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# Applied Project and Minor Dissertation

**Final Year Project**

**B.Sc.(Hons) in Software Development**

**By**

**James Nelly**

**Brendan Toolan**

**Advised by Mark Campbell & Brian McGinley**

Department of Computer Science and Applied Physics Galway-Mayo Institute of Technology (GMIT)

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## Introduction

This is the introduction section of our documentation of our Applied Project and Minor Dissertation project.. For our final year project we both decided to work together and do a joint project for this module. We are doing a web based application that will allow people in the general Galway area to be able to book a driving lesson with an instructor online. The user will be able to register with the website and input their details to sign up. The details that the user will be required to input will be their First name, Last Name, Email address and also to set a password for their account. Once the user has logged in correctly after signing up, they will be brought straight to the locations page of the website where they are able to select on the various locations in the Galway area based on their own location, from there a list of instructors who are in that area will pop up and there information is displayed like there name and email address and phone number. On this page you will be given the option to make a booking with the instructor or delete a booking. (**Adding a booking)**. When making a booking the user will have to pick a date and time for their booking also they can give the booking a title like “first lesson” or “second” etc. **(Delete a booking)**. Once the user has clicked on the delete button they will be able to find the booking they made earlier and delete it with ease. All they have to do is click on the booking and click on the delete option. Also have the other option of editing the booking only if you had made one beforehand. Once you click on the add edit option you will then be able to change the time and date that you would like to book and also the title if you want. Also there will be an option in the header of the web page to logout of your account after you have completed the action that the user wanted to do. Another bit of functionality we have added is the confirmation by Email for the booking you have added and also when you have cancelled a booking. Once the user has finished their booking they can then logout of the website. Our project will consist of a couple of elements, the framework we will be using is Angular the database which we have chosen is MySQL the server we are using is node and we intend to implement this on the cloud. For the cloud service we will be using Google cloud.

## 1 The Idea

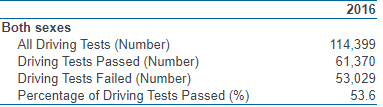
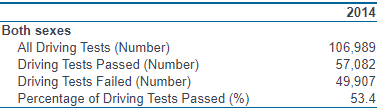
When coming up with ideas for the project we were going to do for our dissertation, at the same time the two of us were in the middle of completing our driving lessons and had our driving tests booked. We both came up with the idea that there was no real platform or website that we could go onto and book our local driving instructor. At this time the only way to get contact with a driving instructor was either to hopefully get their contact details of someone who had got their lessons off them or if you were lucky they may have a facebook page. We felt that this method of trying to find an instructor was not efficient. We then came up with the idea that we would make a website where you could book an instructor within your area of Galway. You could search through all the different locations and find the location nearest to you, and then you could then find an instructor in that location and book, cancel or edit the booking that you have made. Also the user would be able to make an account to register for the website, provide their details to register and that it would be easier to track the various bookings on the website once they had logged in.

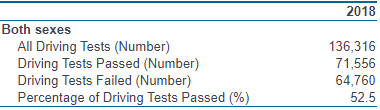
## 1.2 Formulating the solution

When we came to the design of the solution, James got in contact with some of the instructors and asked some questions about how they do their process of booking people for their lesson, and how they slot them in for the week ahead and making everything go as smoothly as possible. Some of the questions I asked were how to handle bookings if you have a busy schedule, also what if there is a cancellation how do you deal with this. Also on how payment is carried out for the booking.At this moment in time none of the instructors that James asked did not have a system or website to carry out the functions they need to book customer’s for lessons. Many of the instructors were using the old fashioned way of keeping the booking’s in their diary and using it as their scheduler. They would take a phone call from a customer and give the customer a date which suited them for the lesson and would take their name and phone number. Most of the instructors had a rule of where they would like to have a day or two notice if the customer wanted to cancel or change the booking to a different or later date

## 1.3 Why there is a need for this website

When we were doing research for the project we wanted to know the number of people who were doing their driving test yearly, we wanted to know the statistics. We found some interesting numbers on the Central statistics office website which gave us most of the information that we wanted. We noticed over the last few years there has been a steady increase of people applying to do their driving test.





With these numbers we could see that the number of people taking the test increased quite a lot. Which led us to believe that there is such a need for a website/platform. This website could facilitate many people who need to book their instructors in an easy and efficient way. These numbers could easily hit 150,000 by the year 2020. The app would also be useful for the driving instructors, as the app would keep information and then remind them of any appointments that have been made through the app.

## 1.4 Level 8 project

We believe this project that we will be undertaking will test our skills as there are quite a few elements that need to be developed in order to have the project up and running at the acquired level. To facilitate some of the elements will be split between the two of us, we came to an agreement that James Nelly would be undertaking the angular development the various functions need to be designed like the connection between server (backend) and the mysql database, and also the various get post and delete methods that are needed for the website. James would also be undertaking the task of setting up the cloud services for the website.This will be carried out on Google Cloud. In the last few years we have developed different applications whether it be a CRUD **(Create, read, update and delete)** application web application or a game application. We believe we have acquired the skills to tackle the problem we have created, and that we will build a viable solution. Brendan would take on the task of creating a register and login system for the project. This will let the user register with the web page. The user will be required to put in their name, surname, address, phone number, email and then create a password for the account. Once done the user can log into their accounts by entering their email and password. The login is made to recognize any existing users. If someone who had registered before logs in, then it should return an error saying that its an invalid email or password. The user information will then be sent to the database. Brendan researched online on how this could be done. From online Brendan found out that the use of JWT( JSON Web Tokens)would be suited for this as there was much documentation available on how to make them work with angular. A JSON Web Token is commonly used for authorization and is an efficient way of securely transferring information between two parties.

## 1.5 Chapter Descriptions

**Methodology**

In this chapter of the documentation we will discuss the methodology that we used in the development of our project and how it has aided us in the development process. The methodology we used was agile, it helped us to increment development on a weekly basis and to keep workflow moving consistently.

**Technology Review**

In this chapter of the documentation we will discuss the different technologies we used for the development of our project, and we will explain why we choose these technologies for our project. We will be describing how these different technologies played a role in the development of the project and how they worked together and why they did not.

**System Design**

In this chapter of the documentation we will discuss the architecture of the project, we will be discussing the research that went into the construction of the project. We will be discussing how all the elements interact with one another. Also there will be aides and diagrams describing the layout of the project.

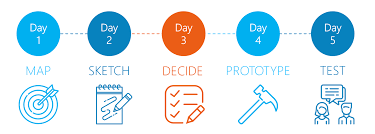
**System Evaluation**

In this chapter of the documentation we will discuss how we tested out our project to see if we can find any limitations and to see how robust or website is. We will discuss some of the ways we went about testing our project. Tables and graphs will be provided for visual results of our completed testing.

**Conclusion**

In this chapter of the documentation we will discuss the conclusion of our project, we will discuss the outcomes of the project. We will reflect on the various problems we came across and the solutions that came with them and also the knowledge we have gained from doing the project.

# Methodology



## 2.1 Overview

In this section we will discuss the approach to the development of the project, describe the methodology that was used and how we implemented it and also talk about how the development of the project progressed in the end. At the end of this chapter the reader should be able to have a good impression of the scale of the project and the necessary steps that were taken throughout the project. For our final year project we both wanted to use an constant design process to which that changes and issues could be kept accounted for and so that we would be able to deal with them when they happened in a easy and dynamic way. As a result we decided to use the Agile method would the best fit for us as we had both had experience and knowledge of it from our previous years from the course. The Agile methodology is a certain approach to the management of a project which is greatly suited to us doing any project in Software Development. In using this method it will help us to come up against any problems or difficulties such as code errors, changing the format of the project so as to suit the clients demands etc. Agile uses work sequences that are call ‘Sprints’ which is a course of time that’s designated for certain stages in the development of a project. When creating a project, time is an important factor especially when one does Software Development so the idea of using Sprints is very important.

Something that we both liked about the Agile Methodology is “Stand Ups”. This term is used to describe daily meetings about the progress of the development of a project. Seeing that both of us we were in the same course we would be able to communicate with each other face to face during our breaks and lunch breaks. We also did this with our supervisors but instead of daily meetings we limited our time with them to once a week as they were not able to meet us on a daily basic due to their schedules. We used these meetings as a way to discuss the progress of the project and as way to make sure that we were individually keeping on top of the development of the project and to see if as a group that we be able to solve any problems that we might of have. And also was a very good technique to keep all informed.

## 2.2 Idea

## Before we decided on what the project would be both James and Brendan were assigned a different supervisor each so they both had separate ideas before coming up with the end product. James and Brendan decided to do a joint project together so as to split the workload between the two. We discussed potential ideas for what we can do for our final year project, and examined what problems that we could come across during the development of the project and how we could be able to solve said problem and the manner we would do so. We also researched what programming languages that would be best suited for us to use and what technology that can be applied to us.

Brendan's first idea for the project was to do an application that would help people cut down on smoking as he saw that a lot of college students smoked and thought that an application as such could help. James had come up with the idea of an application/or website that restaurants/hotels could be able to order food and kitchen supplies from. However we both were unhappy with our initial ideas as we could not see how we would be able to make them stand out. In the end we decided that the project would be an application/website that would let people book driving lessons from certain driving instructors in the Galway area.

Once we had the idea of what our final year project sorted out we both went into the next stage which is the research phase.

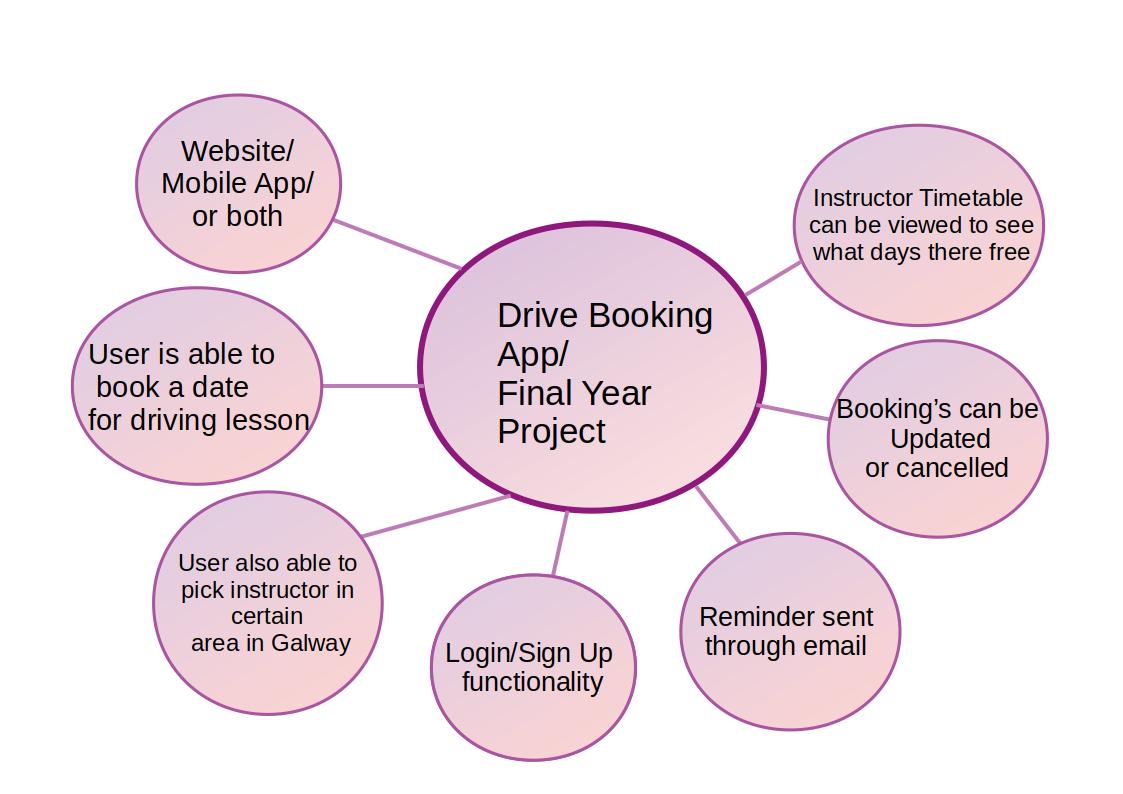
## 2.3 Research

The next stage focused on us going through and researching what would be best needed for the project, i.e. what programming language to use, what program to use and see if there are any external libraries or resources that could be used to help us improve the general scope of the project.

The types of research that we undertook ranged from going online, reading articles, videos on YouTube, forum posts on the website Stack Overflow and as well as peer-to-peer asking our fellow students about their how they felt using certain programming languages in the past and experiences with programs. We also used our time that we met with our supervisor's to ask them their opinions on the subject. We also took advantage of the library in GMIT to go through the books that may be of help to us in the development of the project.

We decided that the best way to develop the project was to use the program ‘Visual Studio Code’. We both had experience in using this program from previous years in college and is multi-platform for both Windows and Linux users. And almost any programming language could be used on it such as Flask, JavaScript and Typescript. It also has a built-in terminal available to users.

We looked into programming languages we could use for the development. We both had agreed to be open to using a programming language that we had never used before so we could be able to learn a new language along the way. We made a list of languages that we could potentially use in the development. For this we had booked rooms in the GMIT library so as we could go through documentation of various programming languages and see the pros and cons of each language. Here we created for ourselves a mind map so we could get a greater scope and understanding of what we both wanted for the project and go about to developing it

**Mind Map**

We made the decision to use Python Flask as we started to use it in another module during this time. However this was later changed into using Angular and node instead as we had experience with it and there was much documentation on it available for us to use. It also seemed to be better suited for the development of the project seeing as we wanted a back-end and front-end for the project.

We also looked into what we could use as a database so as to store information. We decided to use MySQL, an open source relational database management system that’s open source and free. We also were taught about MySQL the year before so we both have some know-how on it.

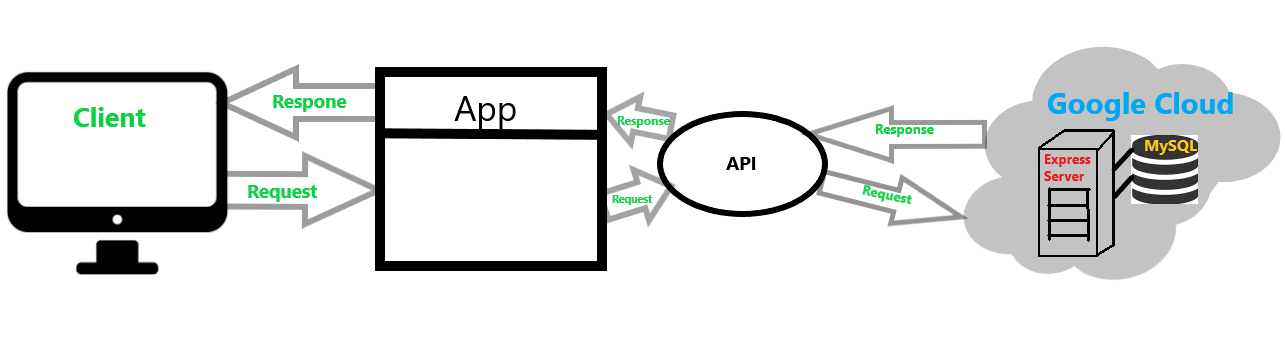
## 2.4 Initial Development

First off we had set up a Github repository that we could store, push and pull the code during the development of the project. When we decided on a framework that we were both happy with we moved onto the groundwork's of the project. To stop the problem of version control we used Github that both of us have considerable experience in using it for past projects. Both of us were then added as collaborators so that we both could work on the project seeing that we live in separate parts of the country.

## 2.5 Weekly Meetings

Each week during the development and thought process of our final year project both Brendan and James attended weekly meetings with their supervisors at certain days and times that suited both parties. During the first semester We all had agreed that one week that both James and Brendan would meet up with Brendan's initial supervisor Mark Campbell at 2pm in prefab 18 on the GMIT campus and then the following week the two would then meet up with Brian McGinley James initial supervisor on a Tuesday at 1pm. This arrangement would continue during the first semester where we would meet one of the supervisor’s a week. Once the second semester began, time was more flexible for all four people to meet all together. We arranged that we would meet every Monday at 2pm in the canteen. As a result of the Covid-19 Pandemic, GMIT had to close campus for students and staff for the health and safety of those people. However through the use of Microsoft teams we could still have our weekly meetings online from our homes. The purpose of these meetings were so that we could chart the progress that we were making with the project with our supervisors. This was also time that we could get feedback from our supervisors to see what direction we can go with the project, their opinion on the progress we had made from the week before and check in with them to see if they would be able to help us with any errors that we might be having with the project. After each of these meetings we would then email both supervisors a summary of what was discussed in the meeting.

# Technology Review



## 3.1 History of booking systems

The idea of booking systems first came about in the 1960’s, when IBM **(International Business Machines)** developed a system called Sabre. This system could handle reservations and the seat inventory. The system was developed for American Airlines. This system was developed as there was an influx of people wanting to travel, before this system was developed the system that was in place before hand was very labour intensive, the booking operator could be on the phone with the customer for one hour and thirty minutes, this operation took a very considerable amount of time and was not effective as there were a lot of demand for bookings and there was not enough booking operators to carry out these tasks. The way in which the system carried out these tasks goes as follows. The passengers' details were inputted into the system and then stored on disk storage, they were then retrieved from disk storage using a gross and a fine index, the gross index containing pointers to all American flight numbers by date, and the fine index referring to individual passengers booked on their respectable flight. [1]



## 3.2 The Angular Framework

## **3.2.1 Background on Angular**

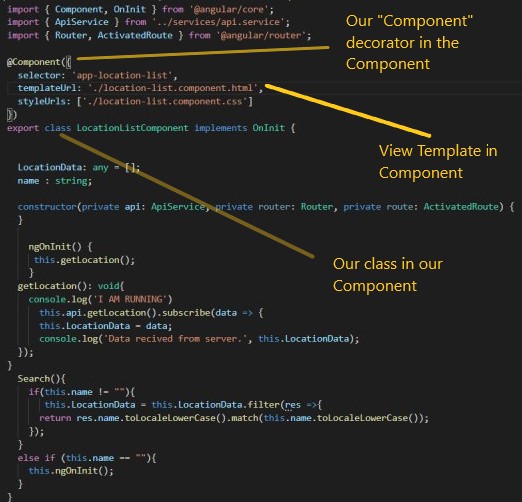
Angular is a TypeScript based open-source web application framework which is being led by the Angular team at Google and by a community of different individuals and various corporations. It was released in 2016 which will make it 4 years old this September. It was released on Version 2 at this moment in time, it is on version 9 it was just released, and offers many new improvements with the framework. Some of these improvements are better debugging, improved CSS class and style binding, improved type checking and improved build errors.

## **3.2.2 Why we used the Angular Framework**

When we decided that we would use the Angular Framework we did not have long to think about it as we had used it before in previous modules. We had some knowledge on the inner workings of how an angular application would run, and also we knew that there were different components, services, modules and routing paths that would have to be used and configured for our project to take off .

## 3.3 Using components from angular in our project

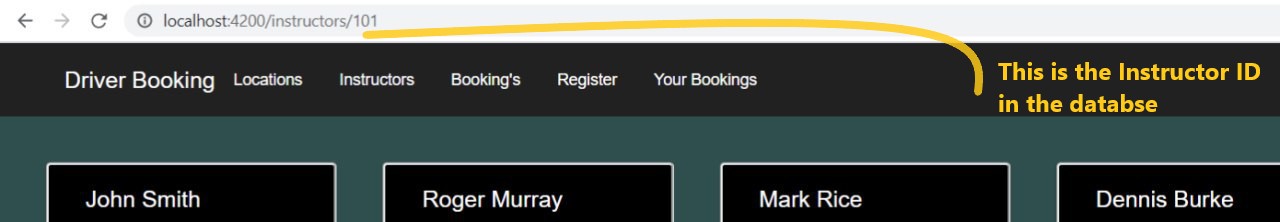
Components are the basic building blocks of an angular application, there are 3 elements to a component first you have the template. The template defines the user interface containing the html. The second element is the Class contains the code for the view template, just like any other class in any other programming language, the class element contains methods and different properties for the application. The last element in the component is the decorator, the decorator adds metadata to the class to make it an Angular component. In our application we have many components that carry out different functions. The picture below is an example of the use of the component we have set up to show a list of locations. There is a method getting the locations and we have properties to store the location data and another property to the name of those locations. There is another function to to search the name of locations to filter them on the html page. [2]

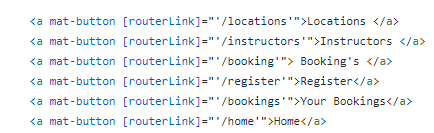


## 3.4 Using Routing from angular in our project

Routing is quite nested in our application and it's implemented in many components. Like for instance on the locations page there are links to the different locations which bring you to the various instructors that are in those location’s. Routing allows the user to navigate from one view to the next as users perform application tasks. The way I implemented routing in my application for the Location page was that I used the Location id from the database, and performed a select method in the database to get the location id of all the Instructors in the database, this function was carried out in the server. The API **(application programming interface)** then requested this data from the server. The data was then relayed back the Location logic and then displayed in html for the user. The steps to do this in the application are carried out very quickly. Another element from the routing aided this was the ActivatedRoute where in this case the data was injected into the url to display the data in the html.

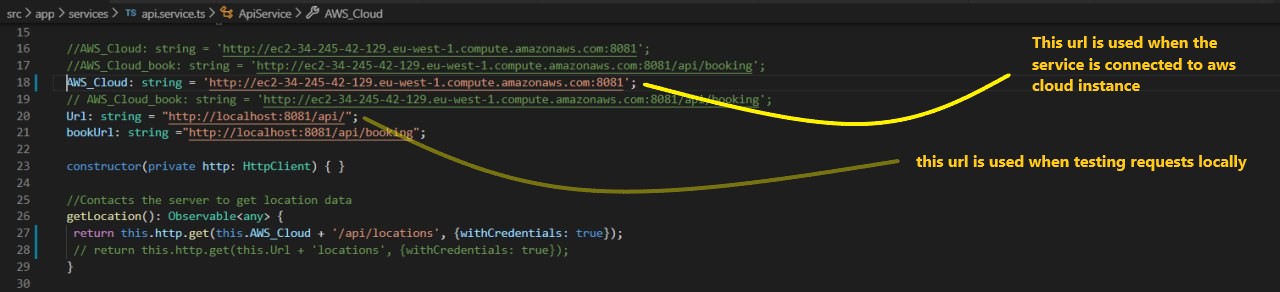
The Routing was also implemented into the instructor page where the same kind of action occurred above but in the database I used the select method in Mysql to get all the instructors in that table and in turn it displays all of the data on the html. Also implemented in the navigation bar is a link to all the different pages. To navigate to them you just have to click them, but they are using the routing module and the directive that is being used is the RouterLink, it is used to link the various routes to one another. Another advantage of using RouterLink is that the page will not lose its state. [3]





## 3.5 Using Services from angular in our project

The Service component is widely used in our project. We have two main service classes, the Api class and the Auth class. The angular service is a stateless object and it also provides very useful functions. The functions can be invoked from any component that has been setup correctly. The Api Service that I have setup is in contact with the server and carries out various CRUD operations that are needed in our project. Another module that is needed to make this work is the HttpClientModule. This module offers a simplified client HTTP **(Hypertext Transfer Protocol)** API for Angular applications that rests on the XMLHttpRequest interface exposed by browsers. The Api service handles the data when it is connected to the aws cloud service. It is accessed through the public DNS **(Domain Name System)** assigned to the instance that was created in the aws cloud [4]



## 3.6 Languages used in our project

### 3.6.1 Typescript

TypeScript is a language for application-scale JavaScript. TypeScript adds optional types to JavaScript that support tools for large-scale JavaScript applications for any browser, for any host, on any type of OS. TypeScript compiles to readable, standards-based JavaScript. TypeScript is also an open-source language developed and maintained by Microsoft

**Why Typescript**

We have both used TypeScript quite a few times during our years of college and we are familiar with some of the aspects of this programming language. I found that the readability of the code was good, there is also plenty of documentation online that helped with some of my problems. [5]

### 3.6.2 Javascript

JavaScript was designed by Brendan Eich and it first appeared 24 years ago. Javascript is a client scripting language which is used for creating web pages. It has curly-bracket syntax, dynamic typing, prototype-based object-orientation, and first-class functions.

**Why Javascript**

I had Some Knowledge in using JavaScript.I used last year in one of our projects, we mainly used to develop our server. There was quite a bit of documentation on it and many resources. The development of our server was implemented with the JavaScript language. The different methods and functions used hard at first to create but once you were researching it and trying different solutions it all started to flow smoothly.

### 

### 3.6.3 HTML

Hypertext Markup Language (HTML) is the most common language used to create documents on the World Wide Web. HTML uses hundreds of different tags to define a layout for web pages. Most tags require an opening <tag> and a closing </tag>.HTML was first developed in 1990 and it was developed by WHATWG (The Web Hypertext Application Technology Working Group). This group was founded by individuals from Apple inc, Mozilla Foundation and Opera Software

**Why HTML**

We have used HTML on numerous occasions during our four years of college, we have grasped many elements of this programming language and had enough understanding to use it for our project. With this programming language there is endless amounts of documentation, tutorials and resources on HTML.

### 3.6.4 CSS

CSS is a language used to describe the presentation of Web pages. With CSS you can change colors, the font and the general layout of the web page. Also with CSS you can adapt the one web page to many devices whether they have a small screen or a larger one. The initial release of the language was in 1996. It was developed byHåkon Wium Lie; Bert Bos; World Wide Web Consortium. CSS is the cornerstone language of the World Wide Web.



## 3.7 Using MySQL database for our project

## **3.7.1 Background on MySQL**

MySQL is an open-source relational database management system. It was developed by tye Oracle corporation and it was first released in 1995. It was written in the C programming and C++ programming language.

## **3.7.2 Why we used MySQL**

We had worked with various databases through our years in college. In one module we used Neo4J database and also in this module we used MySQL, in this module we got a flavour for those 2 separate databases. In another module we worked with MongoDB and we touched upon this but did not go into great detail with it. Then in our 3rd year we had a database module which was mainly focused on the MySQL database. We gain more knowledge and understanding of the workings of the mysql database that is why we decided to choose this database for our project. Also there is lots of documentation on the web. This came in useful as it solved most of our problems when we had to connect it up with express server

## **3.7.2 Our MySql setup**

The database we created there are four tables, the first table is the locations table which holds the information of the different locations in the Galway area of the number of instructors in those locations and each location has their own Location ID and a picture of the location. The next table we created was the Instructor table that has all the data about each instructor, their name, email, phone number, the location they are situated in and also a picture of them. Our next table is the users table which stores the users who register for the website they register with their username and a password. The last table is the booking table which holds all the bookings made by the users. It stores the instructor that they have picked, the date on which the booking is, the start time of the booking and also the end time of the booking

## 

## 3.8 Using Express server for our project

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## 3.9 Using Aws cloud for our project



## 3.10 Using Postman for our project

**References**

**[1] Head, R. V. (2002). Getting Sabre off the ground. IEEE Annals of the History of Computing, 24(4), 32–39. doi:10.1109/mahc.2002.1114868**

**[2] https://angular.io/api/core/Component**

**[3] https://angular.io/guide/router**

**[4]** [**https://angular.io/tutorial/toh-pt4**](https://angular.io/tutorial/toh-pt4)

**[5] https://www.typescriptlang.org/docs/home.html**