A Footballing Web Application to Enhance the Fan Experience

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Statement of Originality

This report is submitted as part requirement for the degree of BSc (Hons) Computer Science at the University of Sussex. It is the product of my own labour except where indicated in the text. The report may be freely copied and distributed provided the source is acknowledged.

Signed:

Jack Richardson-Payne

Project Summary

This report is a documentation of the creation of a web application with the aim of enhancing the fan experience of following a team. This web application was created with PHP, HTML, CSS and JavaScript the specifics of which are outlined in the report. This report also outlines all aims associated with the project and also states any considerations the project has, for example how ethical guidelines were followed and a consideration of what existing products are available.

The first step the project had to consider was all the requirements that the system would need, this ranged from technical requirements such as what software would be needed, down to specific system requirements that would need to be met. The specifics of which are detailed in the report. Once this was done the design phase could be completed, this section of the report outlines how the project was managed timewise. As well as specific designs for the front and backend of the system, these designs consisted of relevant diagrams to be used for the implementation.

The next section outlines how the system was implemented using these designs with explanations for how specific tasks are completed in the system. The report then outlines the testing phase of the project, this was split into three sections; requirements testing, error testing and user testing. The findings of these are outlined in the relevant sections, the user testing was completed using interviews conducted with ethical approval where users would use the system and give feedback. This outlined a number of improvements that the system could implement to fix problems or enhance the system, these improvements were implemented where possible and an explanation is given for how this was done for each. Once this improvements phase was done an evaluation of the system was completed and conclusions were drawn as to whether the system is successful and effective for its aims. This conclusion takes into consideration the projects initial aims as well as target user needs and predefined heuristics to form an overall conclusion.

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1.0 Introduction

The world football industry is one of the largest global markets in the world, with European football alone being valued at around £21.9 billion [1], just showing the huge power that the sport has. The major driving force in this market being the fans, and the ever-growing popularity of the world's most watched sport, with approximately 4 Billion fans worldwide [2]. The 'problem area' this project will be focused on is fan involvement in the sport and ways of improving fans experience of following a team and attending football matches. The solution proposed by this project to this area will be the making of a web application to allow users to track matches they have attended by registering them when they attend, the web app will then show the user statistics about the matches they have seen personalised for them. Some example statistics would be, total goals seen and how many of those goals were scored by the team they support etc. This will enhance the fan experience as it gives fans a way of analysing the matches they have attended, in a way that is personalised to them, making them feel more involved in the sport. This can be used by fans to see the effect they may have on their team whether it be lucky or unlucky, or simply as a way of recording all the matches they have attended in a collected space. The frontend of the web app will display information to the user and allow them to interact with it, this will be coded in HTML, CSS, PHP and JavaScript where appropriate. The Backend of the application will be a database with all relevant data that needs to be displayed, this will be coded in MySQL.

The motivations for this project are providing a service to football fans that attends matches, who are often neglected or inconvenienced in the name of profit for sponsors and TV schedules. This is a motivation because without those fans football could not exist especially in lower levels of the footballing pyramid where fan ticket sales are a major income for clubs. My motivations for this project are that web development is an area that I may be interested in pursuing a career in. An understanding of how to build a full product from start to finish will help me later on, if this is an area I start a career in. This project is relevant to the course as it encompasses many areas of web development, there are several languages used for this project and that are huge areas of website development. The project also includes areas in database development, giving the project both front-end and back-end development scope to the project. This report will be split into large sections containing the main stages of the project from prerequisites like considerations and requirements, to the design phase and then the body of the report containing implementation and testing. The report will aim to conclude whether the project was a success by analysing if all aims had been met.

1.1 Aims and Objectives

This section will outline the main aims and objectives for the project, these aims will be used as part of the evaluation of the final system:

- Create a web app which enhances the fan experience of following a team and attending matches.
- Provide a service for fans to see statistics personalised to matches they have attended in creative and graphical ways.
- Allow fans to analyse their stats on a team by team basis and delve deeper by analysing statistics for individual matches.
- Create a space for fans to record all matches they have attended, so they do not have to remember them themselves.
- Allow fans to see the effect they have when attending matches, e.g. whether they have a positive or negative impact on their team.
- Create a web app which is easy to use and understand for the target demographic with little explanation.
- Create a secure service that users can trust with their information.

The hope is if all these aims are met a service will have been created that will encourage more fans to attend matches with the incentive of improving their stats or through friendly competition between friends. This will have a particularly positive effect on smaller teams who rely heavily on fan attendance for finances.

2.0 Professional Considerations

In this section of the report any aspects that need to be considered before work on the web application could begin will be explained.

2.1 Ethical considerations

This project followed the BCS code of conduct [3] and adhered to the standards set out in them. Any work that is not created during this project is referenced and credit given to the original creator. The most applicable sections of the BCS code of conduct are :

PUBLIC INTEREST

You shall:

1. Have due regard for public health, privacy, security and wellbeing of others and the environment;
2. Have due regard for the legitimate rights of third parties;
3. Conduct your professional activities without discrimination on the grounds of sex, sexual orientation, marital status, nationality, colour, race, ethnic origin, religion, age or disability, or of any other condition or requirement;

This project required users to participate in the testing of the product, and feedback was gathered to be used to improve the service. This poses a very low risk to anyone participating however, written consent was gathered from every participant and the project applied and received ethical approval before conduction any testing on participants. This was done by completing an ethical compliance form signed off by the supervisor of the project (see Appendix C) The project also considered the legal side of creating a product for online use, the project abided by the General Data Protection Regulations (GDPR). This outlines how data should be stored and protected in the EU, this is important as the project will be storing small amounts of data on users and that needs to be protected. For example, the database will only store hashed passwords so if the database is compromised the attacker would still not see user passwords.

2.2 Background Research/Existing work

In order to build the web application some background research had to be done to find what websites and products existed with a similar premise. The websites and apps outlined by the research (see Appendix D) are a few examples of what is available to football fans when looking for content online. The vast majority of what is available tends to have a focus on giving its users a more statistical analysis of games and giving build up and reports for matches, the market is very saturated with sites of this kind. This is good for users as it gives a way for fans to absorb football content outside of matchdays and allows for creative debate and discussion where people have facts and figures to back up what they are saying.

The web application proposed by this project however does not fall into this market, there are a few specific sites/apps that do have a similar purpose, some good examples are the Futbology App and the Sky Bet EFL Rewards App. Futbology [4] is an app available on IOS and Android which allows users to log that they have been to matches which are then stored for the user. The app differs from the one proposed in this project however as there is little to no statistics available to the user, the app is heavily focused on keeping track of what football grounds have been visited and some of the limited stats available include number of grounds visited and most visited ground. This differs from what has been proposed by this project because the web application proposed aims to provide more detailed stats of the matches to users rather than just a record of what grounds have been visited. Something Futbology does well is allowing users to suggest their own match if the match they wish to log is not available, this makes it easy for users who follow teams who are not well known to use the app too. The leader board section for each club is also a good way to promote competition between fans.

The Sky Bet EFL Rewards app [5] is also an app with a similar premise, it is available on IOS and Android and allows users to 'check-in' to EFL matches (Championship to League two and cups). The users can select that they are at the stadium which is verified using location services and receive the chance to win rewards from Sky, or they can select that they are at home and will not be eligible for rewards. There are achievements that can be completed by going to matches, but there is no other purpose of the app and no statistics are available to users. Although these apps have a similar premise to the one proposed they do not have the same functionality or pose the same solution to the problem, this means that there is a gap in the market for the web app proposed as there is not an app like it available or not a popular one. This shows that this web app would be something new to the target audience which could help enhance their user experience.

3.0 Web Application Creation and Testing

3.1 Requirements Analysis

This section will outline any requirements the project has before moving on to the design phase. These requirements will be outlined, and an explanation given for how these requirements were handled.

3.1.1 Target User Analysis

The intended target user for this project is football fans who attend matches. The main focus in this demographic will be fans who attend games in the top four leagues in England, as the statistics for these games are readily available to be used whilst still maintaining a moderately large scope for the project. The section of fans within this target audience most likely to use a service like the one proposed would be young to middle age fans, these fans are much more likely to be 'internet savvy' than older fans and would be much more likely to find a service like the one outlined in this project useful. Although often younger fans can be frozen out by ever rising ticket prices in England's topflight [6], these fans will be much more likely to use the service provided so the app will be tailored towards them. It is also important to consider older fans, so the system will aim to be designed in a way that everyone can use.

There will be a limited number of needs that the target demographic has for this project, this is simply because this product is meant to enhance the fan experience not be a requirement for it. This considered there are a few things that will be required by users for example, that the data is accurate for the matches. If the data is not accurate a user will not use the web app as the stats personalised for them would not reflect the real matches they have seen. Another requirement will that the site is simple to use, because there are a vast number of football applications available to football fans, users will not be interested in a product that is not easy to use. The web app will need to be personalised for each fan by having fans select the team they support to give them more personalised stats for their team. This would enhance the experience for each fan as it gives stats relevant to their experience.

3.1.2 Technical requirements and choices

The languages chosen to make the system were PHP, JavaScript, HTML and CSS. These were chosen as they are most widely used languages for web development. PHP formed the main shell of the system and handled interaction between the front and backend, this was chosen as it is a simple and easy to use language with built in database connection modules. This allowed a simple way to connect the front and backend. PHP also is an established language, so help was readily available online when needed during implementation. JavaScript was then used for displaying graphs on the statistics page as online code libraries could be sourced to create different interactive graphs. The project also wanted to use a variety of technologies hence the mix of languages, no framework was used to create the system as the intention was to create the system from scratch.

The project had a number of technical requirements. For example, when making the front-end of the web app the coding was done in visual studio code [8] which is free to download so it is readily available. The backend was made in XAMPP's phpMyAdmin which allows databases to be created and hosted locally, which is free to download and use. In terms of how the project was hosted, initially as the site was being made it was hosted locally on home machines using XAMPP, this allowed the site to be changed freely and tested before users interact with it. The site was then hosted via Amazon Web Services (AWS), this allowed the user testing to be done. The project utilised AWS free tier services so no payment was taken to host the web app.

3.1.3 System Requirements

The system proposed by this project has a number of functional and non-functional requirements. These are outlined below and have been updated as the project has unfolded to produce a comprehensive list of requirements, they were used as a guide for the creation of the web app. In the table mandatory requirements have the wording 'shall' and desired requirements use the word 'should', mandatory requirements form the more integral requirements while desired requirements form things that improve the system but are not essential.

3.1.4.1 Functional Requirements

Requirement No.	Requirement
1.	Pages of the web application shall include: • Home page • Sign-Up page • Search results page • User stats page • User matches page
2.	Additional pages should be: • Profile page • Match information page • Web page customisation page (e.g. colours)
3.	Each page shall include a navigation bar at the top.
4.	The Navigation bar shall have areas for users to log in if not logged in already / sign out if they are logged in.
5.	Nav bar shall have button to link to sign-up page if the user is not logged in so the user can create an account.
6.	Each page shall only display the content of the page if the user is logged in (except the sign-up page) otherwise it should display 'Please log-in or Sign-up'.
7.	Home page shall display a search bar and links to the user stats and user matches page, when logged in.
8.	Search bar shall only take valid team names as input.
9.	Database shall hold stats for leagues: • Premier League • Championship • League One • League Two
10.	Database shall hold matches for seasons: • 15/16 • 16/17 • 17/18 • 18/19
11.	Database should have matches from current ongoing season.
12.	Tables that display match data on both search results and user matches page shall have columns: • Date • Home team • Away team • Home score • Away score
13.	Users shall be able to 'log' they have attended a match from the search result screen using a button on each row of table, this shall add the match to the user-matches table with the users ID.

14.	Users shall be able to 'remove' a match from the 'My Matches' page using a button on each row of table, this shall remove the match from the user-matches table.
15.	Tables outputting matches should have a button to open more information about each match.
16.	Users shall be able to log/delete a match from their logged matches in this information page.
17.	Matches should be organised by season on both the 'My Matches' page and search results page.
18.	Sign up page shall take from users to make an account: • Email • Favourite team • Password This data shall be stored in the database if all the inputs are valid.
19.	Navigation bar shall have a button to return to home page from any page.
20.	Stats section shall use the users logged matches to create the stats, these should be generated every time the page is accessed to keep up to date.
21.	The user stats page shall display stats for users chosen favourite team.
22.	User stats page shall display stats for all teams seen (not just favourite).
23.	Stats section shall include graphs/graphics made using JavaScript to represent the user's stats.
24.	Stats page should be able to be customised by team/season.
25.	All data used to display tables on pages and stats, shall be taken from database.
26.	Database tables shall include: • Users • Matches • User-Matches • Team
27.	Header should include a navigation to user's profile page if logged in.
28.	Pages shall have clear descriptions for what user can/should do on each page.
29.	Any changes made to stats page should reset back to defaults once navigating off the page
30.	By default, stats page shall display stats for favourite team for all time.
31.	Each page shall have a footer.
32.	Matches that the user has already logged should display with a green background for that row on the search result page.
33.	Errors shall be displayed to the user at the top of each page and should be clear what the error is pertaining to.
34.	User profile page should have spaces for user to change favourite team and change password.
35.	Stats page should include a navigation bar to jump to different sections on the page.
36.	Navigation bars should also be available on 'My Matches' and 'Search Results' pages to jump to different sections on the page.
37.	Team that was searched for shall be displayed in bold for each match on the search results page.
38.	Users favourite team shall be displayed in bold for each match on the 'My Matches' page.
39.	If the user has no logged matches, they shall not be able to enter the 'My Matches' and 'My Stats' pages, error should be thrown.
40.	Data on graphs on the stats page should be customisable.
41.	'My Matches' page should include an undo button to undo deleted matches.
42.	User shall not be able to log the same match twice .
43.	'My Matches' and 'Search Results' pages shall update automatically as user interacts with them.
44.	Users should be redirected to same position on page after logging/removing match.

TABLE 1 – FUNCTIONAL REQUIREMENTS

3.1.4.2 Non-Functional Requirements

Requirement No.	Requirement
45.	Each page shall have the same design colours and layout.
46.	The same font shall be used across the site.
47.	Users password shall be hashed to encrypt them before being stored in the database.
48.	Dates of matches shall be displayed in Consistent Format.
49.	The site shall check if the user already has an account using their email before allowing them to make an account.
50.	The site should be as 'easy' to navigate as possible.
51.	The web app Front-end shall be coded in HTML, PHP and JavaScript.
52.	The back-end database shall be coded in MySQL.
53.	The colours used on the system should be acceptable for people who are colour blind.
54.	Input forms shall not allow users to leave input fields empty.
55.	Input shall not allow MYSQL code which could damage back end database.
56.	Website shall be viewable on PC and mobile.
57.	User interface should be well designed (e.g. no overlapping elements).
58.	Text on pages shall be big enough so it can be easily read.
59.	Users shall be able to reset their password if they can't remember it .
60.	When the user logs into the site a session shall be created which expires after a certain amount of inactivity.
61.	Pages and elements on each page shall scale to the size of the screen.
62.	Team names shall be clear to all fans (e.g. no nicknames etc.).
63.	Web pages should load as fast as possible with little delay.
64.	Page shall be viewable on all (major) browsers.

TABLE 2 - NON-FUNCTIONAL REQUIREMENTS

3.1.4 Data Requirements

The project required data from football matches in order to complete its purpose, this data was used to fill the database for the backend of the web app. All the data for this project was sourced from '*football-data.co.uk*' [7], this site provides data in the form of CSV (comma separated values) files containing statistics for each match for a full season. This file format was ideal for the project as CSV files can be imported easily into tables in a database. The site provides data for football leagues in England, the sample chosen for this project is data from England's top four leagues (Premier League, Championship, League One and League Two) for the past 4 seasons (18/19, 17/18, 16/17, 15/16). This sample was chosen as it gives plenty of data for users to interact with on the site but is still a manageable amount. Going beneath data for League Two, i.e. North and South Divisions, there is less information available for each match, for the purpose of this project all the data must be in the same format otherwise errors may occur on the data retrieval from the database. This site provides the data free of charge and allows it to be edited before use, this is important as some data in the CSV files is irrelevant for the purpose of this project. For example, the betting odds for each match, which were removed before being inserted into the database and team names were replaced with a number identifier. This data sample had the potential to be expanded upon as the project unfolded if deemed necessary.

3.2 Project planning and Design

This section of the report will outline the planning and design phases of the project. This encompasses how the project was managed time wise and how the system was designed before coding. The design phase was important as it gave the ability to see what would or wouldn't be possible as well as setting out how front-end mechanics will look and work and how the backend database was structured.

3.2.1 Time Planning

This project used a Gantt chart to plan roughly when parts of the project would aim to be completed (see Appendix E). This was used as a guide for deadlines and to keep the project on track, however this was not a strict plan and was subject to change as the project unfolded, for example some sections lasted longer than originally planned when needed. The most time was allocated to the coding section as this was the most important and where the most information had to be learned to be completed. The project used a waterfall design technique where tasks were generally completed in order and one section had to be finished before the next started, e.g. coding had to be done before testing. It was also possible however that some aspects may be completed at the same time e.g. the resource gathering, and design phases happened around the same time.

3.2.2 System Design

This section of the report will outline how the front and backend designs of the system were done this will include a step by step of the process along with a description for how these designs were used.

3.2.2.1 Front-End Designs

The design of the system started with the frontend design; this included all the pages that the user would see when accessing the site. This section will outline what was done to design these elements and how they were used for implementation.

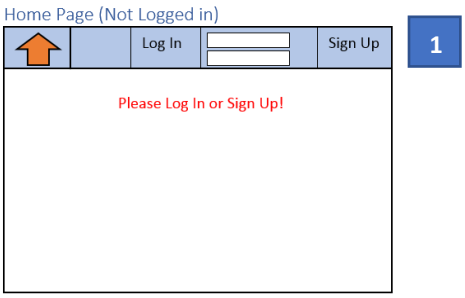

FIGURE 1 – HOME PAGE (NOT LOGGED IN)

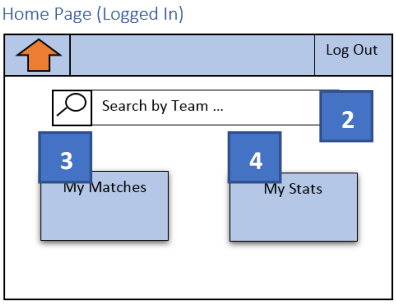

FIGURE 2 – HOME PAGE (LOGGED IN)

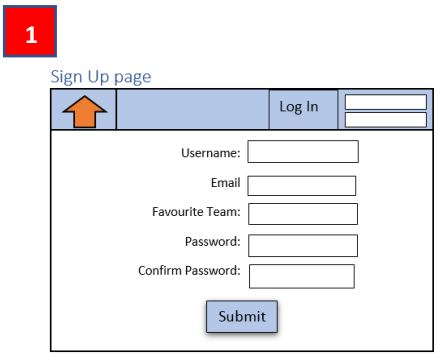

FIGURE 3 – SIGN UP PAGE

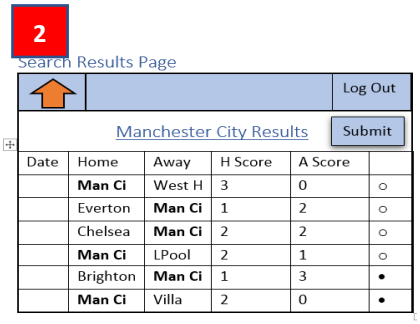

Figure 4 – Search Results Page

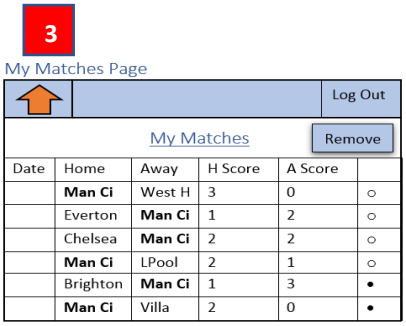

Figure 6 – My matches Page

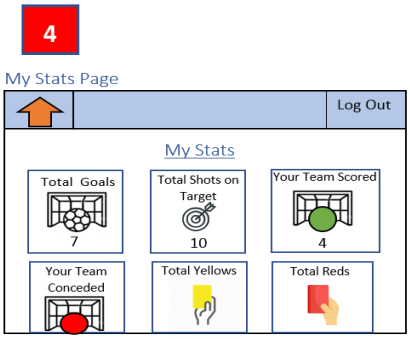

Figure 5 – My stats Page

Above are the initial designs of the web application, they show all the pages that the site used along with the rough layout of each page. These designs are simply to show how the pages linked rather than how the final product would necessarily look, all the colours and other aspects of the pages were subject to change. These were however used to guide the project moving forward, the designs were created using the system requirements as a guide. For each page pressing the orange 'house' button in top left will take user to home page. The numbers on the diagrams show how pages link with blue numbers showing which page the button links to and the red numbers used to identify the pages. Note that the only pages a user will be able to reach when not signed in would be the home page and signup page. Once this simple page designs had been completed a more detailed digital prototype had to be made. This was done using the online developer tool Figma.

https://www.figma.com/file/S1ef6KW1IUmxA3sVngO9Qg/project-prototype?node-id=0%3A1

Above is a link to the location of the digital prototype (simply press the play button in the top right to use it). This digital prototype was used to design how components on the page react when the user interacts with them, for example when the user logs a match or removes a match. Note that this prototype again is a very simplified version like the original and aspects like team searching and viewing your matches display blank tables, when in the real product they will be populated with data. Pages will also have more descriptions and error handling to guide the user. But the prototype is detailed enough to build on the original designs to help make the final product. Aspects like the profile page and bar to update the stats page have been added to fill more of the requirements outlined.

FIGURE 7 – SCREENSHOT FROM FIGMA EDITING SCREEN

With both simple screen designs and a digital prototype completed the frontend designs where complete and ready for to be implemented.

3.2.2.2 Back-End Designs

With the frontend designs completed the next step was to move onto the backend design. In order to create the backend of the website there were a number of designs that need to be done, initially it was important to set out what the entities will exist in the database. Below is the entity relationship diagram for the database:

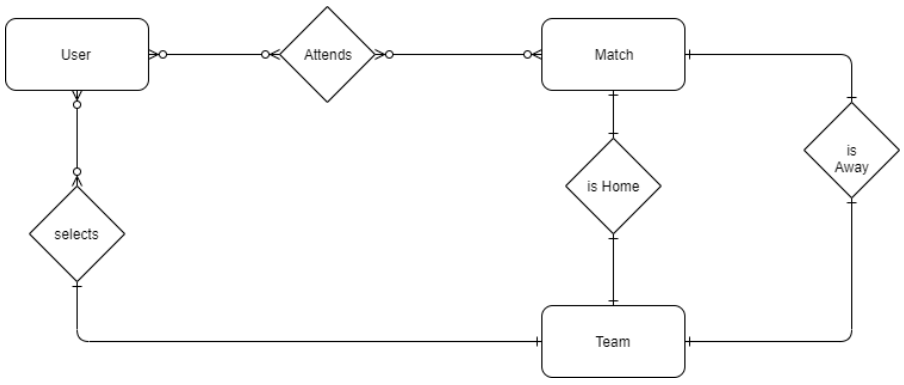

FIGURE 8 - ENTITY RELATIONSHIP DIAGRAM

The entity relationship diagram shows the relationship between entities of the database along with cardinality constraints. This was useful as it helped guide what the backend would be storing and how these elements interact. This diagram shows that:

- zero or many users may attend zero or many matches, and zero or many matches are attended by zero or many users.
- Zero or many users must select one team and one team may be selected by zero or many users.

- A match must have a home team and a team must be at home for a match.
- A match must also have an away team and a team must be away for a match.

Once this diagram was completed a more detailed version had to be created showing all the tables and their variables, this is outlined below.

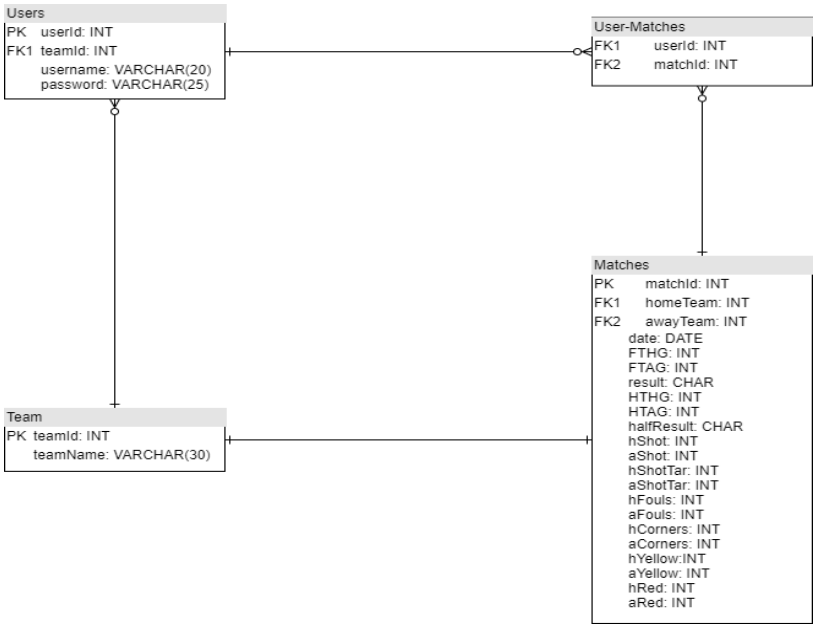

FIGURE 9 ENTITY RELATIONSHIP DIAGRAM 2

This diagram was used in the creation of the tables and was important for outlining the types of the columns, for the matches table these columns were designed to line up with how the data is provided from the source. This diagram also shows the primary and foreign keys used in the tables to identify elements. The next step was to outline a sequence diagram which shows the interaction between the user, front-end and back-end of the web app. The diagram (see figure 10) shows how main processes of the product will work e.g. log-in, searching for a team, logging a match and removing a match. The diagram shows how elements interact under different scenarios of processes, for example when logging in the user will receive an error if the login details do not match the details in the database. The sequence diagram does not show all possible intercactions of the web app, only the more important ones. It also shows how control changes as processes are completed.

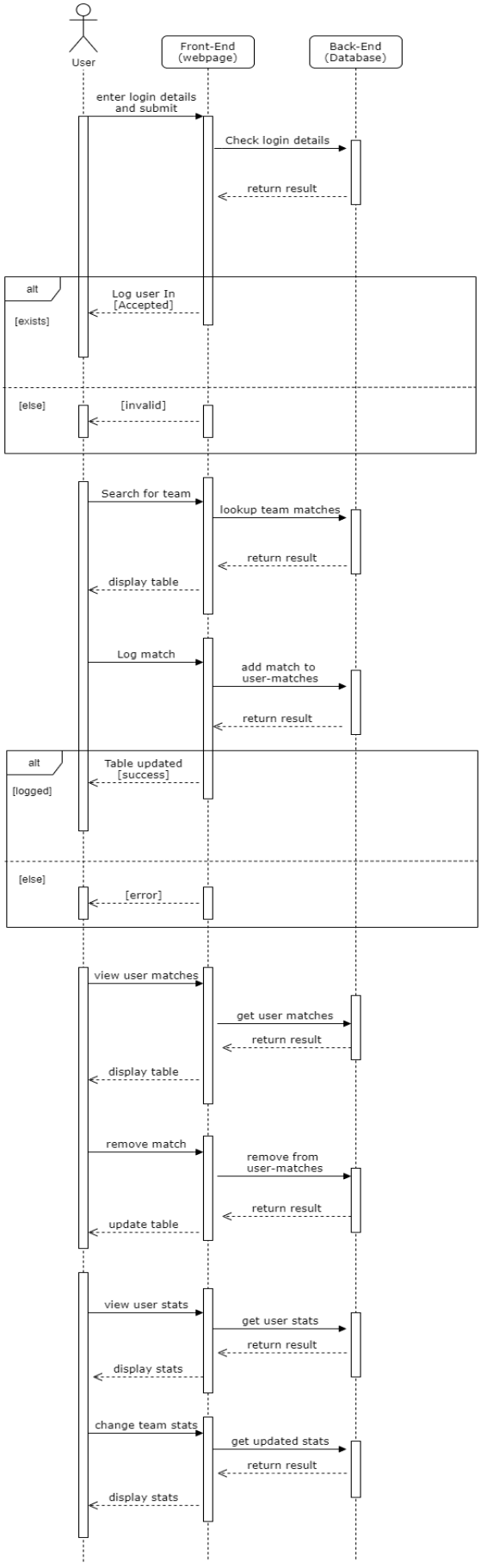

FIGURE 10 - SEQUENCE DIAGRAM

3.2.3 Testing Strategy

The testing strategy that this project used aimed to triangulate an approach that tested every aspect of the product, this testing strategy included a number of phases. These were requirements testing, error testing and finally a user testing phase. These aimed to fix any errors that existed in the product but also aimed to compile a list of improvements for the system. These testing areas will be explained in more detail in the testing section of the report along with the results.

User testing was conducted via interviews, these interviews were designed with the aim of gathering improvements to the existing product. The interviews consisted of two parts; first users were asked to complete a number of tasks with minimal instructions of how to do them. The aim of this was to observe if the user could use the web app and to evaluate its design. The second part of the user testing was to ask a number of follow up questions to extract what the user liked or disliked about the site, and how they thought it could be improved. As explained above the user testing followed ethical guidelines and was conducted with supervisor consent and participants filled out consent forms (see Appendix I).

3.2.4 Risk Analysis

Risk Number	Risk description	Risk impact (High – Low)	Risk Likelihood (High – Low)
1	Tasks are not completed within deadline, causing further delays down the line.	High	Moderate
2	Problems with the technology leading to tasks not being possible to complete without change.	Moderate	Moderate
3	Project not being completed at all, having to change system fully.	High	Low
4	Unforeseen events e.g. illness disrupting timeline.	Moderate	Low
5	Web app is not able to be hosted on the chosen platform, alternative needing to be found.	Low	Moderate
6	Ethical approval not received for user testing.	Moderate	Low
7	Languages intended to be used not being learned properly, causing errors in system.	High	Moderate
8	Errors in hardware/memory causing loss of work.	High	Low
9	Having to change methodology of process	Moderate	Moderate
10	Other deadlines causing work to be delayed	Moderate	Moderate

TABLE 3 - RISK ANALYSIS

3.3 Implementation

This section of the report will outline how the designs were implemented into the final system; the section will explain how these designs were used. An explanation of the more complex processes will also be given.

3.3.1 Back-End Implementation

Using the diagrams and description set out in the design the backend of the web app was created. As explained in the requirements, the database was created using XAMPP's phpMyAdmin. The tables were created with the Entity Relationship Diagrams as a guide for the columns and relationships of the tables. The next step was to populate some of the tables with the required data, as all the data had already been sourced and downloaded, the data needed to be formatted to fit the tables. All the data came in the form of .CSV files, these could be imported into XAMPP's SQL tables assuming the format matches the table. The data came in files separated by season and by league these had to be concatenated into one large file, then all non-essential

data needed to be removed this included all betting information such as odds that were also included for each match as they would not be used on the site. Once this was done the data needed to be edited again to remove team names and replace them with a number assigned to the team, so that there was no repeated unnecessary data in the database. This was also done so that each team had a unique identifier to be used to link to the 'teams' table which included a list of all the teams in the data. Once all this was done the data could be imported to populate the 'matches' and 'teams' tables, all other tables could be left empty to be filled as users interact with the site.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	HomeTeam	AwayTeam	Date	FTHG	FTAG	FTR	HTHG	HTAG	HTR	HS	AS	HST	AST	HF	AF	HC	AC	HY	AY	HR	AR
2	54	47	########	2	1	H	1	0	H	8	13	6	4	11	8	2	5	2	1	0	0
3	11	21	########	2	0	H	1	0	H	12	10	4	1	11	9	7	4	1	1	0	0
4	39	31	########	0	2	A	0	1	A	15	10	6	9	9	11	5	5	1	2	0	0
5	43	24	########	0	3	A	0	2	A	6	13	1	4	9	8	2	5	2	1	0	0
6	60	88	########	1	2	A	1	2	A	15	15	2	5	11	12	3	5	2	2	0	0
7	91	14	########	2	0	H	1	0	H	19	6	5	0	10	16	8	2	2	2	0	0
8	95	35	########	2	2	D	1	1	D	11	6	4	5	8	7	3	6	0	1	0	1
9	3	53	########	0	2	A	0	1	A	9	17	3	8	11	14	2	9	2	2	0	0
10	50	93	########	4	0	H	2	0	H	18	5	8	2	14	9	5	4	1	2	0	0
11	81	17	########	0	0	D	0	0	D	18	16	3	6	10	9	8	5	0	1	0	0
12	21	60	########	0	0	D	0	0	D	12	12	1	6	14	16	5	5	2	2	0	1
13	24	3	########	3	2	H	2	2	D	24	15	11	6	12	9	5	1	0	2	0	0
14	35	81	########	2	1	H	2	0	H	13	15	7	4	8	20	2	5	0	5	0	0
15	47	95	########	2	0	H	2	0	H	6	11	2	3	10	8	1	9	2	1	1	0
16	88	39	########	3	1	H	1	0	H	25	10	11	3	9	5	5	2	0	0	0	0
17	93	11	########	1	2	A	1	0	H	11	12	5	5	14	10	6	4	6	2	0	0
18	14	54	########	3	2	H	3	1	H	6	9	3	3	16	13	3	5	1	1	0	0
19	17	91	########	1	3	A	1	1	D	8	9	3	6	8	19	5	2	1	2	0	0
20	53	43	########	6	1	H	3	1	H	32	5	14	1	9	4	10	3	0	2	0	0
21	31	50	########	0	2	A	0	1	A	8	16	2	6	6	13	6	7	1	1	1	0
22	3	93	########	3	1	H	1	1	D	17	13	10	5	16	13	10	2	1	3	0	0
23	11	35	########	2	2	D	0	0	D	17	11	5	3	12	10	6	2	0	3	1	1
24	43	21	########	0	0	D	0	0	D	5	14	1	4	8	10	7	7	0	1	1	0
25	50	14	########	1	0	H	1	0	H	22	6	8	2	8	14	8	5	1	1	0	0
26	81	47	########	1	2	A	0	0	D	11	8	5	5	13	11	10	3	1	1	1	0
27	95	53	########	1	1	D	0	0	D	11	18	2	6	13	8	5	9	1	2	0	0
28	39	17	########	4	2	H	3	2	H	25	12	12	2	11	8	6	4	2	1	0	0
29	60	24	########	1	2	A	0	0	D	6	15	2	3	16	8	4	5	3	1	0	0
30	91	31	########	2	1	H	0	0	D	13	9	5	3	14	11	6	3	4	2	0	0
31	54	88	########	0	3	A	0	0	D	23	9	5	5	11	16	5	2	2	4	0	0
32	14	39	########	2	2	D	0	1	A	15	10	5	5	12	14	7	1	3	3	0	0
33	24	11	########	2	0	H	0	0	D	24	8	6	1	10	7	7	6	2	2	0	0
34	31	81	########	0	2	A	0	0	D	20	19	6	6	11	12	7	4	1	1	0	0
35	35	43	########	1	1	D	1	1	D	11	9	1	6	13	14	4	3	3	3	0	0

FIGURE 11 - SCREENSHOT FROM EXAMPLE CSV FILE CONTAINING MATCH DATA

3.3.2 Front-End Implementation

3.3.2.1 File and Folder Structure

The coding for the project was completed in Visual Studio Code [8], a code editing software specifically suited towards creating web applications. The implementation of the front-end of the web app began by creating the folders for how the project would be organised. The folder structure for the project was structured as follows; main pages that the user accesses and sees are in the main project folder, pieces of code that are run when completing a process e.g. login are all organised into a folder called 'includes', images are all organised into a folder called 'pictures' and the style sheet is in its own folder called 'style'.

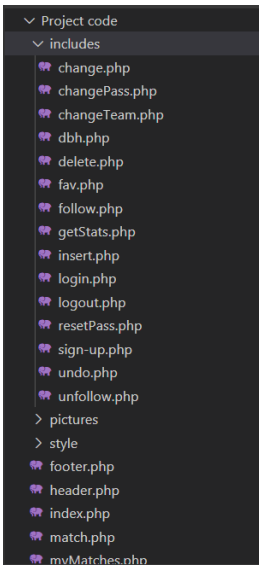

FIGURE 12 - SCREENSHOT FROM VISUAL EDITOR SHOWING FOLDER STRUCTURE

Each page that the user accesses on the web app has a footer and a header, these are both outlined in their own files and then imported to each page. This means that no unnecessary code is repeated, all files included in the project are .php files as every page uses php to display content and interact with the database. Files that the user accesses in the 'includes' folder are only accessible by pressing a button or are imported to a page as the user accesses them, this means that the user is not able to run these pieces of code in any way other than intended. The whole project folder needed to be located within XAMPP's 'htdocs' folder so that the php code could be hosted and run locally when testing the website.

3.3.2.2 PHP coding Style

All the pages of the web app follow the same structure, every page imports the header file and the footer file at the top and bottom of the pages respectively. The rest of the page content are contained within the body html tags, giving each page the same structure without repeating the same code on each page. As all the files in the project are php files, to implement html elements the 'echo' function had to be used which takes input as a string and allows the browser to read the elements as html code. Which is why most of the pages have large portions of code inside echo strings. All the websites stylings are contained within a single stylesheet, where multiple style classes are used across multiple pages to have a consistency of style and theme on pages. Every page has a check for if the user is logged in and only displays content where appropriate e.g. if a user is not logged in, they cannot access most of the pages other than index and signup. All pages then have a test to see if any error/success messages should be displayed to user at the top of each page. The page content follows below.

3.3.2.3 HTTP Session Variables and Features

The web app uses http sessions to deal with login, layout of pages is changed depending on the values of session variables. When the user successfully logs into the system by entering a correct email and password, a session is started in the user's browser this has a time limit and will end if the user is inactive for a period of time. When the session is started a number of variables are initialised, these variables are used to display appropriate content on pages. For example, there is a test on the home page which tests if the session variable for the user ID is set to a value, if it is the user must be logged in so can view the logged in page content. If this is not the case the user is not logged in. These sessions variables are used to store information without having to interact with the backend every time, for example the user's favourite team is stored to create default values for the stats page. These session variables are also useful as they allow variables to be passed between pages. The session variable is destroyed when the user logs out or if the session expires, then the user will have to log back in.

3.3.2.4 Logging a match/ Removing a match

The process of logging a match works as follows; the user uses the search bar located on the home page to lookup matches for a particular team. The search results page takes the selected team and displays all the relevant matches from the database into a table, these are matches where the selected team is either the home or away team. Each match has a button the user can press to log the match. If the user wants to log the match, they will press this button. As the button is located in a form, when it is pressed the ID for the match is posted and the 'insert.php' page is run. This is a piece of code that adds the match to the user_matches database table along with the users ID, the user is then redirected back to the search page they were previously located with the page updated showing logged matches in green, if there are no errors.

The process of removing a match from the users logged matches works in a very similar way, on the user's 'My Matches' page the users logged matches are displayed. These are all the matches in the users_matches table with the selected user's ID, along with a button to remove the match. When this button is pressed the matches, ID is passed to the 'delete.php' page and the row containing the match ID and the users ID is

removed from the user_matches table. This removes the match from the users logged matches and the page updates to show this change.

3.3.2.5 Stats and Graph Generation

The next important process the web app does is generating user stats. When the user accesses the 'My Stats' page the stats are gathered automatically, a file called 'getStats.php' is called which gathers all the users logged matches and totals up stats like goals seen etc., for all matches seen and for matches under the specific settings of the page, changeable by the user. These totals are assigned to variables and are displayed for the user in graphical and statistical ways. JavaScript graphs are also used to display stats to the user, the graphs are sourced from chart.js [9] an opensource JavaScript library. To use these graphs the php variables needed to be encoded into JavaScript elements this was done using an inbuilt function in php json_encode(). This allowed the content to be displayed on graphs that are interactive for the user.

3.3.2.6 Mobile Support

Although this is a web application designed to be used on a browser on a user's computer, it was also important to implement support for viewing the page on mobile. This was done using CSS to scale the objects to fit the screen the user is using, when accessing the web app on mobile users will be prompted on each page to rotate their device to landscape with a heading at top of each page. This was done using CSS to display the message when the page is viewed in portrait, and then not to display when in landscape. This was the easiest way to add mobile support without re-styling the entire web app to fit for mobile, as this would be out of the scope of this project.

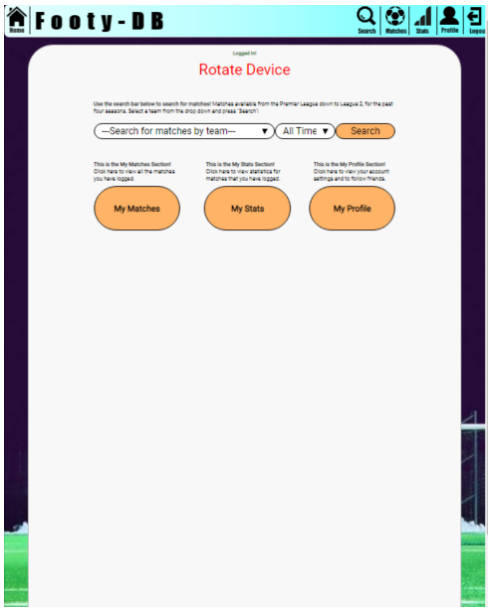

FIGURE 13 - EXAMPLE SCREENSHOT OF MOBILE SUPPORT AND WARNING MESSAGE

3.3.3 Hosting

Once all the pages outlined in the design phase had been implemented the next step for the project was to make the website accessible to other machines for testing. This was done via Amazon Web Services [10]; this allowed the project to be hosted on a virtual machine that received and distributed http requests and responses. This virtual machine had XAMPP installed on it and the connection was left running so it could always be accessed. An elastic IP address was bound to the machine so that when someone enters the address into their browser the web app is displayed. The backend access is protected using a password so users cannot access this data using the phpMyAdmin page. Files were transferred to this virtual machine via

the secure file transfer service WinSCP [11] to transfer and update files for the pages, without having to restart the connection. Note that the web app was only hosted during the testing phase and is no longer available remotely.

3.3.4 Implementation Screenshots

Below are screenshots of all the pages that were implemented for the web app. With the implementation phase completed the next phase was to move on to testing the product.

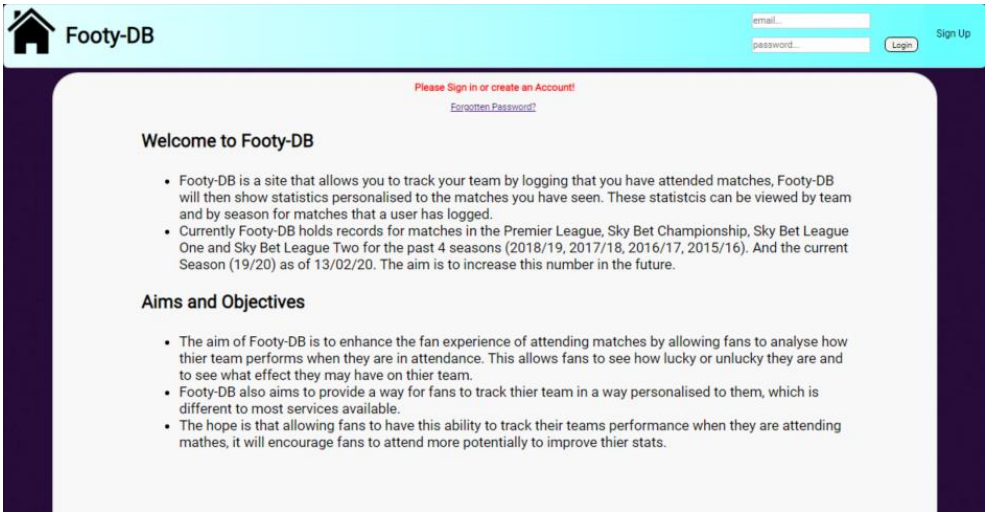

FIGURE 14 - INDEX PAGE (NOT LOGGED IN)

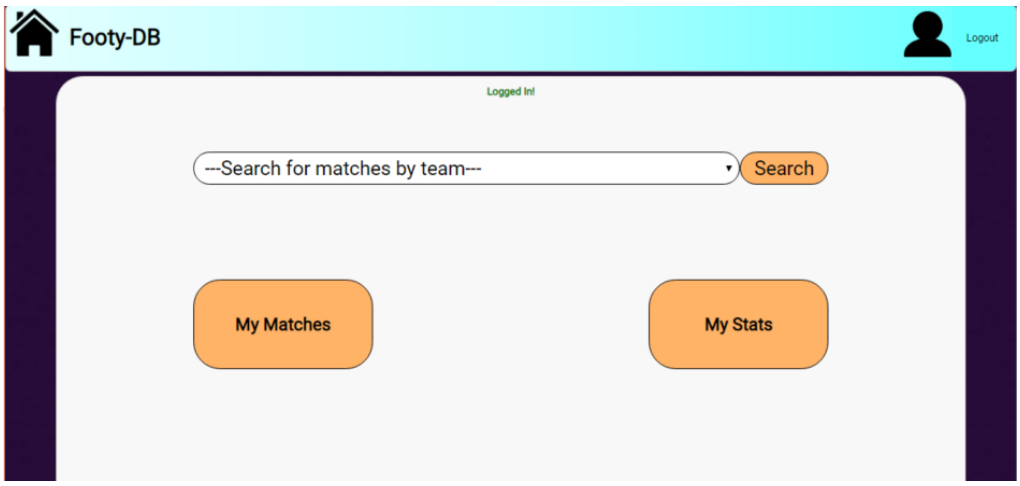

FIGURE 15 – HOME PAGE (LOGGED IN)

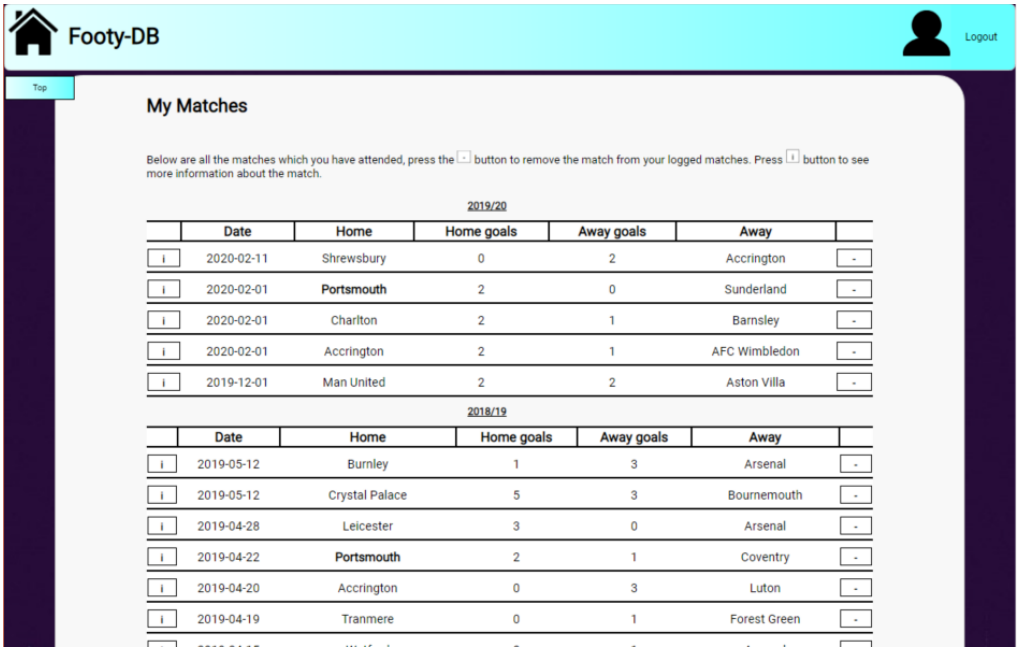

FIGURE 16 - USER MY MATCHES PAGE

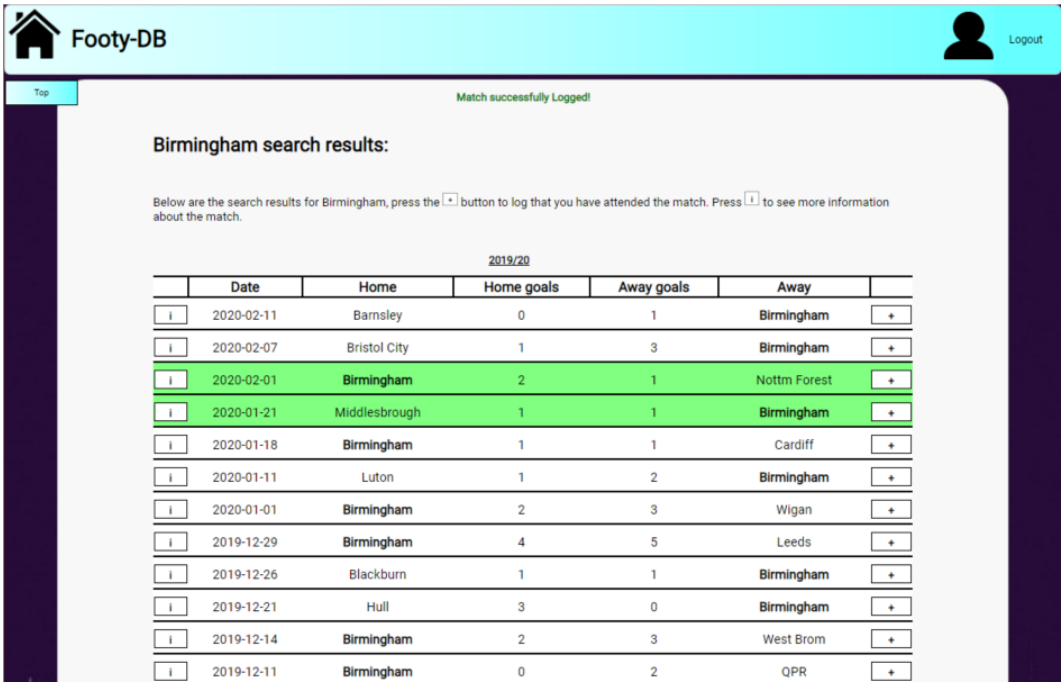

FIGURE 17 - SEARCH RESULTS PAGE

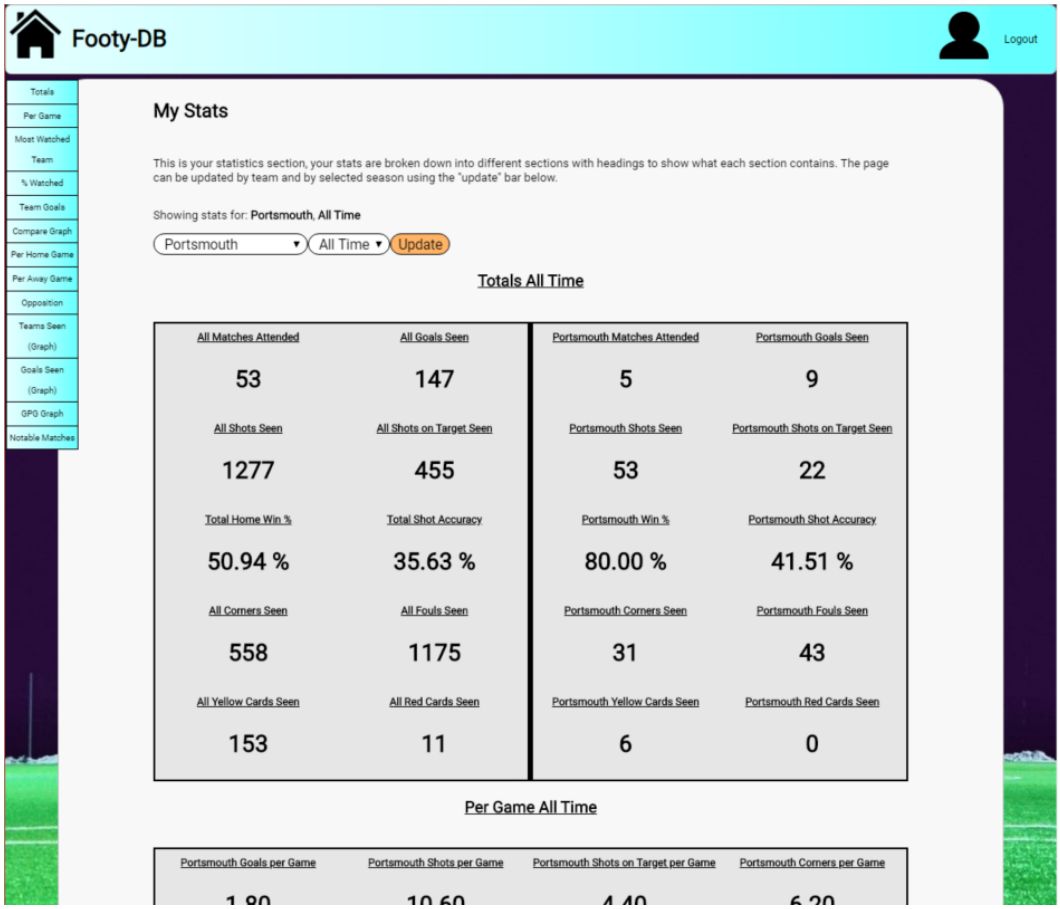

FIGURE 18 - USER STATS PAGE

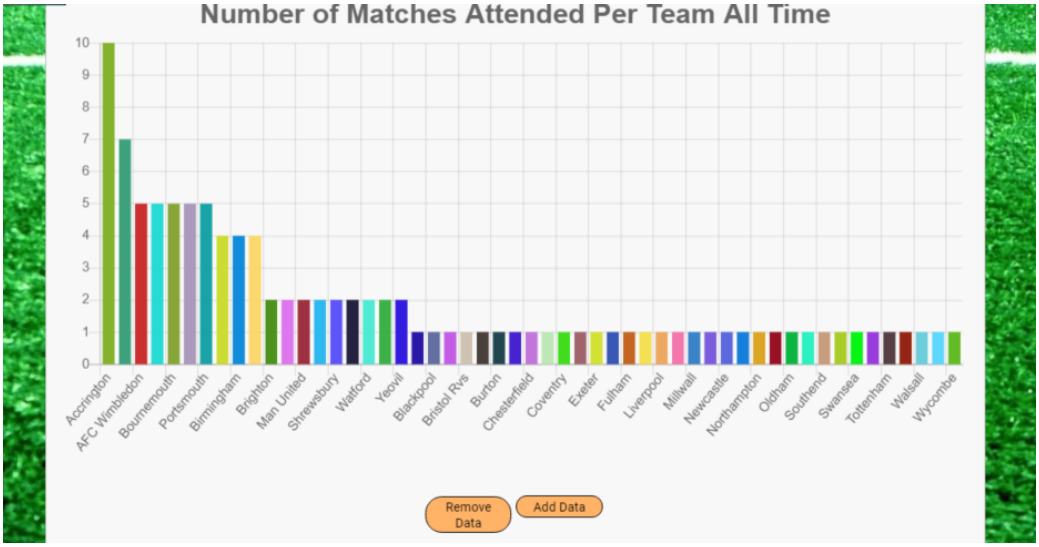

FIGURE 19 - STATS PAGE GRAPH EXAMPLE

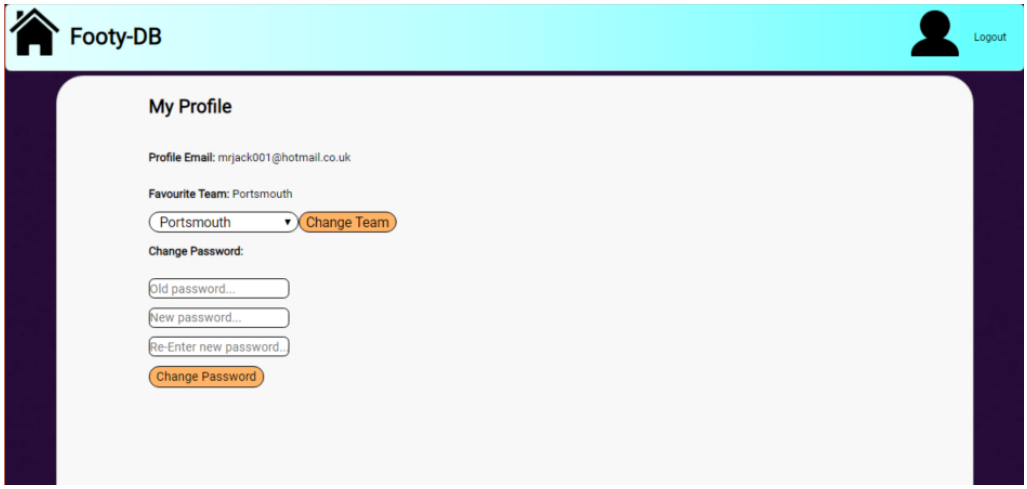

FIGURE 20 - USER PROFILE PAGE

3.4 Testing

As outlined in the testing strategy section of the report the testing of the product was split into three main phases. These are outlined below, and each section will show details for how they were conducted and the result of the testing.

3.4.1 Requirements Testing

This phase of the testing was completed using the requirements table outlined as a guide, the aim of this phase was to gather which requirements had been achieved. This testing phase used the system requirements and each requirement was analysed to see it had been met fully, met partially or not met. The results of this testing (see Appendix F) were summarised into a table giving an explanation for each requirement. Overall this testing showed that all mandatory functional and non-functional requirements had been achieved, and that most of the desired requirements had also been met either fully or partially. For example, the requirement no. 3 'Each page shall include a navigation bar at the top.' had been fully met as this is the case on each page of the web app. But requirement no. 2 'Additional pages should be: Profile page, match information page and a customisation page (e.g. colours)' had only been partially met as there was no implementation for the customisation page, but as this was a desired requirement and not a mandatory one it is acceptable that it is not fully achieved. Overall this phase of the testing showed that the product met the requirements outlined and that it was in a usable state to be tested further.

3.4.2 Error Testing

The second phase of testing was designed to test whether the product could be put into an 'error state' and if the error handling was sufficient to tell the user what had gone wrong. This was done by testing each aspect of pages on the site that users interact with e.g. forms and buttons. The aim of this phase of the testing was to prepare the product for user testing by identifying and removing errors. The results of this testing (see Appendix G) were summarised into a table. Each aspect that needed to be tested was given a description along with an expected output, this was compared against the actual output. In the limited cases where there was an error this was fixed, and the table updated to the new value for what should happen. For example, a common error was that if the user manually typed in page URL when they weren't logged in, pages that the user shouldn't be able to access were accessible. This was easily fixed by having a test on each page if the user was logged in, if not they were directed back to the home page. Overall this test phase showed that putting the app into an error state should not be possible. This phase also showed that users are given the correct

error/success messages when competing a task. After this testing phase was completed the product was in a usable state for user testing.

3.4.3 User Testing

3.4.3.1 User Testing Prerequisites

Before the user testing could be done a number of things had to be completed. An ethical approval submission had to be made, this was done by completing an ethical compliance form signed off by the supervisor (see appendix C). Once the compliance form was signed and the previous testing phases had also been completed, the user testing was able to begin.

3.4.3.2 User Testing Methodology

As outlined in the test strategy section of this report, user interviews were used to gather feedback for improvements to the web app. The sample of users used for this testing phase were chosen to be as close to the target demographic of the web app as possible. The sample used were a mixed range of ages, were all football fans and most do attend or have attended football matches in the past. Limitations caused by the global COVID-19 pandemic meant that only 4 of these face to face interviews were able to be completed, this limited the ability to go out and find participants, so the sample consisted of friends and family who were available/reachable safely, this sample was deemed sufficient to complete the testing and gather feedback.

When an interview was conducted each participant was read an interview script (see appendix H). and were shown a consent form (see appendix I). Their responses were collected but no personal information was gathered, apart from age to create sample demographic data. Users were then asked to sign a consent form (see Appendix K). The interview then began with the tasks that users were asked to complete using the site, these were:

1. Create an account and Log in to the site
2. Log that you have attended a match for your favourite team in at least two different seasons (if possible, e.g. Salford not)
3. Can you tell me how many Shots were made by Arsenal When they played Burnley on 2020-02-02?
4. Delete a match that you have logged
5. How many goals have you seen for your team?
6. Who is your most watched team?
7. Change the stats page to show for Bolton
8. compare their Wins/Draws/Losses to another team
9. Change your favourite team

These were created by analysing all the tasks a user can complete on the site (see appendix J) and condensing the most important into a list. They were designed to be descriptive enough but without telling the user how to complete a task, as this would gather unbiased feedback from the user. Users were asked the following questions after completing all the tasks:

1. Was the site easy to understand/use?
2. Did you have any trouble completing any tasks?
3. What did you like overall about the site?
4. What did you dislike? How would you fix that?
5. Any features you would like to see added to site as a whole?
6. Was the Stats section easy to user/understand?
7. Are there any particular stats you would like to see added?
8. Any other Comments?

These questions were designed to cover all bases of gathering the user's opinions, whilst also prompting them to evaluate and suggest improvements to the product. Once the interview script and consent form were

outlined the user testing was able to begin. Users were also debriefed and thanked after completing an interview. As outlined by the compliance form.

3.4.3.3 User Testing Results

Below is a summary table for the user interviews, this was created from the full results table (see appendix L) to condense all user responses and to see trends in answer.

Question	Summary
How old are you?	Sample of users of mixed ages, all are football fans, and most do attend or have attended matches in the past. So, all fall in the target demographic.
Are you a football fan?	
Do you attend matches?	
Task	----------
1	Users generally had no trouble signing up and logging in to the system.
2	Users generally were able to complete the searching for matches, only confusion was caused by users not knowing that all the seasons displayed on one page.
3	Users had trouble finding home button to navigate back to search page. Once this was done most users were able to complete the task by searching for Arsenal and looking at the match info.
4	Users were able to do this task relatively easily.
5	A few users didn't realise this was located on the stats page and initially tried to count goals on the 'My Matches' page. Once they found the stats page, they were able to complete the task.
6	Most users were able to complete this task, only trouble was that some users didn't realise that the stats page had more content after scrolling.
7	This task caused the most confusion, users didn't realise they could change the stats page to show for teams they haven't necessarily logged matches for. But all users were able to complete the task eventually.
8	Most users were able to complete this task when they found the graph which allowed comparison.
9	Many users didn't see the profile icon or didn't realise they needed to navigate there. Once they directed themselves there (usually by process of elimination) they were able to complete the task.
Question	----------
1.	Things users liked about design: • Simplistic design is good, allows little margin for error. • Readable fonts and colourful design. • Placement of items on pages felt natural. Things users didn't like about design: • Header should scroll with page, so users don't have to scroll back up. • Nav bar should have links to all pages.
2.	Main tasks which caused trouble: • Tasks which made the user navigate to home/profile using icons, users didn't think icons were intuitive enough. • Stats page change bar caused some confusion.
3.	Things users liked: • Simplistic design, readable fonts and colours. • Stats page graphics were appealing and well designed.

	• Users generally liked stats page and felt it was a comprehensive list of stats they could delve in to. • Liked selection of teams and matches.
4.	Users disliked and how to fix: • Nav bar was hard to understand, fixed by adding text description to icons. • Nav bar should move with page and link to all pages. • Users wanted the ability to search by season. • More page descriptions/text to explain things e.g. graphs and how to use them. • Stats page should be condensed/separated out.
5.	Feature users wanted to add: • Adding friends/ seeing friends stats. • Upcoming matches for teams. • User customisation by team e.g. colour scheme. • The ability to favourite matches.
6.	How to improve stats page: • Stats page was cluttered and could be separated out into smaller pages/condensed. • Descriptions of what each section is/does e.g. graphs. Things users liked about stats page: • Graphical and text representations of data allow users to choose how they prefer their data. • Colours and graphics are appealing to look at. • Large selection of data allows users to delve into stats.
7.	Possible stats to be added: • Goal scorer data • More match data e.g. tackles, passes, possession etc.
8.	No.

TABLE 4 – USER TESTING RESULTS SUMMARY

The user testing outlined a number of improvements that could be made to the product based on user feedback. These improvements were condensed into a list, some improvements came directly from the users whereas others were gathered from the observation phase based on tasks the users had trouble with, the list is outlined below:

1. Have the navigation bar at the top of the page follow the users scroll, so users do not have to scroll back up the page.
2. Add a link to profile page on main page rather than just on navigation bar.
3. Some way of adding friends/ following people so you can view their stats e.g. for comparison.
4. Decluttering stats page by reorganising components or moving components to separate pages.
5. More page descriptions especially on the stats page, e.g. explanation of what each graph or section represents and how the user can interact with them.
6. Some way of favouriting matches.
7. More matches added from different competitions e.g. cups or new leagues.
8. Header navigation bar should have links to each page rather than forcing users to go through home page.
9. More control on the searching e.g. search by season.
10. Some way of seeing teams upcoming matches.
11. More stats for each match e.g. passes, tackles etc.
12. Icons for home and profile page must be made clearer e.g. make more obvious or add text description.
13. User customisation e.g. themes being club colours or crest as background.
14. Stats for goal scorers.
15. Teams on the search page could be clickable to view their matches.
16. Possibly remove teams that the user has not logged from the stats change bar, avoids confusion and means users can easily see which teams they have seen.
17. Description on home page as to what each section is for.
18. A way for users to hide the jump nav bar on the stats page, to make page seem less cluttered.

A number of these improvements were areas where nearly all the users struggled, for example many users reported that the home and profile icons were not clear and that they needed to be improved by adding some kind of textual description too. Users also wanted more descriptions on each page to explain some of the more complex elements e.g. graph interaction. The next step was to gather these improvements and identify which ones were achievable and to make those improvements to the product.

3.4.3.4 User Testing Improvement phase

Once a comprehensive list of improvements were gathered the project moved into the improvement phase. In this phase of the project the aim was to collect all the user suggestions and try to implement most or all of them. Below is a table showing the outcome of this phase, it shows the improvement number (links to the list outlined above), the action taken for each one and an explanation along with screenshots of elements where necessary. The table shows that all but 6 of the 18 improvements outlined by the testing were implemented, the main reasons that certain improvements were not implemented was due to them being improvements for the data for the matches. For example, adding goal-scorer records or passing data etc. these were not implemented as it would require a whole restructure of the web app and new data would need to be sourced to fit into the requirements set out, these were not feasible improvements. All other improvements were completed in some form.

Impro-vement No.	Action Taken	Explanation
1	Suggestion followed making the header follow the view down the page as they scroll.	Suggestion was easy to implement and was a minor quality of life improvement for users. Improvement was particularly important for the larger pages, so the user did not have to scroll all the way back up on each page.
2	Added a button on the home page linking to the user profile page.	Simple improvement, that gives users another way of navigating to the profile page if they miss it on the nav bar. 
3	Added a way for users to follow each other and then view the stats of people they are following on the ‘my stats’ page.	This was done so users could interact with each other and compare stats. Which is an important aspect for fans who like to compete with friends. The follow section is fully error tested and users should not be able to create errors from this new feature.
4	Components have been reorganised into closable tabs, that by default are closed when the user loads the page. Tabs can be open and closed with buttons.	User feedback suggested that the stats page was too long, so by breaking it down into sections that the user can open and close they have all the control. This was more preferable than splitting the page up into separate pages as the user would then have more pages to deal with and would have to remember what’s on each page. 
5	More page descriptions added to home page and stats page.	Each section on stats page given a description where necessary, especially graphs. This is to make it clearer for user what sections mean and what users can do to graphs.

6	Users can now favourite and un-favourite matches on the 'My Matches' page.	Allows users to mark their favourite matches, and implementation could go further to allow them to view only their favourites or to view stats of their favourites. This would require further user testing to see if this is something a lot of users would want.  2019/20 undo Date | Home | Home goals | Away goals | Away | Fav 2020-02-11 | Blackburn | 3 | 0 | Hull 2020-02-08 | Shrewsbury | 1 | 1 | Milton Keynes Dons 2020-01-28 | Blackburn | 2 | 1 | QPR 2020-01-21 | Chelsea | 2 | 2 | Arsenal 2019-12-01 | Norwich | 2 | 2 | Arsenal 2018/19
7	No action taken.	This is something that if this were a real website would be done as games happen or as users demand more leagues. But the sample of matches used is more than enough for the purposes of this project. This would be an extension that could be done.
8	Links to the 'My Matches', 'My Stats' and search pages (index) added to the nav bar.	Buttons added as another quality of life improvement for users, meaning users do not have to navigate to the home page to get to any of these pages. The search button just links the user to the home page with a prompt for the user to use the search bar. The user stats page is now reset to defaults whenever the user navigates off the page rather than just when entering the home page.
9	Added the ability for users to search for matches by season.	Done so users don't have to scroll through all the matches to find a season. The search bar by default searches for all matches if the user doesn't select a match. This could be taken further to allow users to search by date etc.
10	No action taken.	This would be outside the scope and intended use of the website. The site was designed for users to view stats for matches that they have already attended. Not used for a fixture planner or all their go to football stats. This could be another extension that could be done were this a real website, but does not fall under the purpose of this project
11	No action taken.	This would require a full rework of where the stats are sourced from and a full rework of the database. The stats for each match are sufficient for the intended use. This is something that could be done if this were a real website and there was user demand for more stats.
12	Textual description added to all buttons, all buttons now have an image and a page description.	Change was made to avoid any confusion users had when using these buttons, the image with a text description also improves the look of the site.  Search Matches Stats Profile Logout
13	No action taken.	The problem with this improvement is that the use of club's crest/likeness is not allowed due to copyright laws. The use of colours would be acceptable and if this were a real site this would be something that could be considered if user demand was there. But as this is not the case the improvement would be minimal to the existing product.
14	No action taken.	This again is an improvement to the source of the stats. This require a complete rework of the back end and front end and doesn't really fall under the scope of the project. As the site is for users to track their team rather than track individual players.

15	Made all the teams on both search results and my matches page clickable to display search results for the selected team.	Makes it very easy for users to search through matches and search without having to use the search bar. Quicker and easier for users.
16	No action taken.	This has the possibility of causing confusion too, as users may not understand why a certain team isn't appearing for selection. The stats page in the current build tells users when no matches have been logged for the selected team. There should be no confusion if the user is paying attention.
17	Added descriptions for what each section on the home page does.	This removes any confusion for the user as to what each page is for.
18	Added a close button for the jump bar on the stats page. Along with a button to re-open it.	Done so the user can de-clutter the screen if they want, some users may not want or use the jump bar so should have the option to close it.

TABLE 5 – IMPROVEMENTS TABLE

Improvements which required changes to the back-end database e.g. adding a user followers' section needed to be planned out via diagrams before being attempted. This was to outline how these new elements would interact with the current database. Below are the diagrams used for this planning. These diagrams show the relation required for user followers and the table defined as a result. It shows one user can follow zero or many users and has zero or many followers. The second diagram outlines how the new table will be structured.

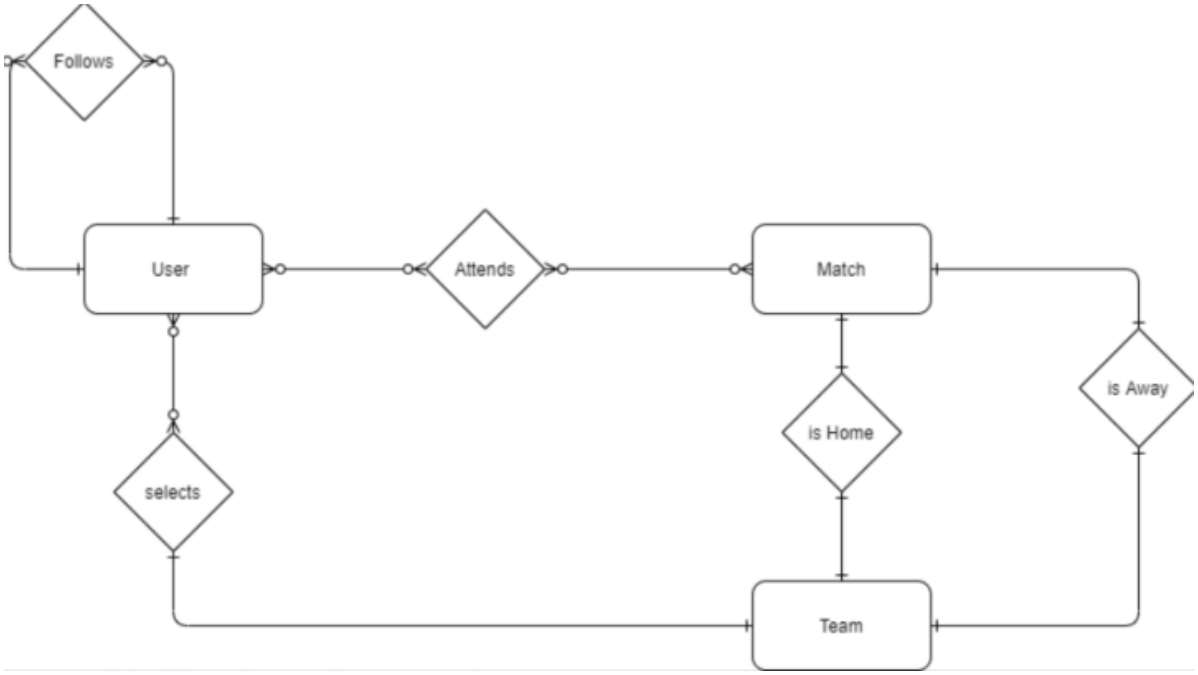

FIGURE 21 - ENTITY RELATIONSHIP DIAGRAM UPDATED

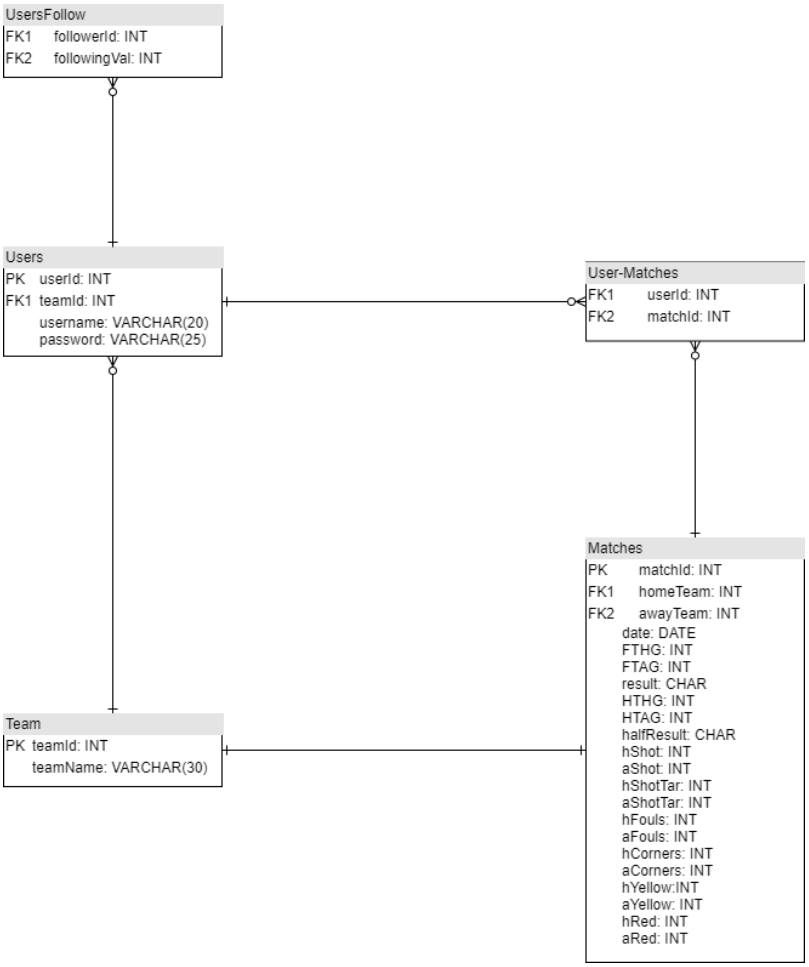

FIGURE 22 - ERD VERSION 2 UPDATED

This new user follow feature requires some explanation of how it work. This new feature is located on the user profile page allows users to follow other users by entering their email, this allows them to compare their stats with someone they are following on their stats page. When a user wishes to follow another user, they enter their email into the new section created on the profile page. A check is done to see if that user exists in the back-end database if not an appropriate error message is displayed. If the user does exist a record is added to the new table 'UserFollow' that inputs the user's ID who is following and the ID of the user who they wish to follow. Note that if two users wish to follow each other they will both have to do this process, similarly to how twitter following works. When this is done a list of who the user is following is displayed, on the 'myStats' page the user can now select to view stats of users they are following.

3.4.3.5 Post-improvement Screenshots

This section includes a number of screenshots of the improvements made to the product, note these are screenshots of the frontend as this is where most improvements occurred.

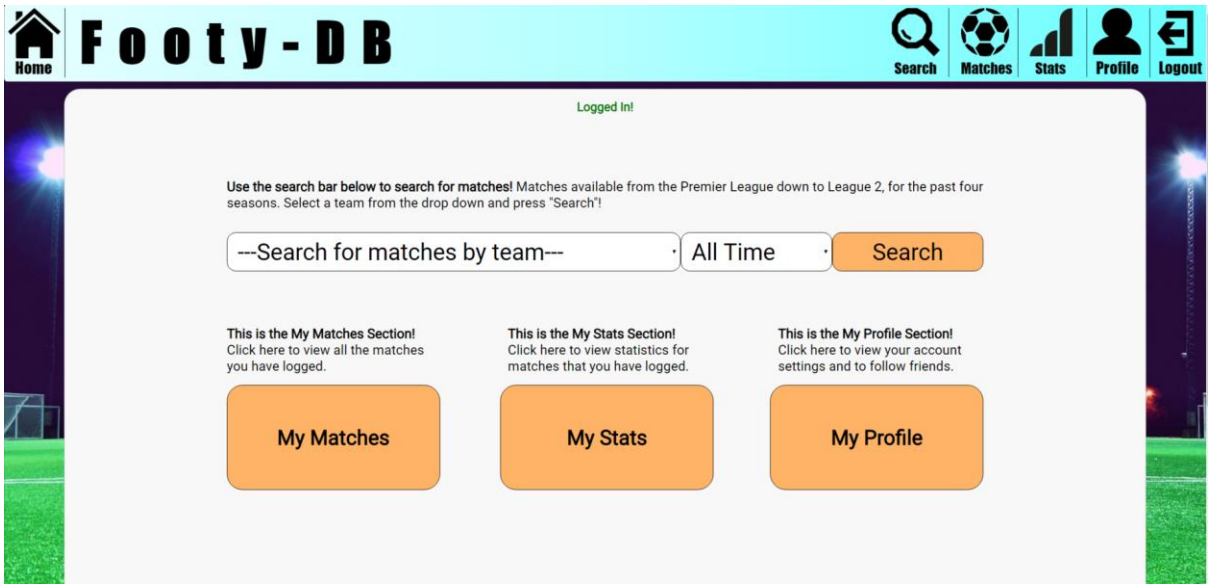

FIGURE 23 - IMPROVED INDEX PAGE

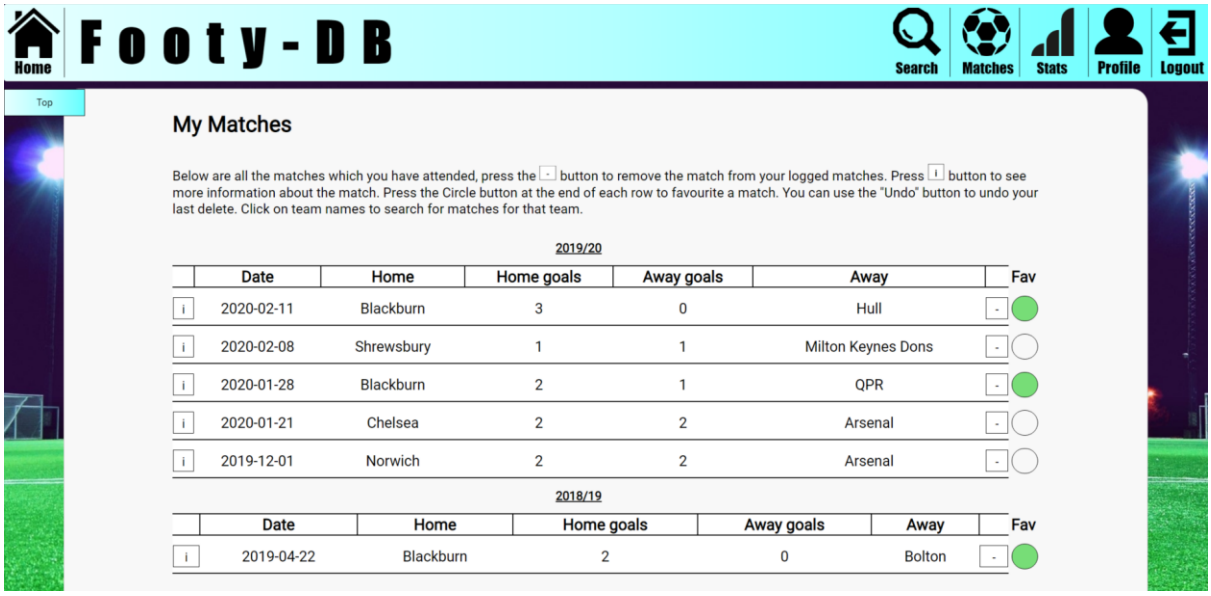

FIGURE 24 – IMPROVED MY MATCHES PAGE

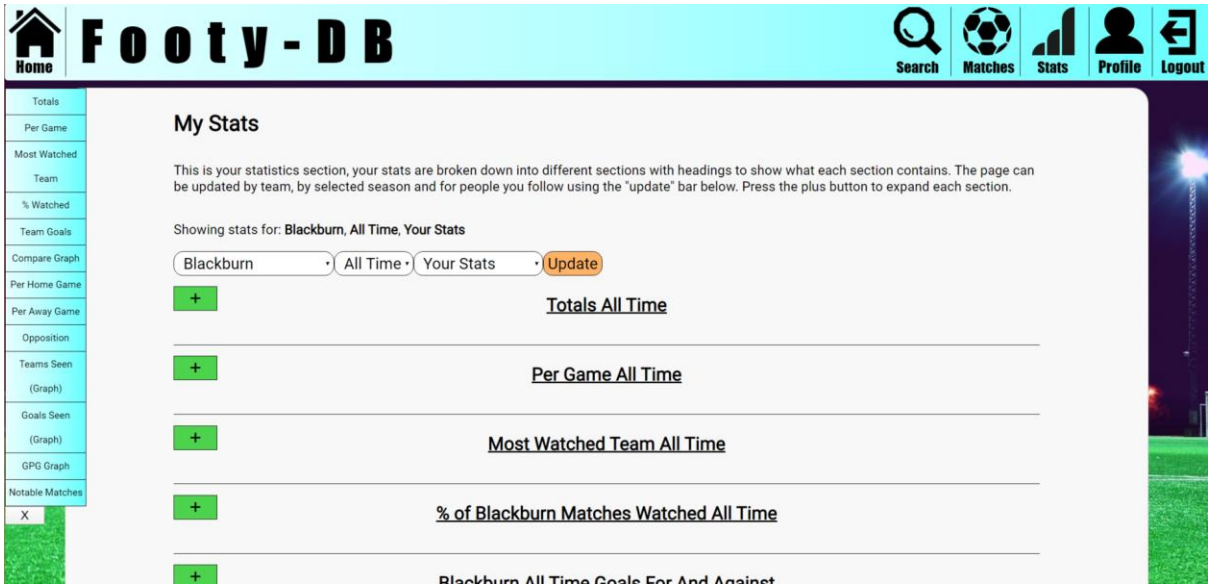

FIGURE 25 - IMPROVED MYSTATS PAGE

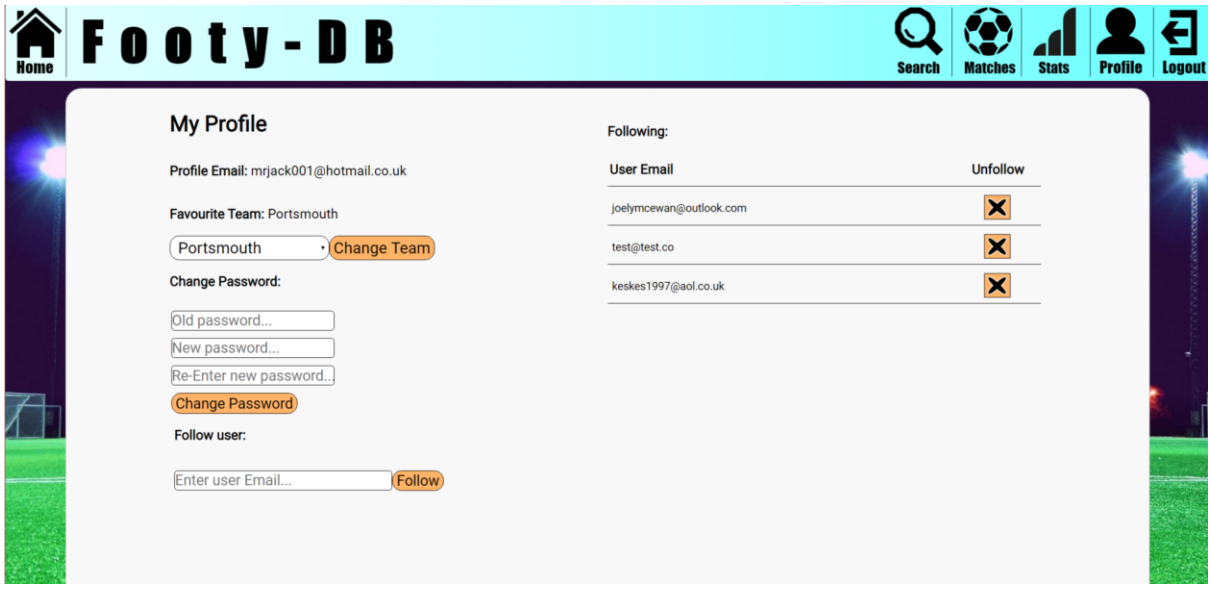

FIGURE 26 - IMPROVED PROFILE PAGE

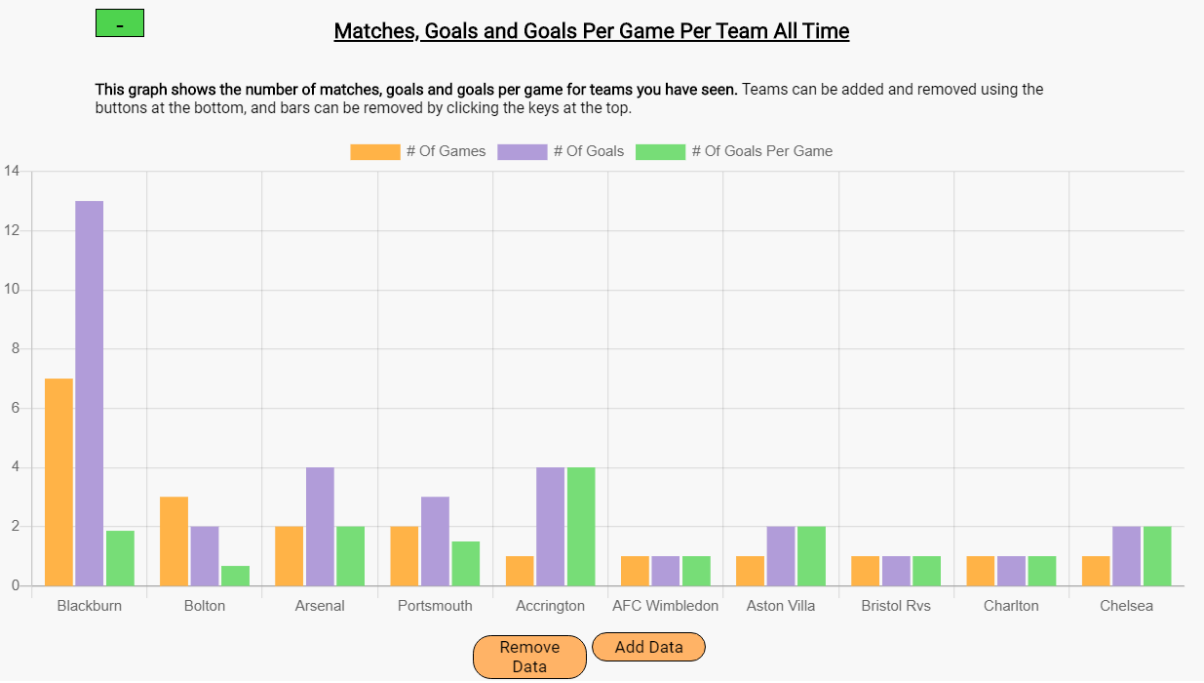

FIGURE 27 – IMPROVED GRAPH INTERACTION (DESCRIPTION AND BUTTONS)

3.4.4 Testing Evaluation

This section will evaluate the testing of the product, the methods used to test incorporated a number of different testing techniques to triangulate an approach. These testing methods were designed to cover all bases of the product to gather improvements and fix errors. Overall the testing was a success as it showed a number of improvements for the system along with showing that all requirements had been met and error states were not easily caused by the user. The main aspect of the testing that needs a further evaluation would be the user testing. The user testing phase was itself a success as it was produced a comprehensive list of improvements that were implemented. The user testing followed all ethical guidelines by having signed permission to be completed by supervisor and by gathering consent from participants (see appendix K). The main issues for the testing was the limited sample size, which was caused by the outbreak of COVID-19 meaning no further interviews could be conducted face to face, however as the interviews that were able to be conducted had already produced a number of improvements no further experiments were deemed necessary. It would have also affected the integrity of the results if some tests had been conducted face to face and other had been completed online, as users would have had different analysis conditions. The feedback gathered from user testing was unbiased as the instructions were not leading or descriptive enough to tell the user how to complete tasks, evident as some users struggled on certain tasks. This was important as the feedback needed to be free from interviewer bias. An interview was a good choice of method as it allowed more descriptive feedback from the user, which would have been more difficult in a survey, it also allowed an observation phase to get feedback based on the user's actions not just their words. Overall as the feedback gathered from the users was effective in creating improvements for the system the user testing was a success.

The next step for this project were this a real system intended for online global release would be to have another user testing period to see how these improvements are received by users. But as this is not the case this is as far as the project will go in terms of improving and testing the product.

4.0 Conclusion

This section of the report will be an evaluation of the system produced to form an overall conclusion as to whether the project has been a success. The first area that needs to be considered is to evaluate if the aims of the project have been met. The main aim of this project was to create a web application which enhances the fan experience of following a football team. This aim has been achieved as a web application has been created which provides fans with a service allowing them to track matches that they have attended and see statistics personalised for these matches. This enhances the fan experience as it gives a service to fans not necessarily available to them before therefore building on the fan experience. Something that does need to be evaluated the effectiveness of this solution to the problem area, as stated in the requirements testing all system requirements have been met in some capacity. For the initial criteria set out by the requirements the project is therefore effective.

The fact that the system meets its initial requirements doesn't necessarily mean that the system is effective for its users, to evaluate this it is important to look at the user testing phase. This testing highlighted a number of areas users wanted improved; these improvements were then implemented to meet these new demands. This made the system more effective as it met, in most cases, what users wanted. It is also important to note that users were generally able to use the system with little direction or explanation, therefore the system has a fairly intuitive design. Were this a real system the user testing phase would be performed again, to gather more feedback and further improvements. In terms of target audience needs, the system presents correct match data to users, so the data has integrity. The system is also secure and protects the small amount personal information it stores effectively e.g. hashing passwords. It can be concluded the system is effective for its user's needs. The other main aims the project has have also been met by creating the system e.g. presenting personalised stats to users and creating a space for users to record and see all matches they have attended.

This report will also look at Nielson's 10 Heuristics for user interface design [12], these are a set of standards set out to evaluate if the system has an effective design. The system meets all but one of these heuristics in some context. For example, heuristic no. 9 states 'Help users recognize, diagnose, and recover from errors', this is met as the system provides clear error messages to the user if an error occurs and they are never stuck in an error state. The only heuristic not specifically met is no. 10 which says a system should provide help/documentation to users for how to carry out tasks. Although pages have brief descriptions for how to complete tasks there is no thorough documentation for users who struggle, this could be achieved with a FAQ page explaining common problems users have. Therefore, the system's design is fairly effective.

There are a number of improvements to the system which could be implemented if the project was to go further. For example, stats could be automatically gathered through online sources and added to the database, then this would not have to be done manually. The system could also be expanded to incorporate more stats, this could be through adding more teams/leagues or through adding more stats for each match e.g. passing and possession stats. This would widen the target audience making the service usable by more fans. There is also potential for improvement in terms of the social side of the web app, users could be given the ability to comment on matches or create forums to share stats or have discussions etc. Another improvement would be the addition of roles to the system e.g. allowing admin accounts. These admins would have more abilities than normal users e.g. viewing specific user data and altering match info. This would allow the site to be maintained easily and improve the security of the site, as admins could recover accounts for users or block users who are security threats. Many of these improvements are out of the scope of this project but would be realistic improvements for a real system. Overall with all areas considered this report concludes that the project has been a success in meeting its aims and is fairly effective in the way it does this.

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6.0 Appendices

Appendix A – Project Proposal

Project Proposal

Working Title: A Footballing web application to enhance the fan experience

Supervisor: Ian Wakeman

What?

I propose for my project that I will make a web application that will allow users to log that they have been to football matches, the application will then display stats relating to matches a user has seen e.g. goals seen, win % ect. I will try to display these stats in an appealing way to users, and will try to make a wide variety of stats available. Users will need to make an account to access the application, as their matches that they have seen will need to be saved in a database to access them. The matches available for the application will initially be the top four leagues in England (Premier League - League two) for the past 4 seasons (18/19 – 15/16), but this could be expanded as the app is made.

How?

The Web application will be written using HTML, CSS, PHP and Javascript, to create an interactive site for the user. A database will need to be made using mySQL and will store multiple tables, these would include registered users, all the matches available and the matches the user has logged. The web app will be hosted locally as the site is being made, using services such as XAMPP, then on a service such as AWS once it is in a usable state. The majority of the data will be sourced from the site: http://www.football-data.co.uk/englandm.php?fbclid=IwAR1f8XRCQeomCWs45udgXUsN91D9h0t6ZrM57Fx-7la6ixYUhWld9SXDIk0

Which provides data free to use in CSV format. The site will be tested initially by me on my own machine, then on users once the site is finished.

Why?

I want to make this web application because I have a lot of interest in football, and I would like to enhance the spectator experience of going to football matches. I feel this app would do this as it can help users analyse the games they have seen and potentially even compete against friends to who has the 'best' stats. I also have an interest in web development and would like to learn how to build my own product from start to finish, which would help me in future careers.

Appendix B – Supervisor meeting Log

Meeting number	Date	Topics for discussion	Work for next meeting
1	01/10/19	• General discussion of interests • Discussed how the application on the database was not a complex enough idea for a final year project • Discussed possible ideas to extend off of it	• Continue research on topics of interest • Develop the idea and work out what would be realistic • Do market research to see what products are already available
2	18/10/19	• Discussed findings of research • Presented the new working idea and concluded that it was suitable • Discussed more of the logistics of how the project will be done	• Submit proposal • Carry on work on research for what will be required for the project • Begin designing the web application
3	11/11/19	• Go through interim report for suggested improvements • Discuss how to begin coding	• Finish the interim report by adding the small improvements outlined in the meeting. • Continue design phase to prepare for coding
4	10/12/19	• Show progress on the web application. • Ask about ethical approval for user tests	• Progress shown • Completed ethical application form for review • Emailed inCrowd about setting up a meeting
5	07/02/20	• Show progress of web app • Ask about testing / next steps	• Add graphics to stats section • Start to think about testing once coding is complete

Note that no further face to face meetings were able to occur due to outbreak of COVID-19.

Appendix C – Ethical Compliance form

Ethical Compliance Form for UG and PGT Projects*

School of Engineering and Informatics

University of Sussex

*This checklist was originally developed by Professor Steven Brewster at the University of Glasgow, and modified by Dr Judith Good for use at the University of Sussex with his permission.

This form should be used in conjunction with the document entitled "Research Ethics Guidance for UG and PGT Projects".

Prior to conducting your project, you and your supervisor will have discussed the ethical implications of your research. If it was determined that your proposed project would comply with **all** of the points in this form, then both you and your supervisor should complete and sign the form on page 3, and submit the signed copy with your final project report/dissertation.

If this is not the case, you should refer back to the "Research Ethics Guidance for UG and PGT Projects" document for further guidance.

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1. Participants were not exposed to any risks greater than those encountered in their normal working life.

   Investigators have a responsibility to protect participants from physical, mental and emotional harm during the investigation. The risk of harm must be no greater than in ordinary life. Areas of potential risk that require ethical approval include, but are not limited to, investigations that require participant mobility (e.g. walking, running, use of public transport), unusual or repetitive activity or movement, physical hazards or discomfort, emotional distress, use of sensory deprivation (e.g. ear plugs or blindfolds), sensitive topics (e.g. sexual activity, drug use, political behaviour, ethnicity) or those which might induce discomfort, stress or anxiety (e.g. violent video games), bright or flashing lights, loud or disorienting noises, smell, taste, vibration, or force feedback.

2. The study materials were paper-based, or comprised software running on standard hardware.

   Participants should not be exposed to any risks associated with the use of non-standard equipment: anything other than pen-and-paper, standard PCs, mobile phones, and tablet computers is considered non-standard.

3. All participants explicitly stated that they agreed to take part, and that their data could be used in the project.

   Participants cannot take part in the study without their knowledge or consent (i.e. no covert observation). Covert observation, deception or withholding information are deemed to be high risk and require ethical approval through the relevant C-REC.

   If the results of the evaluation are likely to be used beyond the term of the project (for example, the software is to be deployed, the data is to be published or there are future secondary uses of the data), then it will be necessary to obtain signed consent from each participant. Otherwise, verbal consent is sufficient, and should be explicitly requested in the introductory script (see Appendix 1).

4. No incentives were offered to the participants.

   The payment of participants must not be used to induce them to risk harm beyond that which they risk without payment in their normal lifestyle. People volunteering to participate in research may be compensated financially e.g. for reasonable travel expenses. Payments made to individuals must not be so large as to induce individuals to risk harm beyond that which they would usually undertake.

5. No information about the evaluation or materials was intentionally withheld from the participants.
   Withholding information from participants or misleading them is unacceptable without justifiable reasons for doing so. Any projects requiring deception (for example, only telling participants of the true purpose of the study afterwards so as not to influence their behaviour) are deemed high risk and require approval from the relevant C-REC.

6. No participant was under the age of 18.
   Any studies involving children or young people are deemed to be high risk and require ethical approval through the relevant C-REC.

7. No participant had a disability or impairment that may have limited their understanding or communication or capacity to consent.
   Projects involving participants with disabilities are deemed to be high risk and require ethical approval from the relevant C-REC.

8. Neither I nor my supervisor are in a position of authority or influence over any of the participants.
   A position of authority or influence over any participant must not be allowed to pressurise participants to take part in, or remain in, any study.

9. All participants were informed that they could withdraw at any time.
   All participants have the right to withdraw at any time during the investigation. They should be told this in the introductory script (see Appendix 1).

10. All participants have been informed of my contact details, and the contact details of my supervisor.
    All participants must be able to contact the investigator and/or the supervisor after the investigation. They should be given contact details for both student and supervisor as part of the debriefing.

11. The evaluation was described in detail with all of the participants at the beginning of the session, and participants were fully debriefed at the end of the session. All participants were given the opportunity to ask questions at both the beginning and end of the session.
    Participants must be provided with sufficient information prior to starting the session, and in the debriefing, to enable them to understand the nature of the investigation.

12. All the data collected from the participants is stored securely, and in an anonymous form.
    All participant data (hard-copy and soft-copy) should be stored securely (i.e. locked filing cabinets for hard copy, password protected computer for electronic data), and in an anonymised form.

Project title: A Footballing web application to enhance the fan experience

Student's Name: Jack Richardson-Payne

Student's Registration Number: 21601974

Student's Signature: JRP

Date: 02/03/20

Supervisor's Name: Ian Wakeman

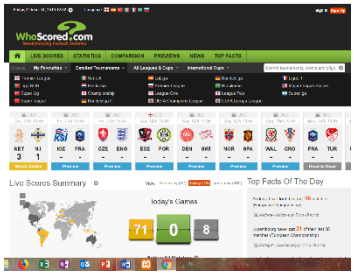
Supervisor's Signature: [signed off electronically on Sussex direct]

Date: 02/03/2020

Appendix D – Full Background Research

Background research of websites and apps with short description and pros and cons.

Name	Description/Features	Pros	Cons
HesGoal	• Mainly a news/articles website relating to football. • Shows previous matchdays and tables of some leagues. • News page for specific teams. • Match report for each game with reviews and votes for users e.g MOTM. 	• Simple Design very easy to use and understand • User interaction in form of votes	• Articles are just links to outside sources • Limited usefulness for stats etc.
Soccer-Base	• Sections include scores, results, tables, player and team stats • News and tips sections	• A lot of information available for many leagues.	• Very tailored towards betting, odds given in each section. • Little user interactivity. • No page for each game, just pop-up stats.

	• Somewhat in-depth stats for teams and players and comparisons allowed 		
Whoscored	• Live-scores, stats, comparisons, match previews etc. • Users can make comments and make predictions • Stats for offense and defence, giving very detailed stats • Expected line-ups given for each game • Users can favourite teams to have information about them on their home page 	• Very detailed stats section • Lots of user interactivity • Information available for many leagues and teams • Language settings • Map showing where upcoming and finished games are	•
ForzaFootball	• Match results, tables, team and player stats • Displayed mainly in a calendar format, showing games by date • Fixture and form of teams given	• Allows users to favourite teams and competitions to follow them easily • Easy to use app, clean interface • App customisation e.g. theme	• Paid service to remove ads, although ads on the app are not intrusive

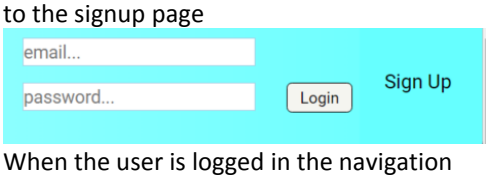
	• Discover section giving information a user may be interested in 	• Replays of top games given • Very user interactive, votes etc.	
StatsZone	• Very in-depth stats for games given, good for people who over analyse • Stats for current and previous top division seasons • Animations for games showing activity throughout • Player and team stats given 	• User activity in form of votes • A lot of information	• Paid service to use mostly • Can be very overwhelming at first • Mainly for top divisions
Official premier league app	• Results and table given for the premier league • Season and all-time stats given in form of leader boards • Fantasy football focus • Match reports, articles and replays 	• Very user friendly as designed for fantasy football, where users can play with friends • Web and app • Text commentary for each game given in real time	• Limited to premier league • Stats are somewhat limited for in depth analysis
Bleacher Report	• News article focus • Section for each top league • App shows match results and fixtures	• User interactivity in form of favourites, newsletter can	• No stats on the website, mainly rumours etc.

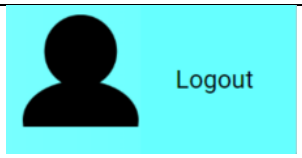
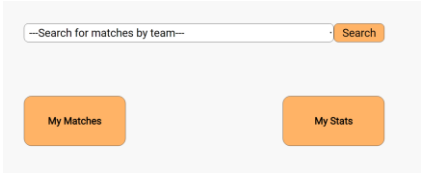
	• Users can favourite teams, which allow them to see articles relating to that team 	be signed up via email • Not just limited to football • Simple design, not cluttered	• Limited to top leagues or teams
Futbology	• App that allows users to log that they have been to games • Users can see their stats relating to this limited to number of games visited, most visited ground/ club • Photo section where users can upload • Nearby fixture section 	• User interactivity in form of leader boards for each club • Users may submit their own matches if not available • Most leagues/ teams included • Easy to use interface	• Very limited stats • Paid subscription to view games from all time seasons • No in-depth stats for games visited
Sky bet EFL Rewards	• Allows users to check in to games and receive rewards providing they are at the stadium • Users can check in if they are not at the game but will not receive rewards • Achievements for users to gather • Limited fixtures and league tables • Fans stats for goals seen etc. 	• Users can choose favourite team to appear on home page • Simple design • Links to already made sky bet accounts • Uses location services to check if users are really at the stadium	• Limited to EFL games • Stats limited to goals and results

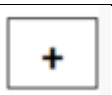
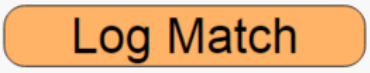
Appendix E – Gantt Chart

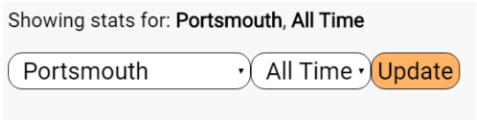
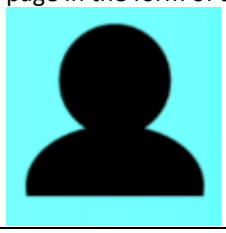
Appendix F – Requirements Testing Results

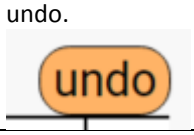
This is the table containing the full results of the requirements testing, both functional and non functional requirements.

Require-ment No.	Requirement	Desired/ Mandatory	Achieved	Explanation
1.	Pages of the web application shall include: • Home page • Sign-Up page • Search results page • User stats page • User matches page	Mandatory	Yes	All pages required are present on the website, and all are reachable in the correct ways.
2.	Additional pages should be: • Profile page • Match information page • Web page customisation page (e.g. colours)	Desired	Partial	User profile pages and match information pages are present and functional, web page customisation is not implemented in current build of the web page. User testing will determine whether this is something that is important to users.
3.	Each page shall include a navigation bar at the top.	Mandatory	Yes	Each page has the same header which includes a navigation bar, this is created using the 'header.php' file so the code did not need to be repeated on each page.
4.	The Navigation bar shall have areas for users to log in if not logged in already / sign out if they are logged in.	Mandatory	Yes	When the user is not logged in the navigation bar shows a login form and a link to the signup page  When the user is logged in the navigation bar shows a link to the users profile page, as well as a logout button

				
5.	Nav bar shall have button to link to sign-up page if the user is not logged in so the user can create an account.	Mandatory	Yes	As per last requirement sign up page link is viewable when the user is not logged in.
6.	Each page shall only display the content of the page if the user is logged in (except the sign-up page) otherwise it should display 'Please log-in or Sign-up'.	Mandatory	Yes	Pages which are meant to be viewed when logged in are viewable when logged in and not when logged out, if a user tries to manually reach these pages when logged out they will be redirected to the index page. (see error testing for full details)
7.	Home page shall display a search bar and links to the user stats and user matches page. (when logged in)	Mandatory	Yes	When the user is logged in these elements are viewable, and all link to the relevant pages. 
8.	Search bar shall only take valid team names as input.	Mandatory	Yes	The search bar allows users to select teams from a drop down to avoid issues such as spelling etc. if the user presses search without selecting a team they will see a relevant error message. Only teams which exists in the database are searchable.
9.	Database shall hold stats for leagues: • Premier league • Championship • League one • League two	Mandatory	Yes	Matches for all these leagues are present in the database and teams from these leagues are able to be represented on the website.
10.	Database shall hold matches for seasons: • 15/16 • 16/17 • 17/18 • 18/19	Mandatory	Yes	Matches from these seasons in the leagues outlined above exist in the database. Users are also able to select one of these seasons to show stats from on the user stats page.
11.	Database should have matches from current ongoing season	Desired	Partial	Matches for the 19/20 season up until 13/02/2020 are available on the website.
12.	Tables that display match data on both search results and user matches page shall have columns: • Date • Home team • Away team • Home score • Away score	Mandatory	Yes	The columns outlined are the ones displayed in both search tables and tables in the my matches page. 
13.	Users shall be able to 'log' they have attended a match from the search result screen using a button on each row of table, (this shall add the match	Mandatory	Yes	On each row of the search results tables displaying a match there is a + button the user can press to log a match.

	to the user-matches table with the users id)			 Users can also log matches by going through the match information page. Logged matches are displayed in green to the user and if they try to log them again they will be given an error message.
14.	Users Shall be able to 'remove' a match from the 'my matches' page using a button on each row of table (this shall remove the match from the user-matches table)	Mandatory	Yes	In the users my matches page each row displaying a match has a – button which when pressed removes the match from the users logged matches.  Users can also remove matches by going through the match information page.
15.	Tables outputting matches should have a button to open more information about each match	Desired	Yes	Each match row on both the my matches and search results page have i buttons which when pressed open a page to display match information 
16.	Users shall be able to log/delete a match from their logged matches in this information page	Desired	Yes	In the match information page the user can log/remove a match from their logged matches, a remove match button is displayed if the match is already logged.  And a log match button is displayed if not. 
17.	Matches should be organised by season on both the 'my matches' page and search results page	Desired	Yes	Matches are split up by seasons in both the search results and my matches page with each table having a header to show what season is displayed in it.
18.	Sign up page shall take from users to make an account: • Email • Favourite team • Password This data shall be stored in the database if all the inputs are valid.	Mandatory	Yes	Sign up page takes only these fields from the user and has appropriate error detection. (see error testing)
19.	Navigation bar shall have a button to return to home page from any page.	Mandatory	Yes	The navigation bar has a house button to allow users to return to index/home when pressed 

20.	Stats section shall use the users logged matches to create the stats (not matches they have not attended) , these should be generated every time the page is accessed to keep up to date.	Mandatory	Yes	Stats display information based on the users logged matches (ones that exist in the user-matches table), these stats can be customised by team and season.
21.	The user stats page shall display stats for users chosen favourite team	Mandatory	Yes	The default of the my stats page is the users favourite team and all time for the time period, this can be changed on the page but will revert back to defaults when navigating off the page.
22.	User stats page shall display stats for all teams seen (not just favourite)	Mandatory	Yes	The totals sections on the my stats page show totals for matches seen (not just favourite team)
23.	Stats section shall include graphs/graphics made using JavaScript to represent the users stats	Mandatory	Yes	Stats page includes various graphics and 4 graphs to show different elements relevant to the users matches
24.	Stats page should be able to be customised by team/season	Desired	Yes	Stats page includes a form to customise what the page displays, with relevant error handling etc. 
25.	All data used to display tables on pages and stats, shall be taken from database.	Mandatory	Yes	All data from matches and stats is taken from the database and the used in calculations for stats.
26.	Database tables shall include: • Users • Matches • User-Matches • Team	Mandatory	Yes	These are the tables that are used in the database, all link in relevant ways and show no repeated data.
27.	Header should include a navigation to users profile page if logged in	Desired	Yes	Header contains a link to the user profile page in the form of a button 
28.	Pages shall have clear descriptions for what user can/should do on each page	Mandatory	Yes	Pages have a description of what the user should do on the page. This will however be tested in user testing to find out if these are descriptive enough.
29.	Any changes made to stats page should reset back to defaults once navigating off the page	Desired	Yes	When the user navigates off the stats page the stats will be reset to defaults (favourite team for all time)
30.	By default stats page shall display stats for favourite team for all time	Mandatory	Yes	These are the default settings.
31.	Each page shall have a footer	Mandatory	Yes	Every page has the same footer created in the 'footer.php' doc to make sure no code is repeated.
32.	Matches that the user has already logged should display with a green	Desired	Yes	On the search results page matches that exist in the users logged matches are displayed with a green background.

	background for that row on the search result page			
33.	Errors shall be displayed to the user at the top of each page and should be clear what the error is pertaining to	Mandatory	Yes	Every error is displayed at the top of each page in red.
34.	User profile page should have spaces for user to change favourite team and change password	Desired	Yes	These forms exist on the user profile page
35.	Stats page should include a navigation bar to jump to different sections on the page	Desired	Yes	Nav bar moves down page as user scrolls to allow them to jump to sections on page. 
36.	Navigation bars should also be available on 'my matches' and Search Results pages to jump to different sections on the page	Desired	Partial	Navigation bar is available to jump to top of page only.
37.	Team that was searched for shall be displayed in bold for each match on the search results page	Mandatory	Yes	In each match team searched for is displayed in bold
38.	Users favourite team shall be displayed in bold for each match on the my matches page	Mandatory	Yes	In each match in my matches favourite team is displayed in bold
39.	If the user has no logged matches they shall not be able to enter the 'my matches' and 'my stats' pages, error should be thrown	Mandatory	Yes	Users cannot enter these pages with no matches logged, error will be thrown and they will be redirected to home page.
40.	Data on graphs on the stats page should be customisable	Desired	Partial/Yes	Users can add/remove data and customise graphs by changing team/time period but no extra customisation available
41.	'My Matches' page should include an undo button to undo deleted matches	Desired	Yes	Users can undo last delete only using an undo button. Table updates to show this undo. 
42.	User shall not be able to log the same match twice	Mandatory	Yes	Users will see an error message if they try to log the same match twice.

43.	'My matches' and 'Search Results' pages shall update automatically as user interacts with them	Mandatory	Yes	Pages reload as the user interacts with them to show interactions
44.	Users should be redirected to same position on page after logging/removing match	Desired	Yes	Users will be redirected to relevant sections when being redirected back.

Require-ment No.	Requirement	Mandatory/ Desired	Achieved?	Explanation
45.	Each page shall have the same design colours and layout.	Mandatory	Yes	Every page has same layout and CSS styling as well as same header and footer
46.	The same font shall be used across the site.	Mandatory	Yes	Only font used is 'Roboto' sans-serif
47.	Users password shall be hashed to encrypt them before being stored in the database.	Mandatory	Yes	Passwords are hashed when entering the database and only hashes are compared when trying to log in etc.
48.	Dates of matches shall be displayed in Consistent Format	Mandatory	Yes	All dates displayed in YYYY-MM-DD
49.	The site shall check if the user already has an account using their email before allowing them to make an account.	Mandatory	Yes	User database is checked before the user can make new profile.
50.	The site should be as 'easy' to navigate as possible.	Desired	Yes	Pages have a consistent navigation style and page descriptions help users to distinguish what to do, again this will be tested in user testing.
51.	The web app Front-end shall be coded in HTML, PHP and JavaScript.	Mandatory	Yes	These are the languages used to display the pages
52.	The back-end database shall be coded in MySQL.	Mandatory	Yes	MYSQL used to create database and interact with it
53.	The colours used on the system should be acceptable for people who are colour blind.	Desired	Yes	Pages are designed with colour blindness in mind and similar colours are not used close to each other, only problems may come from graphs as they display random colours
54.	Input forms shall not allow users to leave input fields empty	Mandatory	Yes	Error checking available on all forms
55.	Input shall not allow MYSQL code which could damage back end database	Mandatory	Yes	Prepared statements used to make sure SQL code cannot be entered into the database
56.	Website shall be viewable on PC and mobile	Mandatory	Yes	Pages viewable on browsers and safari on a mobile, these were available to test. Mobile users are prompted to rotate their device to better view the pages.
57.	User interface should be well designed (e.g. no overlapping elements)	Desired	Yes	Elements on pages are not overlapping and scale to screen size.
58.	Text on pages shall be big enough so it can be easily read	Mandatory	Yes	Fonts are big enough to be read and scale to screen size
59.	Users shall be able to reset their password if they can't remember it	Mandatory	Partial	Users can reset their password by entering their email, this just resets that accounts password to 'password'. Which is not the most secure way to do this but is effective.
60.	When the user logs into the site a session shall be created which expires after a certain amount of inactivity	Mandatory	Yes	Sessions are created as the user logs in and views different web pages, these expire after some time.

61.	Pages and elements on each page shall scale to the size of the screen	Mandatory	Yes	CSS used to scale the elements to screen size
62.	Team names shall be clear to all fans (e.g. no nicknames etc.)	Mandatory	Yes	No nicknames etc. used for teams, abbreviations are used but names are still clear
63.	Web pages should load as fast as possible with little delay	Desired	Yes	Pages load with little delay
64.	Page shall be viewable on all (major) browsers	Mandatory	Partial	Pages can be viewed on all browsers but some interactivity e.g. page positioning when returning to a page cannot be done on some (IE and Firefox). Also some graphs do not load in IE, however chrome safari and Firefox are the most popular browsers accounting for around 80%+ of browser market share so this isn't that much of an issue.

Appendix G – Error Testing Results

This is a table containing the results of the error testing phase of the project.

Website Location (e.g. form/page)	Error Test Number	Error Test description	Expected output	Actual Output
Sign-up page (signup.php)	1.	Submitting form with empty fields	Error message appears prompting user to fill out all fields	Error message appears in red at top of the page stating '**Please fill out all fields!**'
	2.	Submitting form without matching passwords	Error message appears prompting user to enter the same password in both password fields	Error message appears in red at top of the page stating '**Passwords did not Match!**'
	3.	Submitting form with invalid email	Error message appears prompting user to enter a valid email	Error message appears at top of page stating '**Enter a Valid Email!**'
	4.	Submitting form with email already taken	Error message appears telling user account with that email exists	Error message appears at top of page stating '**Account already exists with this email!**'
	5.	Submitting form with SQL code (SQL attack)	Either database error or input accepted as a string without changing database	User will either be redirected to home page with text '**Database error!**' or if all other fields are valid the input will be used as a string and will not interact with database
	6.	Submitting form with valid email and matching passwords	User successfully signed up	User redirected to home page with success message in green '**Successfully signed up!**'
Reset Password page (reset.php)	7.	Submitting form with empty fields	Error message appears prompting user to fill out all fields	Error message appears in red at top of the page stating '**Please fill out all fields!**'

	8.	Submitting form with email not registered to account	Error message appears telling user no account with that email exists	Error message appears in red at top of the page stating '**No user with this email!**'
	9.	Submitting form with SQL code (SQL attack)	Either database error or input accepted as a string without changing database	User will either be redirected to home page with text '**Database error!**' or if all other fields are valid the input will be used as a string and will not interact with database
	10.	Submitting form with valid email	User password reset with entered email	Success message appears at top in green stating '**Password Reset to "password"! Please Secure account by changing this once signed in!**'
Login form	11.	Submitting form with empty fields	Error message appears prompting user to fill out all fields	Error message appears in red at top of the page stating '**Please fill out all fields!**'
	12.	Submitting form with incorrect password	Error message appears prompting user to enter correct password	Error message appears in red at top of the page stating '**Password Incorrect!**'
	13.	Submitting form with invalid/unregistered email	Error message appears prompting user enter valid email	Error message appears in red at top of the page stating '**No user registered with this email!**'
	14.	Submitting form with SQL code (SQL attack)	Either database error or input accepted as a string without changing database	User will either be redirected to home page with text '**Database error!**' or if all other fields are valid the input will be used as a string and will not interact with database
	15.	Submitting form with valid email and password	User logged in	User directed to home page after logging in.
Search Bar (index.php logged in)	16.	Submitting form with no team selected	Error message appears prompting user to pick team from drop down	Error message appears in red at top of the page stating '**Please select a team from a drop down!**'
	17.	Submitting form with team selected	User redirected to search results for selected team	User redirected to search results page for selected team
Search results page (searchResult .php)	18.	Pressing the + button on a match to log it when match is not logged	Match logged in users matches, success message appears	Success message appears in green at top of the page stating '**Match successfully Logged!**', page reloads and table updates showing row of match in green

	19.	Pressing the + button on a match to log it when match is already logged	Error message appears telling user match already logged	Error message appears in red at top of the page stating '**Match already Logged!**', page reloads
	20.	Pressing the i button on a match	User redirected to match info page for selected match	User redirected to match info page for selected match
Home page logged in (index.php)	21.	Pressing the 'My Matches' button with no games logged	Error message appears prompting user to log a match	Error message appears in red at top of the page stating '**No matches have been logged for this season or No Matches Logged at all!** '
	22.	Pressing the 'My Matches button with games logged	Page loads and displays users' matches	User redirected to myMatches page
	23.	Pressing the 'My Stats button with no games logged	Error message appears prompting user to log a match	Error message appears in red at top of the page stating '**No matches have been logged for this season or No Matches Logged at all!** '
	24.	Pressing the 'My Stats button with games logged	Page loads and displays users' stats	User redirected to myStats page
User matches page (myMatches .php)	25.	Pressing the – button on a match	Match removed from user matches and table updated	Success message appears in green at top of the page stating '**Match successfully deleted!**', page reloads and table updates
	26.	Pressing the undo button, if not already pressed	Last match delete undone, table updated	Success message appears in green at top of the page stating '**Delete successfully Undone!**', page reloads and table updates
	27.	Pressing the undo button after it has been pressed	Error message prompting user that match deleted has already been undone	Error message appears in red at top of the page stating '**Match already undone!**'
	28.	Pressing the i button on a match	User redirected to match info page for selected match	User redirected to match info page for selected match
Match info page (match.php)	29.	Pressing the Back button	User directed back to previous page and position	User directed back to previous page and position
	30.	Pressing the Remove match button, visible if match is already logged	Match removed from users matches, user directed back to previous page	Match deleted from users matches and user directed back to previous page and position, Success message appears in green at top of the page stating '**Match successfully deleted!**'
	31.	Pressing the Log match button, visible if match is not logged	Match logged, user directed back to search results page	Match added to users matches and user directed back to search results page

			(only place a user could've come from)	in same position, Success message appears in green at top of the page stating '**Match successfully Logged!**'
User Stats page (myStats.php)	32.	Submitting the update form after changing the team/ time period to a valid team/ season	Page updated to display stats for this team in the selected time period, error message will tell user if no home/away matches logged for selected team	Success message appears at top in green stating '**Table Updated!**', stats update to selected team and time period, if user has no home matches Logged for selected team warning shows in red '**No home matches logged for selected team!**' or away matches '**No away matches logged for selected team!**'
	33.	Submitting update form to a season where no matches have been logged at all	User redirect to home page with error message	User redirected to home page with error message appears in red at top of the page stating '**No matches have been logged for this season or No Matches Logged at all!** '
	34.	Adding team to graph using the 'Add team' button	Selected team added to graph	Selected team added to graph
	35.	Pressing the 'Remove Data' buttons on any graphs	End data removed from graph	End data removed from graph, updating with animation
	36.	Pressing the 'Add Data' buttons on any graphs	Last data removed added back to graph	Last data removed added back to graph, updating with animation
	37.	Pressing the 'Semi/Full Circle' Button on goals graph	Graph changes to display full or semi circle	Graph changes to display full or semi circle, updating with animation
User profile page (profile.php)	38.	Submitting Change team form	Users favourite team changed to selected team	Success message appears in green at top of the page stating '**Team Changed!**', users team changed to selected team
	39.	Submitting change password form with empty fields	Error message appears prompting user to fill out all fields	Error message appears in red at top of the page stating '**Please fill out all fields!**'
	40.	Submitting change password form with incorrect password	Error message appears prompting user to enter correct password	Error message appears in red at top of the page stating '**Password Incorrect!**'
	41.	Submitting change password form with not matching new password fields	Error message appears prompting user enter two matching passwords in new password fields	Error message appears in red at top of the page stating '**Passwords did not Match!**'
	42.	Submitting change password form with SQL code (SQL attack)	Either database error or input accepted as a string without changing database	User will either be redirected to home page with text '**Database error!**'

				or if all other fields are valid the input will be used as a string and will not interact with database
	43.	Submitting change password form with valid input	Password of user changed	Success message appears in red at top of the page stating '**Password Changed!**' user password changed in database
Accessing pages when not logged in (manually entering into URL)	44.	Search results page	Redirected to index	Redirected to index
	45.	My stats page	Redirected to index	Redirected to index
	46.	My Matches page	Redirected to index	Redirected to index
	47.	Match info page	Redirected to index	Redirected to index
	48.	Sign-up page	User can access this page when not logged in	Sign-up page loads for user
	49.	Reset password page	User can access this page when not logged in	Reset password page loads for user
	50.	Home page	User can access this page when not logged in	Home page loads for user
	51.	Profile page	Redirected to index	Redirected to index
Accessing pages when logged in (manually entering into URL)	52.	Search results page	User redirected to index, as no team selected	If user has previously searched for a team, page will load with the last searched team info, if not redirected to index
	53.	My stats page	User can access this page when logged in	User accesses my stats page (if they have matches logged)
	54.	My Matches page	User can access this page when logged in	User accesses my matches page (if they have matches logged)
	55.	Match info page	User redirected to index	User redirected to index, button must be pressed on match row so page knows which match to load
	56.	Sign-up page	User can access this page when logged in, no harm in them being there	Sign-up page loads, this could be changed but no harm in user being there
	57.	Reset password page	User can access this page when logged in, no harm in them being there	Reset password page loads, this could be changed but no harm in user being there
	58.	Home page	User can access this page when logged in	Home page loads
	59.	Profile page	User can access this page when logged in	Profile page loads
Log out form	60.	Pressing Log out button	User logged out	User logged out and redirected to home page

Appendix H – Interview Script

Pre-Interview:

"Hello, I am collecting feedback for my website Footy-DB that allows users to log football matches they have attended and view stats for these matches. The aim of this project is to create a web application that enhances the fan's experience of attending and following football matches. The purpose of this study is to gather user

feedback to make improvements to the site, interviews will last 10-15 mins. The interview will consist of two phases, the first phase I will ask you to complete a selection of tasks using the Footy-DB web app. The second section I will ask a few follow up questions to gather feedback. This data will be collected anonymously, and there will be no way of linking an answer back to a user. Responses will be used to create suggested improvements for the web app only. You have the right to withdraw at any time. Do you have time for an interview?"

Post interview:

"The interview is now over, thank you for participating in the interview, your feedback has been very useful to us!"

Appendix I– Blank consent form

Project title:

Footballing Web Application to Enhance The Fan Experience

Project information:

The aim of this project is to create a web application that enhances the fan's experience of attending and following football matches. The purpose of this study is to gather user feedback to make improvements to the site, interviews will last 10-15 mins. This interview will consist of two phases, the first phase I will ask users to complete a selection of tasks using the Footy-DB web app. The second section I will ask a few follow up questions to gather feedback. This data will be collected anonymously, and there will be no way of linking an answer back to a user. Responses will be used to create suggested improvements for the web app only.

		Please circle as appropriate
1.	I confirm that I have read and understand the project information and have had the opportunity to ask questions.	Yes/No
2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	Yes/No
3.	I agree to take part in the above study.	Yes/No
4.	I agree sign up to and use the Footy-DB web app	Yes/No
5.	I agree to the interview questions after I have used the web app	Yes/No
6.	I agree to the use of anonymised quotes in presentations/ publications	Yes/No

Name of Participant	Date	Signature

Contact details:

Researcher: Jack Richardson-Payne (jor22@sussex.ac.uk)

Supervisor: Ian Wakeman (ianw@sussex.ac.uk)

Appendix J – List of User tasks on web app

Complete list of all tasks a user can complete on the site.

Home/index

- Create an account as a new user
- Log-in to their account
- Reset Password (if forgotten)
- Search for matches by team
- View their matches logged
- View their stats section
- View their profile section
- View footer content e.g. website data is sourced from

Search Results

- Log they have attended a match using “+” button
- View match info using “+” button
- Scroll down page viewing matches

My matches

- Remove a match using “-“ button
- View match info using “+” button
- Undo last delete with “undo” button
- Scroll down page viewing matches

My Stats

- Scroll down page viewing stats
- Change team stats is focused on
- Change season stats focused on
- Use nav bar to jump to points on page
- Add team to the W/L/D graph
- Add/remove data from Number of matches graph
- Add/remove data from Number of goals graph
- Change Number of goals graph to circle/semi-circle
- Add/remove data from matches, goals and GPG graph

Match info

- View match info content
- Use “Back” button to return to previous page
- Log match using “log match” / “Delete match” to un-log depending if already logged

User profile

- View email
- Change favourite team
- Change password (using current password)

Header

- Navigate to index using “home” button
- Navigate to profile using “profile” button
- Logout
- Login using email and password
- Navigate to signup page using “Sign up” button

Appendix K – Signed Consent forms

Signed Consent forms

Project title:

Footballing Web Application to Enhance The Fan Experience

Project information:

The aim of this project is to create a web application that enhances the fan's experience of attending and following football matches. The purpose of this study is to gather user feedback to make improvements to the site, interviews will last 10-15 mins. This interview will consist of two phases, the first phase I will ask users to complete a selection of tasks using the Footy-DB web app. The second section I will ask a few follow up questions to gather feedback. This data will be collected anonymously, and there will be no way of linking an answer back to a user. Responses will be used to create suggested improvements for the web app only.

		Please circle as appropriate
1.	I confirm that I have read and understand the project information and have had the opportunity to ask questions.	(Yes)/No
2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	(Yes)/No
3.	I agree to take part in the above study.	(Yes)/No
4.	I agree sign up to and use the Footy-DB web app	(Yes)/No
5.	I agree to the interview questions after I have used the web app	(Yes)/No
6.	I agree to the use of anonymised quotes in presentations/ publications	(Yes)/No

Name of Participant	Date	Signature
Scarlet Payne	23/3/20	

Contact details:

Researcher: Jack Richardson-Payne (jor22@sussex.ac.uk)

Supervisor: Ian Wakeman (ianw@sussex.ac.uk)

Project title:

Footballing Web Application to Enhance The Fan Experience

Project information:

The aim of this project is to create a web application that enhances the fan's experience of attending and following football matches. The purpose of this study is to gather user feedback to make improvements to the site, interviews will last 10-15 mins. This interview will consist of two phases, the first phase I will ask users to complete a selection of tasks using the Footy-DB web app. The second section I will ask a few follow up questions to gather feedback. This data will be collected anonymously, and there will be no way of linking an answer back to a user. Responses will be used to create suggested improvements for the web app only.

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2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	(Yes)/No
3.	I agree to take part in the above study.	(Yes)/No
4.	I agree sign up to and use the Footy-DB web app	(Yes)/No
5.	I agree to the interview questions after I have used the web app	(Yes)/No
6.	I agree to the use of anonymised quotes in presentations/ publications	(Yes)/No

Name of Participant	Date	Signature
Louis Payne	3/3/20	LP

Contact details:

Researcher: Jack Richardson-Payne (jor22@sussex.ac.uk)

Supervisor: Ian Wakeman (ianw@sussex.ac.uk)

Project title:

Footballing Web Application to Enhance The Fan Experience

Project information:

The aim of this project is to create a web application that enhances the fan's experience of attending and following football matches. The purpose of this study is to gather user feedback to make improvements to the site, interviews will last 10-15 mins. This interview will consist of two phases, the first phase I will ask users to complete a selection of tasks using the Footy-DB web app. The second section I will ask a few follow up questions to gather feedback. This data will be collected anonymously, and there will be no way of linking an answer back to a user. Responses will be used to create suggested improvements for the web app only.

		Please circle as appropriate
1.	I confirm that I have read and understand the project information and have had the opportunity to ask questions.	(Yes)/No
2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	(Yes)/No
3.	I agree to take part in the above study.	(Yes)/No
4.	I agree sign up to and use the Footy-DB web app	(Yes)/No
5.	I agree to the interview questions after I have used the web app	(Yes)/No
6.	I agree to the use of anonymised quotes in presentations/ publications	(Yes)/No

Name of Participant	Date	Signature
Joely Anne McEwan	03/03/20	

Contact details:

Researcher: Jack Richardson-Payne (jor22@sussex.ac.uk)

Supervisor: Ian Wakeman (ianw@sussex.ac.uk)

Project title:

Footballing Web Application to Enhance The Fan Experience

Project information:

The aim of this project is to create a web application that enhances the fan's experience of attending and following football matches. The purpose of this study is to gather user feedback to make improvements to the site, interviews will last 10-15 mins. This interview will consist of two phases, the first phase I will ask users to complete a selection of tasks using the Footy-DB web app. The second section I will ask a few follow up questions to gather feedback. This data will be collected anonymously, and there will be no way of linking an answer back to a user. Responses will be used to create suggested improvements for the web app only.

		Please circle as appropriate
1.	I confirm that I have read and understand the project information and have had the opportunity to ask questions.	Yes/No
2.	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	Yes/No
3.	I agree to take part in the above study.	Yes/No
4.	I agree sign up to and use the Footy-DB web app	Yes/No
5.	I agree to the interview questions after I have used the web app	Yes/No
6.	I agree to the use of anonymised quotes in presentations/ publications	Yes/No

Name of Participant	Date	Signature
SIMON PAYNE	9-3-20	SP

Contact details:

Researcher: Jack Richardson-Payne (jor22@sussex.ac.uk)

Supervisor: Ian Wakeman (ianw@sussex.ac.uk)

Appendix L – User testing results

A table to show the full responses for user testing.

Task	User 1	User 2	User 3	User 4	Summary
How old are you?	23	18	51	20	Sample of users of mixed age ranges, all are football fans and most do attend or have attended matches in the past. So fall in the target demographic.
Are you a football fan?	Yes	Yes	Yes	Yes	
Do you attend matches?	Occasionally	Yes	Used to when younger, Not anymore	No	
Observation	----------	----------	----------	----------	----------
1	Initially missed the sign-up button Once found was able to complete sign-up and login in successfully.	Was able to sign up and login easily	User found signup button, and was able to make an account easily User was then able to log in. After one failed password attempt.	User was able to login and signup successfully.	Users generally had no trouble signing up and logging in to the system.
2	Understood search bar mechanics. Was able to log 2 matches in 2 seasons easily.	Was able to log matches, didn't initially realise more seasons were below	User recognised the use of search bar, had some confusion when they tried to click my matches section first. User was then able to log a number of matches.	User was able to use search bar and realised they had to scroll down to see more seasons.	Users generally were able to complete the searching for matches, only confusion was caused by users not knowing that all the seasons displayed on one page.
3	Understood that they needed to search for arsenal to do this and then look for the selected match. Understood i button meant match info.	Realised they had to search for arsenal to do this, tried to click the row at first but realised had to press i button.	User had a lot of trouble with finding home button, needed help. Once they were redirected to home page they were able to search for arsenal and check the match stats.	User did not see home button. Once they were able to direct back to home they could complete task by searching for arsenal.	Users had trouble finding home button to navigate back to search page. Once this was done most users were able to complete the task by searching for arsenal and looking at the match info.
4	Was able to delete a match, with no hesitation.	Was able to do this easily	User was able to delete a match they had logged.	User was able to do this successfully.	Users were able to do this task relatively easily.
5	Initial hesitation when asked the question but realised it was in stats section	Initially tried to count them on my match page, then realised they	Initially tried to count them on my match page, then realised they	User realised this was on stats page and was able to complete task.	A few users didn't realise this was on the stats page and initially tried to count goals on the 'my Matches' page.

	Was able answer question successfully	would be in stats page. Didn't realise stats show for all teams seen not just favourite team.	would be in stats page. Once they found stats page was able to tell me how many goals seen.		Once they found the stats page, they were able to complete the task.
6	Able to answer the question, as was already in stats section	Found this after scrolling down stats page.	Once user realised, they could scroll down they were able to complete task.	Once user realised they could scroll, they were able to complete this task.	Most users were able to complete this task, only trouble was that some users didn't realise that the stats page had more content after scrolling.
7	Was very confused at the question, didn't realise they could do this without having logged a match for that team.	Was confused did not see that they could do this on stats page, once realised was able to complete task	User recognised they had to scroll back up page and change team.	User recognised they had to use update bar to do this.	This task caused the most confusion, users didn't realise they could change the stats page to show for teams they haven't necessarily logged matches for. But all users were able to complete the task eventually.
8	Once they realised was able to change team and season and they compare WDL to another team.	A little hesitation when using graph but was able to add a team to compare.	User struggled to find graph but when they did, they were able to compare with another team.	User was able to use the comparison graph to do this, they had seen it earlier when scrolling.	Most users were able to complete this task when they found the graph which allowed comparison.
9	Realised person icon lead to profile page and then was able to change team.	Didn't see profile button, after some time and searching saw it was on nav bar then was able to complete task.	User could not find/recognise the profile button must be pressed to do this. Once directed there they could change team.	User hesitated but by process of elimination, was able to navigate to profile page and complete task.	Many users didn't see the profile icon, or didn't realise they needed to navigate there. Once they directed themselves there (usually by process of elimination) they were able to complete the task.
Question	----------	----------	----------	----------	----------
Was the site easy to understand/use?	User did not like that the top navigation bar did not scroll with the page. Felt that every other mechanic and page placement was good.	Relatively easy to use, very few pages so fairly self-explanatory. Nav bar could have links to pages rather than forcing users to go through home screen.	Fairly intuitive design had trouble recognising icons were clickable links to pages.	Mostly easy to use and understand, fonts readable and limited choices meant there was limited chance to go wrong.	Things users liked about design: • Simplistic design is good, allows little margin for error. • Readable fonts and colourful design. • Placement of items on pages felt natural. Things users didn't like about design: • Header should scroll with page so users

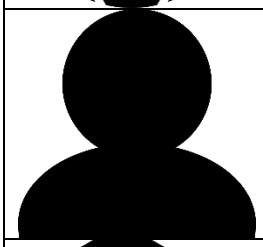
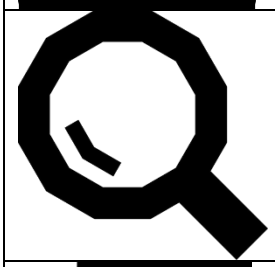
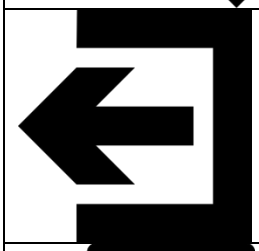
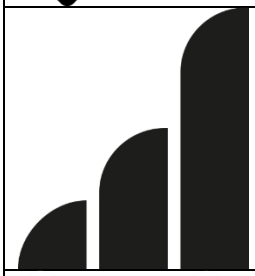
					don't have to scroll back up. • Nav bar should have links to all pages.
Did you have any trouble completing any tasks?	Did not realise they could change the stats page to display for a team they hadn't logged for but was still able to complete the task.	Only had trouble with profile page, missed button. Could be made clearer.	User had a lot of trouble with icons and needed help to complete these tasks.	Had trouble with home button. Also did not realise at first stats page could be scrolled.	Main tasks which caused trouble: • Tasks which made the user navigate to home/profile using icons, users didn't think icons were intuitive enough. • Stats page change bar caused some confusion.
What did you like overall about the site?	Liked stats variety, felt graphics had good colouring and were easy to use. Liked organisation of matches and pages.	Liked simplicity and colour scheme.	Liked the use of site, liked they could log all their matches, so they didn't have to remember themselves. User liked they could delve into the stats etc. Site did not feel 'clunky'	Site was easy to use/ understand. Liked amount of data available for each match and selection of teams.	Things users liked: • Simplistic design, readable fonts and colours. • Stats page graphics were appealing and well designed. • Users generally liked stats page and felt it was a comprehensive list of stats they could delve in to. • Liked selection of teams and matches.
What did you dislike? How would you fix that?	Top navigation bar, user felt it should move with page. User wanted more matches e.g. cup matches. And potentially more teams. Add a link to profile page on main page, button could be easy to miss.	Nav bar should have links to pages, so user doesn't have to go back to home page. Search bar could allow users to type in team. More user control on searching e.g. by season	Icons need some text description or something, to avoid confusion. Maybe more page descriptions for some more difficult tasks, e.g. on graphs. More user customisation, e.g. colours/themes.	Home button should be clearer, or use a back button instead to navigate to home page. Stats page is too long, should be shortened.	Users disliked and how to fix: • Nav bar was hard to understand, fixed by adding text description to icons. • Nav bar should move with page and link to all pages. • Users wanted the ability to search by season. • More page descriptions/text to explain things e.g. graphs and how to use them. • Stats page should be condensed/separated out.
Any features you would like to see added to site as a whole?	Being able to add friends and see their stats, for comparison and competition.	Teams upcoming matches or fixture lists for teams.	More team customisation e.g. favourite team badge as background	No specific features that need to be added.	Feature users wanted to add: • Adding friends/ seeing friends stats. • Upcoming matches for teams.

	Being able to favourite a particular match or set of matches.				• User customisation by team e.g. colour scheme. • The ability to favourite matches.
Was the Stats section easy to user/understand?	Felt the stats section was a bit cluttered, splitting boxes more with lines may make some aspects clearer. More descriptions for what graphs represent and how to use them. Decimal representations caused some confusion. Could have some explanation.	Liked how sections were split up, page is very large could be split up into separate pages. Jump bar could be used as link to pages.	Yes, numbers and graphs allowed varying users to understand data e.g. people who like visual data over numeric. Could be split up to avoid having it all on one big page.	Stats section is a lot to read could be simplified/ condensed. E.g. with closable tabs or by splitting it up. Liked colours and details of the page.	How to improve stats page: • Stats page was cluttered and could be separated out into smaller pages/ condensed. • Descriptions of what each section is/does e.g. graphs. Things users liked about stats page: • Graphical and text representations of data allow users to choose how they prefer their data. • Colours and graphics are appealing to look at. • Large selection of data allows users to delve into stats.
Are there any particular stats you would like to see added?	Could add goal scorers if possible.	Tackles and passes for teams, for pass accuracy etc. Possession stats.	Some way for users to delve deeper e.g. you click the number of goals and see stats for when and who scored or matches these goals were scored in.	No particular stats they would like to see added felt the stats page was already very full.	Possible stats to be added: • Goal scorer data • More match data e.g. tackles, passes, possession etc.
Any other Comments?	No	No	No	No	No

Appendix M – Image Source table

Table containing all images used and source

Image	File Name	Source
	House.png	https://freesvg.org/house-or-home-vector-icon

	Football.png	https://freesvg.org/vector-drawing-of-soccer-ball-pictogram
	Profile.png	https://www.needpix.com/photo/964711/house-svg-vector-free-vector-graphics
	Search.png	https://publicdomainvectors.org/en/free-clipart/Vector-illustration-of-black-search-ideogram/33055.html
	Logout.png	https://publicdomainvectors.org/en/free-clipart/Logout-vector-icon/9200.html
	Signup.png	https://publicdomainvectors.org/en/free-clipart/Vector-illustration-of-black-search-ideogram/33055.html
	Stats.png	https://publicdomainvectors.org/en/free-clipart/Bar-graph-icon/78794.html
	Unfollow.png	https://publicdomainvectors.org/en/free-clipart/Remove-symbol/61574.html

	Goal.jpg	https://www.pexels.com/photo/evening-field-football-field-goal-399187/