content-Type': 'application/json' },
7       body: JSON.stringify({
8         user_id: 1
9       })
10    };
11
12    return fetch(url, options)
13      .then(response => {
14        if (!response.ok) {
15          throw new Error('Error fetching your data!');
16          ~~/Documents/test-server/p
17        }
18        return response.json(); // parse response as JSON
19      })
20      .catch(error => {
21        console.log(error);
22      });
23  }
24}

```

## App.js file:

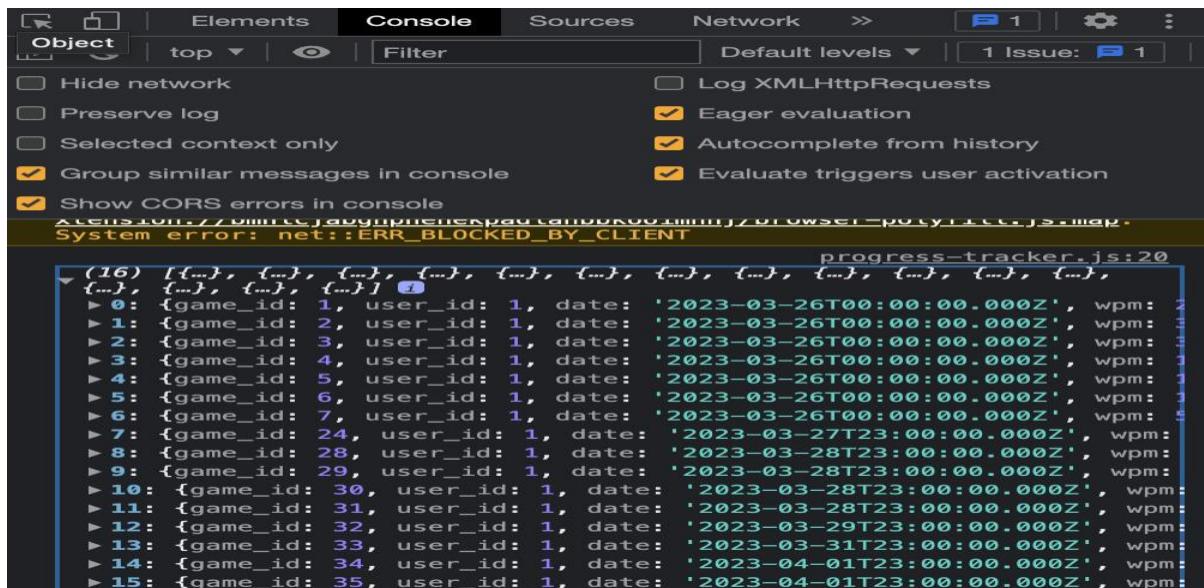
```

115 app.post('/fetch-progress-tracker', (req, res) =>{
116   const { user_id } = req.body;
117   const fetchProgress ='SELECT * FROM games WHERE user_id= ?';
118   con.query(fetchProgress, user_id, (err, result) => {
119     if (err) {
120       console.error(err);
121       res.status(500).send('Error fetching data from the database');
122       return;
123     }
124
125     // return the data as JSON
126     res.json(result);
127   });
128 });

```

I am fetching all the game statistics of user\_id. This is an Express.js route handler that listens for a POST request on the /fetch-progress-tracker path and retrieves progress tracker data for a given user from a MySQL database.

Test			Result	
Description	Type	Code	Expected	Actual
Test if the game statistics have been fetched.	Normal	Line 117	Returns a JSON object.	<input checked="" type="checkbox"/> Returns a JSON object.



To test if the data were fetched, I printed the object.

calculateHighestWpm

```

35 calculateHighestWpm(data) {
36   const highestWpm = data.reduce((acc, curr) => [
37     return curr.wpm > acc ? curr.wpm : acc;
38   ], 0);
39   this._highestWpmElement.textContent = highestWpm;
40 }

```

It loops through the array of objects that has been fetched from the database. The reduce method takes two parameters - a callback function and an initial value for the accumulator. The callback function then compares the wpm property of the current object to the current accumulator value and returns the greater of the two. This ensures that the accumulator holds the highest WPM value at any given point in the iteration. It then returns the final accumulator value when the end of the object has been reached.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the highest WPM is displayed out of all the other games,	Normal	Line 36-39	465	✓ 465

```

wpm: 225, a
wpm: 32, ac
wpm: 38, ac
wpm: 140, a
wpm: 180, a
wpm: 165, a
wpm: 57, ac
, wpm: 28, a
, wpm: 465,
, wpm: 54, a
, wpm: 34,
, wpm: 44,
, wpm: 33,
, wpm: 53,
, wpm: 56,
, wpm: 41,

```

465 is the highest wpm value.



### calculateAverageWpm

```

45  calculateAverageWpm(data) {
46    const sumWpm = data.reduce((acc, curr) => {
47      return acc + curr.wpm;
48    }, 0);
49    const averageWpm = Math.round(sumWpm / data.length);
50    this._averageWpmElement.textContent = averageWpm;
51  }

```

Looping through the object again and using the reduce function to sum up all the WPM values. Then the program will divide the sum by the number of objects in the array. I am rounding the average WPM values so that it is not a decimal.

### Test\_id 37

This user played 16 games. So their average WPM is  $225 + 32 + 38 + 140 + 180 + 165 + 57 + 28 + 465 + 54 + 34 + 44 + 33 + 53 + 56 + 41 = 1645$ .  $1645/16 = 102.8125$  which rounds to 103.



The average WPM in my program matches with the WPM calculated above.

### calculateHighestAccuracy

```

45  calculateHighestAccuracy(data) {
46    const highestAccuracy = data.reduce((acc, curr) => {
47      return curr.accuracy > acc ? curr.accuracy : acc;
48    }, 0);
49    this._highestAccuracyElement.textContent = highestAccuracy;
50  }

```

Using the reduce method to iterate through the object which then returns the highest accuracy among the values.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the highest accuracy is displayed out of all the other games,	Normal	Line 36-39	100	<input checked="" type="checkbox"/> 100

Highest WPM	Average WPM	Highest accuracy	Ave
465	103	100	

There have been 4 games where I had an accuracy of 100 so the highest accuracy is 100.

CalculateAverageAccuracy

```

59 calculateAverageAccuracy(data) {
60   const sumAccuracy = data.reduce((acc, curr) => {
61     return acc + curr.accuracy;
62   }, 0);
63   const averageAccuracy = Math.round(sumAccuracy / data.length);
64   this._averageAccuracyElement.textContent = averageAccuracy;
65 }
```

I am calculating the average accuracy the same way I have calculated average WPM.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the average accuracy is including all the games that have been played.	Normal	Line 60-63	94	<input checked="" type="checkbox"/> 94

```

accuracy: 100, ...}
accuracy: 95, ...}
accuracy: 92, ...}
accuracy: 96, ...}
accuracy: 100, ...}
accuracy: 100, ...}
accuracy: 96, ...}
accuracy: 96, ...}
, accuracy: 100, ...}
accuracy: 96, ...}
, accuracy: 87, ...}
, accuracy: 70, ...}
, accuracy: 88, ...}
, accuracy: 96, ...}
, accuracy: 99, ...}
, accuracy: 90, ...}
```

So the average accuracy will be:  $100 + 95 + 92 + 96 + 100 + 100 + 96 + 96 + 100 + 87 + 70 + 88 + 96 + 99 + 90 = 1501$ .  $1501/16 = 93.8125$ . which rounds to 94.

Highest WPM	Average WPM	Highest accuracy	Average accuracy
465	103	100	94

The average accuracy matches with the average accuracy calculated above.

## CalculateTimeTyping

```

67   calculateTimeTyping(data) {
68     const sumTimer = data.reduce((acc, curr) => {
69       return acc + curr.time_taken;// sum of time_taken values
70     }, 0);
71     this._timeTypingElement.textContent = formatTime(sumTimer);// setting the fomatted value to
72     this element
73   }
74
75   function formatTime(seconds) {
76     let hours = Math.floor(seconds / 3600);// calculating how many hours in this many seconds
77     let minutes = Math.floor((seconds - (hours * 3600)) / 60);//calculating how many whole minutes
78     let remainingSeconds = seconds - (hours * 3600) - (minutes * 60);// remaining seconds.
79
80     // Add leading zeroes if necessary
81     if (minutes < 10) {
82       minutes = "0" + minutes;
83     }
84
85     if (remainingSeconds < 10) {
86       remainingSeconds = "0" + remainingSeconds;
87     }
88
89     // Concatenate the values into a string
90     return hours + ":" + minutes + ":" + remainingSeconds;
91   }

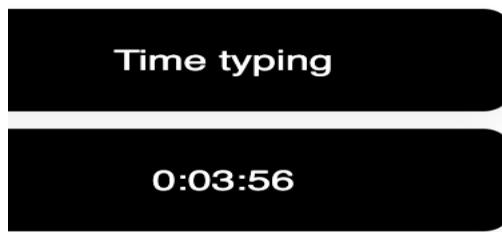
```

The time\_taken values in the database are seconds. The reduce method is iterating through the object and adding all the time\_taken values of all the games. The 'sumTimer' is in seconds so I need to convert it into hours: minutes: seconds before displaying it to the user. So I have added another function 'formatTime' which will convert seconds to hr:min: s.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the time typing is being displayed in the correct format.	Normal	Line 67-90	0:03:56	<input checked="" type="checkbox"/> 0:03:56

time_taken
5
27
13
13
6
4
20
24
4
10
16
15
11
24
16
28

These are all the time\_taken values in the database for user\_id 1. The total time taken would be:  $5 + 27 + 13 + 13 + 6 + 4 + 20 + 24 + 4 + 10 + 16 + 15 + 11 + 24 + 16 + 28 = 236\text{s}$  There are 3 minutes and 56 seconds in 236s.



calculateWpm

I have inserted the game statistics manually for testing purposes because I will be generating graphs for previous months and I have not developed the code yet.

Run SQL query/queries on table **typing\_game\_database.games**:

```

1 | INSERT INTO games (user_id, date, wpm, accuracy, time_taken)
2 | VALUES
3 | (1, '2023-04-01', 68, 93, 32),
4 | (1, '2023-04-02', 82, 86, 10),
5 | (1, '2023-04-03', 47, 90, 23),
6 | (1, '2023-04-04', 73, 95, 44),
7 | (1, '2023-04-05', 88, 88, 19),
8 | (1, '2023-04-06', 59, 91, 50),
9 | (1, '2023-04-07', 94, 99, 5),
10 | (1, '2023-04-08', 55, 85, 17),
11 | (1, '2023-04-09', 78, 92, 37),
12 | (1, '2023-04-10', 67, 87, 29),
13 | (1, '2023-04-11', 91, 97, 7),
14 | (1, '2023-04-12', 43, 80, 26),
15 | (1, '2023-04-13', 76, 88, 12),
16 | (1, '2023-04-14', 82, 90, 21),

```

Bind parameters

Bookmark this SQL query:

Delimiter   Show this query here again  Retain query box  Rollback when finished  Enable foreign key checks

I am inserting random game statistics into the games table.

Before calculating the average wpm of each day for the last 3 months, I need to make an array of all the days in those months which will be used as the x-axis of the graphs.

```

785
786 // Create a new Date object representing the current date and time
787 const now = new Date();
788 // Extract the current year from the Date object
789 const year = now.getFullYear();
790 // Extract the current month (0-based index) from the Date object
791 const month = now.getMonth();
792 // Get the number of days in the current month
793 // Create a new Date object representing the first day of the next month (month + 1),
794 // then subtract one day (using a day value of 0) to get the last day of the current month
795 const daysInMonth = new Date(year, month + 1, 0).getDate();
796 // Initialize an empty array to hold the date strings
797 const daysArray = [];
798 // Iterate over the days of the current month, from 1 to daysInMonth
799 for (let i = 1; i <= daysInMonth; i++) {
800
801     // Create a new Date object representing the current day of the month
802     const date = new Date(year, month, i);
803     // Format the Date object as an ISO 8601 string in the format "YYYY-MM-DD",
804     // and extract only the first 10 characters (the year, month, and day)
805     const formattedDate = date.toISOString().slice(0, 10);
806     // Add the formatted date string to the daysArray array
807     daysArray.push(formattedDate);
808 }
809 // Output the resulting array of date strings to the console
810 console.log(daysArray);

```

This is my first attempt at making an array of all the days in the current month. I have created a new ‘Date’ object to get the current year and month. I am using a controlled loop which will iterate depending on how many days there are in the current month. I need to format the date so that it matches with the date in the database.

Test			Result	
Description	Type	Code	Expected	Actual
Check if all the days in the month are displayed correctly.	Normal	Line 802	From 2023-04-01 to 2023-04-30	✗ From 2023-03-31 to 2023-04-29

► (30) ["2023-03-31", "2023-04-01", "2023-04-02", ...]

It started from the last day of the previous month to the penultimate day of the current month.

Improvement

```
const date = new Date(year, month, i+1);
```

I am starting from the second day of the month.

▼ (30) ["2023-04-01",  
        0: "2023-04-01",  
        1: "2023-04-02"]

It works for this month but does not work for any other months.

```
791 const month = now.getMonth() - 1;
```

Taking away one to get all the days of the previous month.

```
▼ (31) ["2023-03-02"
  0: "2023-03-02"
  1: "2023-03-03"]
```

But it starts on the second day.

```
73 calculateCurrentMonthWpm(data){}
74   const now = new Date();
75   const year = now.getFullYear();
76   const month = now.getMonth();
77   const daysInCurrentMonth = new Date(year, month + 1, 0).getDate();//
78   const currentMonthDays = [];// 
79   for (let i = 1; i <= daysInCurrentMonth; i++) {
80     const date = new Date(year, month, i);
81     const formattedDate = `${date.getFullYear()}-${(date.getMonth()+1).toString().padStart(2, '0')}-${date.getDate().toString().padStart(2, '0')} `;
82
83     currentMonthDays.push(formattedDate);
84 }
```

The problem was when I was formatting the date using the ‘toISOString()’ method which gets the first 10 characters from the ‘Date’ object. So now I am formatting the data manually and converting it to a string and to 2 digits long using ‘padStart()’.

```
▼ (30) ["2023-04-01"
  0: "2023-04-01"  28: "2023-04-29"
  1: "2023-04-02"  29: "2023-04-30"]
```

I have changed the method name to ‘calculateCurrentMonthWpm’ and I will have different methods for different months so that the relevant method is only called when the user clicks on the relevant graph instead of running the processes for all other months.

```
86 // Create an array of average WPM for each day of the current month
87 const currentMonthWpm = currentMonthDays.map(day => {
88
89   // Filter the games played on the current day
90   const gamesOnDay = data.filter(game => game.date.startsWith(day));
91
92   // Calculate the total WPM for all the games played on the current day
93   const totalWpmOnDay = gamesOnDay.reduce((totalWpm, game) => totalWpm + game.wpm, 0);
94
95   // Calculate the average WPM for all the games played on the current day
96   const averageWpmOnDay = gamesOnDay.length > 0 ? totalWpmOnDay / gamesOnDay.length : 0;
97
98   // Round the average WPM to the nearest whole number and return it
99   return Math.round(averageWpmOnDay);
100});
```

Now I creating an array for the y-axis which will be the average WPM of all the days in the month. I am using the map function to iterate through the ‘currentMonthDays’ so if there are 30 days, it will iterate 30 times. I am using the filter function to keep the games from the fetched object that were played on that specific day. So if two games were played on the start of the month the length of the object will now be two. I am using the ‘reduce’ to iterate through the filtered object, add the wpm values then dividing by the length of the object to calculate the average WPM. If no games were played then the average wpm is zero. The rounded values are then pushed into an array. Each line of code is doing more than one process which is referred to as pipelining. But in this case, it is suitable because it makes the code more concise and easier to read.

Test			Result	
Description	Type	Code	Expected	Actual
Check if the average values match with the database values	Normal	Line 87-99	If no games played then zero, if one game was played then the same value, and if more than one game was played then the average is calculated.	✗ Everything has been shifted by one index to the left in the array.

```
(30) [60, 47, 73, 312, 59, 94, 55, 78, 67, 91, 43, 7
▶ 6, 82, 59, 96, 70, 85, 51, 0, 0, 0, 0, 0, 0, 0, 0,
  0, 4, 4, 0]
```

According to the database I have played a game on the 2023-04-29 and 2023-04-30 with a WPM of so I am expecting two 4s at the end of the array.

Big problem

I have realised the values in the database do not match with values read from the database.

78	1	2023-04-05	51	96	7
----	---	------------	----	----	---

```
▶ 55: {game_id: 78, user_id: 1, date: '2023-04-28T23:00:00.000Z', wpm: 4, accuracy: 100, .
▶ 56: {game_id: 78, user_id: 1, date: '2023-04-04T23:00:00.000Z', wpm: 51, accuracy: 96, .
```

For example, game\_id 78 has a date of 2023-04-05 in the database and when I have fetched the values the game\_id 78 has a date of 2023-04-04 which does not match. This is why the array was shifted.

Improvement

I am assuming this is because of time zones. The database is probably set to a different time zone. So I have tried to set the time zone of the database manually.

```
~ con.query('SET time_zone = "+00:00";', (err, result) => {
~   if (err) {
~     console.error(err);
~     return;
```

This did not work.

So I have decided to change the data type of the date field in the database to integer so I do not have to think about time zones.



game_id	user_id	date	wpm	accuracy	time_taken
1	1	20230326	225	100	5
2	1	20230326	32	95	27
3	1	20230326	28	98	12

The format of the date field changed and is stored as integer.

But I have formatted the date as it was before after fetching the data because my array of days is in a different format.

```
133 // modify each object's date property
134 const modifiedResult = result.map((game) => {
135     const dateStr = game.date.toString();
136     const year = dateStr.slice(0, 4);
137     const month = dateStr.slice(4, 6);
138     const day = dateStr.slice(6, 8);
139     const formattedDate = `${year}-${month}-${day}`;
140     return { ...game, date: formattedDate };
141 });
```

I have formatted the date before passing the object back to the main file. It iterates through the object and splits the date values into 3 sections as the 4 digits are year, the next two digits are month and the last two digits are day and add – in between so that it is in the same format as before. The spread syntax ‘...’ is used to copy all the properties of the original object to the new object.

▶ 56: {game\_id: 78, user\_id: 1, date: '2023-04-05', wpm: 51, accuracy: 96, ...}

Now the date read matches with date in the database, and it is formatted correctly as well.

Test\_id 35

This test was initially a failure as it was in the wrong position.					
game_id	user_id	date	wpm	accuracy	time_taken
33	1	20230401	53	96	24
57	1	20230401	68	93	25

More than one game was played on 2023-04-01 so the average of those two games should be calculated. So average wpm = $(53+68)/2 =60.5$  which rounds to 61. So I am expecting the value 61.

The value 61 is in index zero as it was played on the first day of the month

```

108 | calculateLastMonthWpm(data) {
109 |   const now = new Date();
110 |   const year = now.getFullYear();
111 |   const month = now.getMonth() - 1;
112 |   const daysInLastMonth = new Date(year, month + 1, 0).getDate();
113 |   const lastMonthDays = [];
114 |   for (let i = 1; i <= daysInLastMonth; i++) {
115 |     const date = new Date(year, month, i);
116 |     const formattedDate = `${date.getFullYear()}-${(date.getMonth() + 1).toString().padStart(2, '0')}-${date.getDate().toString().padStart(2, '0')}`;
117 |     lastMonthDays.push(formattedDate);
118 |   }
119 |
120 |   const lastMonthWpm = lastMonthDays.map(day => {
121 |     const gamesOnDay = data.filter(game => game.date.startsWith(day));
122 |     const totalWpmOnDay = gamesOnDay.reduce((totalWpm, game) => totalWpm + game.wpm, 0);
123 |     const averageWpmOnDay = gamesOnDay.length > 0 ? totalWpmOnDay / gamesOnDay.length : 0;
124 |     return Math.round(averageWpmOnDay);
125 |   });

```

To calculate the average wpm of the previous month I must take away one from the month variable (line 111) and the rest of the processes are the same. And take away two for the month before the previous one.

```

calculateYearWpm(data) {
  // Create a new date object with the current date and time
  const now = new Date();
  // Get the current year and month
  const year = now.getFullYear();
  const month = now.getMonth();
  // Initialize empty arrays to store the average WPM and month names for the past 12 months
  const yearWpm = [];
  const yearMonths = [];
  // Loop through the past 12 months, starting with the current month
  for (let i = 0; i < 12; i++) {
    // Calculate the month and year for the current iteration of the loop
    const monthToAverage = new Date(year, month - i, 1).toISOString().slice(0, 7);
    // Filter the data to only include games played in the current month
    const gamesInMonth = data.filter(game => game.date.startsWith(monthToAverage));
    // Calculate the total WPM for all games played in the current month
    const totalWpmInMonth = gamesInMonth.reduce((totalWpm, game) => totalWpm + game.wpm, 0);
    // Calculate the average WPM for all games played in the current month
    const averageWpmInMonth = gamesInMonth.length > 0 ? Math.round(totalWpmInMonth / gamesInMonth.length) : 0;
    // Add the average WPM for the current month to the beginning of the yearWpm array
    yearWpm.unshift(averageWpmInMonth);
    // Get the name of the current month and year and add it to the beginning of the yearMonths array
    const monthToPush = new Date(year, month - i, 1).toLocaleString('default', { month: 'long', year: 'numeric' });
    yearMonths.unshift(monthToPush);
  }
}

```

By following the same logic, I am iterating through each month of the year and adding all the games played in a specific month and dividing by the length of the filtered object. The ‘yearMonths’ array will store the date in this format : May 2020, June 2020 ....

```

▶ (12) ['May 2022', 'June 2022', 'July 2022', 'August 2022', 'September 2022', 'October 2022', 'November 2022',
'December 2022', 'January 2023', 'February 2023', 'March 2023', 'April 2023'] progress-tracker.js:178
▶ (12) [0, 0, 0, 0, 0, 0, 0, 58, 55, 88, 88] progress-tracker.js:179

```

No games were played before 2023 so zero is inserted into the array and the average is calculated for the other months.

### calculateAccuracy

This method will follow the same logic as the calculateWpm method but instead of wpm properties it will be manipulating the accuracy properties from the object.

### Chart.js

Chart.js is an open-source JavaScript library that would me allow to create customisable graphs for the user showing their performance overtime.

```
● Tahers-MacBook-Air:test-server tahir.ahmed$ npm install chart.js
```

I am installing the chart.js library.

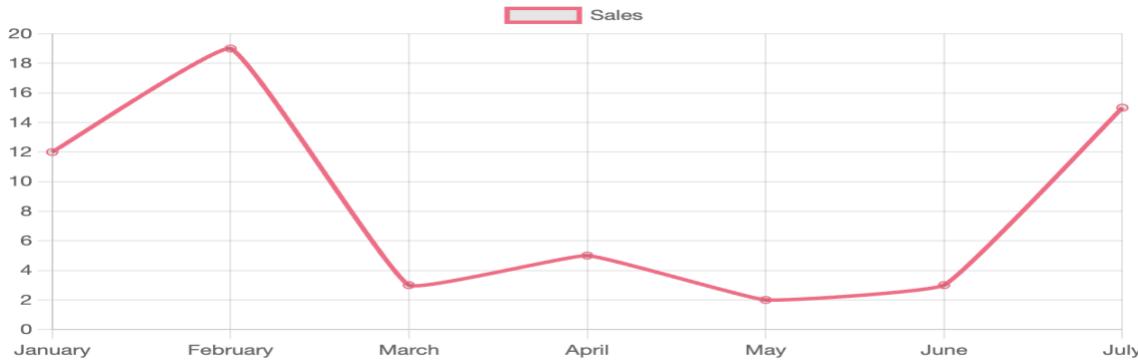
```
8 <script src="https://cdn.jsdelivr.net/npm/chart.js"></script>
```

I must include the chart.js library in my HTML file in order to create a canvas element in my HTML.

```
<canvas id="myChart"></canvas>
<script>
  const data = {
    labels: ['January', 'February', 'March', 'April', 'May', 'June', 'July'],
    datasets: [
      {
        label: 'Sales',
        data: [12, 19, 3, 5, 2, 3, 15],
        borderColor: 'rgb(255, 99, 132)',
        tension: 0.1
      }
    ];
  const config = {
    type: 'line',
    data: data,
    options: {
      scales: {
        y: {
          beginAtZero: true
        }
      }
    }
  };
  var myChart = new Chart(
    document.getElementById('myChart'),
    config
  );
</script>
```

Creating a random graph.

Test			Result	
Description	Type	Code	Expected	Actual
Testing if the chart.js library was installed	Normal		Line graph generated.	<input checked="" type="checkbox"/> Line graph generated.



### WpmGraph

```
<canvas id="wpm-graph" width="800" height="400" style="margin: 0 auto;"></canvas>
```

Created a canvas element in my HTML file.

```

291  currentMonthWpmGraph(currentDays, currentMonthWpm) {
292
293  const chart1 = new Chart(document.getElementById('wpm-graph'), {
294    type: 'line',
295    data: {
296      labels: currentDays,
297      datasets: [
298        {
299          label: 'Average WPM',
300          data: currentMonthWpm,
301          fill: false,
302          borderColor: 'rgb(75, 192, 192)',
303          tension: 0.1
304        }
305      },
306      options: {
307        scales: {
308          x: {
309            title: {
310              display: true,
311              text: 'Date'
312            }
313          },
314          y: {
315            title: {
316              display: true,
317              text: 'WPM'
318            }
319          },
320          responsive: true,
321          maintainAspectRatio: true,
322          plugins: {
323            legend: {
324              position: 'top',
325            },
326            title: {
327              display: true,
328              text: 'Average WPM for current month'
329            }
330          }
331        }
332      }
333    }
334  }
335
336  chart1.render();
337
338  // Additional code for chart configuration and rendering
339
340  // ...
341
342  
```

I am passing the two arrays, the 'currentMonthWpm' array is the y-axis and 'currentMonthWpm' array is the x-axis. The 'option' object contains further customisation for the chart but will not be playing with it for now. (Line 294) ensures it is a line graph and I can change it to a bar chart if I want just by changing the type.

```

const graph = new Graph();
graph.currentMonthWpmGraph(currentMonthDays, currentMonthWpm);

```

I am creating an instance of the class so that I can call the method, pass the arrays and generate a graph.

```

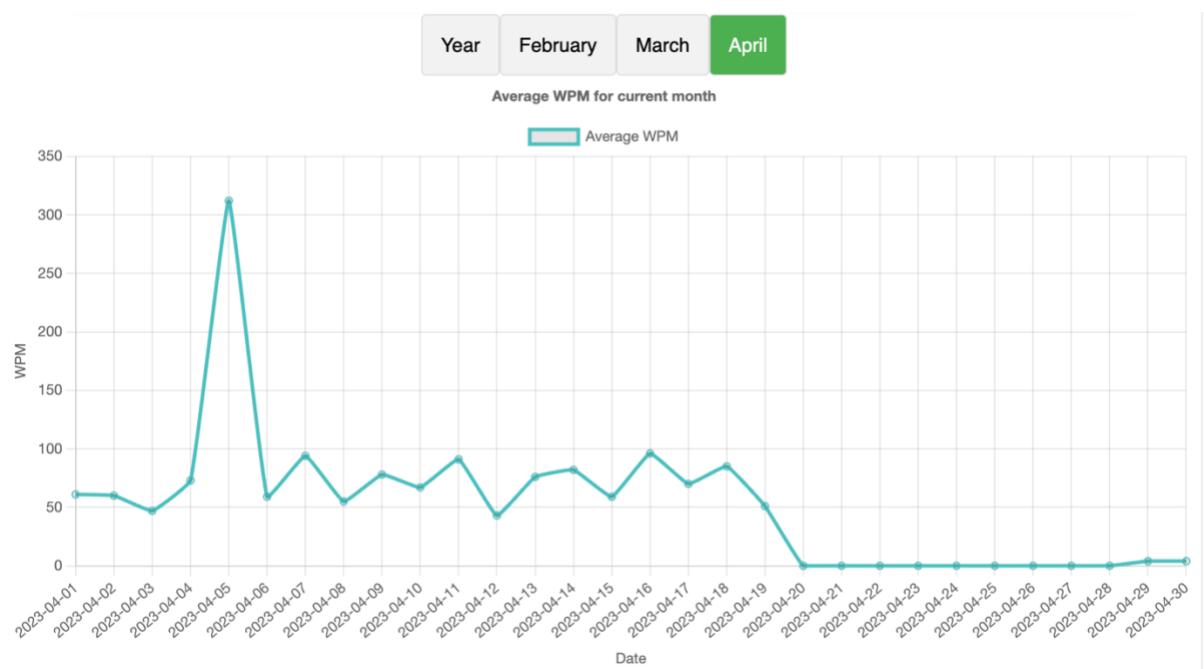
678
679 |     optionMonthWpm.addEventListener('click', function() {
680 |       progressTracker.calculateCurrentMonthWpm(data)
|     });
  
```

I have added an event listener so that the graph is generated when the user clicks on the relevant month.

Test			Result	
Description	Type	Code	Expected	Actual
Checking if the data points in the graph matches will the arrays	Normal		Matching values	<input checked="" type="checkbox"/> values matched

```

progress-tracker.js:102
(30) [61, 60, 47, 73, 312, 59, 94, 55, 78, 67, 91, 43,
▶ 76, 82, 59, 96, 70, 85, 51, 0, 0, 0, 0, 0, 0, 0, 0,
  4, 4]
  
```



I clicked on April, so the graph was generated. The peak is at 5<sup>th</sup> position in the graph which corresponds to 312 wpm in the array.

To generate the other graphs, I will pass the relevant array for their graphs.

```

336 lastMonthWpmGraph(lastMonthDays, lastMonthWpm ) {
337
338   const chart2 = new Chart(document.getElementById('wpm-graph'), {
339     type: 'line',
340     data: {
341       labels: lastMonthDays,
342       datasets: [
343         {
344           label: 'Average WPM',
345           data: lastMonthWpm,
346           fill: false,
347           borderColor: 'rgb(75, 192, 192)',
348           tension: 0.1
349         }
350       ],
351       options: {
352         scales: {
353           x: {
354             title: {
355               display: true,
356               text: 'Date'
357             }
358           },
359           y: {
360             title: {
361               display: true,
362               text: 'WPM'
363             }
364           },
365         responsive: true,
366         maintainAspectRatio: true,
367         plugins: {
368           legend: {
369             position: 'top',
370           },
371           title: {
372             display: true,
373             text: 'Average WPM for previous month'
374           }
350       }
351     }
352   }
353 }
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374

```

All the graphs will have the same style. This will generate the previous month graph.

```
graph.lastMonthWpmGraph(lastMonthDays, lastMonthWpm);
```

Passing the previous month array.

Test			Result	
Description	Type	Code	Expected	Actual
Checking if second graph is generated	Normal		The graph for the previous month generated	✗ Uncaught Error: Canvas is already in use.

The graph was not being displayed.

Improvement

```

destroyWpmGraph(){
  // Get references to canvas element
  const wpmGraph = document.getElementById('wpm-graph');

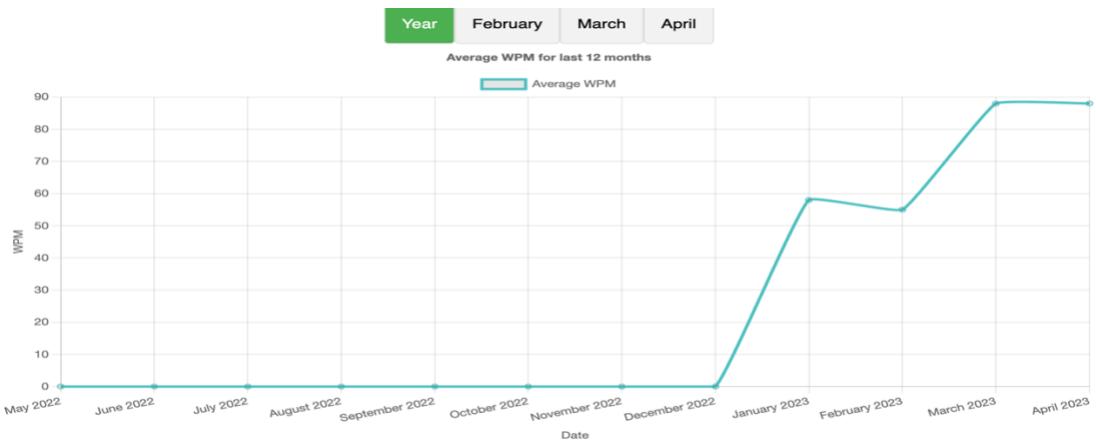
  // Get the corresponding Chart instance for each canvas element and destroy it
  Chart.getChart(wpmGraph)?.destroy();
}

```

I have to destroy the previous chart before generating another chart with the same canvas element.



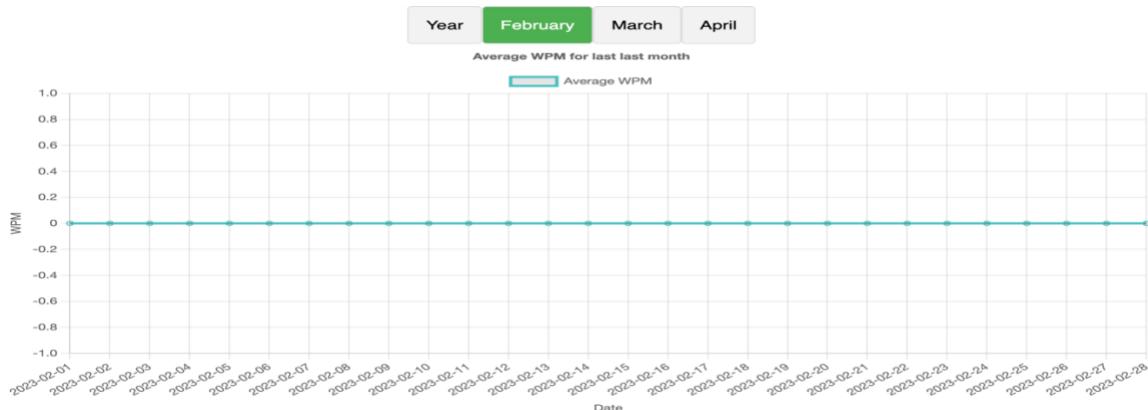
The graph for the previous month was being generated and it overlapped the other graph, this is because I am using the same canvas.



This is how the year graph looks like.

### Test\_id 36

I have mentioned no graph should be generated if no games were played. But I have decided that all the data points will be zero instead.



No games were played in February so the WPM is zero for all the days.

## AccuracyGraph

To generate the accuracy graph I have created another canvas and used the same graphing style and logic.

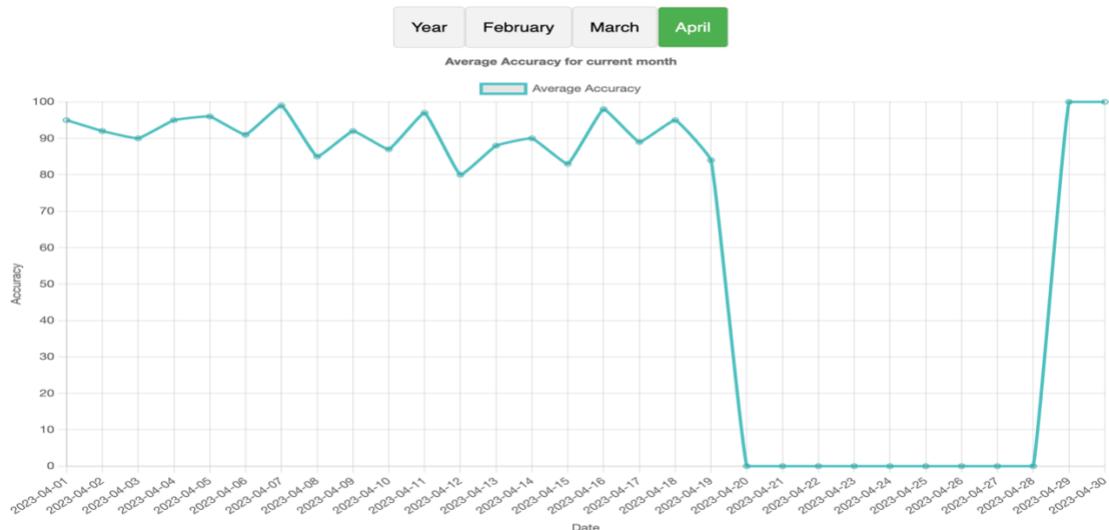
```
<div class="toggle-bar-accuracy">
  <div class="option active" id="yearAccuracy">Year</div>
  <div class="option" id="lastLastMonthAccuracy"></div>
  <div class="option" id="lastMonthAccuracy"></div>
  <div class="option" id="currentMonthAccuracy"></div>
</div>
<canvas id="accuracy-graph" width="1000" height="600" style="margin: 0 auto;"></canvas>
```

Created another toggle-bar where the user can switch between the graphs.

```
471 currentMonthAccuracyGraph(currentDays, currentMonthAccuracy) {
472   this.destroyAccuracyGraph()
473   const chart5 = new Chart(document.getElementById('accuracy-graph'), {
474     type: 'line',
475     data: {
476       labels: currentDays,
477       datasets: [
478         {
479           label: 'Average Accuracy',
480           data: currentMonthAccuracy,
481           fill: false,
482           borderColor: 'rgb(75, 192, 192)',
483           tension: 0.1
484         }
485       ],
486       options: {
487         scales: {
488           x: {
489             title: {
490               display: true,
491               text: 'Date'
492             }
493           },
494           y: {
495             title: {
496               display: true,
497               text: 'Accuracy'
498             }
499           },
500         responsive: true,
501         maintainAspectRatio: true,
502         plugins: {
503           legend: {
504             position: 'top',
505           },
506           title: {
507             display: true,
508             text: 'Average Accuracy for current month'
509           }
510         }
511       }
512     }
513   })
514 }
```

I have changed the title of the graph as different graphs are different information. But I am using the same layout. And I will passing the relevant accuracy arrays.

Test			Result	
Description	Type	Code	Expected	Actual
Checking if the accuracy graph is generated and is similar to WPM	Normal		Accuracy graph generated.	<input checked="" type="checkbox"/> Accuracy graph generated.



<b>Leaderboard</b>	
Table	There should be a table with top 10 faster typists.
Live update	The table must be updated instantly if the user manages to get a higher speed than the people in the database
<b>Progress tracker</b>	
WPM table	The user should be able to see their change in typing speed over a period of time.
Accuracy Table	There will be a table showing their change in accuracy speed over the last month or year. By looking at this graph they can conclude whether they have worked on their accuracy.
Extra Stats	This will summarise their performance and they do not have to look at the graphs. This will have the time spent typing and their average WPM.

## Review

There should not be any errors when fetching the date from the database. Only running one method at a time when generating the graphs would really improve the overall efficiency. The problem is when the user plays the game for a year and the JSON object becomes very large. The complexity of the reduce function which iterates through the object is  $O(n)$  and the program is iterating through the object multiple times, when calculating highest WPM, average WPM etc. It is not a problem for now but some changes could be made in the future, for example only fetch the games played last year instead of all the games in their lifetime.

<b>Success criteria</b>	
<b>Criteria</b>	<b>Met?</b>
Extra Stats	Met

WPM table	Met
Accuracy Table	Met
<b>Test</b>	
<b>Test_id</b>	<b>Passed or failed?</b>
37	Passed
35	Failed
36	Passed

## Final iteration

In this iteration I will add a front page, display the leaderboard and include the user\_id when logging in or signing up.

I will go back to PHP and pass the user\_id in the URL when logging in or signing up.

```

39     $sql = "SELECT user_id FROM users WHERE email = ?";
40     $stmt = mysqli_stmt_init($conn);
41     if (!mysqli_stmt_prepare($stmt, $sql)) {
42         header("Location: otp.php?error=sqllerror");
43         exit();
44     } else {
45         mysqli_stmt_bind_param($stmt, "s", $email);
46         mysqli_stmt_execute($stmt);
47         $result = mysqli_stmt_get_result($stmt);
48         if ($row = mysqli_fetch_assoc($result)) {
49             $user_id = $row['user_id'];
50             // redirect to another page with user_id in the URL
51             header("Location: http://localhost:3004?user_id=$user_id");
52             exit();
53         } else {
54             header("Location: otp.php?error=nouser");
55             exit();
}

```

In the opt.php file where the users verify their account, I am reading the user\_id from the users table and including it in the URL (line51).

Test			Result	
Description	Type	Code	Expected	Actual
Checking if the correct user_id was fetched and included in the URL.	Normal	Line 39-51	The next user_id will be 73.	<input checked="" type="checkbox"/> http://localhost:3004/?user_id=73

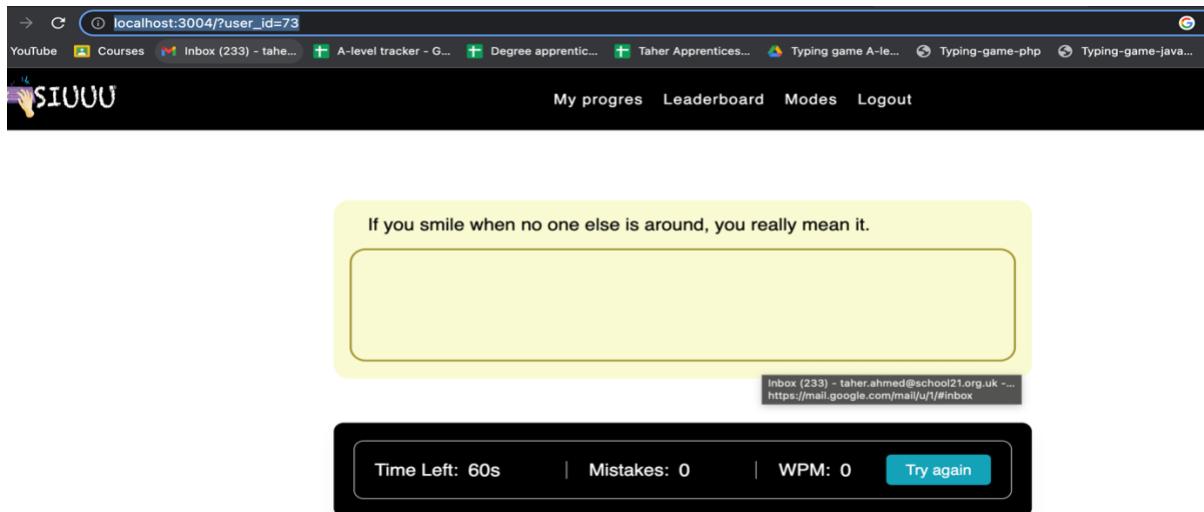
73 hellogsdfs

kelopa9617@fectode.com

\$2y\$10\$hzo.FOTIIxEk5oJPhtgk4.UW7mdZaSXkZwB8C/GXfa2...

1

Just created an account.



The user\_id in the URL is 73.

I need to include the user\_id when logging in as well.

```
const urlParams = new URLSearchParams(window.location.search);
const userId = urlParams.get('user_id');
// Store the userId value in sessionStorage
sessionStorage.setItem('userId', userId);
```

I need to make sure I am storing the userId in my js code. By using the 'URLSearchParams' object with 'window.location.search' property, I am able to get the user\_id from the URL. I am using cookies so that I do not need to pass the user\_id through the URL each time I am changing pages. The 'sessionStorage' object stores data on the client side for the duration of the browser session. I do not have to set the user\_id manually now.

I will be displaying the leaderboard table now.

```
<table id="leaderboard-table"></table>
```

I have created a table element where I will insert the values.

```
54 app.post('/fetch-leaderboard', (req, res) => {
55   const query = `SELECT leaderboard.wpm, users.uidUsers
56   FROM leaderboard
57   INNER JOIN users
58   ON leaderboard.user_id = users.user_id
59   ORDER BY leaderboard.wpm DESC`;
60
61   // execute the SQL query to fetch the data
62   con.query(query, (err, result) => {
63     if (err) {
64       console.error(err);
65       res.status(500).send('Error fetching data from the database');
66       return;
67     }
68
69     // return the data as JSON
70     res.json(result);
71   });
72 }
```

I have created a new post request which reads the leaderboard table from the database. The leaderboard table in the database stores the user\_id and WPM, but when displaying the

leaderboard I will display the corresponding username which is why I am using the ‘JOIN’ operation to retrieve the username from the ‘Users’ table and ‘WPM’ from the learderboard table. The JSON object will already be sorted so that I do not need to sort it in my js code.

```

43  data.forEach((item, index) => {
44    const row = document.createElement('tr');
45    const rankCell = document.createElement('td');
46    rankCell.textContent = index + 1;
47    const usernameCell = document.createElement('td');
48    usernameCell.textContent = item.uidUsers;
49    const wpmCell = document.createElement('td');
50    wpmCell.textContent = item.wpm;
51    row.appendChild(rankCell);
52    row.appendChild(usernameCell);
53    row.appendChild(wpmCell);
54    table.appendChild(row);

```

This function will iterate through the object, will create a table and assign a rank to the username.

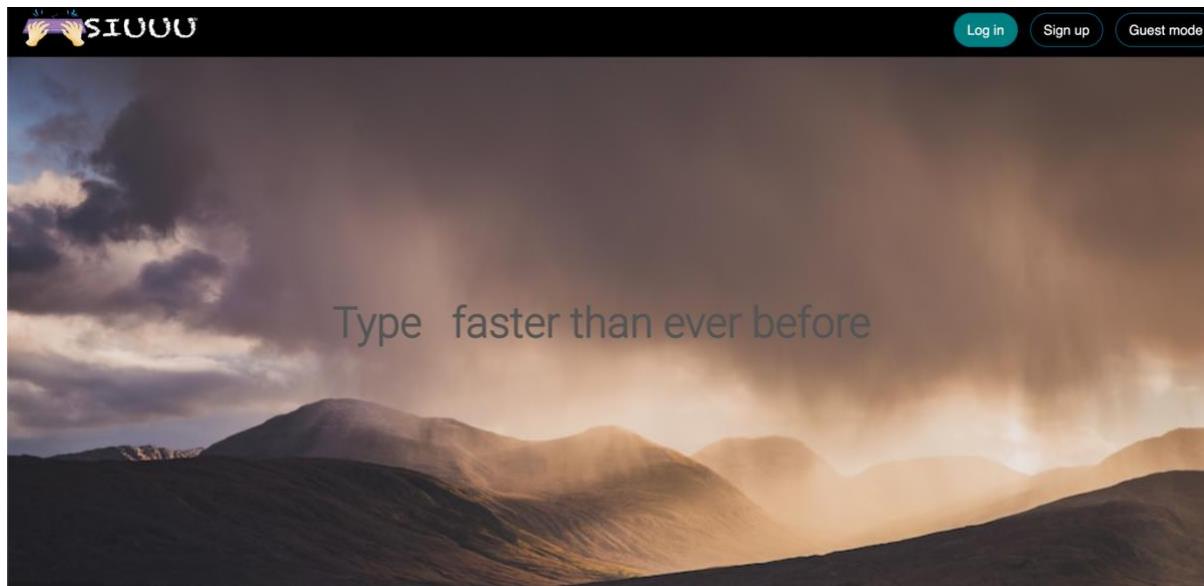
Test			Result	
Description	Type	Code	Expected	Actual
Check if the table matches with the database leaderboard table.	Normal		Matching table with username	<input checked="" type="checkbox"/>

user_id	WPM	Rank	Username	WPM
1	1140	1	T_eight211	1140
73	780	2	hellogsdfas	780
72	620	3	hekkhids	620
73	320	4	hellogsdfas	320
3	266	5	mynameisdf	266
43	216	6	itsgalibgamingg	216
49	208	7	dftahersdfsdfsdf	208
5	90	8	poupylmhm	90
42	89	9	itsgalibgaming	89
50	69	10	dftadfsdfsdf	69

1 T\_eight211      taher.ahmed2004@hotmail.com \$2y\$10

'user\_id' has a username of 'T\_eight211'.

I will be making the front-page now.



Want to be in the leaderboard!

Rank	Username	WPM
1	T_eight211	1140
2	hellogsdfas	780
3	hekkhids	620
4	hellogsdfas	320
5	mynameisdf	266
6	itsgalibgamingg	216
7	dftahersdfsdfsdf	208
8	poupylmhm	90
9	itsgalibgaming	89
10	dftadfsdfsdf	69

## Feedback

**What do you think about the design for the front page?**

[Saad] – The animation is amazing. Is the leaderboard table updated live?

[me]- Yes, the leaderboard table is updated as soon as a user beats their score.

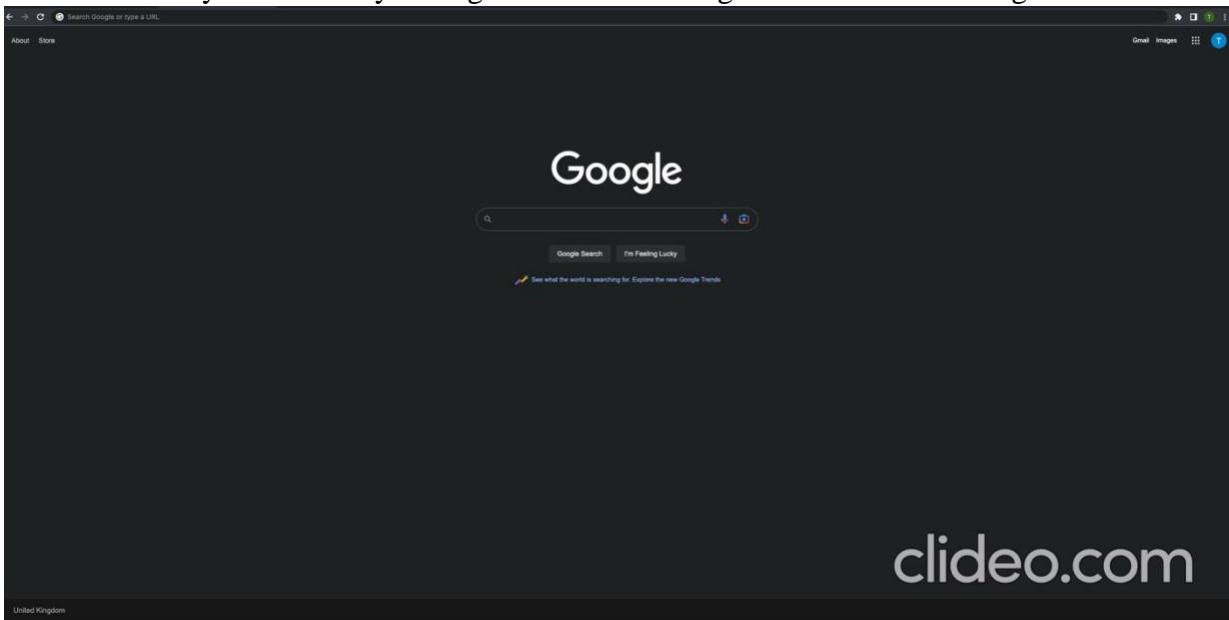
## Review

I am not able to show the animation with a screenshot. In this iteration I have completed the parts that I was not able to do before the previous iteration.

# Evaluation

## Post development testing

My stakeholder will now come in and will use my software. My stakeholder will do most of the functionality and usability testing and I will be doing the Robustness testing. I will follow



the table from the design section. The software will still be running on a local server during these tests.

[https://www.mediafire.com/file/2ybtcvxyghkyvtt/screen-recording-2023-04-07-at-230423\\_jNKdluSH.mov/file](https://www.mediafire.com/file/2ybtcvxyghkyvtt/screen-recording-2023-04-07-at-230423_jNKdluSH.mov/file)

<https://www.kapwing.com/w/GAJhkgmEo1o1>

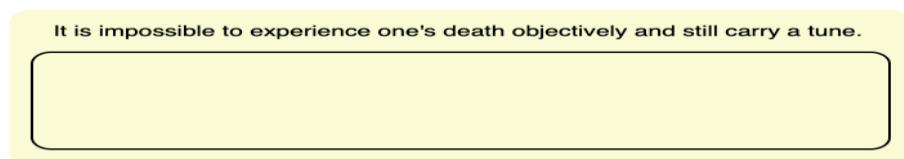
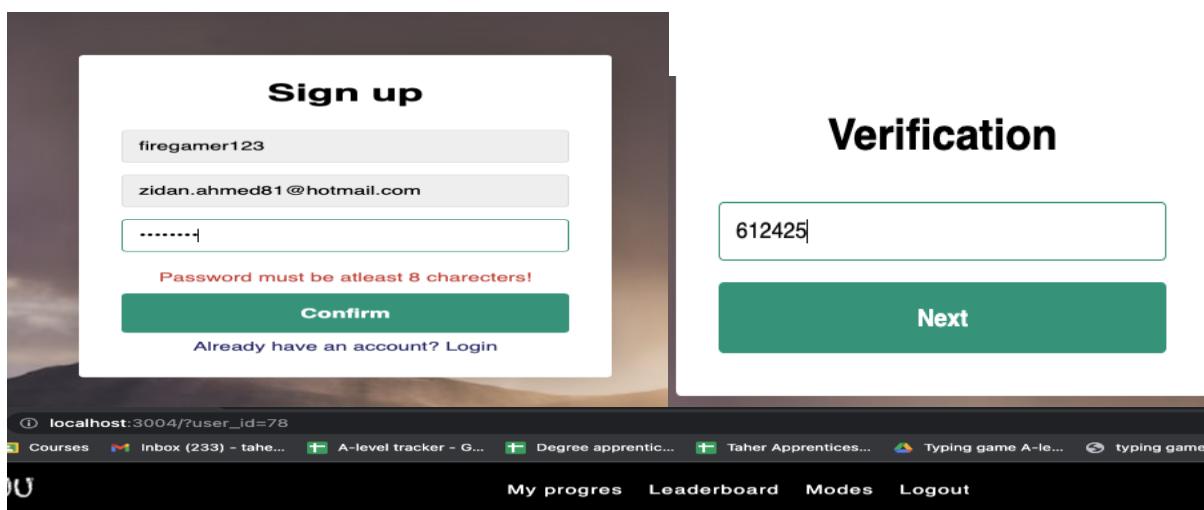
**Original video** - <https://www.mediafire.com/file/56iv643xa4e1if6/Screen+Recording+2023-04-07+at+23.04.23.mov/file>

I have screen recorded a video where my stakeholder Saad, carries out some functionality and usability tests by following the table in my design. I have the URL to the stakeholder to get started.

### Test id 1

At the time interval 00:10-00:15 the stakeholder is refreshing the page a few times so see if the logo, background image and the table loads properly. The animation resets each time. The leaderboard of 10 players is displayed on the front page which meets the requirement.

Test id 2



**Sign up**




Password must be atleast 8 characters!

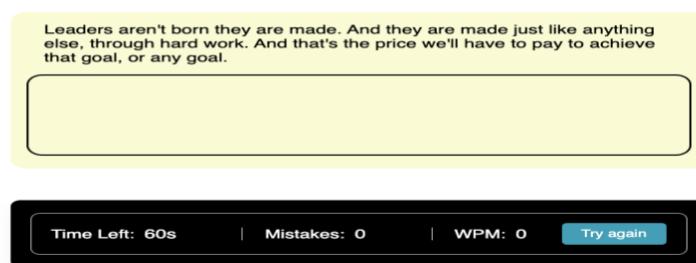
**Confirm**

Already have an account? Login

localhost:3004/?user\_id=7

YouTube Courses Inbox (233) - tah... A-level tracker - G... Degree apprentice... Tahir Apprentices... Typing game A-le... typing game

SIUUU My progress Leaderboard Modes Logout



**Sign up**




**Confirm**

Already have an account? Login

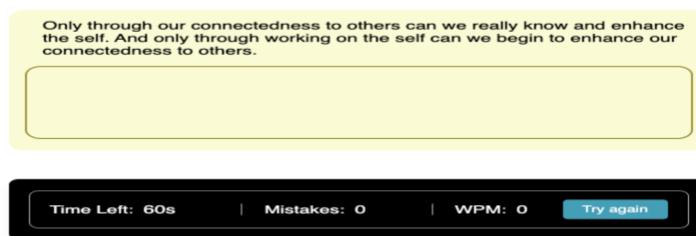
**Verification**

**Next**

localhost:3004/?user\_id=8

YouTube Courses Inbox (233) - tah... A-level tracker - G... Degree apprentice... Tahir Apprentices... Typing game A-le... typing game

SIUUU My progress Leaderboard Modes Logout



Here are 3 other users creating an account. This test shows that multiple users can create an account.

Name: Taher Ahmed

Centre N:13284

Candidate N:1060

### Test id 3

At the time interval 00:41-00:45 the stakeholder holder tried to sign in with a password less than 8 characters and without a special character so there were few error messages in red explaining the user.

The screenshot shows a login interface with three input fields and one button:

- Username:** A text input field containing "mohammad.kashif@school21.org.uk".
- Password:** A text input field showing only four dots (".....").
- Confirm:** A green button labeled "Confirm".

A red error message "Username can only contain letters, numbers, . and \_" is displayed below the username field.

Here is another user attempting to sign in with an invalid username. As a result, an error message is displayed. The success criteria for signing up is to display error messages and to validate the password. This test confirms that those criteria have been met.

### Test id 4

The screenshot shows a login interface with three input fields and one button:

- Username:** A text input field containing "saad123".
- Email:** A text input field containing "mohammad.kashif@school21.org.uk".
- Password:** A text input field showing only four dots (".....").
- Confirm:** A green button.

A red error message "Username has been taken!" is displayed below the username field.

My stakeholder is trying to sign in with a username that was taken by another stakeholder. This test shows that users cannot use taken username which was part of the success criteria.

### Test id 5

During this test the user could not verify their account because they did not receive an email with a random 6-digit code. I was not sure why, but I assumed that the library stopped working. So, I have decided to use a different library.

#### Improvement

<https://github.com/PHPMailer/PHPMailer>

```
use PHPMailer\PHPMailer\PHPMailer;
```

At the time interval 00:49-01:00, an email was sent to the user's Gmail account with a code. The user then copied the code and pasted in the input field. The user then was successfully verified and can log back in. This test shows that a verification email is sent to the user when signing up which was part of the success criteria.

### Test id 6

I am not aware how to do SQL injection. I have used prepared statements, so I believe SQL injections are less likely to happen. This is a robustness testing.

## Sign up

SELECT \* FROM users WHERE username:

taher.ahmed@school21.org.uk

.....

Username must contain 4-20 characters!

**Confirm**

Already have an account? Login

## Sign up

....

taher.ahmed@school21.org.uk

.....

Username must contain 4-20 characters!

**Confirm**

Already have an account? Login

## Sign up

' OR 1=1; DROP TABLE users; --

taher.ahmed@school21.org.uk

.....

Username must contain 4-20 characters!

**Confirm**

Already have an account? Login

## Sign up

1,1,1,1

taher.ahmed@school21.org.uk

.....

Username can only contain letters, numbers, .  
and \_

**Confirm**

Already have an account? Login

Based on my experience, there are common methods for SQL injection attacks when prepared statements are not used. However, I have implemented input validation that has been able to sanitise most of the malicious queries. Furthermore, there have been no recent changes to my database, which indicates that my website is able to protect itself from malicious entries. Additionally, even if someone were to gain access to the data stored in the database, there is no sensitive information stored that could be compromised.

Test id 7

At the time interval 01:01-02:04, the stakeholder played 3 games and all 3 games had a different quote.

Fortune favors the brave.

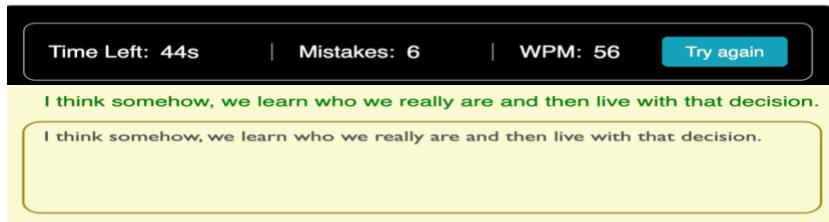
Fortune favors the brave.

Time Left: 55s

Mistakes: 0

WPM: 48

Try again



Here are other users playing. A different quote is generated each time which is part of the success criteria.

#### Test id 8

At the time interval 03:02-03:14, the stakeholder logged back into the account by using the same email and the stakeholder was granted access to their account.

#### Test id 9

At 01:22, the stakeholder finished playing his first game and it took 23 seconds to type and it shows the user took 23 seconds to type the first quote and he took 11 seconds to complete the second game. The timer may seem to go too fast because this is a sped-up video.

#### Test id 10

At the time interval 01:01-01:22, the typing speed WPM is changing while he is typing and the typing speed stops changing when he stops typing at 01:22-01:24. This test shows that the typing speed is calculated and displayed to the user which was part of the success criteria.

#### Test id 11

At the time interval 02:12-02:26, the user is checking his progress in typing speed and typing accuracy over the last 3 months and last year. The user only played for a day which is why the graph is at zero for most of the data points. This test shows that wpm and accuracy graphs are generated as well as some extra statistics are summarised and displayed which was part of the success criteria.

#### Test id 12

At the time interval 01:24- 01:29, the stakeholder tried to copy the quote and paste it in the typing area. The stakeholder could not select the quote. This shows the copying and pasting is not allowed in the game which was part of the success criteria.

### Test id 13

At 02:28, the leaderboard was updated and the stakeholder was on the leaderboard with a WPM of 49 which was higher than another user with a WPM of 10. This test shows that the leaderboard table is updated live which was part of the success criteria.

### Test id 14

At the time interval 02:08-02:11, the stakeholder could see his highest WPM, average WPM, highest accuracy, average accuracy and time typing. This test shows that extra statistics are summarised and shown to the user which was part of the success criteria.

### Test id 15

At the time interval 02:26-02:34 the user is switching between pages without any problem. This test shows that the website has a simple design which is easy to follow which was part of the success criteria.

### Test id 16

At time 02:38, the user clicked on the logout button and the stakeholder returned to the front page. This test shows the user are able to log out.

### Test id 17

At the time interval 02:46-03:00, the stakeholder signed in as a guest and was able to play the game without logging in. This test shows the users is able play the game without signing in which was part of the success criteria.

### Test id 18

**Reset your password!**

An email will be send to you with instructions on how to reset your password.

saadulghar3@gmail.com

**Check your email!**

**Reset my password**

**New password!**

.....  
.....

Password Updated!

**Next**

Here is my stakeholder resetting his password. The stakeholder had insert their email first, the program then checked if the user has an account, it then sent an email to the user with a link where the user could type his new password. This test shows the user can reset their password if they have forgotten their old password which was part of the success criteria.

## Met success criteria

Criteria	What and Justification	Met
<b>Front page</b>		
Front page leaderboard	The leaderboard must be on the front page, this is a feature taken from type racer. It will encourage more people to participate and be on the leaderboard.	<input checked="" type="checkbox"/>
<b>Sign up</b>		
Username and password validation	The username and password must be in a certain format so that username is something reasonable and the password is secure.	<input checked="" type="checkbox"/>
Success message and error message	If the requirements are not met it must output an error message. If the requirements are met it outputs a success message.	<input checked="" type="checkbox"/>
Password hashed	The password used to sign up must be hashed before it is written in the database. So that the account cannot be accessed even if they have the database.	<input checked="" type="checkbox"/>
Username used already	The program must check against the database if the username is already used to make sure the username is unique.	<input checked="" type="checkbox"/>
Account made already	The program must check against the database if the email is already in the database.	<input checked="" type="checkbox"/>
Verification email	A random 6-digit number will be generated and will be sent to the email provided. So that a valid email is used and can access the account later.	<input checked="" type="checkbox"/>
Send verification email	If the user forgot to verify their account, they can send another email to verify it. As the verification code would expire.	<input checked="" type="checkbox"/>
Update verification status	When the user successfully created an account, it must update that the user has verified their email.	<input checked="" type="checkbox"/>
<b>Log in</b>		
Correct Username and password	The user should not be able to access their account without the correct username and password.	<input checked="" type="checkbox"/>
Forgot password	If they have forgotten their password, they will be able to send a link to their email to reset the password so that their account will not be lost.	<input checked="" type="checkbox"/>
Forgot password link expiry	The link sent when the password is forgotten must have an expiry time, so it makes sure that anyone else does not access the link.	<input checked="" type="checkbox"/>

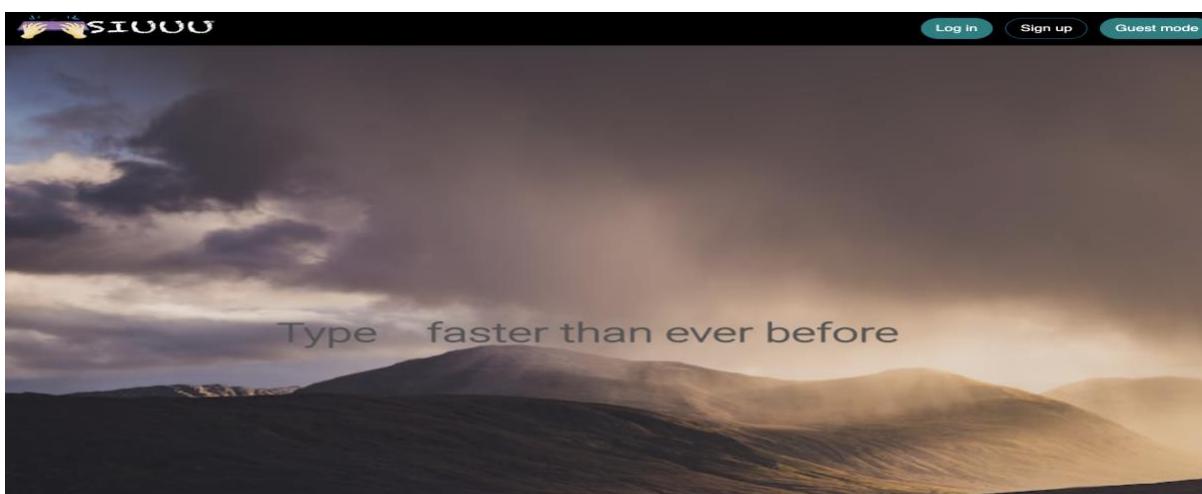
Update database password	The database must be updated with the new password when the password is changed so that the user can log in next time with the new password.	<input checked="" type="checkbox"/>
<b>Typing game</b>		
Create a table	When the user takes the first typing test, it must create a table in the database with their username which will then later be used for the progress tracker.	<input type="checkbox"/>
Random paragraph generator	It must generate a random quote for the user to replicate and type.	<input checked="" type="checkbox"/>
Timer	The user must type the paragraph generated within a fixed period. The timer should start when the user starts typing and it should reset when the user generates a new quote.	<input checked="" type="checkbox"/>
Mistake	It must show how many times the user has typed an incorrect letter, so the user can see their accuracy.	<input checked="" type="checkbox"/>
WPM	The program will perform a calculation and it will display how fast the user is typing(Words per minute) which is a standard measure of typing speed.	<input checked="" type="checkbox"/>
CPM	WPM will not be as accurate as characters per minute because we assume every word is 5 characters long which is not true all the time. CPM is used if they want an accurate measurement.	<input type="checkbox"/>
Prevent copy and paste	The user should not be able to copy and paste in the text area to prevent any cheating.	<input checked="" type="checkbox"/>
Write in the database	After every test the time taken, WPM and mistakes must be written in the database with the current time and the date. This will be useful later when showing their progress.	<input checked="" type="checkbox"/>
<b>Guest Mode</b>		
Typing game	The user will be able to play and take a typing test without logging in.	<input checked="" type="checkbox"/>
<b>Leaderboard</b>		
Table	There should be a table with top 10 faster typists.	<input checked="" type="checkbox"/>
Live update	The table must be updated instantly if the user manages to get a higher speed than the people in the database	<input checked="" type="checkbox"/>
<b>Progress tracker</b>		
WPM graph	The user should be able to see their change in typing speed over a period of time.	<input checked="" type="checkbox"/>
Accuracy graph	There will be a table showing their change in accuracy speed over the last month or year. By looking at this graph they can conclude whether they have worked on their accuracy.	<input checked="" type="checkbox"/>

Extra stats	This will summarise their performance and they do not have to look at the graphs. This will have the time spent typing and their average WPM.	<input checked="" type="checkbox"/>
<b>Design</b>		
Simple design	Most websites are crazy looking with nice animation and the website changes its format if you move your cursor and so on. But I keep my design simple and easy to use for my stakeholder as I am not advertising anything.	<input checked="" type="checkbox"/>
SQL injection	The program should be able to protect itself from SQL injection.	<input checked="" type="checkbox"/>

All my success criteria were met, and I have evidenced that I have met this success criteria in my post development testing. I have not created a new table for each user to store their game statistics, instead I took a different approach where I have stored all user's game statistics in one table. The CPM calculator was removed because the stakeholder suggested that it is an unpopular feature.

My main stakeholder, Saad, is now able to practise his typing on my website. One of the biggest concerns was that the stakeholder did not see much improvement even though he had been using other software to practise. This concern has now been removed because the stakeholder is able to see his progress and how he has improved over time. For example, if he sees on the graph generated that he has been consistently completing his games with a high typing speed but low accuracy, he can conclude that he needs to focus on spelling to further improve his typing. By analysing the graphs and statistics of the games, my stakeholder will now be able to check his improvements and figure out how to further improve. However the program will not suggest automatically what to focus on and how to improve. My other stakeholder Wasi can now have fun being on top of the leaderboard as he is typing expert and the other stakeholder Mohsin now able to practise his typing casually by using the guest mode.

## Evidence of usability



The buttons are easily distinguishable because of their shape and they have a bright colour so that they are visible.

## Want to be in the leaderboard!

Rank	Username	WPM
1	T_eight211	1140
2	hekkhids	620
3	mynameisdf	266
4	itsgalibgaminggg	216
5	dftahersdfsdfsdf	208
6	poupylmhm	90
7	itsgalibgaming	89

The table has a header so that the user knows what these values are.

### Log in

Username or email

Password

Next

[Forgot your password?](#)  
[Don't have an account? Sign up](#)  
[Verify your email?](#)

### Sign up

Username

Email Address

Password

Confirm

[Already have an account? Login](#)

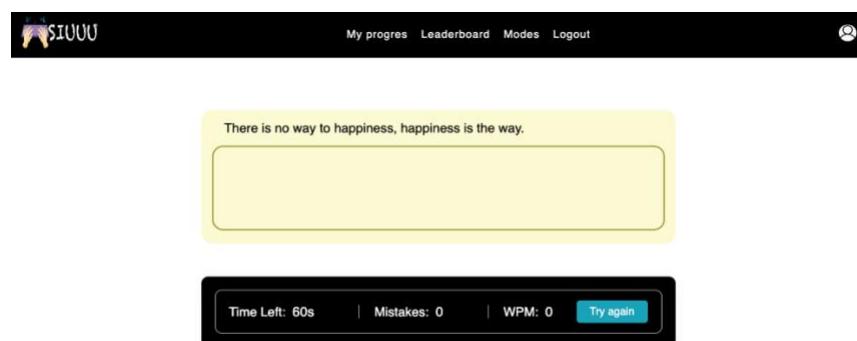
  

### Send verification code!

Enter your email

Next

Consistent web form design and the input fields have labelled so that the user knows what to enter.



Simple design, where all values are labelled, consistent use of button shape and colour. The textarea is auto focused meaning the user does not need to click on the textarea to start typing. The website's navigation menu is at the top, which is very clear and easy to understand. For example, "My progress" would redirect you to a page where it will show your progress over time and "Log out" would log you out and you have to log back in to see your progress.

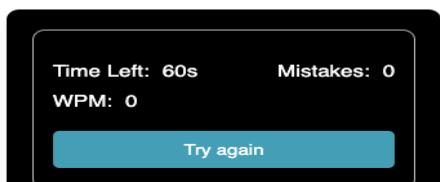
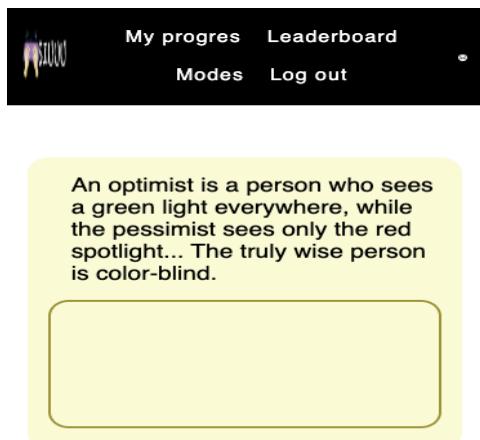


Consistent graph design. All the graphs have a title, the x-axis and y-axis are labelled. The toggle bar is easy to use, the user does not need to do anything complicated to generate the graphs.

Highest WPM	Average WPM	Highest accuracy	Average accuracy	Time typing
1140	96	100	91	0:27:25

These containers have the same design as the container in the typing game where is shows the timer, mistakes and WPM. This design makes it easier for the user to read these values and understand what they mean.

Other usability features include fast load times and responsive design. Users do not need to wait even a second to play another game, see themselves on the leaderboard, or track their progress since there are no resource-heavy elements that can slow down the website. This improves the user experience significantly. The typing game page is also responsive, which means it can be played on a phone. Although the website itself may not be responsive, phone users can still play on the guest mode.



This is how the website appears on a 3.5-inch phone.

The image contains four separate screenshots of a 'Sign up' form, each showing different validation errors:

- Top Left:** Shows an invalid email address ('hello") entered into the email field. A red error message 'Invalid email!' is displayed below the field.
- Top Right:** Shows a username containing non-alphanumeric characters ('hello"£!!') entered into the username field. A red error message 'Username can only contain letters, numbers, . and \_' is displayed below the field.
- Bottom Left:** Shows a password that is too short ('....') entered into the password field. A red error message 'Password must be atleast 8 characters!' is displayed below the field.
- Bottom Right:** Shows a password that does not contain alphabetic letters ('12345678') entered into the password field. A red error message 'Password must contain alphabetic letters!' is displayed below the field.

Each screenshot includes a 'Confirm' button at the bottom and a 'Already have an account? Login' link at the very bottom.

These are some screenshots that show the types of validation on my website, which prevent users from entering unexpected or incorrect input. These validations are necessary to avoid potential problems in both my code and database. For instance, if there is no email validation and an invalid email is entered, the program will store this incorrect email in my database and attempt to send a verification email, which will likely fail. The post development testing section further tests for robustness by performing SQL injection.

## Maintenance

This website requires very low maintenance; however, I am using an API. Therefore, I need to ensure that the API which fetches quotes is functioning correctly and that it is up to date with the new quotes added to the collection. The API was down for a moment during my development process, but unfortunately, I did not have the chance to take a screenshot. To avoid such situations in the future, it would be ideal to implement another API that provides a similar service, so if the primary API is down, it would fetch quotes from the secondary API.

In addition, I am using a library to send verification emails. However, during the end of the development phase, the library suddenly stopped working, and I was not sure why. I had to replace it with another library that did the same job. Moving forward, I need to ensure that the library is updated and check for any security vulnerabilities that may arise.

I am fetching game statistics from the database to generate a user's progress graph. I am iterating through the fetched object multiple times and need to ensure that the object does not become too large, causing the website to become slow while iterating through it. Perhaps in the future, I will only fetch games played in the last year instead of all time.

## Limitations

One of the biggest limitations is that only users who understand English and type in English will be able to use my website. My website does not have any auto-translate feature, and even if it did, it would need to translate the quote fetched from the API. My stakeholders are fluent in English; therefore, it is not necessary to translate the website's content to a different language.

No text-to-speech feature is supported by the website. This would help visually impaired users to use the website since the text-to-speech will automatically read what the user needs to type.

The website currently offers only one type of typing game mode. To prevent users from getting bored easily, other types of modes could be added, such as the 'start-again' mode, where users must restart the game if they type any character incorrectly.

There is a lack of a global leaderboard. A meaningful leaderboard requires competition, and there isn't much competition if the leaderboard is limited to only a few users. To get a better understanding of where your typing speed is, you must compare it with the more skilled typists in the world.

The progress tracker is limited to a year, and the average words per minute (WPM) and accuracy are calculated when the graphs are generated, which may not be an accurate measure. The progress tracker does not show how many games were played or how much time you have spent typing for a specific time period. The time spent typing could reflect on your progress, and the user will be able to better analyse their performance and check if they need to spend more time.

There are no improvement suggestions for my website, as the progress tracker cannot analyse game statistics and provide specific recommendations on what to improve. For example, there are software programs that can analyse data about stocks and provide recommendations

on which stocks to buy or avoid. However, my website's progress tracker is designed to help users track their typing speed and accuracy, and it may provide general guidance on how to improve these skills. That said, it cannot provide personalised recommendations on what specific areas to focus on, such as typing speed, accuracy, or time spent typing.

An internet connection is required even though the website is not hosted because the website needs to be connected to an internet connection. This is because I am using an online API. I do not think it is much of a problem today, but it is still something to consider.

Cheating is possible, as users may still be able to use integrated speech-to-text features in their device. The user will just read out the quote into a microphone, and it will register it as text. They will also be able to use digital handwriting recognition technology where the user will write on a screen, and it will register it as text.

This website uses an API that has a limited number of quotes. While there are 2042 different quotes available, there is still a possibility that a user may receive a repeated quote. However, since the user may not be aware of a repeated quote, it is not a significant issue.

Additionally, this website is designed to be used on laptops or desktops only. It is not responsive and cannot adjust to different screen sizes, meaning it cannot be used on phones or ultra-screens. Furthermore, when discussing typing skills, it is more important to consider typing on a laptop keyboard rather than a phone keyboard.

## Further developed

The success criteria have been fully met as it was addressed in my analysis. However, there are some limitations that make some parts of the website not serve its full purpose.

The purpose of including 'prevent copying and pasting' in my success criteria is to ensure that users do not cheat. However, I have mentioned in the limitations section that cheating is still possible through speech to text or digital handwriting recognition technology. In the future, disabling this feature can be achieved by utilising the speech recognition API, which allows authorised web applications to access the device's microphone and produce a transcript of the recorded voice. Additionally, digital handwriting recognition technology can be disabled on a website by setting the touch-action property to none in CSS. However, even after disabling these features, it is still not possible to guarantee that users will not be able to cheat.

I believe that most users would not be able to identify how to improve their typing through analysing the graphs. To improve the progress tracker, specific game statistics can be added, along with a bot that analyses the game statistics and suggests ways to enhance the typing performance. However, this would significantly increase the complexity of the program. The bot could search for patterns and suggest whether users should focus on accuracy or overall typing speed.

The online mode was a feature suggested by a larger audience, and it could be developed in the future to attract more users. If I were to develop this feature, I would follow these steps. To implement multiplayer functionality, I would use a real-time communication protocol such as WebSockets or WebRTC to enable real-time interaction between players. This would allow players to send and receive game data in real-time. These protocols enable peer-to-peer communication between browsers. However, implementing the online feature could be very

complex as I need to consider network architecture and develop a scalable and reliable server architecture that can handle a large number of players simultaneously. As different users use different browsers and network protocols, making it compatible for a wide range of devices can be challenging.

Adding a secondary API would be ideal to increase reliability as it would increase the percentage uptime of the website. So, when the primary API is unavailable, I could have another API that fetches quotes. 'Quotes REST API' and 'Forismatic API' are examples of APIs that provide famous quotes.

Finally, the rules of the game could be changed, and multiple modes could be developed with different rules. Some of the modes that I have in mind involve typing one character incorrectly and forcing the user to start the game from the beginning. Another mode could involve displaying individual words instead of a paragraph, and the user would have to type random words. Another mode could involve typing the paragraph with varying time limits.

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