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# Chapter 1 – Introduction

## A brief synopsis of the project context

 My project has been based on Ger’s Garage brief provided by CCT College. The requirement which must be accomplished, was the creation of a website to register the tasks that the garage owner (Ger) and mechanics must perform daily as a part of their job. Specifically, Ger wants to automate the process and the flow of customer information. Furthermore, his objective is digitizing the data for proper use and organization in a computer.

Ger’s carries out check-up/services for all kinds of small to medium vehicles, such as motorbikes, cars, small vans and small buses.

Ger also has staff who are responsible to carry out many types of services performed in the garage. For example, air filter change, extensive brake inspection, electrical component tested, engine oil, among other things.

On the other hand, Customers can register on the website and book their vehicle in for services/repairs. There are 4 types of bookings: 1. Annual service, 2. Mayor service, 3. Repair/Fault and 4. Mayor Repair. Customers also need to provide some details about themselves and their vehicles for the registration process. Then, they can choose a date/shift to book the vehicle registered. Once, the appointment is made, they will need to see information about their booking such as status, date, booking number, etc.

The number of bookings allowed per day is limited, and every mechanic can carry out at most 4 services/repairs in one day. If the booking is a Mayor Repair, then this will count double.

Finally, Ger also needs to have an admin user to register information related to management. These ones are allocating costs to each booking, display bookings, print invoice and allocating mechanics to bookings. The invoice printed is not an official document, it is just the detail of the work carried out and/or the items used for the service/repair, because the actual payment is performed on another system.

## General areas of computing that project context covers / requires knowledge of

Firstly, the project requires knowledge of software development life cycle because (SLDC) which explains how we create apps. This SLDC is divided in stages which are: plan, analyses, design, development, coding, testing and maintenance. Particularly, SLDC defines a methodology which details what to do in each step.

There are many methodologies or models such as waterfall, spiral, iterative, agile, etc. Their goal is to deliver high-quality software. This project does not require so much knowledge about these models, but at least requires stages know-how and how we are going to do the project, in other words, a plan.

Secondly, we must have knowledge about software architecture (Client - server) to understand how to develop the website, what programming languages are used on client and server, and database connections.

Thirdly, website security which allow us to reduce the risk of being hacked. This concept is getting more and more important nowadays, because there are many people out who wants to steal information or destruct systems/files. Therefore, this is another topic which require knowledge if we want to develop an application web. The most common threats are:

1. Cross-site Scripting (XSS)
2. SQL injection
3. Cross-Site Request Forgery (CSRF)

We also can mitigate many of the more common vulnerabilities doing the following:

1. Use more effective and secure passwords
2. Configure our server to use HTTPS (HyperText Transfer Protocol Secure)
3. Use [vulnerability scanning tools](https://owasp.org/www-community/Vulnerability_Scanning_Tools)

Fourthly, we need to know how to deploy a web application on a server, or at least we have the minimum knowledge to interact with Software Deployment Administrators.

Therefore, this project covers the following fields:

1. Integration development environment (e.g., Visual Studio, etc.)
2. Software development life cycle (analysis, design, implementation and testing)
3. Diagrams/design tool (e.g., Entity Relation Diagram, use cases, Wireframes, etc.)
4. Relational Database Management System (Workbench Mysql)
5. Tools (e.g., balsamiq to create wireframes)
6. Libraries (JQuery, bootrstrap, etc.)
7. Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS)
8. User Interface and User experience design
9. Programming Languages - client-side and server-side (e.g., Javascript, php, etc.)
10. Protocols (e.g. Hypertext Transfer Protocol Secure (HTTPS))
11. Frameworks (e.g. Django)
12. Algorithms
13. Website security
14. Client-server Architecture
15. Software Deployment (e.g., web application)

## Brief summary of your initial proposed plan for addressing the project context

When I started the project, I divided it in five phases (image below), which are analysis, design, implementation and testing. First, I am going to analyze the system detailing every functionality and how it is viewed from user perspective. Second, I am going to design the software from the requirements gathered in the previous phase, using tools/diagrams such as wireframes, ERD, balsamiq desktop, data dictionary. Third, I am going to install all the programs that I was going to use for coding. Then I am going to implement/develop the web application. Fourth, one of the most important steps in SLCD is testing. I am going to test the application and register the results in an excel file. Fitfh, I am going to install the website on a web server.

Documentation is updated in every step, but I am going to put more focus on the report in last week.

Although the plan is lineal, I am going to work iterating over these stages because the design and analysis can be changed to improve the project, when we are in the implementation stage.

![A screenshot of a cell phone

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4TWiRXhpZgAATU0AKgAAAAgABgALAAIAAAAmAAAIYgESAAMAAAABAAEAAAExAAIAAAAmAAAIiAEyAAIAAAAUAAAIrodpAAQAAAABAAAIwuocAAcAAAgMAAAAVgAAEUYc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAV2luZG93cyBQaG90byBFZGl0b3IgMTAuMC4xMDAxMS4xNjM4NAAyMDIwOjA4OjE0IDA3OjU4OjM4AAAGkAMAAgAAABQAABEckAQAAgAAABQAABEwkpEAAgAAAAM2OAAAkpIAAgAAAAM2OAAAoAEAAwAAAAEAAQAA6hwABwAACAwAAAkQAAAAABzqAAAACAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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## Why is this a good project?

This project was very important to me because I have learned the SLCD which describes the process of software creation, as well as the tools used in each stage and how I got information from them in the process of building a website. I also worked with technologies such as Ajax, bootstrap, fpdf library which were hard at the beginning, but I realized they were so helpful and handy after finishing the web application.

## Novel aspects – a real world business or organization or taking advantage of new technology

Ger’s garage is a small business which needed a website to improve its business and save data/information which is so important for a company nowadays. Ger also can register all process are being carried out in the garage, and this is another advantage against its competitors because in the today’s world everything is on internet and people are using and consuming online applications because it is handy to buy something or make an appointment. Even if we consider the current pandemic situation where mostly of people is working home and will be still doing in the future, it is extremely helpful and necessary having a website where every company can organize all the information.

# Chapter 2 – Literature Review

I used the following technologies to build the website:

1. Visual Studio IDE
2. JavaScript
3. PHP
4. Ajax
5. MySQL workbench 8.0
6. HTML and CSS
7. Bootstrap 4 library
8. jQuery 3.2.1 library
9. Fpdf class

I am going to explain why from my point of view I chose every technology and why they were so useful:

1. I used Visual Studio IDE because we were working with this code editor in the higher diploma and I familiarized with. It also identifies the syntaxis of the different programming languages which was so helpful because it improves readability of the source code. This IDE is also user-friendly.
2. JavaScript is a client scripting language which allow us to add dynamism to a website. Nothing else to say, it is hard to understand but it is necessary if we want to create web page with special effects.
3. PHP is a server-side scripting language which we were using in the career. There are a lot of information on internet, it helps me a lot to find solutions a certain problem. It is a stable programming language which has been in the market for a long time, so it makes php one of the best options if we want to choose a programming language for backend.
4. Ajax is useful because we can update a web page without reloading the page, and we can send/receive data to/from sever after the page is loaded.
5. MySQL workbench is a great tool to work with MySQL databases. It allows us to create a physical database interactively, create models easily from ERD, insert/delete/update records in the database (create queries automatically) and export databases with 2 clicks.
6. HTML and CSS are the core technologies for building web applications.
7. Bootstrap library is a library to build responsive databases, that is, the web page can be run on different kind of devices. The bootstrap web page has many examples which was so handy. The documentation is very well-organized.
8. With JQuery I created the date picker element on the screen. It was very effective because I was able to build the input date quickly and I also can disable some dates on calendar easily.
9. Fpdf library is a PHP class to generate PDF files. After doing a research about different libraries/programs to build a pdf, I chose this one because it was so handy and functional. We just must import fonts and one php class. Then we create a file php and we develop the PDF format. Finally, we can call it from another part of the code to generate the pdf. I found it easy to use.

As a conclusion, I’d like to express I feel comfortable working with these tools because first, I’m familiarized with them, and second, when I have a issue which I need to solve I found a lot information on internet.

# Chapter 3 - System Analysis and Design

As I have already explained in the previous chapter, I am going to show the diagrams and tools which I used to gather the requirements from the brief and design the software. Analysis and Design stages are crucial because:

1. In analysis stage, we define the scope of the project, so we need to identify every process and functionalities to get a deep understanding of the project’s objective.
2. In design stage, we create the solution in paper or diagrams using the requirement collected in analysis stage. The whole structure of the project is created with the database design.

## Functional Requirements

The functionalities were identified by finding what Ger wants he and the users are able to do on webpage. For example, the following extract from brief say:

“Customers can register on the website and book their vehicle in for a service OR a repair. “

We can identify that Ger wants customer to be able to register their vehicles and make an appointment.

Now, I am going to detail the functionalities identified from the brief.

I assume computers are connected to internet before starting each functionality.

1. Login (must have)
2. User clicks on login link on first page of the application
3. Application takes user to login page
4. User enters an email and password (this information is validated)
5. User submits details
6. Application verifies email and password
7. If there is an error, the application takes user to login page again
8. If not, the user is logged in and the application shows to the user the homepage
9. Register (must have)
10. User clicks on register link on the first page
11. Program takes user to register page
12. User enters email, full name, mobile phone, password, vehicle plate number, make vehicle, engine type (this information is validated)
13. User submit information
14. Application verifies all the information sent
15. If there is an error, the application takes user to register page again (for example, email already exists in database)
16. If not, the user is registered and the details are saved, and the application take user to the first page of the application

Register admin could be developed with another screen simpler than this one, or it can be created by database. A user admin can create another user admin. (optional)

1. Display bookings (must have)
2. User is logged in
3. Application shows to the user information about booking (number, date, time, status, collected, etc)
4. Make an appointment (must have)
5. User is logged in
6. Application shows the form to make an appointment on user homepage
7. User selects type of booking, date. User also can add some comments (this information is validated)
8. Application verifies the information, and check if there are available shifts for that date. If there are not, user must select another date
9. App shows the available shifts
10. User selects an available shift
11. User submits the booking
12. Application verifies the booking. It there is an error, app will go back to step 3 (the shift was taken by another user, no more shifts available)
13. Application creates and saves the booking with status booked
14. Allocate mechanic to vehicles (must have):
15. Admin user is logged in and click on button allocate mechanic on admin homepage. Application takes user to allocation mechanic page
16. Application allows user to search bookings filtering by date, email and booking number
17. Admin filled inputs to search data from database and click on search button
18. Application searches data from database and show this information to the user
19. Admin selects the bookings and (s)he assigns a mechanic to each booking
20. Admin submit the allocation
21. Application verifies the allocation sent, and check if every mechanic is available for that shift. If there is a mechanic who is not available, the application shows errors on the screen and the application goes back to step 5.
22. Application saves the allocation
23. Display booking (must have)
24. Admin user is logged in, and (s)he is on admin homepage
25. App allows user to search bookings filtering by date, email and booking number
26. Admin fills inputs to search data from database and click on search button
27. Application retrieve data and shows it to the admin
28. Print schedule (must have)
29. When user display bookings in the previous functionalities, this screen has a button to print the schedule. First, the user searches the bookings, and then th user can print the bookings.
30. Allocate Cost (must have)
31. Admin is logged in, and it click on allocate cost button on admin homepage.
32. Application takes user to allocation cost page
33. Application allows user to search a booking by number or id
34. Admin enters a booking id and click on search button
35. Application retrieves information about booking and show it to the user
36. Admin can enter a task description or select an item/part used to fix/service the vehicle. If admin add a new item, the task will be new item. Currency and total will be filled automatically with the values euros and the total (it summarizes the price value in every line)
37. Then admin submits the cost
38. Application saves the cost
39. Print invoice (must have)
40. Admin is logged in, and it click on allocate cost button on admin homepage. Application takes user to allocate cost page.
41. Application allows user to search bookings filtering by date, email and booking number
42. Admin filled inputs to search data from database and click on search button
43. Application search data from database and show this information to user
44. Then admin chooses a booking to print an invoice.
45. Admin clicks on print invoice button and the app generate the invoice
46. Change status (must have)
47. Admin is logged in, and it click on change status button on admin homepage. Application takes user to change status page.
48. Application allows user to search bookings filtering by date, email and booking number
49. Admin filled inputs to search data from database and click on search button
50. Application searches data from database and it shows this information to user
51. Then admin changes the status of the bookings
52. Admin selects the booking/s that has/have been changed
53. Admin submits the changes
54. Application verifies the status. If there are errors, these are shown on the screen. User can not change a status from fixed/completed, collected or in service to booked. This one is the only restriction.
55. Application saves the new status
56. Extends appointments (optional):
57. Admin is logged in, and it click on extends appointments button on admin homepage. App takes user to extend appointments page.
58. App allow user to search a booking by number or id
59. Admin enters a booking id and click on search button
60. Application retrieve information about booking and show it to the user
61. Admin choose a date.
62. Application verifies the information, and check if there are available shifts for that date. If there are not, user must select another date
63. Application shows the available shifts
64. User selects an available shift
65. Then admin clicks on extend appointment
66. Application verifies the information. If there is an error, app goes back to step 5

(the shift was taken by another user, no more shifts available).

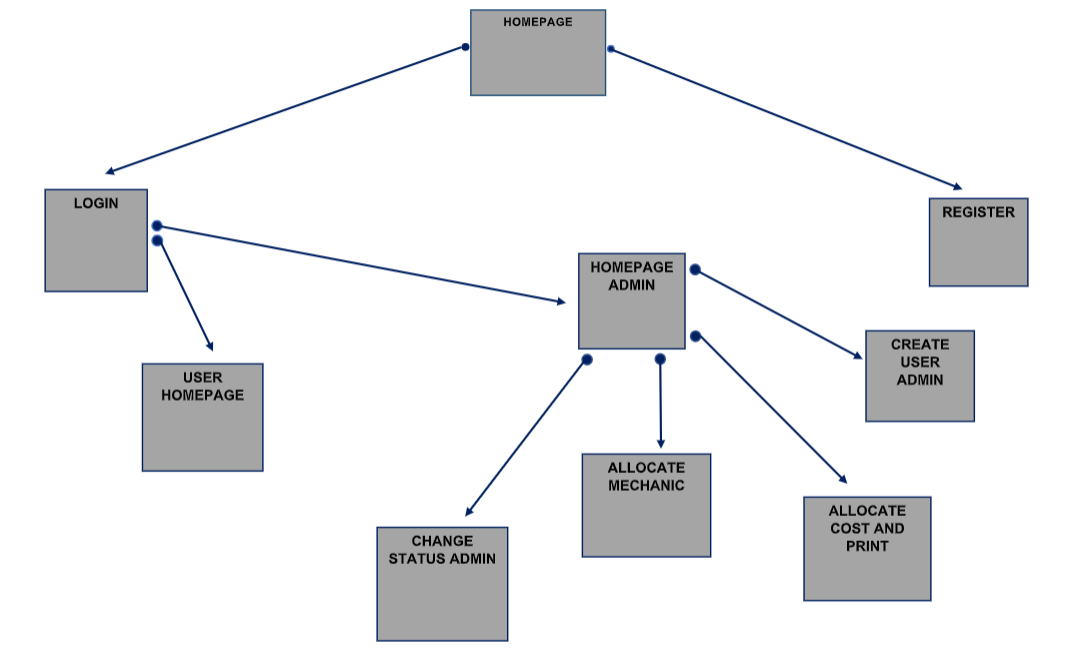
1. Application saves the new booking linked to the previous booking

### Wireframes

I used wireframes because they help us to validate the most important functionalities detected on the previous steps of the SLCD. With Wireframes, we also can identify new functionalities, new inputs/data, as well as shows the structure of every page with the main elements on the screen.

I created the wireframe using balsamiq program. This one is a user-friendly tool, which have all the necessary elements to draw every screen.

I use the following diagram to represent the relationship among wireframes:



The wireframes can be found in format png into the wireframes folder.

## Database design

The database design was done in paper. Below, I show my design (Chen’s notation):

A picture containing text, whiteboard

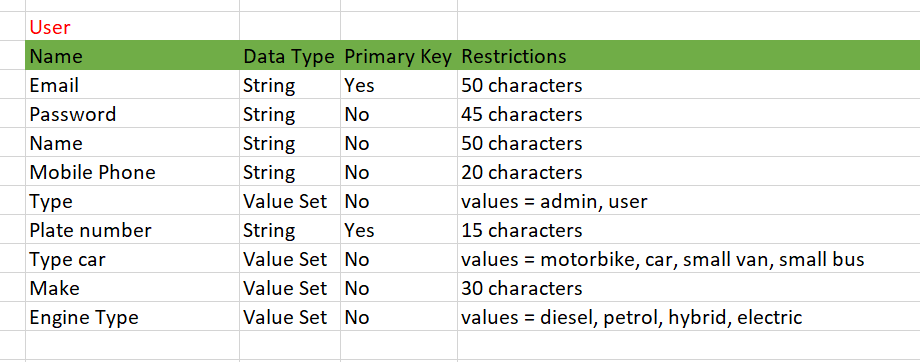
Description automatically generated

The first step to create a database design is to identify entities (nouns) and their attributes (characteristics of the entities). Then, I created the relationship (verbs) between the entities and I assign their cardinalities. Double lines mean mandatory participation of the entity on side with double line.

For example, there is a relationship between user and appointment with cardinality 1:N. It means one user can book many appointments, and one appointment can be booked by one user.

The database design is the first step before creating a physical database. This diagram allows us to represent a database, how many tables we need and how they are related.

On the other hand, I created the data dictionary to define the attributes/characteristics of every field. For example:



Mobile phone field is string which does not belong to primary key, and its length is 50 characters. This repository is crucial to understand the data (metadata) and to know how to use it in the following stages of SLCD. The whole structure can be found into the data dictionary folder.

Lastly, I analysed and check if the database design is in 3FN to reduce data redundancy and improve data integrity. Results:

* 1FN: “First normal for states that each of your columns should contain only one value (atomic data) in it and there should not be any repeating groups, and a designated primary key (no duplicated rows).” (Snel, n.d.)

The design is in 1FN.

* 2FN: “A relation that is in first normal form and every non-primary-key attribute is fully functionally dependent on the primary key.” (Connolly and Begg, 2015)

The design is in 2FN.

* 3FN: “A relation that is in first and second normal form and in which no non-primary-key attribute is transitively dependent on the primary key.” (Connolly and Begg, 2015)

The design is not in 3FN because make, engine\_type and type\_car fields are transitively dependent on primary key. These attributes are dependent on plate Number. So, solution is creating another table in which plate Number is the key and the other attributes are part of the table as non-key fields. I didn’t have time to do this really.

With regards to make, type of user, type of car, engine type, type of appointment, type of status fields which are defined as a value set, I will create a customization table to save the values.

I save the following values in make table:



I just save the vehicle manufacturer, not the model of a vehicle. For example, Ford fiesta is a string which contains manufacturer and model. The idea behind this solution is to create customization tables for each set values. Even, we can add some fields in each table to make the program more independent from data. For example, we can add a field in type of appointment table to represent if the type occupies 1 shift or 2 shifts. Mayor repair would occupy 2 shifts. I know this is not hard, but there are other priorities which I need to do before this.

# Chapter 4 - Implementation of the system

I am going to explain all the decisions made in this stage, as well as technical issues and the whole structure of the program. I already defined the functionalities and I built a solution (wireframes, database design and data dictionary) in the previous stages. I am going to use these diagrams and definitions to create the web application.

## Database Implementation

First, I created the physical model of the database using the ERD. The model is the following:

A screenshot of a cell phone

Description automatically generated

Important issue: This model has an error, the relationship between shift and mechanic is wrong. This relationship must be connected between appointment and mechanic. The image below shows it.

A screenshot of a computer

Description automatically generated

This model was created using the tools/functionalities provided by MysSQL Workbench 8.0. This RDBMS allow us to create model interactively, and when the model is done, we can forward engineer result to database along with the schema.

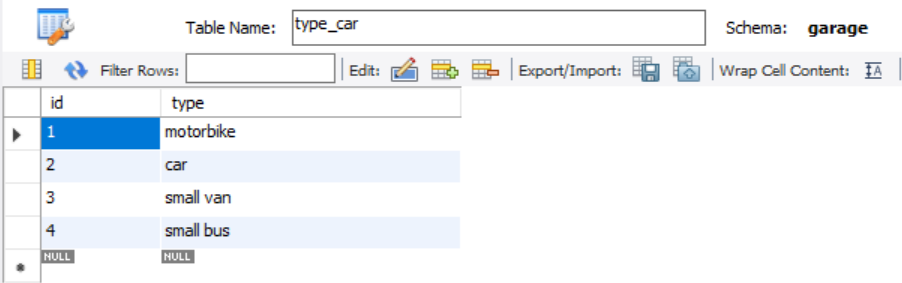
In the model, we can see customization tables which save data about makes, engine types, type of cars, type of users, status and types of appointments. Remember, make table just contains manufacturers. If we want to add the model of a vehicle, we need to add another field in make table.

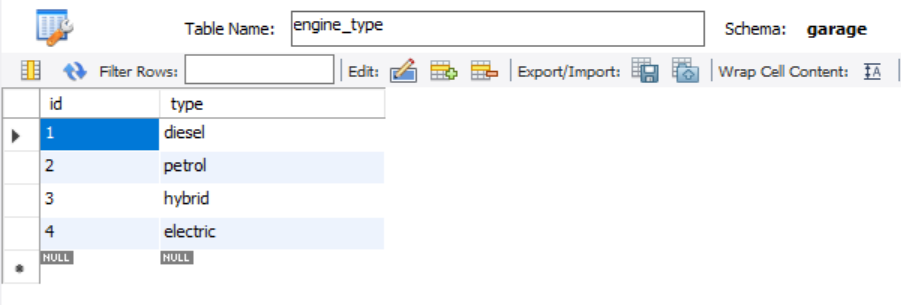
On the other hand, make table is not connected with the user table because the application web is getting information from this table, and when a user is registered, this one would add another make. Next time, a user wants to register, (s)he would see this new make in the list. So, if this new make is added to this table, the admin should check if it is a real make.

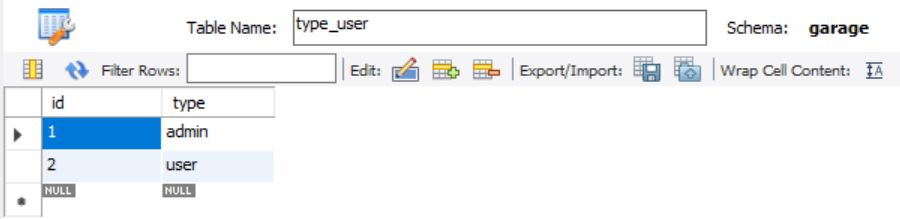
Therefore, we have two solutions:

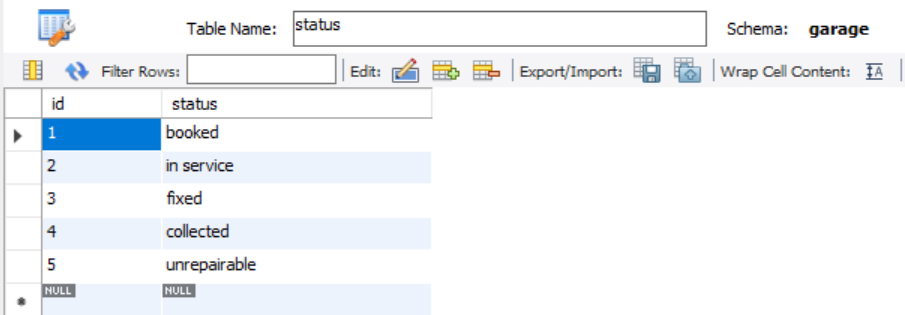
1. The current solution which is easy and quick. Not connect make table with user table, there is a attribute called make in user table with same characteristics as make field in make table.
2. The application web can only get the first 17 entries from this table, and let admin know when a user is registered with a new make to check if this one is correct. If it is correct, we can allow the webpage to get this new make and show it to the user on the screen.

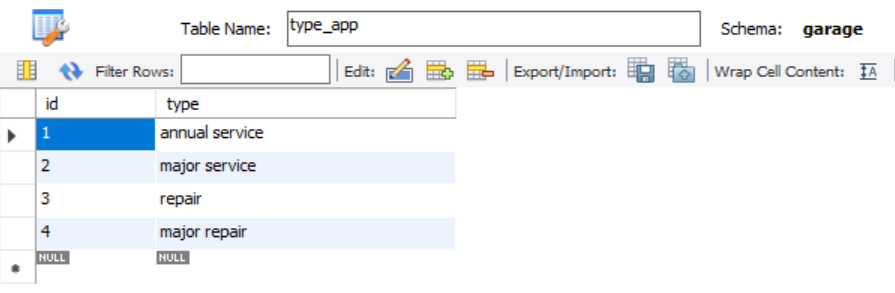
The following images shows the data in each customization table:









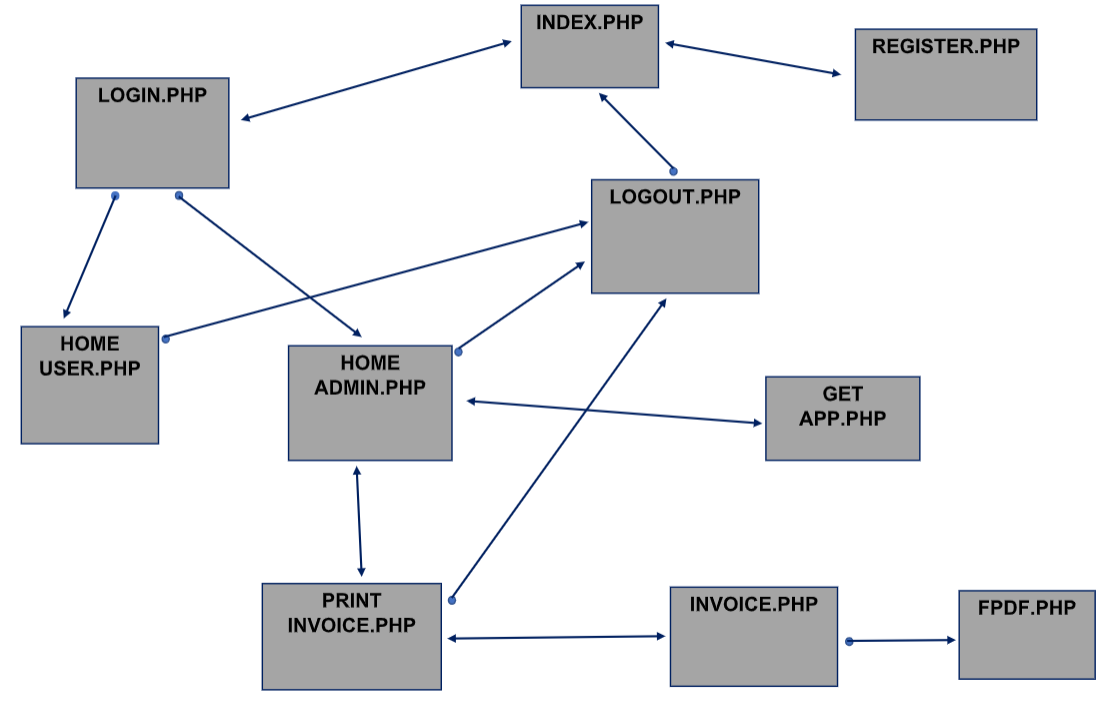


Item customization table was not filled with values.

Another important issue is the table user with email and password. This table must be divided in two tables, one with id, email and password, and another one with details of the user.

## Web application implementation

Now, I am going to explain every file created in the project. First, the following image shows the whole structure of the program and how these files are connected.

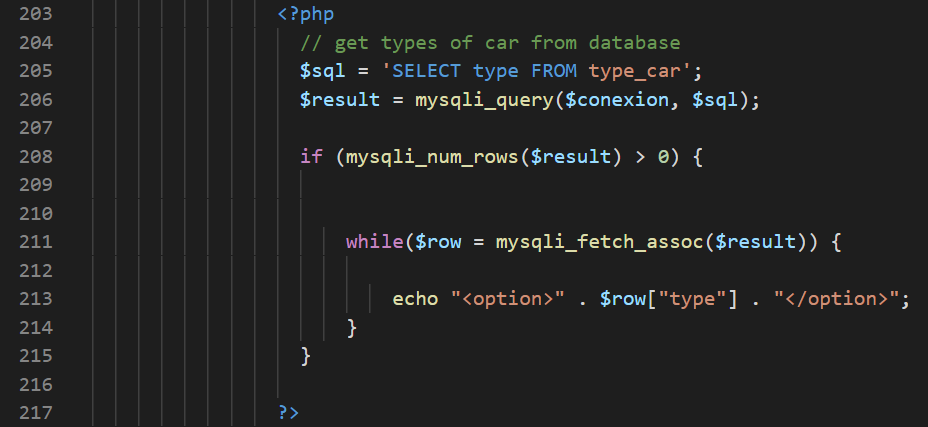


I used bootstrap 4.0 library to style every page and a template provided by <https://getbootstrap.com/>

Files:

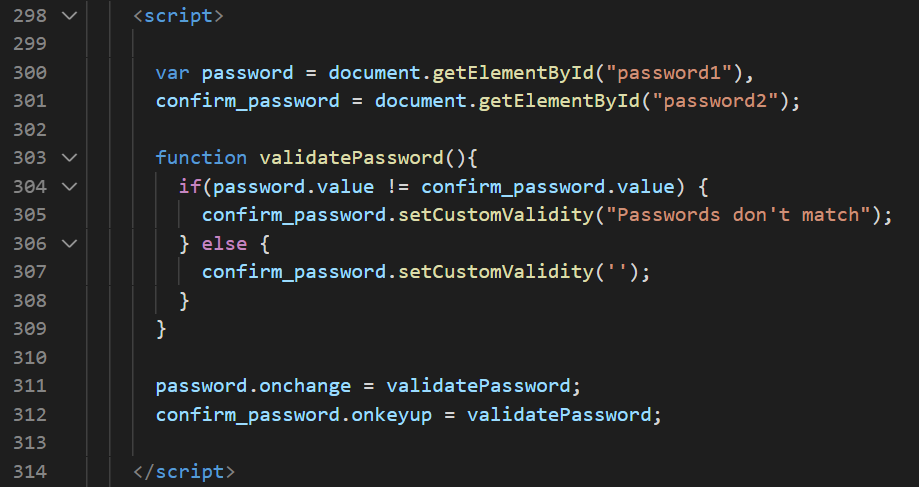
* Index.php is the first page of the website. There are two links on the top, which goes to login.php and register.php. There is a carousel which uses CSS and a bit of JQuery.
* Register.php allows a user to register on the website. This page redirect to homeuser.php or homeadmin.php. It depends on the type of user field in user table; it would be better implemented if we had two user tables separated as I already explained previously.

Php code is used to validate if the user is already registered. I also used php code to get data from database and filled the inputs. For example, the following piece of code shows how the typeVehicle select element on the screen is filled with data from database (car, motorbike, small bus and small van).

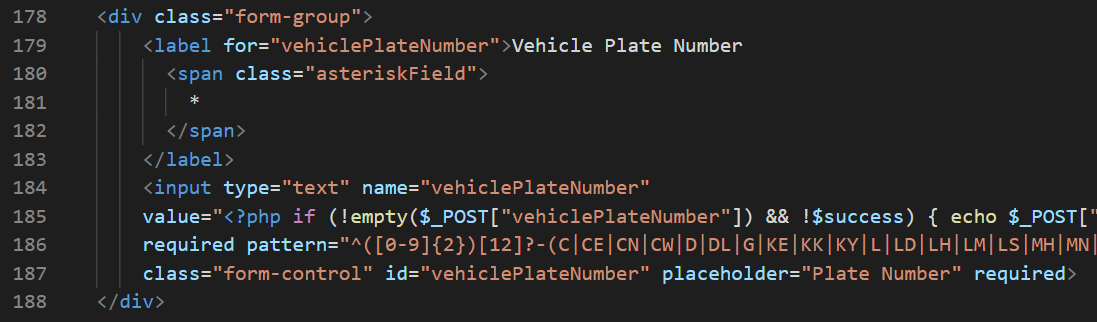


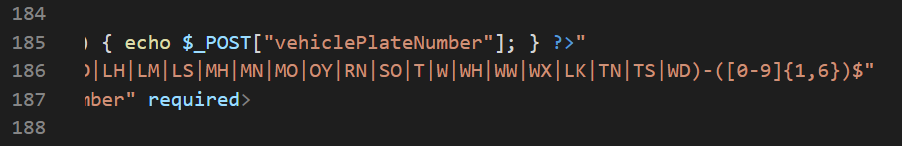
There are many validations implemented on this page. For example:

1. Password and repeat password must match, the image below show this validation. They also have a required pattern in the input HMTL tag.

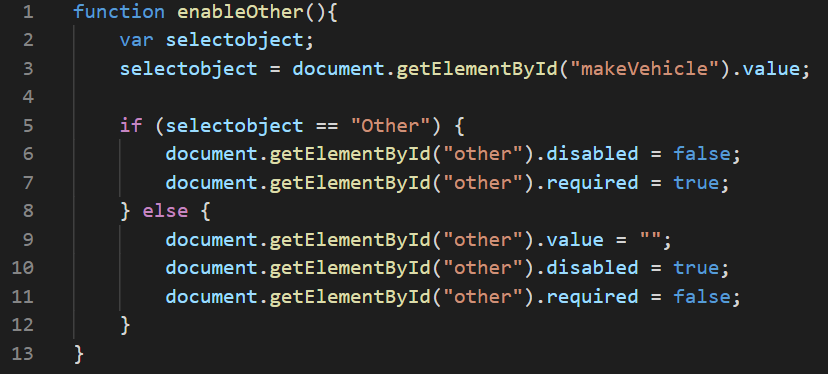


1. Plate number element has a required pattern assigned





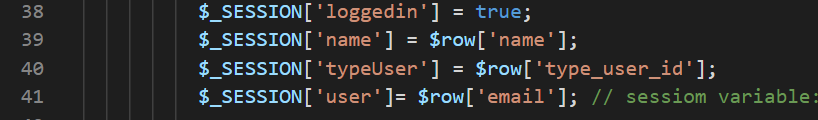
1. Other input is disabled. When the user chooses “Other” from list of makes, Other input is enabled. This functionality was developed in JavaScript.



1. I didn’t add a validation for mobile phone

On the other hand, sha1 (cryptographic hash function) was implemented to encrypt/decrypt the password.

* Login.php: This file contain logic which allow a user to log into the system. I also used the global variable $\_SESSION to pass data between pages.



We could pass more values, for example the customization tables (type of car, engine type, etc.). I did not do this, but it could be done to improve the program.

* Logout.php: Destroy the session and redirect the user to index.php.
* Homuser.php: The following is the wirefreame for this page:

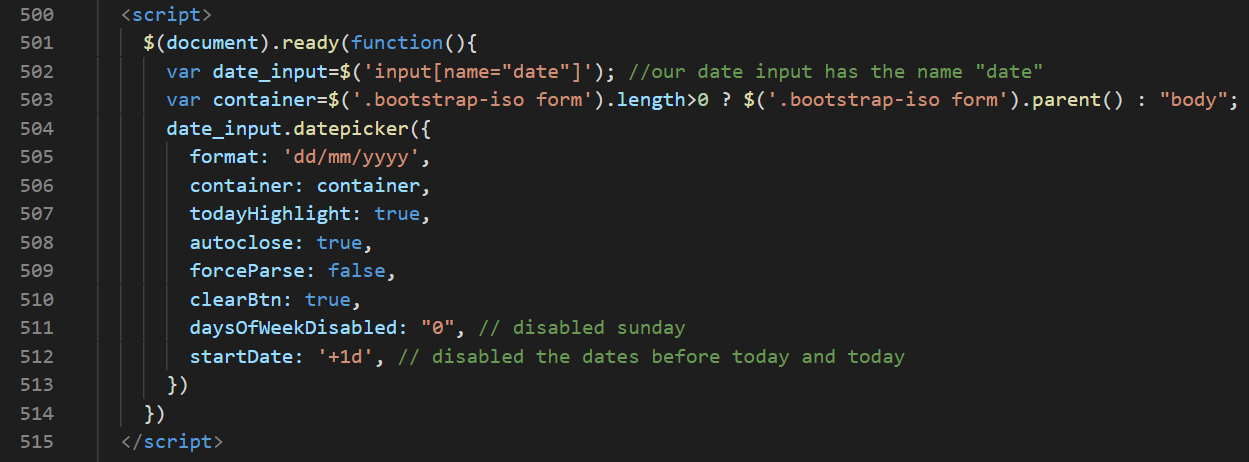
A screenshot of a cell phone

Description automatically generated

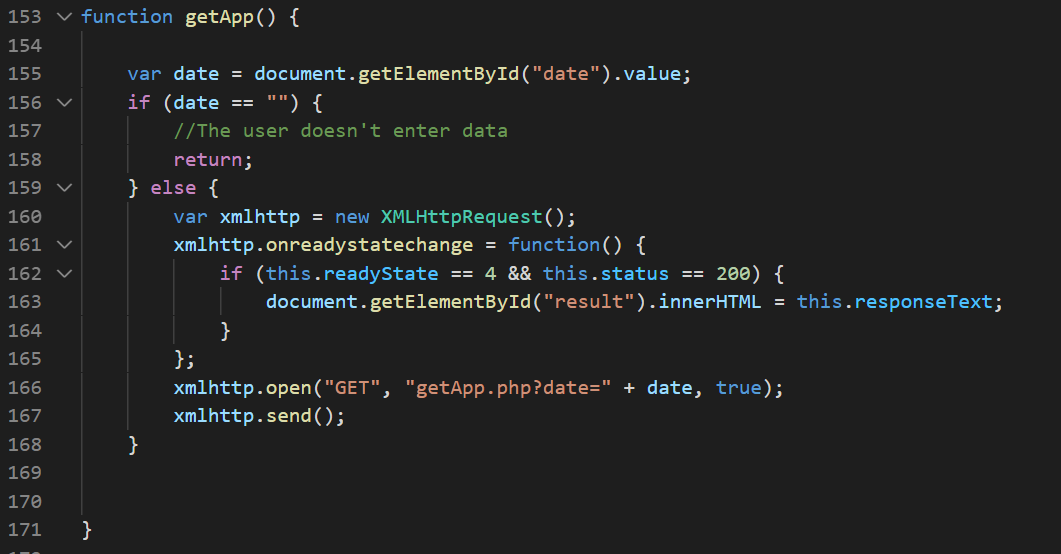
It is main page for a common user. I used PHP code to bring data from database for vehicle, type of booking and the appointments/bookings made by the current user. The appointments are shown in the second table (see wireframe above). PHP was used for making an appointment process, this piece of code gets appointments/bookings and shifts from database to validate if the date and shift(s) selected are available for booking. If the user chooses mayor repair (two shifts), I validate if there are two shifts available because mayor repair counts double. One important issue that I could not do was to show the shifts available when user choose type of booking and date, the program should search information from database to bring shifts available for that date and type of booking, then the element select on the screen must be updated with the shifts. It would be implemented using ajax and php. We can send to php program the date and type of booking, and this one return a json object.

Alternatively, I implemented another solution for the shift select which is quicker than the previous one. When user submits the data to book the vehicle, this one is verified on the server with PHP code. In client-side, when user chooses mayor repair, the application shows only three options (Morning, Morning-Afternoon, Afternoon), otherwise the application shows four options (Morning 1, Morning 2, Afternoon 1 and Afternoon 2). This functionality was implemented in Javascript.

On the other hand, A datepicker was developed with JQuery and Bootstrap. The image below shows the datepicker and for example, how Sunday was disabled.



* Homeadmin.php: It is the main page for admin. The app gets data from database to fill the table (see wireframe in wireframes folder) with the bookings filtered by date. This functionality was implemented with Ajax (the function getApp() is called when user clicks on search button), and then PHP is executed. The image below shows the implementation of the function getApp() in the file javascript.js.



If we click on Allocate Cost and Print invoice, the web app takes the user to another screen to print an invoice.

This screen is not finished, we should check the wireframe to see the whole picture.

* PrintInvoice.php: This file shows a screen to generate a pdf. When a user clicks on submit button (only first line), an action calls to invoice.php file to create the pdf. I used the class fpdf which has all the functions to generate an invoice.

## More Functionalities

The following functionalities were not implemented.

* Allocate Cost and get information from database to print the invoice:

(Remember we can generate a pdf from our application, but it is a prototype, just to show the pdf created)

The screen below displays the wireframe with the most important elements to implement these functionalities.

A screenshot of a social media post

Description automatically generated

I already have developed logic to print an invoice. The screen created for the website is a quite different from the one shown in the previous image, because I wanted to show a prototype which generate a PDF. The above wireframe shows a table with bookings which were selected using the filters date, email or booking number. Then, user should select only one booking and click on print invoice. I used the fpdf php class to print an invoice.

To implement Allocation cost we must bring a booking from database using ajax and php. Then we can implement effects on the screen with JavaScript, for example when user select an item, the task field must be filled with new item, the total also can be calculated in JavaScript. When user clicks on allocate cost button, we call an Ajax function to send the data to the server to save the cost for that booking. Therefore, the algorithm would be:

1. When the user clicks on Search appointment, the application calls an ajax function (GET method). Then this function calls a php file which gets information from appointment, cost and details tables (in case the user wants to modify the cost). Then the application gets information from item table, if it is required. The app shows the data on the screen in the second table with code HTML generated in the php file.
2. Application interact with the user through JavaScript (it has been already explained in the previous paragraph).
3. User clicks on allocate cost, the app calls a function in ajax, then this function calls a PHP file to register the cost. The lines of the cost can be sent in json format. The application saves data in cost and detail tables.

* Allocate Mechanic

The screen below shows a allocate mechanic wireframe.

A screenshot of a social media post

Description automatically generated

This functionality is similar to the previous one. First app must get information about bookings from database using the filter provided. Second the user selects the booking(s) which want to allocate a mechanic and clicks on Allocate Mechanic button. Third, the app calls a ajax function, and then a php file is executed to validate if every mechanic is available for that shift. It must check every mechanic is not assigned to another booking at the same shift. Same as previous functionality we can send data in json format

* Change status: This functionality is very similar to the previous one. App calls a ajax function, then the function calls a php file to validate every status.
* Create admin user: It is also very similar to register/login pages. First, I must validate there is not another user with same email, if so, the admin user is created.
* Extends appointment: This functionality allows an admin user to create another appointment and associate it with the appointment extended. We could add a field to link the new appointment with the previous one. Cost will be allocated to only one appointment (the original).
* There are more files which are used to keep database connection details and to close and open database connections. The files are: configuration.php, closeDatabase.php and database.php.

# Chapter 5: Testing and Evaluation

The website was tested, and the results are in an excel document. This file was saved into testing folder.

# Conclusion

On the whole, I would say that the first stages in SLDC are so crucial to get a high-quality software. In Analysis stage, we can break down the problem in small parts, in other words, we can find functionalities and express them in natural language. In design stage, we can create solution using diagrams and tools. These two stages allow us to see the overall solution broken in small parts. Therefore, we can start to develop watching the whole picture and its parts. If we had to develop without having a plan, analysis and design we would create a software without see its scope which would confuse the development process, and as a result we would get low-quality software.

Unfortunately, I could not finish the program. Sometimes I had to go back to analysis/design stage from implementation stage because I needed to review a something, either to improve the project or to find another solution due to time reasons.

# Appendix A

Repository where source code is maintained:

GITHUB account -------------------------

The website was deployed on 000webhostapp and the link to access is:

<https://gerayrgarage.000webhostapp.com/>

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