



**SE  
TU**

Ollscoil  
Teicneolaíochta  
an Oirdheiscirt

South East  
Technological  
University

# **GAMIFIED TOOL FOR TEACHING GDPR FINAL REPORT**

**NG JING YUAN, C00278713**

**BACHELOR OF SCIENCE (HONOURS) IN CYBERCRIME AND IT SECURITY**

**SOUTH EAST TECHNOLOGICAL UNIVERSITY**

## Contents

Introduction .....	3
Acknowledgement .....	4
Achievement .....	4
What I achieved .....	4
Gamification features .....	4
Security Features .....	4
Web application features.....	4
Hosting .....	4
User Testing .....	4
Quiz .....	13
Problems Encountered .....	14
Design of interface .....	14
Bootstrap .....	14
Programming logic .....	15
Quiz .....	16
Send email.....	16
Hosting .....	16
What I learned .....	19
GDPR .....	19
PHP.....	19
Decision making.....	20
Planning, time management.....	20
Discipline .....	20
Troubleshoot skills .....	20
What I would do differently if starting over .....	20
Declaration of Plagiarism .....	21

## Introduction

This document is a summary of the outcome of the finalized gamified tool for teaching GDPR. The features developed for the tool and the challenges faced in achieving the final product are included. The solutions of how I solved every problem faced are described when discussing the challenges.

## Acknowledgement

I would first like to thank my project supervisor, Dr Joseph Kehoe for guiding me throughout the year in my project. He guided me by telling me the structure of the content for all the documents and help me to review it after I completed the documents or the presentation slides. He also guided me by providing the solution that he can think of when I told him the problems I faced in the implementation of the project. The process of completing this project is so much easier when I got guidance from him.

Next, I would like to thank all my lecturers in the projects for any help I received throughout the year and the feedback received for my presentations. Other than that, I would like to thank my friends and classmates for supporting me all the time throughout this project, whether in filling up the feedback form or giving me moral support.

## Achievement

The greatest achievement and something that I am proud of in this project is my ability to pick a project that is feasible within my ability and knowledge. Because of this ability, I completed everything as proposed at the start of this project and even start doing additional features to this project. On a more in-depth look on what I achieved in the implementation of this project:

### What I achieved

#### Gamification features

The first category of features that I achieved in the implementation of this project is the gamification features. The game that I built has features of what a game should have. They are points, badges, leaderboards, levels, streaks, and title collections.

#### Security Features

Another category of functions that I achieved in the implementation of this project is the security features. The features that I achieved for this category include verifying email after signing up, Google Two Factor Authentication, mitigation of CSRF attack, mitigation of SQL injection and session management.

#### Web application features

The next category of functions that I achieved in the implementation of this project is the web application features. The features that I achieved for this category are sign up, logging in, forgot password, reset the password, change the password, and upload a profile picture.

#### Hosting

The next feature that I achieved in the implementation of this gamified tool for teaching GDPR is hosting. The web application is hosted remotely using Plesk and can be found in URL:

<https://c00278713.candept.com/>

#### User Testing

Other than that, I also managed to complete user testing when completing this project. The purpose of the user testing is to get feedback from the user about anything that they think

can be improved and get suggestions from them about the features that they think would be useful to have in the game that I built for this project.

There are 12 users that participated in this user testing. The user testing is conducted by requesting the participants to fill up the Google Forms after using and playing the web application.

After getting the user testing, feedback and suggestions are implemented into the project. For example, all the security features, title collection and uploading profile pictures are implemented after getting feedback from the users.

The interface of the Google Form sent to the users is shown in Figure 1.0 below:

**User feedback form**

Feedback after using Inshield (Gamified Tool for Teaching GDPR)

njl9826@gmail.com (not shared) [Switch account](#)

\* Required

Did you encounter any confusing or unclear elements on the interface? \*

Yes

No

If yes, please state the element

Your answer \_\_\_\_\_

Did you find the interface to be user-friendly \*

Yes

No

Some yes, some no

Any suggestions you have for improving the interface?

Your answer \_\_\_\_\_

What is your thought on the questions in the quiz? \*

- Too hard
- Hard
- Some are hard, some are easy
- Easy
- Too easy

Any suggestions you have for improving the questions?

Your answer

---

What is your thought on the badge? \*

Badge	Points
Bronze	90 - 99
Silver	100 -199
Gold	200 and above

- Too hard to get
- Reasonable
- Too easy to get

Any suggestions you have for improving the badge?

Your answer

---

Any other suggestions you have to improve this Gamified tool for Teaching GDPR? (eg. feature to add to make the game more interesting or addictive) \*

Your answer

Submit Clear form

Never submit passwords through Google Forms.

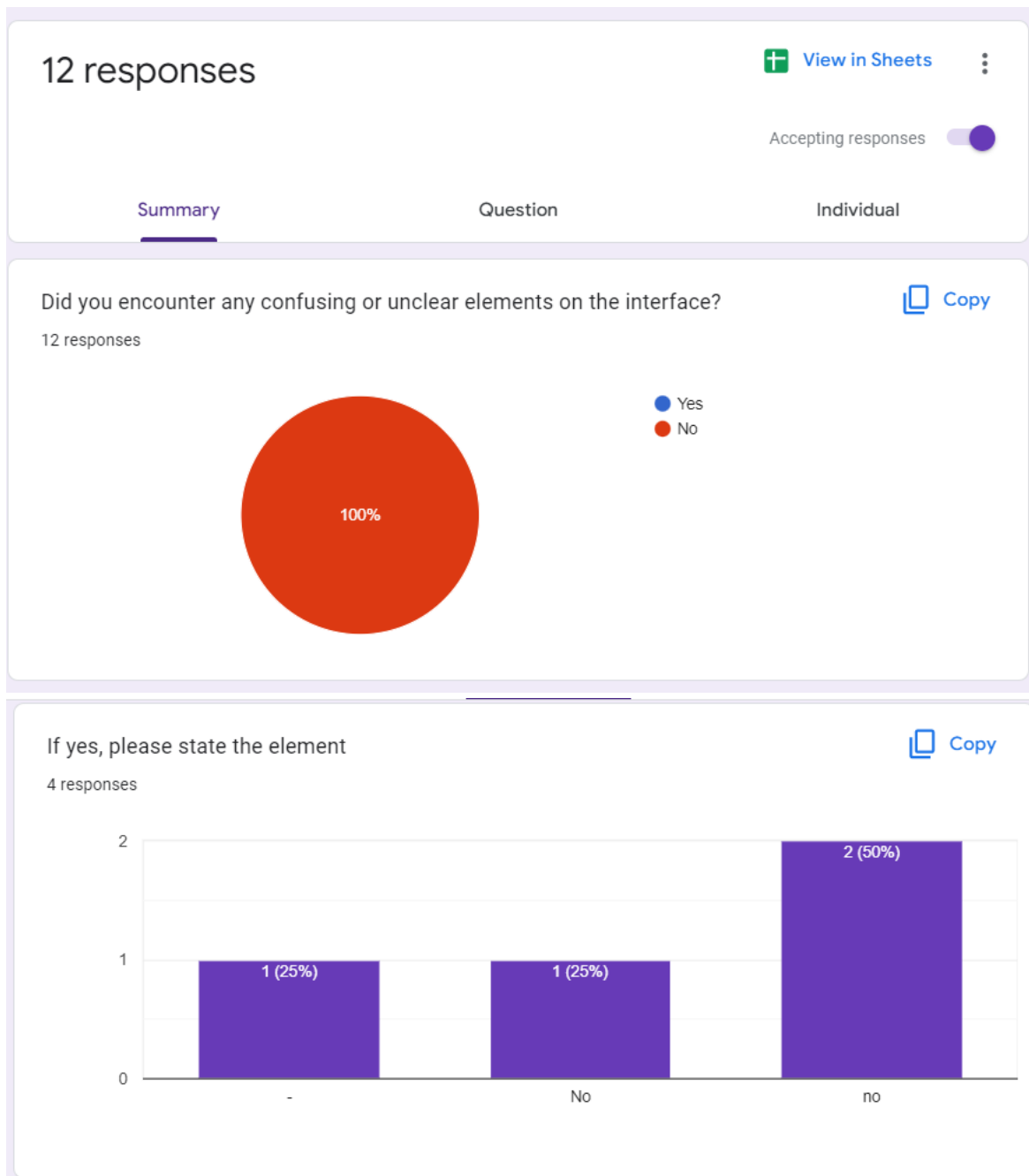
This content is neither created nor endorsed by Google. [Report Abuse](#) - [Terms of Service](#) - [Privacy Policy](#)

Google Forms

*Figure 1.0: The interface of the Google Form sent to the users.*



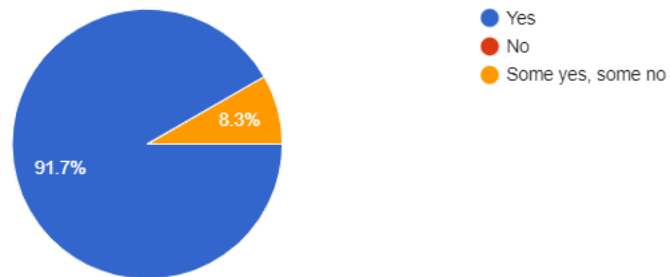
The result from user testing is shown in Figure 1.1 below:



### Did you find the interface to be user-friendly

 Copy

12 responses



### Any suggestions you have for improving the interface?

5 responses

no

no the interface is very good, not too much crowding the screen to confuse users and very easy to navigate

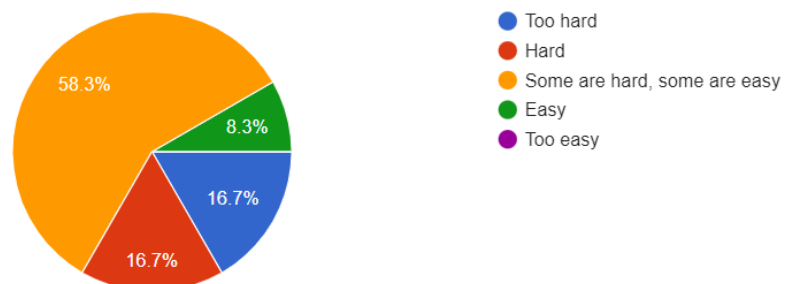
no. the interface is easy to understand and clear

Maybe more graphics, to make it more engaging

### What is your thought on the questions in the quiz?

 Copy

12 responses



### Any suggestions you have for improving the questions?

6 responses

no

I have zero to less experience on GDPR, so the questions will be really hard to me

maybe have like beginner,intermediate,advanced quizzes if its aimed towards everyone like newcomers might try ease themselves into it where as people with more experience with gdpr can choose the harder options and even have a multiplier for the points depending on the difficulty so like 1x for beginner 1.25 points for intermediate and 1.5x for advanced

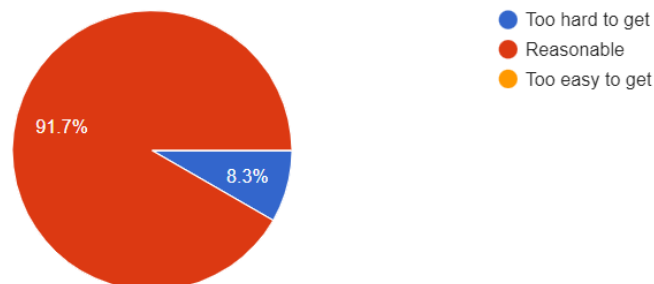
No

Maybe having different stages or levels of questions, ranging from beginner level to advanced level. And maybe having some cheat sheets or some quick content on certain topics before proceeding with the questions. Also, some case studies would be interesting and more engaging.

### What is your thought on the badge?

 Copy

12 responses



### Any suggestions you have for improving the badge?

5 responses

Maybe make the images smaller

no

you could have it so you earn points that you can use to buy special badges instead of just assigning a badge when you get to a certain amount of points to give the user more freedom/options if thats possible.

Nope

None

Any other suggestions you have to improve this Gamified tool for Teaching GDPR? (eg. feature to add to make the game more interesting or addictive)

12 responses

None very impressed

you may want to add in email verification for new user accounts

Can consider adding in two factor authentication using Google Authenticator or Yubikey or both. Can make the system more secure

It would be fun if I can upload a profile picture for my account or select an icon specially for myself

not really

nope. the game element that should be included in a quiz are found

maybe do something like add titles for users based on their average percentage for the results on the quiz some games like nba 2k used to give titles based on how high your win percentage was and people would try to get the best title to 1 up their friends

Implement security features maybe? Like include code that prevent sql injection, prevent user from changing the url to mess up with the get request

maybe can add in a feature that enable people to share their points or score to social media. Can increase the sense of competition among the players like a lot of games allow players to share their score, points to Facebook

Yes, the option to change my password once logged in to the application. With the option of the Google 2 Factor Authentication, it would be considered secure enough with this functionality, like requesting a code or One-Time-Pin, sent to the email, and use it before changing the password to a new one.

maybe can host it remotely. because the web application is only running on the localhost

should fix the aul session management and csrf

*Figure 1.1: The result from user testing*

All the useful suggestions that I got from the user testing are implemented into the project. Here is the list of features implemented from the feedback in the last question from user testing.

#### [Email verification after signing up](#)

The first feature that is implemented into the web application is Email Verification after signing up. This is implemented based on the second suggestion in the last question from user testing.

### Google Two-Factor Authentication

The next feature that is implemented into the web application is Google Two Factor Authentication. This is implemented based on the third suggestion in the last question from user testing.

### Upload profile picture

Other than that, uploading a profile picture is also another feature that is implemented into the web application. This is implemented based on the fourth suggestion in the last question from user testing.

### Title collection

The next feature that is implemented into the web application is title collection. This is implemented based on the seventh suggestion in the last question from user testing.

### Security features

Besides, security features such as mitigation of SQL Injection, Mitigation of CSRF attacks, Session Management, Logout after 10 minutes of inactivity are implemented into the web application. They are implemented based on the eighth and eleventh suggestions in the last question from the user testing.

### Share to social media

Apart from that, sharing to social media is also implemented in the web application. This is implemented based on the ninth suggestion in the last question from the user testing.

### Host remotely

Last but not least, hosting the web application remotely is one of the features that is implemented because of the suggestion obtained in the user testing. The feature is implemented based on the tenth suggestion in the last question from the user testing.

### Quiz

Another function that I achieved in the implementation of this project is the personalized quiz according to the weakness of players. This function works by increasing the questions according to the category of GDPR that the player is weak in.

In the question in the first level for the quiz in a gamified tool for teaching GDPR, the web application will pick two questions randomly in each category from the database. This makes the first level have eight questions. When a player completed the quiz, the number of correct questions scored for each category will be stored in the database. In the second level of the quiz, an extra question will be picked from the database and the category of the question will be the one that the player has the lowest score.

Other than that, the questions to prepare the player to take the Certified Information Privacy Professional/Europe (CIPP/E) are also included in the quiz. Having a CIPP/E certification is very important if the individual is a privacy professional. This is because,

CIPP/E certification can help individual to demonstrate that they have a deep understanding of European data privacy and data protection matters.

## Problems Encountered

### Design of interface

One of the problems that I encountered is the design of the interface. I have very little to no experience in designing an interface for a web application. I faced this problem by referring to other website for their design. After that, I draw out the prototype of the web application using an online interface design tool, Figma. Figma was introduced by my friend as she had experience designing web applications during her internship last year.

### Bootstrap

Before starting this project, I have no experience in writing code using Bootstrap. Even though I heard of Bootstrap before, I have no chance to try using Bootstrap in designing a web application. Writing code using Bootstrap is a totally new experience for me and I learnt Bootstrap in various ways. The first way that I used to learn Bootstrap is by learning it from an online course. I bought an online course on Udemy and watched the video almost every day. Figure 2.0 below shows the online course that I bought from Udemy to learn Bootstrap.

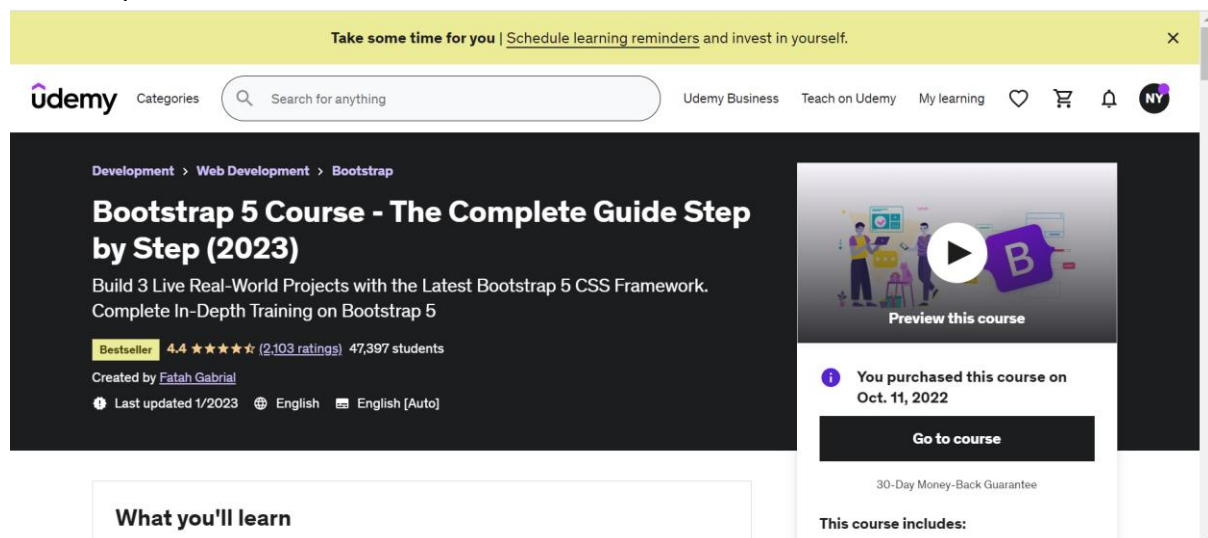


Figure 2.0: Online course that I bought from Udemy to learn Bootstrap.

The online course is clear in explanations, and I like it. However, the whole online course is around 24 hours. I think I will not have enough time if I start implementing this project after finishing the whole online course. Therefore, I start implementing the project using Bootstrap and making use of the official website of Bootstrap when I don't know what code to use to make the design as planned.

## Programming logic

I struggled with the programming logic when writing code for this project. I realise this weakness in me even before I started implementing this project. Therefore, I made use of the time I have during Christmas break and start the implementation as soon as I can.

During Christmas break, I planned to do one page of the web application per day. Sometimes the plan goes as I planned and there are times when I was stuck in thinking of the programming logic. I solved this problem by listing out the function I wanted to achieve on the page on a piece of paper. Then, I will list out the possible steps that are needed to get the function.

For example, when I was writing code for the badge function on the player profile page, I write down the points to get to different types of badges and list down the steps before start writing the code. Figure 2.1 below shows the picture of the functions and steps I listed for the badge function on the player profile page.

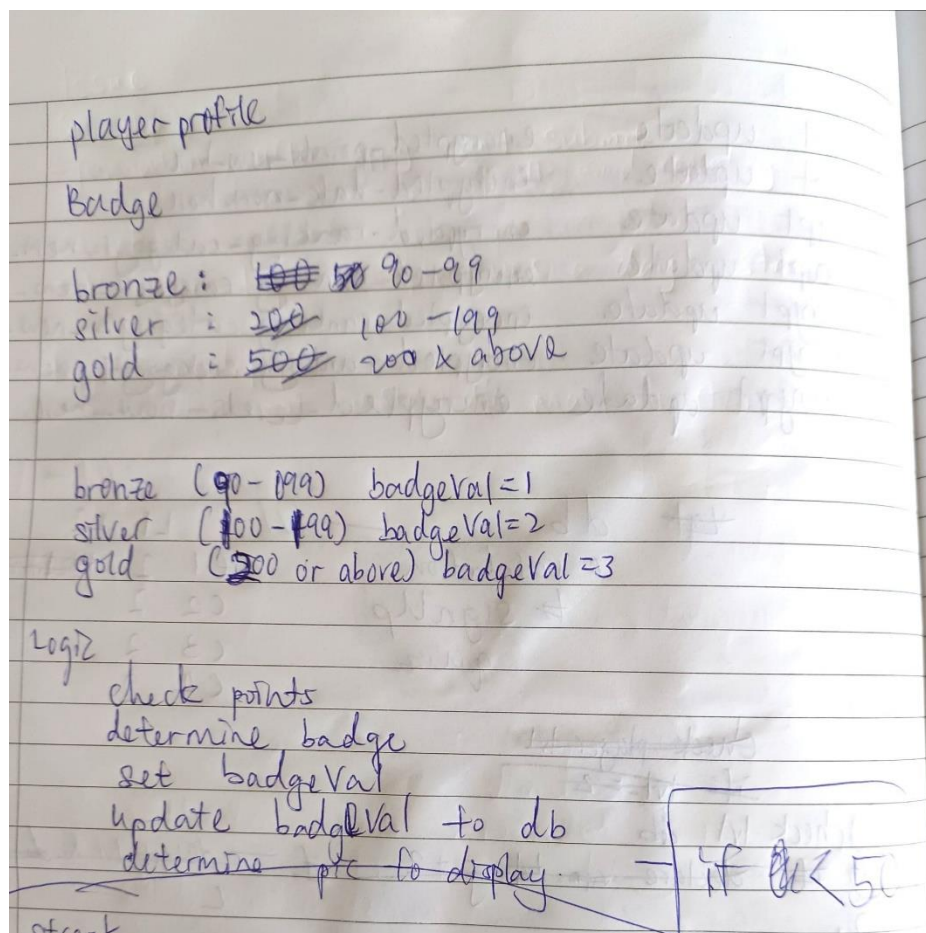


Figure 2.1: The picture of the functions and steps I listed for the badge function on the player profile page.

## Quiz

One of the most challenging pages for implementation that I found in this project is the quiz page. I spent almost a week solely on this quiz page. I think this page is hard because of the complexity of the page. There are a lot of requirements to retrieve the question from the database. They randomized the questions in the database, personalized the question according to the weakness of players and displayed the levels on the quiz page. What makes everything even harder is that all the data for the players are either hashed or encrypted. I solved this problem by writing down the logic as I did for other pages and took a small break when I was stuck writing the code.

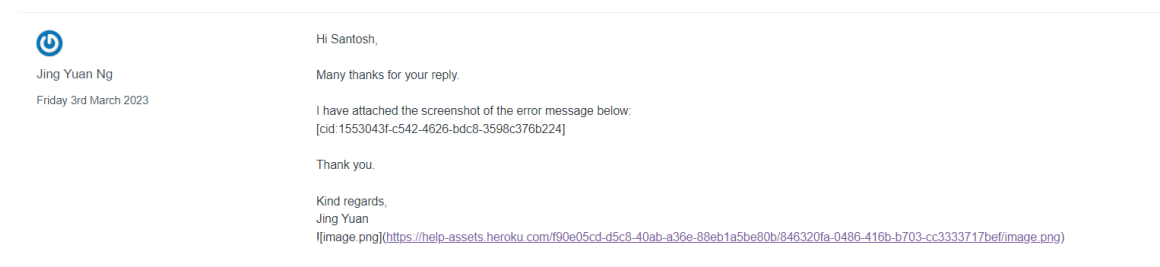
## Send email

There is a function in this project that needs to send out an email. From what I found on the Internet, sending an email can be done by using PHPMailer. For PHPMailer to work, “less secure app access” in that Gmail account has to be disabled. However, Google has turned off Less Secure App access on May 30, 2022. Because of that, the sending email for my project was not working. I told my project supervisor about this problem, and I tried the solution I received from him, but it still didn’t work. I discussed this problem with one of my friends and we found a solution on the Internet. I followed the steps as shown on the web page and the email can be sent using the web application. Basically, I solved this problem by turning on the 2-step verification in the Gmail account and using the app passwords as the password for the code I wrote.

## Hosting

Another problem that I encountered when completing this project is the hosting of the web application remotely. I found a platform that enables users to host apps on it. Since there is a student plan which allows students to host the apps for free on the platform, I planned to host this project remotely using this platform.

At first, I was having problems connecting the web application to the database remotely. After doing research and trying and error, I managed to connect the web application to the database remotely. However, I was having difficulty hosting the web application on the remote server. I searched the Internet for almost a week, but still cannot find the solution to that. Therefore, I created a ticket to customer support from Heroku to get help to solve the problem. Figure 2.2 shows the conversation with customer support from Heroku.







Santosh

Friday 3rd March 2023

Hello,

Seems like you're experiencing issues with ClearDB, please attach a screenshot of the error message you're seeing. To best assist you, I've asked the ClearDB MySQL Database team to look into this. They will be in touch as soon as possible.

Thanks,  
Santosh



Jing Yuan Ng

Friday 3rd March 2023

Hi Santosh,

I have trouble connecting using Postgres but I managed to connect to a ClearDB server now. But I am still getting the same error message.

Hope to hear from you soon.

Thank you.

Kind regards,  
Jing Yuan.

[image.png](https://help-assets.heroku.com/f90e05cd-d5c8-40ab-a36e-88eb1a5be80b/f139cb34-83a1-4e06-ba5d-75e410c7c6ae/image.png)



Jing Yuan Ng

Thursday 2nd March 2023

Hi Santosh,

I have followed the instructions mentioned in the document to establish a connection from my app logic to the database. But I still get the same error when pushing the app to Heroku main. The code is attached as the screenshot below:



Santosh

Thursday 2nd March 2023

Hi Jing,

Welcome to Heroku!

You'll have to follow the instructions mentioned in this document to establish a connection from your app logic to the database: <https://devcenter.heroku.com/articles/connecting-heroku-postgres> (language-specific instructions).

Let me know if I can be of any further help.

Regards,  
Santosh



Jing Yuan Ng

Wednesday 1st March 2023

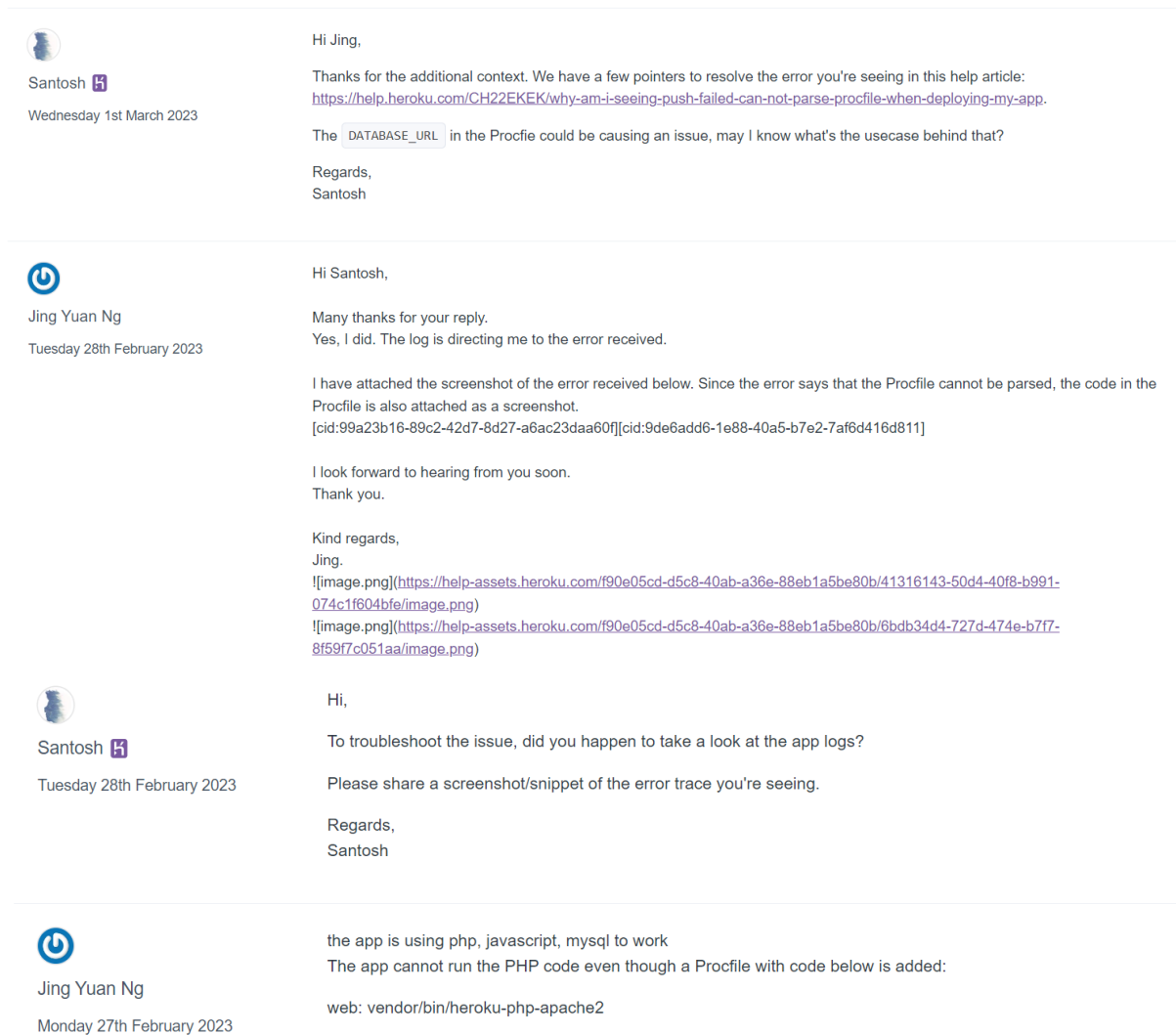
Hi Santosh,

Thank you for your reply.

I am still new to Heroku so please correct me if I am wrong.

The Database\_URL is there to connect the web application to the database and it is from the Config Vars under the app settings in Heroku.

Kind regards,  
Jing Yuan



*Figure 2.2: The conversation with customer support from Heroku*

I didn't get a reply from the Heroku team that is responsible for the add-on I used. I searched online for some solutions and cannot find any that can solve the problem I faced. Therefore, I decided to switch platforms to host the web application.

I found some other platforms to host the web application such as AwardSpace, 000webhost or FreeHost. However, they are either hard to use and do not provide a free domain or subdomain name. In the end, I found a platform that provides free subdomains and free SSL certificates called InfinityFree. I used InfinityFree to host the web application. However, the problem that I had with hosting the web application using InfinityFree is that the old version of PHP was used by InfinityFree. The composer used by phpmailer and the library for Google Two Factor Authentication needs a PHP version of 8.1 or above to run. To upgrade the version of PHP, I need to pay a certain amount of money to InfinityFree and I don't want to pay for hosting as there is a risk that the hosting will not be working even though I paid for InfinityFree. Therefore, the function of sending emails and enabling Google Two Factor Authentication is not working when the web application is hosted using InfinityFree.

Figure 2.3 below shows the PHP version that the composer used by the phpmailer needs.



Figure 2.3 : The php version that the composer used by the phpmailer needs

Meanwhile, figure 2.4 below shows the amount of money that needs to pay to upgrade the PHP version in InfinityFree.

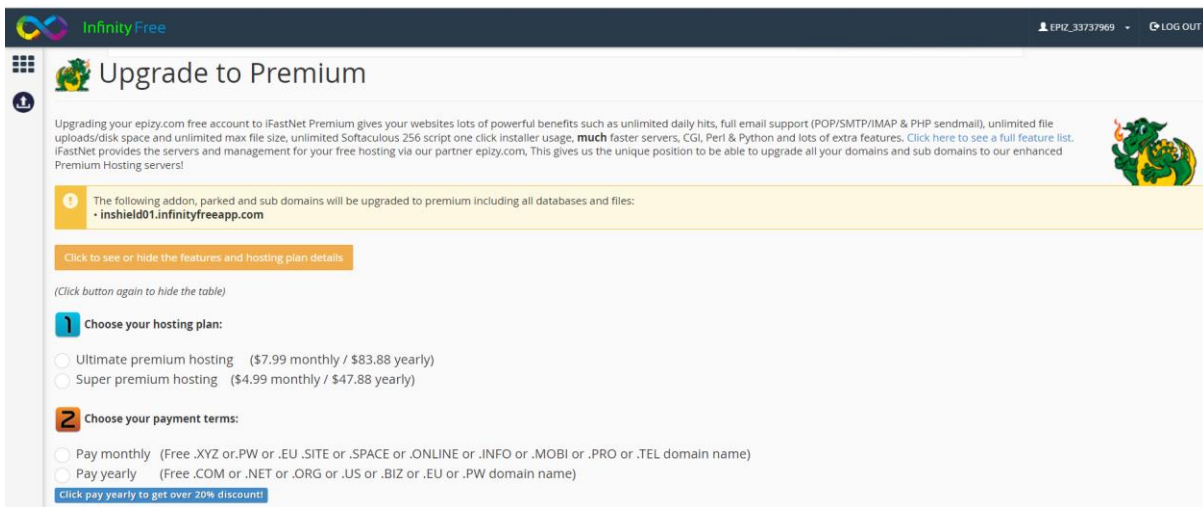


Figure 2.4: The amount of money that needs to pay to upgrade the PHP version in InfinityVersion

I told my project supervisor about this issue that I had, and he reached out to the IT department in the college to ask for hosting credentials. In the end, I managed to host the web application in Plesk using the credentials received from the IT department.

## What I learned

### GDPR

The first aspect that I learned when completing this project is General Data Protection Regulation (GDPR). Even though I learned some basic knowledge about GDPR last year in my course, I realised that I gain more knowledge on GDPR after completing this project. This is because I did a lot of research when completing this project.

### PHP

The second aspect that I learned when completing this project is PHP. Even though I have a basic understanding of PHP, completing this project makes me understand the programming language even more by implementing it in a project. I am more knowledgeable in PHP and can make a web application from scratch after completing this project.

### Decision making

I learned to make decisions by including part of my research into the implementation of this project. There are a lot of areas that I look at when doing research on GDPR. However, there is impossible to include everything in the implementation of this project due to the time I have. I learned to make decisions about the topics that consider important and to include them in the implementation of this project.

### Planning, time management

I realised the importance of planning and time management when completing this project. It is very important to have feasible planning before starting to do any aspects of this project, whether about the documentation or the implementation of this project. I learned how to complete a document before the due date. For example, I know the due date to submit the research document. After determining the section that a research document should have, I complete the research document section by section weekly. This is to make sure I was not overwhelmed by the depth of the research that should be carried out and can complete everything before the due date.

### Discipline

After having good planning, I need to have the discipline to stick to the plan. To make sure that I stick to the plan I have for this project, I will make sure that I work on this project almost every day.

### Troubleshoot skills

Even though I have experience writing code using PHP, I did face difficulties when writing code using PHP. When I was stuck writing code, I learned to take a small break to refresh my brain before trying other ways to solve the problems in the code. When facing some errors that I cannot solve after trying for a few days, I learned to escalate the problem to others that have experience. For example, I will ask my project supervisor, my friends, or even the customer support from Heroku when I have difficulty in solving some error that I faced even after trying a lot of solutions.

### What I would do differently if starting over

I would log the problems that I encounter and take screenshots when problems arose. This would be easier to demonstrate the issues that I faced and how they were overcome.

Next, I would also spend some time revising other subjects from time to time in my course. I spent way too much time on this project and barely spend time revising other subjects when completing this project. This has sometimes caused me to have trouble understanding the content of the subject in class. If I had a chance to start everything over again, I would spend some time revising other subjects from time to time in my course.

## Declaration of Plagiarism



I declare, this document in this submission in its entirety is my own work except for where duty acknowledged. I have cited the sources of all the quotations, paragraphs, summaries of information, tables, diagrams, or other material. This includes software and other electronic media that is integral property rights may reside. I have provided the complete bibliography at the end of my document detailing all the works and resources used in the presentation of this submission. I am aware that failure to comply with the Institute's regulations governing plagiarism constitutes a serious offense.

**Student** : Ng Jing Yuan – C00278713

**Project Supervisor** : Dr. Joseph Kehoe

**Institution** : South East Technological University

**Title** : Final Year Project – Final Report

**Submission Date** : 17<sup>th</sup> April 2023

---

Signature

17<sup>th</sup> April 2023

---

Date