

COM814: Project 2015- 2016

Project Dissertation 2016

MSc Professional Software Development

School of Computing & Information Engineering

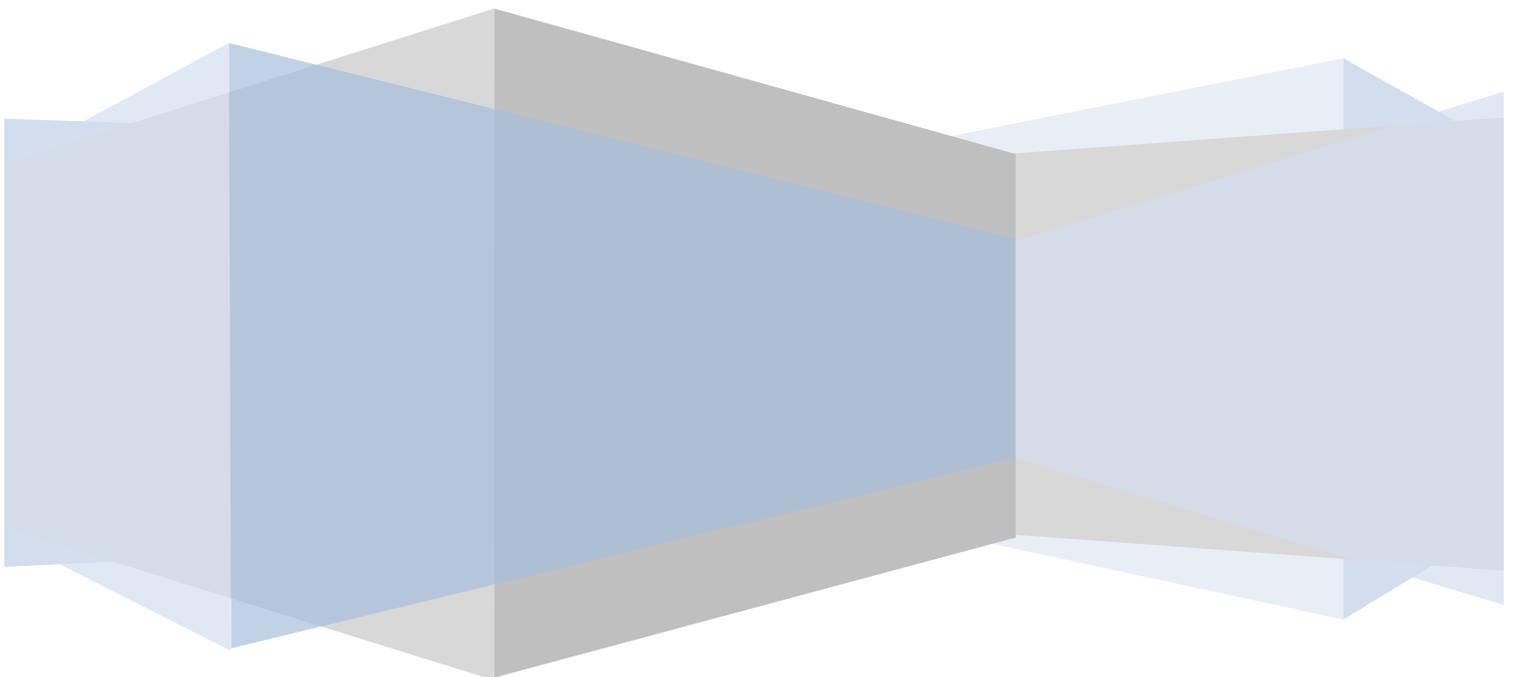
LOCATION SCOUT

MATTHEW McCREARY B00700869

Supervisor: Dr Adrian Moore

Second Marker: Dr Janet Allison

Hand-in deadline: September 1 2016



Acknowledgements

I would like to thank my supervisor, Dr Adrian Moore, for his support and assistance in the development of this project. His patience towards my endless queries and emails and his enthusiasm for the project as a whole made the process enjoyable and educational. Thanks also to Dr Charlie He and Dr Janet Allison for their guidance and feedback at various stages.

The feedback provided by the focus group proved invaluable in helping to shape this report and additional thanks must be given to them for taking the time to share their views and expertise.

Finally, I would like to thank my family for their patience and loving support throughout this project, and the MSc course as a whole. I could not have done it without them.

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ABSTRACT

Over the past ten years, Northern Ireland has become a prime location as a filming destination for television and film crews from around the world. Through featuring in big-budget Hollywood blockbusters such as *Dracula Untold* and epic series such as *Game of Thrones*, Northern Ireland is now enjoying a high profile due to its increased visibility from such productions.

As a consequence, the province is increasingly becoming a draw for tourists from around the world, with a marked increase in visitors here over recent years to a record high level. Many of these so-called 'film tourists' are attracted by Northern Ireland's role in their favourite films and television shows.

While numerous tours and hospitality packages have been created within the private sector here to cater for these tourists, a need has arisen to meet the needs of those visitors who wish to create their own itinerary of locations to access during their stay. At present the options for doing so are limited, with information on locations available only from disparate sources.

This dissertation details the work undertaken to create a one-stop website aimed at collecting details on a wide number of filming locations into one easily accessible online resource. The website further allows users to save locations into a personal itinerary which can then be plotted as a route onto an interactive map. The website will also offer contextual information and access to third party sites for further information.

The system is developed to be usable on a variety of platforms, from desktop PCs to small handheld smartphone devices, and across a variety of web browsers. Key stakeholders from the Northern Ireland film and tourism industry provided essential feedback via a questionnaire, the results of which were used to inform a series of comprehensive aims, objectives and systems requirements.

The same focus group provided further feedback following implementation which was used to amend and refine the system which had been developed. Issues arising were recorded and if not able to be remedied were logged for future analysis and action.

Keywords: film, television, location, tourism, website, tablet, smartphone, mobile, cross-browser

1 INTRODUCTION

1.1 Overview

Recent years have seen movie and television filming becoming big business in Northern Ireland, with an increasing number of high-quality, star-name productions being shot here over sustained periods of time. Well-known features which have been filmed in the country include Hollywood blockbuster *Dracula Untold*, award-winning drama *Philomena*, epic HBO miniseries *Game of Thrones* independent arthouse feature *High Rise* and critically-acclaimed British television shows such as the BBC's *The Fall* and *Line of Duty*. This trend appears to have captured the imagination of visitors and tourists, who now include visits to filming locations as a key part of their itineraries, particularly for sites related to *Game of Thrones*.

As a consequence tourism and film development agencies in the province have been capitalising on this trend with targeted marketing and advertising campaigns to build on the Northern Ireland brand. This includes heavily promoting themed visits and tours and a greater media profile in the local press and broadcasting organisations. Likewise, much is being done by local government to draw in further investment and visits by film production crews and casting agents. Local business has not been slow to capitalise either, with several private enterprises now offering bus or taxi tours to locations, which at the same time giving customers the opportunity to see some of Northern Ireland's most spectacular natural scenery.

However, with regard to film and TV locations, the options available can be expensive and are limited to those based around the aforementioned *Game of Thrones*. For those who wish to visit a wider range of locations, and at their own pace, the options are limited to compiling their own itinerary from a variety of disparate sources and websites, as well as researching transport requirements, accessibility issues, availability of hospitality, overall costs etc themselves. This could prove time-consuming, with the risk of diminishing the appeal of the exercise to potential visitors.

As such, an opportunity has presented itself to take these organisational issues out of the equation by providing users with much of the necessary information in one place, as well as offering them the means to design and plan their own self-guided itinerary to suit their requirements or limitations. It is with this objective and aim that the Location Scout website has been developed.

1.2 Problem Statement

“Visitors to Northern Ireland and film enthusiasts are not well-served in being able to find clear and easily usable information online in order to effectively plan their visits to the province’s filming locations. There is no one single website or resource which combines a comprehensive database of key filming locations, along with visual and written contextual information. There is no dedicated facility to allow users to plot locations onto a map, or create a route planner between locations.”

1.3 Solution

A ‘one-stop’ website which allows users to access the information they need. This should include details of individual locations, organised by category or theme; this should be able to be retrieved quickly and retained by the user; the locations should have geographic coordinates to allow them to be plotted as a route onto an interactive map.

Users should be able to discover if locations have disability access, visitor facilities and/or

accommodation nearby, are reachable by public transport or if there is a cost involved in visiting. Users should be able to save this information safely for future reference.

1.4 Aim

To develop a website which will fulfil all of the requirements outlined in the solution. This system would be able to run on a variety of web browsers and devices/platforms, allowing users the ability to access their saved itineraries and the other functionalities of the website while on the move.

1.5 Objectives

The following objectives have been outlined in order to accomplish the overall aim of this project, as below:

- Gain deeper understanding of the context which informs this project by conducting research into film tourism in Northern Ireland and its impact on the local economy.
- Engage with industry professionals in order to gauge opinion on the project and any requirements or improvements which may be required.
- Research current technologies and options available to visitors and examine the benefits and drawbacks or limitations of each
- Create a simple, easily-used website which will provide the necessary information and functionality in an efficient and effective manner.
- Create a robust and comprehensive testing strategy, covering the functionality, navigability and usability of the system.

1.6 Development requirements

The following hardware and software technologies were used in order to complete this project. All software used is free of cost and readily available.

- Laptop computer – to carry out primary development and testing work
- Tablet and smartphone devices – to enable live testing of the system on a scalable platform to evaluate mobile capabilities.
- Xampp – an all-in-one package containing an Apache server, a MySQL Relational Database Management System, and Php interpreter to facilitate server-side processing
- Good working knowledge of client- and server-side programming languages, including HTML, CSS, JavaScript, PHP and SQL.

1.7 Report summary

Chapter 2 – outlines contextual information on the film location industry in Northern Ireland, as well as research into the options available for film tourists at present. It examines the other ideas investigated as well as looking at the business case of such a project in a real-world scenario. Feedback from a focus group questionnaire is also examined to inform user stories.

Chapter 3 – identifies the system requirements for the website, both functional and non-functional, as informed by the focus group questionnaire and research carried out.

Chapter 4 – a detailed description of the design phase of the project, including visual appearance and system architecture, such as database design. Examination of the underlying principles of good software design is also conducted.

Chapter 5 – examination of the implementation of the system, including methodology chosen, creation of the overall framework and development of individual functions and features. Discussion of problems encountered and solutions achieved are also included

Chapter 6 – outlines the testing and evaluation of the system across a wide number of criteria and contexts, including in-house functional testing by the developer, cross-browser and cross-platform testing and results and feedback gained from external focus group testing and questionnaire.

Chapter 7 – summarises the project from the initial research stages through to final testing. Success of the project measured against the aim and objectives, and recommendations identified and discussed. Appraisal included as to the lessons learned from the project and actions to be taken in future development identified.

2 ANALYSIS

2.1 Introduction

This section will outline the general background and context to the Northern Ireland tourism industry, and the associated popularity of film tourism. Details of research carried out into alternative options and avenues for film tourists will also be explored in detail, along with the pros and cons of each.

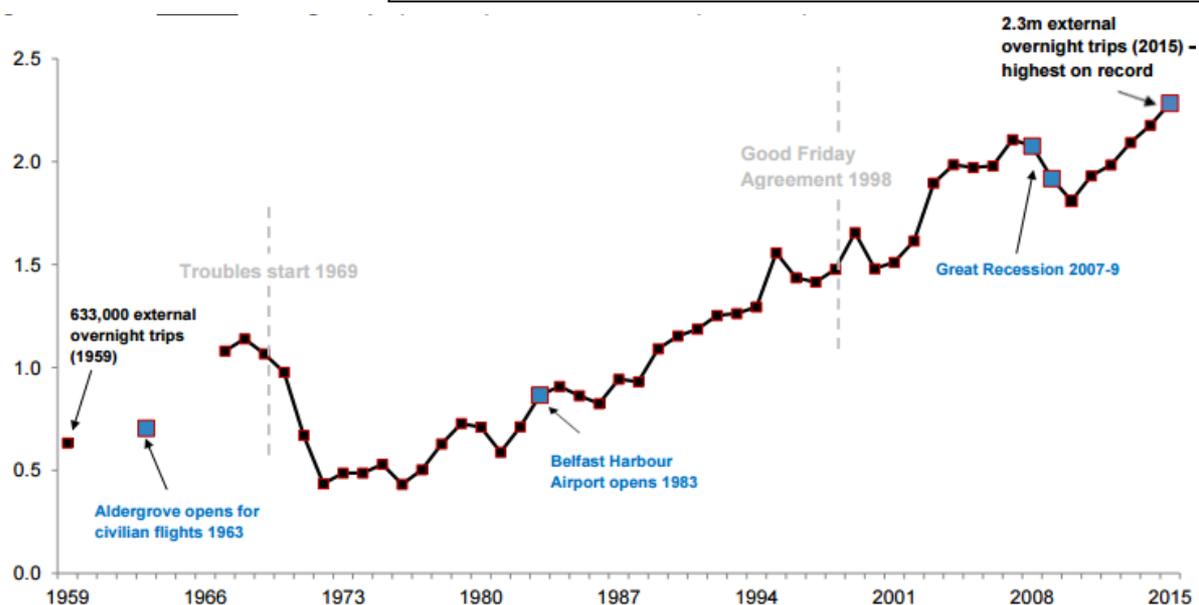
Other ideas explored in developing a system for film tourists will also be considered, along with a business case for the website and its viability as a real-world commercial enterprise.

2.2 Film Tourism – the industry in context

For many years, a key driver in the marketing of Northern Ireland as a tourist destination has been the province's outstanding natural beauty, with areas such as the North Coast, the Fermanagh Lakelands and the Mourne Mountains among the most popular and intensively-promoted to potential tourists.

With the implementation of the Peace Process over the past two decades, the province has seen a marked rise in visits by external tourists (i.e. those who originate from *outside* Northern Ireland, see Figure 1), with a corresponding increase in revenue generated.

Fig 1: Annual external overnight trips (millions) to Northern Ireland (1959-2015), *Graphic from www.economy-ni.gov.uk, 2016*



Last year (2015) proved a strong one for the tourism industry in Northern Ireland, with overnight visits to the province by external visitors standing at 2.3m, the highest on record. Spend associated with these trips amounted to £541m, a rise of 5% on the previous year (economy-ni.gov.uk, 2016).

A more recent trend in tourism generally across the UK and Ireland – and indeed globally – has been based around the links between a destination and popular movies or television productions which are set or filmed there.

Indeed, a location or venue can often see a marked increase in footfall off the back of an appearance in a high-profile film or TV show. For example, visits to the Wallace Monument in Scotland increased by up to 300% a year after the release of the movie *Braveheart*, while The Crown Hotel in Amersham, England, reported being fully booked for at least three years

after it featured in hit 1994 comedy *Four Weddings and Funeral*. Similarly, the inclusion of international locations in major studio films such as *Captain Corelli's Mandolin*, *The Beach* and *Mission Impossible 2* all had a dramatic impact on subsequent visitor numbers (Walairporn R, 2008, p4).

Understandably, this is an area which tourism agencies in Northern Ireland have been keen to capitalise upon in recent years, given the province's increasing popularity as a destination of choice for film crews from around the world.

Culturally, this is certainly an area in which Northern Ireland has seen a marked change over the past decade. Previously, films shot in the province tended to be locally-made, home-grown productions, often themed around Northern Ireland's turbulent political history - often not ideal for promoting a positive impression of the region!

There was a marked change in 2007, however, when the Paint Hall Studios in Belfast's up-and-coming Titanic Quarter were chosen by Hollywood star Tom Hank's production company as the base for the shooting of major big-budget fantasy drama *City of Ember*. This was followed soon after by the comedy drama *Your Highness*, starring well-known names such as James Franco and Natalie Portman (*northernirelandscreen.co.uk*, 2016).

A key point in this nascent popularity arrived in 2009 with the announcement that a pilot episode for upcoming HBO miniseries *Game of Thrones* was to be shot in Northern Ireland. The success of the show, a fantasy drama based around a series of novels by George RR Martin, led to the producers 'adopting' Northern Ireland as a Principal Photography location for the ensuing six series, the latest of which has recently ended on Sky TV.

The production itself merits attention for the sheer amount of interest it has created in Northern Ireland and, more notably, for the financial impact it has had, with NI Screen estimating it to have brought almost £150m to the local economy across its six series so far (see Figure 2). It should be noted here too, though, that the drama receives "generous tax breaks to film in Northern Ireland" (*bbc.co.uk*, July 11, 2016).

Game of Thrones Economic Impact		(Source: Northern Ireland Screen)
	Funding from Northern Ireland Screen	Expenditure on goods and services into the Northern Ireland economy
Pilot / Series 1	£3.2m	£21.2m
Series 2	£2.85m	£21.8m
Series 3	£3.2m	£22.5m
Series 4	£1.6m	£23.2m
Series 5	£1.6m	£26.3m (Estimated)
Series 6	£1.3m	£31m (Estimated)
	Total: £13.75m	£146m (Estimated)

Fig 2: The economic impact of Game of Thrones on Northern Ireland, *Graphic from bbc.co.uk*, 2016

Since then, a succession of both international and home-grown productions have been shot in and around the province, notably blockbusters such as *Dracula Untold*, compelling British dramas such as *High Rise*, starring Tom Hiddleston, and *Philomena*, starring Judi Dench, as well as Oscar-winning short film *The Shore* and critically-acclaimed TV dramas such as *Line of Duty* and *The Fall*.

Governmental agencies and tourism operators have generally been swift to capitalise on this appeal, in particular with regard to *Game of Thrones*, which has gained a huge fan base worldwide. The links between the production and the province have been heavily promoted at all levels, with a wide degree of press coverage on the economic impact that the production has had in Northern Ireland.

As *Game of Thrones* is arguably the most popular draw for film tourists, due to the stunning locations and their easy accessibility, this has led to the rise of a small but robust spin-off industry from the private sector, with guided tours, themed events and even culinary experiences offered by enterprising business owners here.

The area of global film-induced tourism is becoming an area of increasing research and study, although most reports focus on the business and touristic impact of the phenomenon, while the technological aspect – for example, online provision of film location-related content, interactive mapping of film locations, centralised databases of key locations - has been largely overlooked (Lavarone et al, 2015, p4).

Nevertheless, it is an area which merits investigation and further exploitation, given the potential for growth and development and the seemingly insatiable appetite among visitors for personal experiences of a favourite production.

“Films can induce viewers to travel by the physical properties ... and their associated theme, storylines, events and actors, shaping the audience’s feelings, emotion and attitudes towards places” (Walairporn R, 2008, p1); “People come for Game of Thrones and stay for Northern Ireland” (Judith Webb, *Tourism NI*, quoted in *bbc.co.uk*, July 11, 2016).

It is within this positive and encouraging economic and cultural context, then, that this project aims to add value to the current tourism offering with the provision of a website offering a comprehensive database of key filming locations from well-known or high-profile productions, including the aforementioned *Game of Thrones*, which can be presented to and used by visitors in a simple, efficient and, above all, *enjoyable* manner.

2.3 Research and insight

At an early stage informal research was carried out by means of discussions with staff at visitor locations around Belfast and key tourist sites; these included, but were not confined to, counter staff at the main Tourist Information Office in Belfast’s Donegall Square, publicity and promotions personnel for the main bus tour operators and location guides at popular sites such as the Giants Causeway, Castle Ward, Mount Stewart and in towns and cities such as Londonderry, Enniskillen and Newry, among others.

The consensus was that there had been a noticeable increase in enquiries from visitors and tourists as to the accessibility and cost of visiting filming locations, but that in general there was a lack of centralised, up-to-date information on these sites, particularly those which were off the main ‘tourist trail’, for example certain locations on the North Coast were proving difficult to find, and there was little or no contextual information available on-site.

The next step involved extensive internet searching and study of up-to-date tourism brochures and paraphernalia in order to identify the means which currently exist for finding and visiting filming locations in Northern Ireland.

2.3.1 Existing websites/software

In order to ascertain what technology exists for finding and mapping Northern Irish film locations, a number of web searches were conducted through popular engines, as this is the same means by which a tourist or potential visitor would be most likely to initiate their own exploration of the avenues available to them.

A variety of search terms were entered, including permutations of keyword strings such as 'filming', 'locations', 'Northern Ireland'. (Specific location or production names were avoided, as it was felt that this could bias search results in favour of more high-profile results).

A small number of key sites were identified offering varying degrees of content and functionality with regard to Northern Irish filming locations. Each was investigated for a number of criteria which a potential film tourist might expect or hope to find, such as amount and quality of contextual information, presentation of results and suitability for mobile device access.

To begin with, a brief outline of each site is presented:



Fig 3: The Northern Ireland Screen website

Northern Ireland Screen (<http://northernirelandscreen.co.uk/>) – this government-backed organisation is the lead agency for film, television and digital broadcast development and promotion within Northern Ireland. It offers guidance and advice on the practicalities of shooting in Northern Ireland, as well as offering the potential of financial assistance to interested parties.

The website (see Figure 3) offers a comprehensive database of film and television productions which have been shot in Northern Ireland over the past twenty years, with good contextual information on each, such as a synopsis of the production, locations where it was filmed and key credits (director, producer etc.). This includes a search function with date parameters for further refining of results.

While the range of productions covered by the database is good, specific details of locations where it was filmed can be patchy. For example, for sci-fi drama *The Survivalist* it states only 'Ballymoney' as the filming location, whereas the production was filmed in a specific forest location outside of the town.

The site also heavily promotes *Game of Thrones*, with access to an interactive map of filming locations which can also be downloaded as a mobile app (see Figure 4). The map is visually appealing and contains images and contextual information, but no facility for planning a route between locations, with written outlines of directions instead being provided.



Fig 4: The Game of Thrones location map

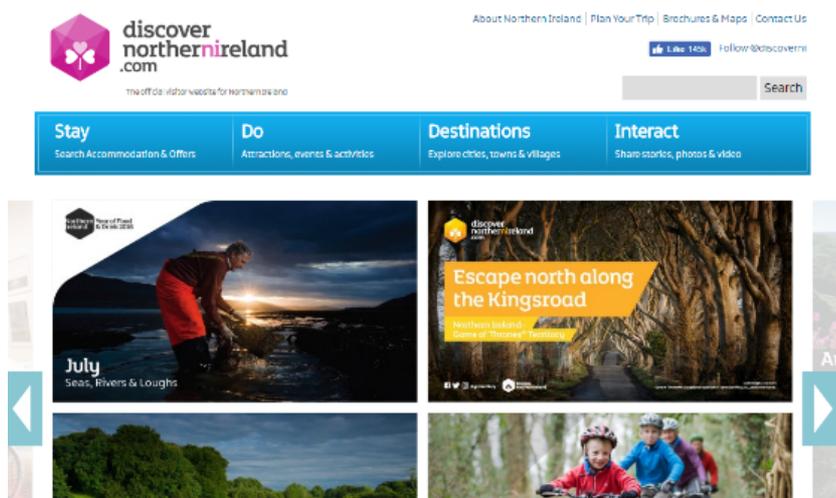


Fig 5: Discover NI homepage

Discover Northern Ireland (www.discovernorthernireland.com) – this is the website for Tourism Northern Ireland (Tourism NI), described as “a non-departmental public body of the Department of Enterprise, Trade and Investment Northern Ireland” (*tourismni.com, August 5, 2016*), and the organisation responsible for the development, promotion and marketing of Northern Ireland as a tourist destination.

The site (see Figure 5) offers a wide range of advice and information to tourists, including a section on filming locations which may be of interest to visitors. This comprises a limited list of key productions over the past ten years (e.g. *Game of Thrones*, *Dracula Untold*). There is some contextual information and images for each but no interactive or mapping component. The site also heavily promotes *Game of Thrones*, with access to the same interactive map of the series’ filming locations as on the NI Screen website.



Fig 6: Movie-Locations.com homepage

Movie Locations (<http://www.movie-locations.com/>) – this website (see Figure 6) describes itself as “the worldwide guide to movie locations”, with a comprehensive list of sites relating to well-known films such as *The Godfather*, *Star Wars* and *Harry Potter*. Visitors can search for locations from a search bar on the homepage or through a navbar link to a worldwide map, divided into clickable regions. Locations can also be identified by searching for actors or directors related to a location or by the film title itself.

While the breadth of countries and regions covered is impressive, there is only one entry for Northern Ireland, for the drama film *Philomena*, although the contextual information pertaining to this production is engaging and thorough.

There is no apparent function for retaining or mapping locations, although the site claims to be partnered with the Google Field Trip app, by which travellers can be alerted whenever they are geographically close to an area or site of interest.

While this site displays enthusiasm for its subject, its overall display is drab and dated and the lack of a full list of NI locations is a clear drawback.

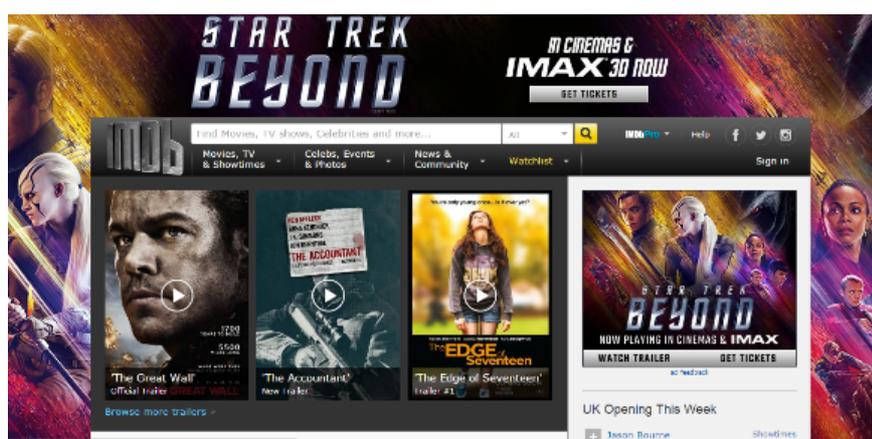


Fig 7: Internet Movie Database homepage

Internet Movie Database (www.imdb.com) – this long-standing website (see Figure 7) offers an extensive database of film and television productions, and is a popular resource for film and media professionals for the breadth and accuracy of its information. Users can find details of a specific production, including full cast and crew, release dates and filming

locations. The latter are presented as a comprehensive list, with some limited contextual information as to which scenes may have been filmed at a certain site. Users can create a free account which allows them to review and rate productions, offers personalised recommendations on films and alerts them to new releases, among other features. There is no functionality for compiling a personal list of specific locations, however, nor can users map these interactively. In summary, key features of each of the above examples have been tabulated (see Table 1) in order to show their effectiveness when compared against one another and also against this proposed project, Location Scout.

Name	Presentation of search results	Images	Create user profile	Location map	Contextual information	Scalable to mobile device
NI Screen	List only	Yes	No	Yes – Game of Thrones only	Yes	Yes – text small
Discover Northern Ireland	List only	Yes	No	Yes – Game of Thrones only	Yes	Yes – text small
Movie Locations	List only	Yes	No	No	Yes	Yes – text small
Imdb	List only	No	Yes	No	Yes	Yes
Location Scout*	List & map	Yes	Yes	Yes – all locations	Yes	Yes

*Intended functionality

Table 1: Comparison of available film tourism websites

2.3.2 Other alternatives

In order to provide as comprehensive as possible a survey of options available to potential film tourists, the student also conducted research into other means which are currently available for those wishing to visit filming locations around Northern Ireland. These are presented below:

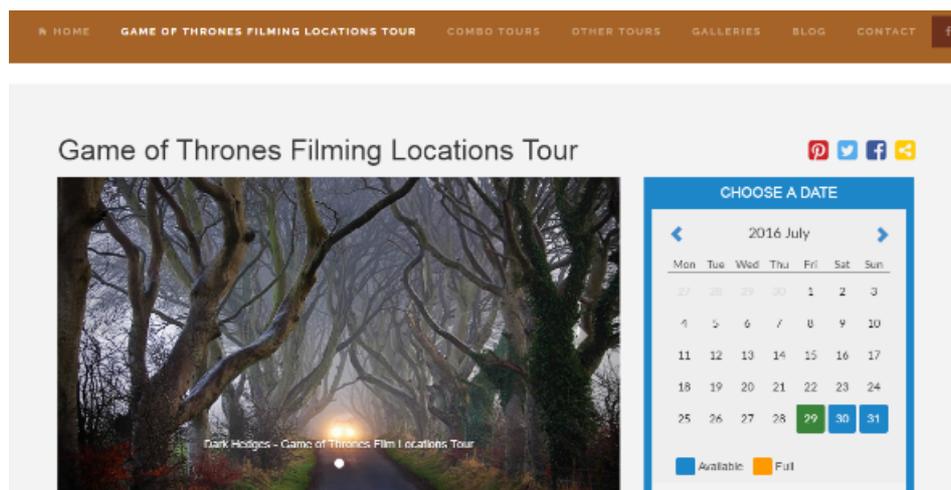


Fig 8: Belfast CitySightseeing homepage

Guided tours – at the time of research, the only dedicated film location tours available to tourists were based around one production, the massively-successful HBO drama series

Game of Thrones. These tours offer users a day-long visit by bus to a limited number of locations, usually with one of two itineraries on offer, one based in south Down or another in north Antrim. It can be surmised that this is due to the geographical demands of covering a wide number of locations within the allotted timescale of one day, a difficult proposition given the mileage involved in each of these itineraries.

Customers are offered a number of contextual features on these trips, such as an audio commentary en route, and in some cases, an interactive component involving dressing up in costumes and engaging in activities such as archery and axe-throwing.

The larger and more high-profile of these companies which offer this experience include Belfast City Sightseeing (belfastcitysightseeing.com, July 23, 2016) (see Figure 8), and Game of Thrones Tours (gameofthronestours.com, July 23, 2016), which offers tours from Belfast and Dublin (see Figure 9).

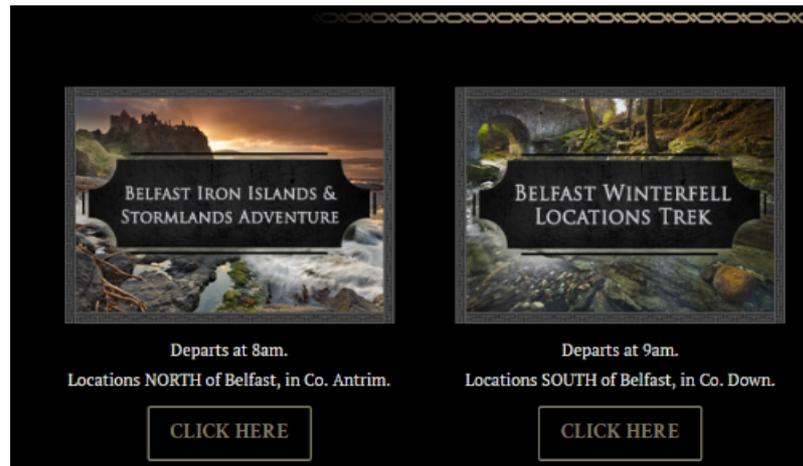


Fig 9: Gameofthronestours.com webpage

Ferry operator Stena Line (stenaline.co.uk, July 23, 2016) also offers a Game of Thrones tour for foot passengers, who are picked up from the ferry terminal in Belfast by minibus and conveyed to meet their tour bus at another location.

PROS: The benefits of this approach are that little effort in planning the trip is required on the part of the user – the tour operator picks up clients from a centralised meeting place (or, upon request, from their hotel/residence), with a driver and tour guide taking care of the navigation and conveyance to each site.

Customer feedback from these tours on websites such as Tripadvisor suggests that the commentary and overall knowledge of the staff is good, with the experience proving enjoyable for users of all ages.

CONS: Tours cost in the region of £35-40 per person, with reductions for larger groups. For a family of five, therefore, the cost could be close to £200. Ticket prices do not include the cost of lunch or refreshments, therefore participants must also factor this in to their budgets, along with the optional costs of buying souvenirs or other such non-inclusive commercial offerings etc. This can add up to a considerable outlay over the course of a day.

As these tours run to a tight schedule and visit only pre-agreed sites, this can place limitations on the scope of the itineraries. A *Game of Thrones* enthusiast wishing to visit locations which are contained in two separate itineraries - for example, the Dark Hedges at Armoy in the 'northern' tour, and Castle Ward, near Downpatrick, in the 'southern' tour – would be required to pay for two tickets for two tours on two separate days, a costly commitment in terms of time and money.

The opportunity for 'free-roaming' upon these tours is also limited; drivers cannot deviate from their schedule at the request or whim of passengers to visit an additional site of

optimum routing, transit options (walking, driving, bicycling, public transport), and easier manipulation of routes (see Figure 10).

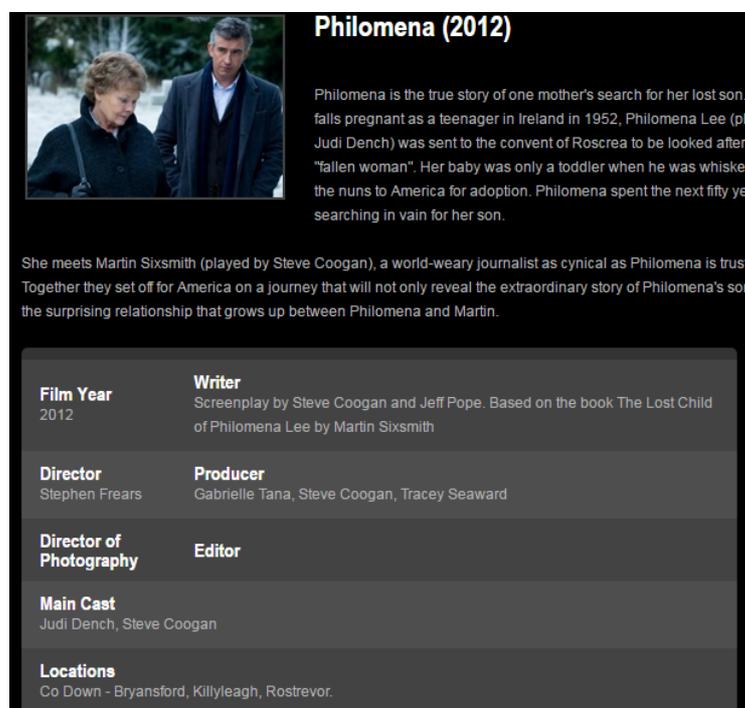
Allied with information from local tourist and/or film websites such as NI Screen or Discover Northern Ireland (the latter of which, as previously mentioned, recently launched an app detailing locations of key *Game of Thrones* locations), a tourist could potentially have unlimited freedom in planning and conducting a self-guided tour to any number of locations within any desired timeframe.

PROS: With access to filming information available for free from the internet, the cost of this is limited only to the mode of transport chosen e.g. hire car, fuel, bike hire, or public transport.

Applications such as Google Maps are of a high standard, internationally-recognised and easy to utilise, and can be accessed across a variety of platforms, from desktop to tablet and smartphone.

This approach also offers greater flexibility to amend, update or recommence planning of a visit with no overheads or financial commitment.

CONS: as this project will show, gathering detailed information on filming locations can be a time-consuming and often frustrating process, as the quality of information on individual filming locations is not always easily accessible, of varying quality and is often to be found across disparate locations. NI Screen, the official body for Northern Ireland's film and television industry, provides the most comprehensive database of productions filmed here, but specific details on filming locations are often not included. For example, for the film *Philomena*, the site (see Fig 11) only states the towns or general areas where filming took place rather than specific addresses.



Philomena (2012)

Philomena is the true story of one mother's search for her lost son. When she falls pregnant as a teenager in Ireland in 1952, Philomena Lee (played by Judi Dench) was sent to the convent of Roscrea to be looked after as a "fallen woman". Her baby was only a toddler when he was whisked away by the nuns to America for adoption. Philomena spent the next fifty years searching in vain for her son.

She meets Martin Sixsmith (played by Steve Coogan), a world-weary journalist as cynical as Philomena is trusting. Together they set off for America on a journey that will not only reveal the extraordinary story of Philomena's son, but also the surprising relationship that grows up between Philomena and Martin.

Film Year 2012	Writer Screenplay by Steve Coogan and Jeff Pope. Based on the book <i>The Lost Child of Philomena Lee</i> by Martin Sixsmith
Director Stephen Frears	Producer Gabrielle Tana, Steve Coogan, Tracey Seaward
Director of Photography	Editor
Main Cast Judi Dench, Steve Coogan	
Locations Co Down - Bryansford, Killyleagh, Rostrevor.	

Fig 11: filming details of *Philomena* on NI Screen website

Upon deciding on their desired locations, a visitor would then be required to manually input details of each one, which could prove problematic when details of each location can be contradictory or erroneous (e.g. the student found that entering 'Dark Hedges' into a Google Maps search almost invariably returned details of a location in England with the same name, rather than the popular site near Armony, Co Antrim).

Furthermore, the details a visitor might find on a location will be unlikely to include such specifics as whether it is accessible to those with a disability/limited mobility, or if there are visitor facilities on-site or whether an entrance fee must be paid.

2.4 Ideas investigated

The typical target user for this website would be a first-time tourist or visitor to Northern Ireland, with little or no geographical knowledge of the country. They would therefore require a clear outline of what is available, the cost associated and details on accessibility. They would require all of this information to be presented to them as clearly and concisely as possible.

With this in mind, it was felt that a 'mothership' desktop website would be best for allowing a user the comfort to spend as much time as they required in searching for locations, applying this information to the overall geographical context of their visit, amending and updating as required and investigating modes of transport, entry fees, accessibility, accommodation etc. With many tourists now able to utilise their mobile devices in a cost-efficient manner when visiting abroad, it was felt that the scalable facility of this website would be adequate to allow them to enjoy all of the features offered by the main desktop site while 'on-the-go', in a visually-appealing and functionally efficient manner. Users would still be able to create a new itinerary as well as accessing plans which they already may have created and saved.

The possibility of utilising emerging technology such as 'iBeacons' – small devices which can be placed at a location to provide contextual information via a Bluetooth mechanism – was also considered at a very early stage by the student, but with these devices costing around £100 for a package of five, this unfortunately had to be discounted on grounds of cost and overall necessity.

2.5 Business case

Although the website is free at the point of use for visitors, it could be considered as a commercially-driven enterprise which would require revenue streams in order to make it viable. A variety of options are available to achieve this:

Advertising – given the broad area of interests covered by this website, both from a tourism and cultural aspect, the potential for creating advertising revenue on the site would be strong. Potential clients could include commercial tourist sites (e.g. the National Trust, Marble Arch Caves, National Museums of Northern Ireland), local authorities which may have responsibility for locations featured, hotels and other accommodation providers, transport providers such as local taxi firms, bus companies, car hire outlets etc., as well as cinemas and video rental outlets, or potentially online streaming providers such as BT, Netflix.

Sponsorship – there exists potential for a committed financial relationship with businesses or organisations with an interest or stake in this sector, whereby branding and logos could be incorporated into the website, or preference given to a partner's services (e.g. car hire, accommodation). This could be negotiated in partnership with stakeholders such as the Northern Ireland Tourist Board, local councils or Non-Governmental Organisations such as Invest NI or NI Screen.

Syndication – the framework which has been developed for this project could easily be adapted to suit any number of areas of interest to visitors. For example, sporting, literary, historical or politically-themed tours. The model could also be developed for paying clients to develop bespoke tour services, or the source code syndicated for a fee to allow interested parties to develop services of their own.

Costs – as this project utilises free existing software packages and platforms for its development, the costs of implementation have been minimal. The only major considerations for developing this further as a commercial enterprise would be the cost of buying and maintaining a web hosting service, and some outlay for a Premium version of the Google Maps API to allow for enhanced functionality.

PROS - the benefits of this project are principally to do with the strong existing interest and market for products linked to Northern Ireland's burgeoning film and television industry. The fact that the website is free and simple to use would give it immediate appeal to tourists and visitors from a variety of backgrounds. Allied to this, the website would offer a service which is flexible and suited to individual tastes. For example, users can search for specific locations or take advantage of suggestions based upon geographic location, accessibility considerations, cost and even specific productions which may be of interest.

CONS – for the purposes of efficiency and integrity, the website would require constant monitoring for updates or changes to locations, their accessibility and availability (for example, many are closed to the public while filming is ongoing!). This could prove time-consuming.

From a commercial point of view, the site may require some time to bed in within the industry and generate the necessary user base and revenue streams from potential clients.

There also exists the potential for competitors to utilise the project as the basis for a similar enterprise, or develop such a site independently. At the time of planning and development around March 2016, for example, it was announced that the new Discover Northern Ireland web app previously mentioned in this chapter was being launched to map the principal filming locations around Northern Ireland for Game of Thrones. It is acknowledged that this was not an infringement on any ideas already considered, submitted or implemented by the student, but it again demonstrates the keen interest in utilising Northern Ireland's filming industry which exists within the tourism and business sectors here.

3 SYSTEMS REQUIREMENTS

3.1 Introduction

The principal aim of this section is to re-examine the results of a focus group survey which was originally carried out for the first Analysis & Design phase, and how these can be presented as a series of 'user stories' which outline the views and requirements of a range of stakeholders, from industry professionals and tourists to the developer himself.

These in turn have been used to inform a series of functional requirements for the general content and functionality of the website, while a comprehensive series of non-functional requirements will also be examined.

3.2 Focus Group Findings

A key aspect of the analysis and research process involved the gathering of opinion from stakeholders within the tourism and film industry in Northern Ireland. A number of key figures were identified whose opinions and feedback would prove of considerable use in the process, including tourism and development officers for all eleven of Northern Ireland's local councils, senior marketing officers for tourism organisations such as NITB, NMNI etc, and prominent members of the arts and cultural sector, including an independent cinema manager and a film programmer. All provided feedback on the proviso that their personal details be kept confidential from publication.

A Googleforms-based questionnaire was compiled and issued to a total of 16 individuals or organisations, with around half of those approached responding (see Appendix C).

To begin with, respondents were asked for their opinions on the state of the film and TV location industry in Northern Ireland, with all agreeing that this was proving one of the most exciting emerging industries in the province. However, it was also agreed by most that while there were enough locations which would be of interest to visitors and tourists, they were not well-served in being able to find clear and easily usable information on these in advance of their visit.

It was further agreed that visitors to Northern Ireland should be given the opportunity to discover more about the industry in a cost-effective manner, and that any website seeking to address this issue should do so in a simple and straightforward way.

Mobility was also a crucial consideration for those questioned, with 87.5% agreeing that information should be accessible on a smartphone/tablet platform in order to allow for greater mobility for users.

It was also agreed that any such website should include a mapping facility for users to be able to visualise their selected locations, as well as details on accessibility and contextual information. The ability to find locations by means of search terms based around production and location names were also considered of paramount importance.

3.3 User Stories

Results of the questionnaire and comments from some of those canvassed provide the basis for the functional and non-functional requirements of this project. To summarise, the key feedback from the survey is presented below as a series of user stories.



Fig 12: User stories

3.4 Functional & Non-Functional Requirements

From both the feedback from those surveyed, and from the research which was carried out by the student as part of the analysis phase, a series of functional and non-functional requirements are identified, as outlined below:

3.4.1 Functional Requirements

Searchability – the system must allow users to find information on filming locations within Northern Ireland by a number of means. These must include a pre-defined list of existing locations presented as a series of clickable menus, with associated parameters and filters. For example, By County, By Accessibility (disabled, public transport, cost etc) or By Production (e.g. Game of Thrones, Line of Duty).

Users must also be able to enter terms into a search bar which will return any locations matching or even partially matching the entered text. For example, inputting ‘toy’ as a partial string will return the location ‘Ballintoy Harbour’.

Presentation of results – the locations must be presented, in the first instance, as a list of matching results. Each will be clearly named, with a strong colour image, and contextual information to allow for further consideration of relevance.

Crucially, locations must be able to be mapped onto a Google Map accurately and clearly, with contextual information again accessible upon the clicking of a marker above the specified site.

Personalisation – users should be able to create a personal profile by registering their details – an email address (utilised as a unique identifier) and a password. This information can then be used to allow users to regain access to the website at a later date to plan further itineraries or to retrieve previously-saved itineraries.

Retention/manipulation of information – during a browsing session, a user should be able to add locations to an itinerary, to remove locations as desired or to clear an itinerary altogether and be able to start again. They should be able to view this information on their itinerary at any stage of their browsing session.

Users should also be able to save their itineraries to a database which can then be retained at a later date, even after they have logged out and logged in again.

Links – As users may wish to find further contextual information on their chosen locations, each location should provide a weblink offering safe access to third party sites.

Administrative functions – due to the changing nature of accessibility available to filming locations, the facility must be created to allow the site administrator to manipulate data which is held within the database in an efficient manner. This should be done by means of a separate and distinct admin interface to which only the administrator will have access. Within this facility will be the provision to view, insert, edit or delete locations and user details.

3.4.2 Non-functional Requirements

Availability – as it is targeted at a globally-diverse user base, the system must be available to on a 24-hour basis, with any requisite downtime (e.g. system upgrades, database amendments) kept to a minimum so as to cause as little disruption as possible.

Efficiency – in order to maximise performance speeds the system should not utilise an excessive amount of RAM/CPU space on host devices or place excessive strain on internet

resources at point of use. Image sizes should be kept to a necessary minimum, and animations or graphics should only be considered where absolutely necessary.

Flexibility – the system must allow for the addition or deletion to/from the databases and user interface as required by the administrator/developer.

Performance – the system must carry out its functions in a fast and efficient manner from the point at which the user inputs/selects the required information. The system should be able to process this information within one to two seconds (with acceptable allowance for the constraints of the technology being utilised by the end user e.g. hardware quality, internet speed/strength/usage load). It should carry out this function without impairment of any kind, such as linking to dead webpages, error messages etc.

The system should also take account of the inadvertent loss of connectivity during use and be able to retain any information already compiled within an itinerary upon resumption of service.

Portability – this software should be able to run on a wide variety of devices and platforms, from desktop and laptop PC devices, to handheld devices including tablets and smartphones. It should be compatible with standard operating systems, including iOS and Windows.

Integrity – as users will be required to input email addresses and passwords, this information must be stored securely and robustly, with all considerations taken for malicious infiltration or injections by external parties.

Ethical – While no age-restrictions are in place for this website, consideration must be given that images and language used in pictures and information are age-appropriate, given that it may be visited by those aged under 18.

Reliability – the software must be capable of maintaining its performance standard over time without loss of information or input from the user.

Reusability – the system should be able to be accessed on a variety of web browsers – Safari, Chrome, Firefox, Edge etc – without significant or noticeable difference to performance, layout, and accessibility.

Robustness – error handling should be carried out and feedback produced to the user in a clear and effective manner.

Scalability – in keeping with the overall aims of this project, users must be able to access this system on portable/handheld devices. Therefore it must be suitably configured to scale down from the main ‘mothership’ site to differing screen sizes/resolutions, memory capacities and processor speeds.

Usability – the website must be clearly laid out, easily understood, simple to use and straightforward for users to learn. Navigation between pages should be easy, and on each page visited users should clearly be offered the option to return to the homepage or their profile page.

4 DESIGN

4.1 Introduction

This chapter will examine the principles behind website design which will be applied in this system, as well as a detailed look at the overall design, including navigability, appearance, programming languages used and overall structure of the site and databases.

4.2 Creating a successful website

As already discussed in the preceding chapters, this system has been designed ostensibly as a main desktop site with the ability to scale to a variety of different device sizes. In this regard, the system will take full advantage of the wide range of platforms which are now available on the market to enable internet access.

Research indicates that global mobile device ownership and usage is continuing strongly, with market penetration set to hit 69.4% by 2017 (*emarketer.com, January 16, 2014*). In the UK alone, 71% of adults own a smartphone device, with a notable rise in the subscription to 4G networks and services from 2.7m at the end of 2013 to 39.5m by the end of 2015 (<http://media.ofcom.org.uk/facts/>).

The rationale for choosing a multi-platform approach for this project, however, goes beyond mere popularity of the devices and covers the necessity of allowing users to access their information while on the move, whether on a smartphone, tablet or laptop device.

This approach creates an important consideration for the developer in establishing the design features which will be implemented in this system and the limitations which may be imposed upon it by the existing hardware and connectivity of the chosen device. For example, mobile devices have only limited memory and power sources which can be quickly overwhelmed or depleted by sustained or excessive demands from the operating system or running applications.

Likewise, the impact of the screen size of the device on the general look and accessibility of the system is an important consideration.

Therefore it is helpful to establish a clear outline of key principles of accessibility which must

- Provide equivalent alternatives to auditory and visual content – i.e. a text alternative for non-text content.
- Ensure that text and graphics are understandable when viewed without colour.
- Mark up documents with the proper structural elements. Control presentation with style sheets rather than with presentation elements and attributes.
- Ensure that tables have necessary mark up to be transformed by accessible browsers and other user agents.
- Pages should be accessible even when newer technologies are not supported or turned off.
- Ensure that moving, blinking, scrolling or auto-updating objects of pages may be paused or stopped.
- Ensure that the user interface follows principles of accessible design: device-independent access to functionality, keyboard operability, self-voicing etc
- Use features that enable activation of page elements via a variety of input devices e.g. mouse, keyboard, voice, head wand.
- Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.
- Provide context and orientation information. Grouping elements and providing contextual information about the relationships between elements can be useful for all users.
- Provide clear navigation mechanisms e.g. orientation bars, site map. Important to people with cognitive disabilities or blindness, and benefit all users.
- Ensure that documents are clear and simple. Consistent page layout, recognizable graphics, and easy to understand language.

be adhered to and considered in the development of this system. In this regard, a good example on which to base this is provided by the Worldwide Web Consortium (W3C), which is the main international standards organisation for the world wide web. The organisation has published web content accessibility guidelines (see Figure 13).

4.3 User Interface Design (UID)

One of the overarching principles involved in the design of the user interface for this project was that of simplicity and comprehensibility for users, regardless of their experience or expertise with websites or mobile devices. The Eight Golden Rules of Interface Design (see Figure 14), as outlined in 1987 by Ben Shneiderman of the University of Maryland are easily applicable to most systems, subject to being properly refined, extended and interpreted.

1) Strive for consistency - Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent commands should be employed throughout.

2) Enable frequent users to use shortcuts - As the frequency of use increases, so do the user's desires to reduce the number of interactions and to increase the pace of interaction. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.

3) Offer informative feedback - For every operator action, there should be some system feedback

4) Design dialog to yield closure - Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators ... an indication that the way is clear to prepare for the next group of actions.

5) Offer simple error handling - As much as possible, design the system so the user cannot make a serious error. If an error is made, the system should be able to detect the error and offer simple, comprehensible mechanisms for handling the error.

6) Permit easy reversal of actions - This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options.

7) Support internal locus of control - Design the system to make users the initiators of actions rather than the responders.

8) Reduce short-term memory load - The limitation of human information processing in short-term memory requires that displays be kept simple, multiple page displays be consolidated, window-motion frequency be reduced, and sufficient training time be allotted for codes, mnemonics, and sequences of actions.

SOURCE: <http://faculty.washington.edu/jtenenbg/courses/360/f04/sessions/schneidermanGoldenRules.html>

Fig 14: Eight Golden Rules of Interface Design, Shneiderman

4.3.1 Page layout

From the outset, visual hierarchy – that is, a clear viewing order with on-screen elements such as buttons, menus etc in the same or similar position on each screen - was considered a key facet of a successful and intuitive UID. To this end, a clear, simple layout will be created (see Figure 15), consisting of a header area in which is displayed the name of the website and the home and user profile button links. To the right of the home screen will be placed a functional sidebar, consisting of a short welcome message to display the purpose of the website, a search bar and submit button, a number of dropdown search menus, clearly identified by name/type, and buttons to allow an existing user to login or a new user to register a profile.

The remaining area of the home screen offers the main ‘activity window’ for the website, in which search results are displayed, maps can be rendered and the user profile examined, as well as any location choices which have been made. In practice this is the only part of the screen which should change as the user navigates between various pages; the intention is that the transition between pages should be as seamless as possible with no interruption to the visual hierarchy or the focus of the user’s attention.

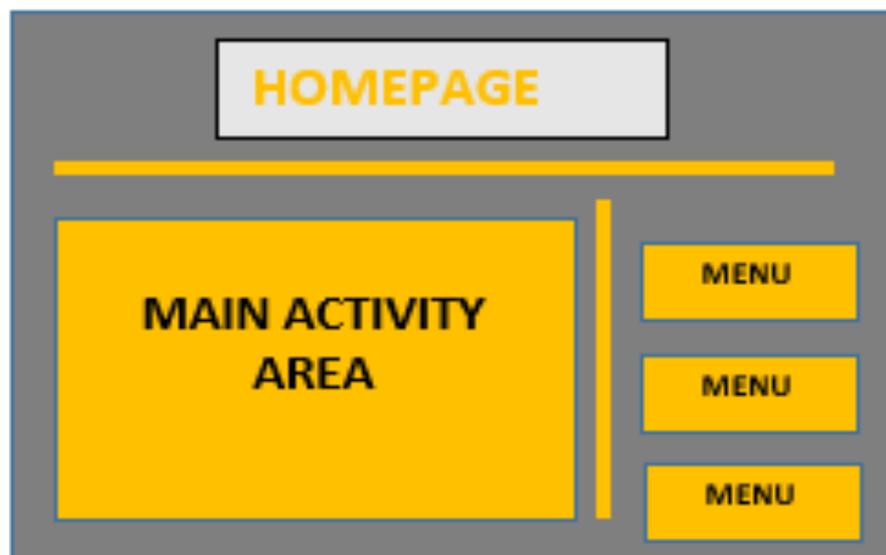


Fig 15: Wireframe diagram of proposed homepage

4.3.2 Colour scheme

A wide array of colours and shades are available to developers now thanks to the tools such as the HTML Colour Picker, available on the W3 Schools website, whereby subtle hues, tones and effects can be discerned.

Again, however, many sources of advice on web design stress the importance of simplicity in this regard. “You can often achieve a very effective design with just black, white and one or two other colours. If you use a consistent colour scheme throughout the site, it can give it a more professional look“ (plainenglish.co.uk, 2016).

From the earliest stages of the project, it was felt that a strong contrast of colours would present a bold look, and allow for greater clarity in the readability of text. As a base background colour, black was selected as it was felt that this best evoked the cinematic theme of the project – the idea of a darkened auditorium, with the focus of attention by the user on the images and text which are being projected before them.

The corollary of this was that a much brighter colour should be utilised for the display of text.

A number of samples were considered, from plain white to bright yellow, but it was felt that an orange/gold colour best encapsulated the vibrant, artistically visual subject matter of the website and provided a strong sense of contrast. For smaller text elements, though, white was chosen as the default colour as this provided optimum contrast with the dark background.

4.3.3 Font

While the range of fonts available as standard via HTML and CSS is considerable, further research was conducted into alternative offerings which might offer more visual flair.

A valuable resource in this regard was the 'font-awesome' website (<http://fontawesome.io/>), which allows users to download and test out a variety of fonts which can be used within the Bootstrap framework.

Consideration was given to the limitations which some fonts can face when rendered on a computer screen, which has a lower resolution than print. For example, Serif fonts – those with extra details on the main strokes of letters – are usually best suited to print publications, but can be utilised on-screen if the font size is large enough. Sans-serif fonts – which feature straight ends to letters – offer a cleaner design, and are therefore often better for use with smaller-sized text when rendering on screen (*Duckett J, 2014, p267-270*).

Initially a uniform Serif font entitled 'Arvo' was considered for the site, but it was felt that this looked merely functional in appearance and lacked the artistic flair which the website seeks to encompass. A more suitable choice came with the Serif-based 'Stoke' font. While this rendered well in the main headings and <h> elements of the site, it proved problematic in the presentation of the smaller <p> elements, which appeared to look 'smudged'. A compromise solution involved retaining the Stoke font for the main headings and menus, while the smaller textual elements were rendered in a more familiar Arial font and, as previously described, the colour white.

As the rendering of the Stoke font is dependent on internet connectivity, however, a back-up default font was added to the CSS style sheet which would render if the former was unavailable. Times New Roman was chosen as it offered a similar appearance to the Stoke font and was known to be readily available as standard across browsers and systems.

4.3.4 Navigation

As previously described, the navigation system for the website is centred on a small number of buttons and dropdown menus which remain in a consistent position throughout the user journey through the website.

Clicking or touching the button will lead the user to the relevant information as advertised by the button. For example, clicking on 'Login' will take them to the login page, while clicking on 'Antrim' within the 'By County' dropdown menu will display all locations within that county. In the early stages of development, simple HTML-style links were used as the means of action for users to navigate between pages. However, it was suggested that the default blue colour of these was not visually appealing and instead these were replaced with more striking Bootstrap-style buttons.

Again in keeping with the principles of good UID as outlined by Shneiderman and the Plain English Campaign, the user should be able to navigate anywhere in the website within as few clicks as possible, ideally no more than three.

Should the user inadvertently enter erroneous or already existing information, such as during the login or registration process, they are presented with a message outlining the error and suggesting an appropriate remedy.

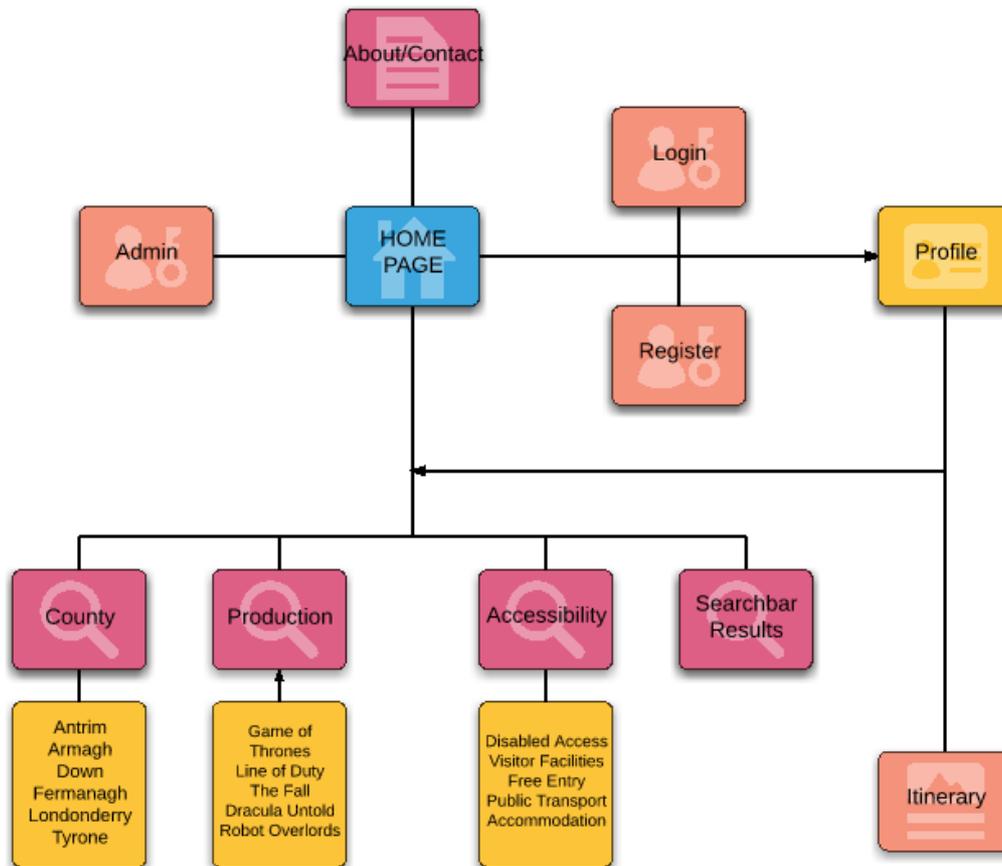


Fig 16: Sitemap for Location Scout website

A typical user interaction will first of all involve either registering or logging in (unregistered users attempting to do the latter will be redirected to the 'Registration' page). From there, the user is free to create and amend their itinerary at will, this itinerary will always be accessible through their personal profile page (see Figure 16). A typical interaction involving the user visiting and saving locations from a specific county is outlined in a storyboard (see Figure 17).

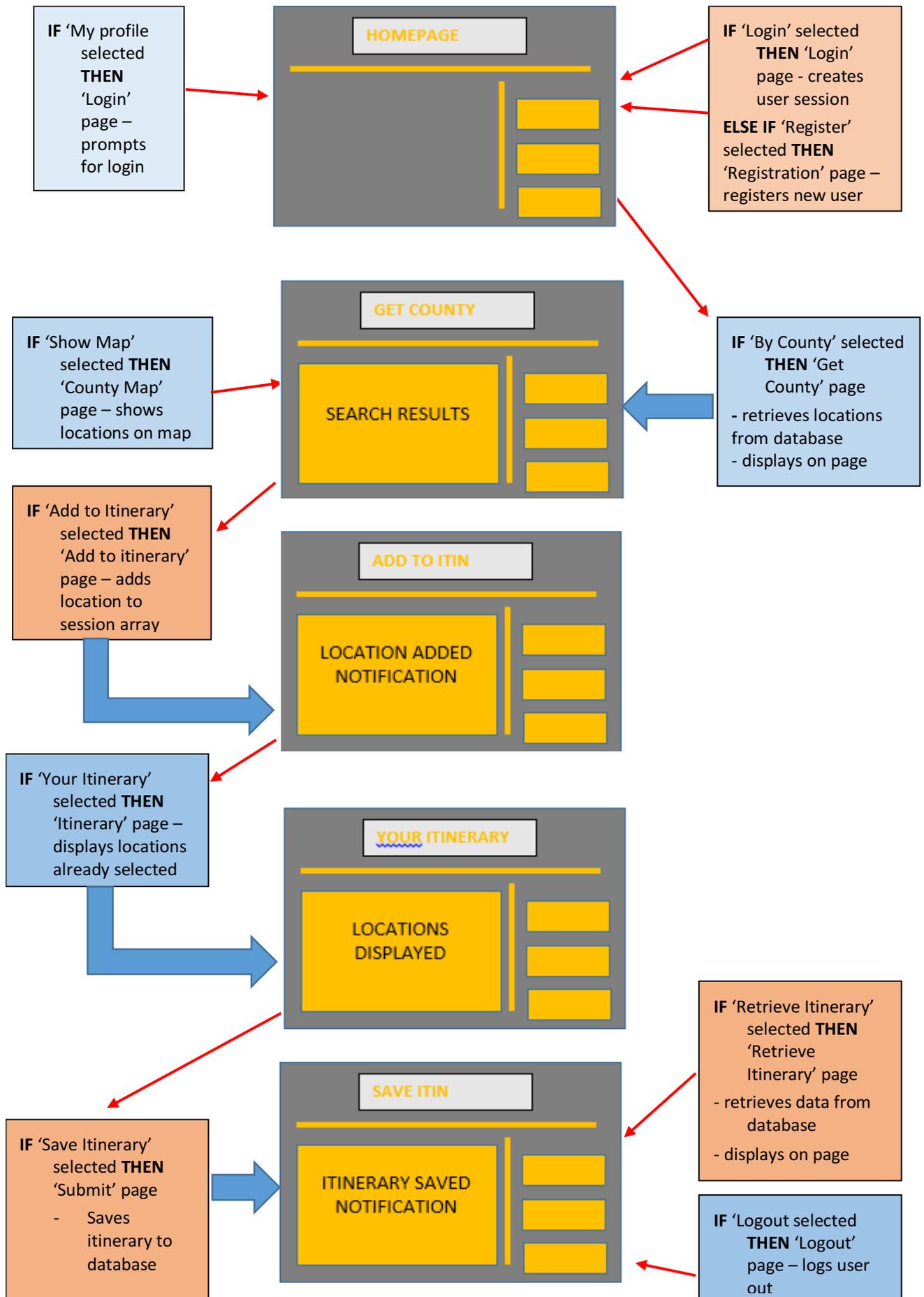


Fig 17: Storyboard showing example search and save by County

4.4 System Architecture

The successful completion of this system involved the utilisation of a number of so-called 'front-end' and 'back-end' languages and systems.

Simplistically, the former can be described as those languages and programmes which are used to create the visual display of a website or application which the end-user experiences. Back-end systems are those which largely remain hidden from the user, such as database systems, web servers and languages such as PHP. When a user accesses an application at the front-end, the information is verified and processed via the back-end before being presented back to the user.

While the front-end languages and systems being utilised in this project are examined in the next chapter, it is useful to look at the composition of the database within the 'back-end'.

4.4.1 Database structure and design

As the database is central to this system, the structure and integrity of this aspect was subject to careful planning and consideration from an early stage.

The database used for Location Scout requires the retention of a large amount of information, which can be easily accessed, updated and manipulated as required. This information needs to be stored in separate data tables.

Locations – the largest of the four tables, this contains a total of 17 fields of information, including the location's unique identifying number, as well as its name, details of its nearest town, its county and visitor information, such as whether it is accessible to the disabled, or if there is a cost involved in visiting.

Other key attributes include a latitude and longitude for mapping purposes, and keyword field to enable users to search for a location.

Itineraries – this table contains details of itineraries which have been created by a user. This is important as it allows them to save and then retrieve details of an itinerary which they have created and may wish to revisit later.

Itin_loc – following on from the data contained in the itineraries table, this stores the details of the specific locations which have been saved by a user within a particular itinerary. This allows the user to examine their selection in detail as well as allowing them to map these specific locations.

Users – this contains details of each user registered on the system, as defined upon registering. Data includes a unique user id, their first and last names, and their login details (email and password). This table cannot be manipulated by the users and is intended only for use by the site administrator.

Of these four tables, two – **Users** and **Locations** - can be directly manipulated by the administrator through the Admin panel function. However, deletion of a user's details from the database will also trigger the deletion of that user's saved itineraries and its dependent locations (as will be shown in the next chapter.)

The database is built upon the relational principles of database design, whereby data tables are interconnected by a defined relationship. For example, in this system one user may have anything from zero to numerous Itineraries, each of which could contain anything from one to many Locations. The nature of these relationships is perhaps best summarised by means of an Entity Relationship Diagram (see Figure 18).

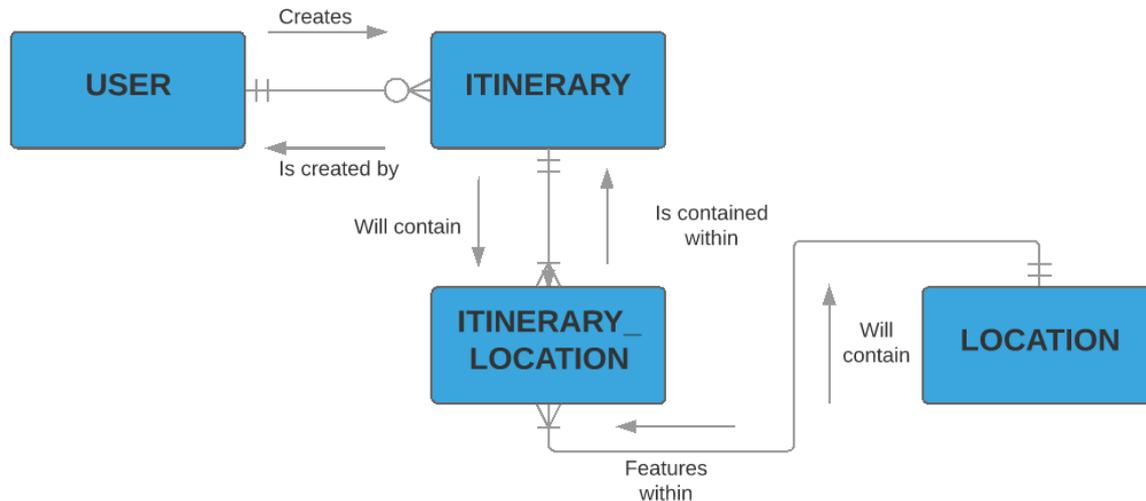


Fig 18: Entity Relation Diagram for the Location Scout database

A field of information which is contained in one data table may also appear in a related table as a 'key'. This allows for stored data to be combined in a number of ways. For example, a Primary Key, which provides a unique identifier for data within a table, may be referenced from another table as a 'Foreign Key'. Without the latter it would be difficult to associate data from one table with data in another.

5 IMPLEMENTATION

5.1 Introduction

This chapter will look at how the concepts and designs as described in the preceding chapters were applied to the implementation of the Location Scout project. This will include the implementation methodology chosen and look at the different phases of the process and how the technologies identified were utilised.

5.2 Development environment

5.2.1 Implementation tools

The system was developed on a Toshiba Satellite Pro C650-18D 64-bit laptop, running Windows 7 on an Intel Celeron processor. Code was written, developed and edited via the Notepad++ text editor.

The languages and programs used are outlined below, in order to provide contextual detail of how they operate within a software system.

PHP - Hypertext Preprocessor is a widely-used general purpose scripting language which is well-suited for web development and which can be easily embedded with the front-end language of HTML. PHP allows a user to manipulate web page content on the server before a page is delivered to a client browser, adding features and dynamism which HTML cannot achieve by itself. For example, a PHP script which runs on the server can alter or generate HTML code, but the client browser will still receive an HTML web page, without necessarily being aware that PHP has been involved in the process (*Beighly L & Morrison M 2009, p3*). One of the key advantages of PHP, particularly with regard to this system, is that it offers an effective and efficient means of connecting with and storing and retrieving information to/from a database system, incorporating the data into the HTML code which it generates. The overall benefit of this is that pages and content do not have to be stored on the local memory system, thereby keeping much of the functional efficiency of the device and OS free.

MySQL - Described as “the world’s most popular database software” (*McGrath M 2014, p8*), MySQL is an example of a Relational Database Management System (RDBMS). SQL, or ‘Structured Query Language’, is, as its name suggests, the query language which is used to communicate with a MySQL database, and offers an effective and easily-learned means of manipulating data within an RDBMS. Data is stored within the database in a series of data tables, which will almost all have some form of inter-relational capacity, with some sharing key pieces of information or data attributes.

JavaScript - not to be confused with Java, this is a programming language which is designed for performing dynamic tasks on a website, from popping up new windows to checking the integrity of information which is typed into a form. One of the most engaging and powerful examples of JavaScript at work is in Google Maps software, which allows users to create and manipulate map objects in a multitude of ways (*Duckett J, 2014, p441-447*).

Apache - this free, open source web server provides an effective platform for web pages to be developed and delivered to a client system. It enables communication to take place between the client and server systems by the use of HTTP files.

HTML – one of the bedrocks of web programming, Hyper Text Markup Language is how the structure and content of web pages are created. It consists of using tags '<>' to define elements which are then displayed on a webpage, for example headings, blocks of written text or images (*Duckett J, 2014, p20-24*).

Code is developed by means of a simple 'text editor', such as Notepad++, with copy being saved in a file within a project folder, while some systems such as Adobe Dreamweaver allow a more intuitive approach, by displaying the end result as you go.

CSS – Cascading Style Sheets are the means by which HTML pages can be styled and given more visual appeal. It effectively creates 'rules' which determine how the content of an HTML element should appear, for example the background colour of a page, the colour, size or style of font, or the general positioning of an element (*Duckett J, 2014, p227-236*).

Styles can be applied to an entire range of elements, such as images, main headings or paragraph text, or to specific individual elements which may require a style to be applied only once. CSS code can be either 'internal' (appearing within the HTML code file) or 'external' (contained within a separate file which is then 'called' by the HTML file).

The latter two were developed within the framework of Twitter Bootstrap, to allow for responsiveness and scalability to different screen and device sizes, the impact of which will be discussed in greater detail in this chapter.

5.2.2 Methodology

The student was already familiar with the Agile development process from previous experience of app development on the course, and it was felt that the principles of this approach could be applied to this project. One of the principal benefits of Agile development is that allows for testing of key functions to be carried out at an early stage, allowing flexibility for change should the need arise. This is compared to the more established 'waterfall' methodology, whereby the project is developed in a linear fashion, meaning that testing is delayed until a very late stage (*udemy.com, September 9, 2013; base36.com, 2012*).

The Agile method could particularly be applied to the earlier stages of the project in which search and return functions had to be set up and tested thoroughly in order to establish the integrity and accuracy of the information. For example, if latitude and longitude coordinates were returned as inaccurate, this would badly affect the mapping of the locations.

Nevertheless, some key aspects of waterfall development were maintained, notably the importance of keeping a clear idea of the end product throughout the overall development.

5.3 Development phases

5.3.1 Database creation

As databases are central to this system, the first approach taken by the student was the creation and population of a workable database with data tables from which information could be retrieved.

Details of around 70 filming locations – including key data such as name, latitude/longitude and searchable keywords – were compiled into an Excel spreadsheet over a period of several weeks.

A database, named 'ltest1' was created in the XAMPP server, initially with six tables – 'locations', 'users', 'itineraries', 'itin_loc', 'productions' and 'prod_loc'. The latter two were intended to hold details of individual movie/TV productions and their relations with individual filming locations. However, it became apparent that due to the relatively small number of locations featuring multiple productions, this added a level of complexity which was not necessary to the system, and an alternative approach was developed using SQL 'wildcard' characters, as will be described later in this chapter.

Creation of the data tables was carried out by means of the XAMPP user interface. Primary Keys were given to the 'locations', 'users' and 'itineraries' table, as these all featured unique data rows which could be specified by a unique 'id' number in the first column. The 'itineraries' table also included the 'user_id' Primary Key field from the 'users' table, as it was necessary for each itinerary which is created to be cross-referenced to a specific user. The 'itin-loc' table features relational dependencies on both the 'itineraries' table and the 'locations' table, in order to allow for the correct referencing of each individual location which features within an itinerary. Initially this consisted of two Foreign Key fields, 'itinerary_id' and 'user_id', but following advice offered during the presentation of the prototype, these were altered to become a Composite Primary Key.

Table	Action	Rows
itineraries	Browse Structure Search Insert Empty Drop	2
itin_loc	Browse Structure Search Insert Empty Drop	4
locations	Browse Structure Search Insert Empty Drop	70
users	Browse Structure Search Insert Empty Drop	2
4 tables	Sum	78

Fig 19: Location Scout data tables

As the interdependent nature of the relationship between tables was crucial to the integrity of this system, great care had to be taken that all tables were correctly set up and linked (see Figure 20).

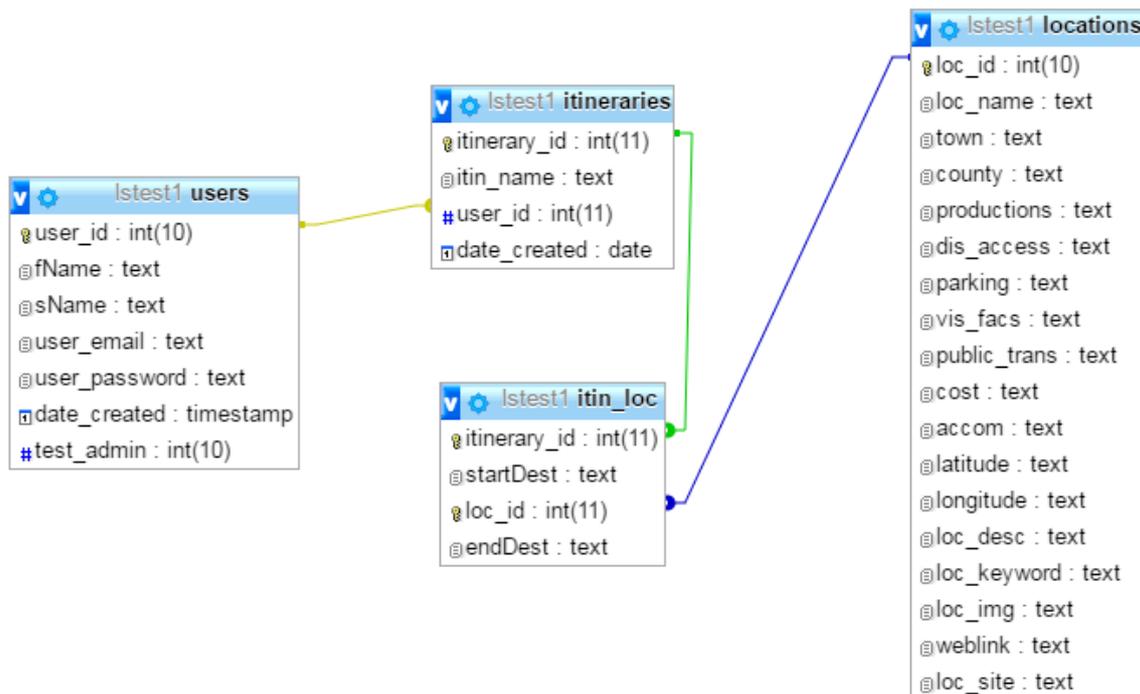
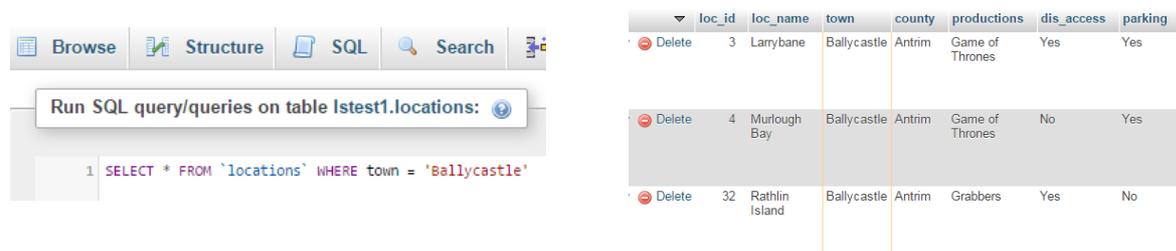


Fig 20: The relational database in action

The location content was imported directly into the 'locations' table following conversion into a Comma-Separated Values format (CSV). This caused some complications at first, as the 'location description' field in the spreadsheet had originally included several commas as part of the text, and the database was unable to import until these had all been removed. Nevertheless this proved an expedient and efficient manner of uploading this large volume of data.

In order to ensure that the data had been correctly uploaded and could be properly retrieved, a number of test searches were conducted from the database via the PhpMyAdmin interface. This was an important first step in the Agile approach to this project development, as the foundation of this system is the search for and retrieval of records from data tables. All queries were executed correctly and returned the required results (see Figure 21).



Run SQL query/queries on table ltest1.locations:

```
1 SELECT * FROM `locations` WHERE town = 'Ballycastle'
```

	loc_id	loc_name	town	county	productions	dis_access	parking
Delete	3	Larrybane	Ballycastle	Antrim	Game of Thrones	Yes	Yes
Delete	4	Murlough Bay	Ballycastle	Antrim	Game of Thrones	No	Yes
Delete	32	Rathlin Island	Ballycastle	Antrim	Grabbers	Yes	No

Fig 21: Example SQL query and result

5.3.2 User interface framework

In order to have a usable framework in which to begin the first main Agile phase of the display of data from the database, it was first of all necessary to develop a workable interface.

For this iteration the site was compiled as a basic static HTML interface, which featured a search bar and menus relating to the search categories available.

As development continued, migration took place into a Bootstrap-based framework. A number of sources and references were consulted in order to learn the concepts of Bootstrap, including online tutorials which proved useful in displaying the system at work. While ready-made templates are available online from the official Bootstrap website, it was felt that it would be beneficial to the learning process to construct a template from the ground up and modify it as necessary during the development process.

A key component of the Bootstrap system in terms of responsiveness is the ability to create a grid-based layout system. By this means, the screen can be divided into 'rows', contained within a 'container' or 'container.fluid' class, which can then be divided into 'columns' of varying widths, of which there must be no more than a total of 12. This allows for the elements to be 'stacked' on top of one another as the display window is made smaller, whether due to the browser window being manipulated or the screen size of the hosting device.

In keeping with the aim of keeping the UI as clean and simple as possible, a design grid was created consisting of a header encompassing 12 columns at the top of the page, below which was a second row, consisting of two areas, one of 9 columns which would provide the main activity area for the site and a second of 3 columns, into which would fit the sidebar, featuring the navigation actions. On a large desktop screen of around 1200px with a container width of around 1170px, this would equate to around 873px total width for the main activity area and 291px for the sidebar area (see Figure 22) (www.w3schools.com, August 3, 2016).

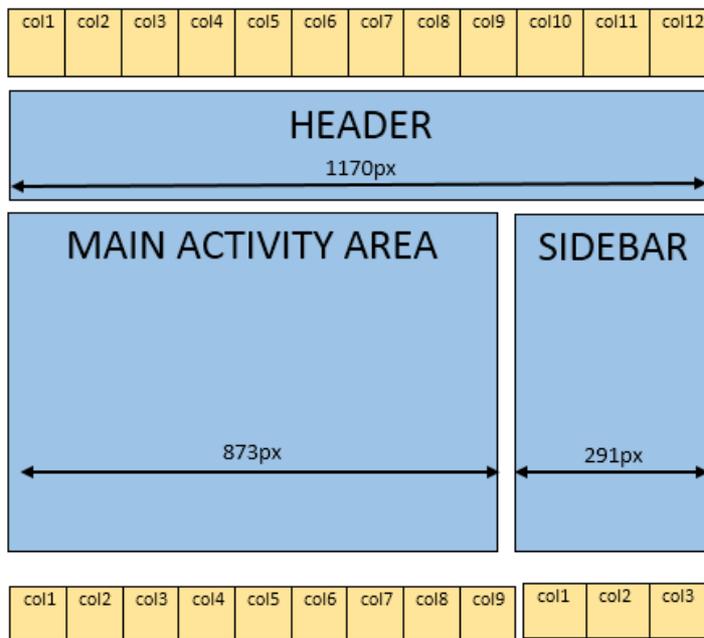


Fig 22: How the Bootstrap grid applies to the web page

Styling of the site is carried out by means of a custom-made CSS style sheet, which is saved externally to the HTML code used and linked to it within the <head> section. This ensures that code relating to the overall look of the site and the positioning of elements (see Figure 23) can be reused throughout the site, thus eliminating the need for duplicate code.

```
.container-fluid {
background-color: black;
overflow: hidden;
color: gold;
font-family: 'Stoke', courier, serif;
}

.col-md-9 {
padding-top: 10px;
padding-left: 50px;
text-align: left;
display: inline-block;
}
```

Fig 23: CSS code to style the colour scheme, and set the parameters of the main activity area

HTML is used for the overall structure of the elements on the site. For example, in the sidebar area the varying elements such as dropdown menus, search bar and text are each contained within <div> tags, which can then be individually styled if needed (see Figure 24). Text types were further specified by means of <h> or <p> tags, which again can be styled individually or collectively via CSS.

```
<div class="btn-group">
<button type="button" class="btn btn-danger">By County</button>

<button type="button" class="btn btn-danger dropdown-toggle" data-toggle="dropdown">
<span class="caret"></span>
</button>
<ul class="dropdown-menu" role="menu">
<li>
<a href="getCounty.php?county=Antrim">Antrim</a>
</li>
```

Fig 24: Using HTML to create a dropdown menu

For efficiency, the header and sidebar code is saved into a separate file which was contained within the 'includes' folder in the htdocs root folder. This is called on each page via the 'includes' function; this approach allowed the developer to make any changes to the structure or content of the sidebar/header just once and not repeatedly on each page. Another key aspect of the UI framework is that specific, individual elements should respond to being displayed on differing sizes and resolutions of screens. In order to achieve this, the special Bootstrap '@media' function is included in the CSS file which enables fonts and element widths to be altered in line with the screen size. For example, if the website was being viewed on a large desktop of more than 1200px, the main heading elements would show at a font size of 52px, whereas if the site were being viewed on an extra small smartphone screen, this would alter to 32px (see Figure 25).

```
@media (max-width: 1199px) {  
  .col-md-12 h1 {  
    font-size: 52px;  
  }  
  .col-md-9 h2 {  
    font-size: 30px;  
    text-align: left;  
  }  
}  
  
@media (max-width: 767px) {  
  .col-md-12 h1 {  
    font-size: 32px;  
  }  
  .col-md-9 h2 {  
    font-size: 24px;  
    text-align: left;  
  }  
}
```

Fig 25: CSS code to create responsive headings according to screen size

5.4 Key functionalities

The system consists of a number of core functionalities covering a range of actions within the website. These include the search for and retrieval of location information from the database, the creation of a user profile and user sessions to enable the saving of locations to an itinerary, and the plotting of these locations onto an interactive map. Each of these will be examined in turn.

5.4.1 Search and return

Two frameworks are created to allow users to search for and retrieve information from the database. The first is a series of dropdown menus, each of which contains a list of search terms; for example under 'By County', users can search for locations in any one of the six counties of Northern Ireland.

Each choice features an <a href> element tag which links to the same 'getCounty.php' file, but with the specified county name assigned as a value (see Figure 26).

```
<a href="getCounty.php?county=Antrim">Antrim</a>
```

Fig 26: Passing a search value via an href link

Upon receipt in the 'getCounty.php' file, the value which has been passed across (e.g. 'Antrim') is then assigned to a new PHP variable, which in turn is used as a value within an SQL query. This query is then executed to the database (see Figure 27).

```
//If this URL request exists ... proceed with the function
if (isset ($_GET['county'])) {
    //Assign value passed in the a new php variable
    $mycounty = mysqli_real_escape_string($db, trim($_GET['county']));
    //Define variable to hold SQL query as a String of text
    $get_county = "select * from locations where county='$mycounty'";

    //Execute the query to the server/database
    $run_county = mysqli_query($db, $get_county);
```

Fig 27: Value is assigned and used in SQL query

A while loop then searches through the results, returns the relevant data row by row and assigns this information to new variables (see Figure 28).

```
while ($row_locations=mysqli_fetch_array($run_county)) {
    $loc_id = $row_locations['loc_id'];
    $loc_name = $row_locations['loc_name'];
    $town = $row_locations['town'];
    $county = $row_locations['county'];
    $productions = $row_locations['productions'];
    $disabled = $row_locations['dis_access'];
```

Fig 28: Data retrieved and assigned to variables

The results are then output and displayed within the main activity area of the web page by means of a PHP 'echo' statement (see Figure 29).

```
echo "
<div class = 'locations'>
<h3>$loc_name</h3><a href=$loc_website target='_blank'><img src = 'Admin_area/location_images/$loc_image'
width='180' height = '180' alt=$loc_image/></a>
<p><b>Featured in ";

for ($i=0; $i<count($productionsArr); $i++) {
    echo "<h4><a href=$websiteArr[$i] target='_blank'>$productionsArr[$i]</a></h4>";
}

echo "</b></p><p><b>$description </b></p>
<a href=add_to_itinerary.php?value=$loc_id class='btn btn-info' role='button'>Add to Itinerary</a>
<br></br>
</div>
";
```

Fig 29: Outputting the search results

In order to facilitate this action, a connection to the database is established by means of a special PHP script named 'db.php' (see Figure 30). While it would be possible to run this code in each and every PHP script, it is much more efficient to save this into a separate file which is then enabled for use by means of the PHP 'includes()' function which is placed at

the top of the page. The script establishes a connection via parameters – host name, username, password and database name - which relate to the database being searched.

```
<?php
$db = mysqli_connect("localhost","root","","lctest1")
OR die (mysqli_connect_error());

mysqli_set_charset($db, 'utf8');

if (mysqli_connect_errno())
{
    echo "The connection was not established:" .mysqli_connect_error();
}
?>
```

Fig 30: Creating a database connection

A similar method of search and return is used with the second main function, the search bar, although there is a key difference in the means by which potential results are identified. As this is a function into which the user inputs a search term directly, it is important that the system can recognise full or partial search terms. In this case, this is achieved by use of a so-called 'wildcard' character (%) within the SQL query (see Figure 31).

```
$get_locations = "select * from locations where
(loc_keyword) like '%$user_keyword%'";
```

Fig 31: Using the wildcard character

This enables the query to find any values which match any part of the user query which was passed in via the search bar. For example, simply entering 'Thro' will return any locations whose keywords include the same pattern as those letters (*Game of Thrones* being the most obvious here, perhaps) ([w3schools.com, August 3, 2016](#); [www.tutorialspoint.com, August 3, 2016](#)).

The wildcard character is also applied to the search for locations relating to individual productions, as conducted from the 'By Production' dropdown menu (see Figure 32).

```
$get_production = "select * from locations
where productions LIKE '%$production_name%'";
```

Fig 32: Using the wildcard character to find productions

The query again returns results which match a similar string pattern to that which has been entered as a search value. This successfully accomplishes the intended result with a relatively simple and straightforward solution.

5.4.2 Login and sessions

An important functionality of this system is the ability for users to create a profile through which they would be able to compile their own travel itineraries.

A number of options were available to achieve this, either through the use of Cookies or Sessions. While the former are better able to retain information such as login info, they can

prove problematic if the user has knowingly (or unknowingly) disabled them in their browser, as they are stored on the client side. Alternatively, sessions are stored on the server, which puts the session data outside of the browser limitations of cookies.

One of the main limitations of sessions is that any data which has been created within a session is automatically lost if the browser is closed or the user logs out. However, as the amount of information being retained by the user in any one itinerary creation is relatively small (usually around 6-8 locations), and this information will be stored permanently in a database, it was felt that sessions offered a more practicable solution to this issue (*php.about.com, August 3, 2016; Beighly L & Morrison M, 2009, p389-393*).

Upon first visiting the site, users can register their profile via the 'registration.php' script by means of an HTML <form> requesting their name, email address (which acts as a unique identifier) and password. Upon clicking 'Register', the data which has been entered by the user is handled by a 'POST' request. This is used primarily with forms and in situations where data is sent to the server which causes a change in the state of the server e.g. inserting an entry to a database. Unlike the similar 'GET' request, in which data passed can be visible in a URL, information sent in a 'POST' request is hidden from view, which makes it more suitable for the passing of sensitive or secure data (such as an email address or password) (*Beighly L & Morrison M, 2009, p278-282*).

Throughout this process, the input fields are also checked to ensure there are no empty fields, or mismatched passwords (see Figure 33), before the new user's details are entered into the database.

```
if (empty($_POST['email'])) {
    $errors[] = 'Please enter your email address!'; //if
} else {
    {$email = mysqli_real_escape_string($db, trim($_POST['email']));} //else
```

Fig 33: Creating an error message

Login attempts by the user are then validated by means of the 'login_tools.php' and 'login_process.php' scripts. The former contains a function named 'validate_user' which checks that all fields have been filled in and the information therein is correct, and a second, similar function named 'validate_admin' which carries out the same checks.

Within each function however, there is a subtle difference in the SQL query to differentiate between a user and the site Administrator. When a user creates a new profile, by default they will be assigned a value of '0' within the 'users' table in the database. The SQL query in this function (see Figure 34) determines that if their value is equal to zero they will be directed to their user profile page via the 'login_process.php' file.

```
$query_users = "select user_id, fName, sName from users where
user_email='$email' and user_password=SHA1('$password') and test_admin='0'";
```

Fig 34: Verifying user status

If, however, the email and password entered match those in the database where the value is '1' (see Figure 35), the page will redirect to the administrator panel at 'Admin_area.php' via the 'login.process.php' file.

```
$query_users = "select user_id, fName, sName from users where
user_email='$email' and user_password=SHA1('$password') and test_admin='1'";
```

Fig 35: Verifying admin status

This functionality was added in response to suggestions offered during the prototype demonstration, at which stage the admin panel was accessed directly from the homepage by means of a button. For security and integrity reasons this was not considered ideal, and so this more robust method of access was implemented.

Upon logging in, a session is automatically created for the user by invoking the PHP 'session_start()' function. This piece of code, which is inserted at the very top of the script, before any HTML or other elements, allows the user to stay logged in during the length of their browsing session, and provides the means by which they can select and retain locations in their own personal itinerary.

Upon clicking on the 'Add To Itinerary' button, which is located beneath each individual location, details of that location are added to the session array (see Figure 36).

```
if (!isset($_SESSION['itinerary'][$loc_id])){  
    $_SESSION ['itinerary'][$loc_id] = array();  
    echo '<p>Location ' . $row_loc["loc_name"] . ' has been added to your itinerary</p><br>';  
}
```

Fig 36: Adding a location to the itinerary session array

The user can repeat this process as many times as they wish (although it should be noted here that there is a limitation on the number of locations which can be mapped, as will be discussed later in this chapter).

Upon clicking on the 'Your itinerary' button in their user profile, the user is directed to the 'itinerary.php' page. Here they will find displayed all locations that have been selected thus far. At this point they are able to further amend their itinerary by removing individual locations or clearing the itinerary altogether. The latter two functions are carried out by means of the 'Unset' function (see Figure 37).

```
if(isset($_SESSION['itinerary'][$loc_id])) {  
    unset($_SESSION['itinerary'][$loc_id]);  
    echo '<p>Removal successful!</p>';  
}
```

Fig 37: Removing a location from the itinerary session array

At this point the user is required to add in an itinerary name as well as a start and end destination via a form input, for route-mapping purposes. If satisfied with their selection, the user can save their itinerary by clicking on the 'Save itinerary' button. This passes the values from the itinerary into the database via the 'submit.php' script. Within this script there are two SQL queries. The first enters the user's unique id number and the itinerary name into the 'itineraries' table, while the second enters the specific details relating to the itinerary – the start/end destination and the individual location ids – into the 'itin_loc' table, along with the unique 'itinerary_id'. Once saved, the itinerary is then emptied by assigning it a Null value (see Figure 38).

```
$_SESSION['itinerary'] = NULL;
```

Fig 38: Emptying the itinerary session array

While the itinerary has now been cleared, it has also been saved into the database, and is able to be retrieved and viewed. This is enabled by the 'retrieve_itin.php' script which in turn

allows the user to look at the specific locations contained within the itinerary via the 'get_locs.php' script. The latter utilises SQL queries to first of all return the individual locations from the 'itin_loc' table, as well as the details specific to each – name, description, lat/long. (The latter two are used to map the user's itinerary).

The final procedure for the user is to log out. This is a relatively simple process which is implemented by means of the session_destroy() function, which is contained within the 'logout.php' script (see Figure 39).

```
$_SESSION = array();
session_destroy();
echo "<p><br>You are now logged out.</p><br>
```

Fig 39: Logging out

5.4.3 Mapping of locations

Rendering of locations onto a map is implemented by means of creating arrays of latitudes and longitudes which can then be passed in to Google Maps for each site to be shown individually.

The first step was to create a basic map object and integrate this into a webpage, where its dimensions and layout could be adjusted to fit.

Random samples of latitudes and longitudes from the saved locations were hardcoded as values into a basic map constructor in order to establish that this data was accurate and rendered the correct location.

The next step involved the plotting of locations directly from the data which was saved in the database. These are exported into an XML format which can then be retrieved through asynchronous JavaScript calls. Implementation via this method proved successful, with locations rendering accurately onto the map object (see Figure 40).

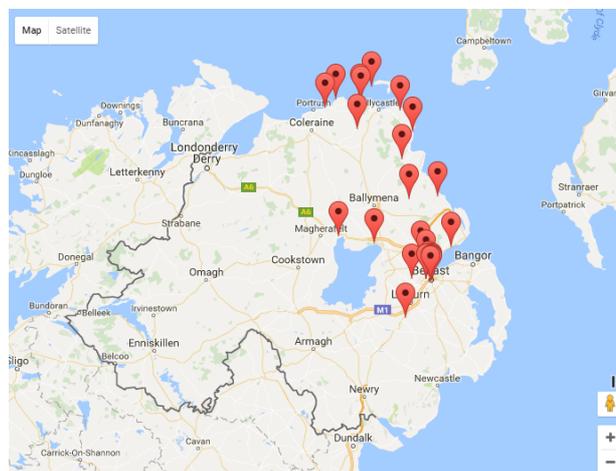


Fig 40: Locations plotted using XML

However, while this approach works for a single instance of a map, it does not provide the adaptability to render a variety of search results efficiently, as potentially an individual PHP file would have to be created to handle the results of each search parameter e.g. for each individual county, production, accessibility feature etc.

A more efficient and adaptable approach is to use a JavaScript Object Notation (JSON) array. By this means, an associative array of location values – as passed in via a 'GET'

request - can be created in PHP. The values are retrieved from the database via an SQL query before being added to an empty array named '\$locations' (see Figure 41).

```

if (isset ($_GET['loc_value'])) {
    // Empty array to store location information
    $locations = array();
    // What is going to be mapped
    $county = mysqli_real_escape_string($db, trim($_GET['loc_value']));
    $get_county = "select * from locations where county='$county'";
    $result = $db->query($get_county);
    while ($row_locations = mysqli_fetch_assoc($result)){
        $loc_id = $row_locations['loc_id'];
        $loc_name = $row_locations['loc_name'];
        $latitude = $row_locations['latitude'];
        $longitude = $row_locations['longitude'];
        $description = $row_locations['loc_desc'];

        $newLocation = array ("title" => $loc_name, "lat" => $latitude,
            "lng" => $longitude, "description" => $description, "loc" => $loc_id);
        array_push($locations, $newLocation);
    }//while
} //if

```

Fig 41: Creating a JSON array

As Google Maps requires that data be added in JavaScript format, however, the values contained within this array must then be added to a new JS variable, 'var locations' (see Figure 42).

```

var locations = <?php echo json_encode($locations, JSON_PRETTY_PRINT); ?>;

```

Fig 42: Assigning the array to a JavaScript variable

The details of the locations are then passed through the mapping functions one-by-one via a 'for' loop and rendered onto the map by being passed into the 'position' parameter (see Figure 43).

```

for (var i = 0; i < locations.length; i++) {
    var data = locations[i];
    var myLatLng = new google.maps.LatLng(data.lat, data.lng);
    var marker = new google.maps.Marker({
        position: myLatLng,
        map: map,
        title: data.title
    });
}

```

Fig 43: Passing values through mapping function

With the functionality now established to allow the plotting of database locations onto the website, the next development phase involves the rendering of these points as a route map. At an early stage of development it was surmised that the most effective way of conducting this was to create a facility whereby the user could apply a 'sequence number' to each location in their itinerary. This could then be used as the basis by which routes could be plotted in a sequential fashion.

To this end code was incorporated onto the 'itinerary.php' page which allowed the user to do this through <form> input elements.

However, the Google Maps Directions Service API also contains an in-built function called

‘optimise waypoints’, which if set to *true* renders locations in a route map by the shortest or most efficient distance possible between markers (*developers.google.com/maps, 2016*). This provides an elegant and effective solution to this issue, as the student had encountered difficulty in formulating ideas as to how the previous solution might have been implemented. (**NB:** Under the limits of the free plan for the Google Maps API key, only a maximum of eight waypoints can be included in a route map). Again, Google Maps code samples are used as a starting point for development of this feature and proved extremely effective and useful given the complexity of the task (*developers.google.com/maps, 2016*). As part of the Agile approach to this development process, the code was implemented on a basic static HTML page (see Figure 44), from which the necessary adaptations and amendments could be applied.

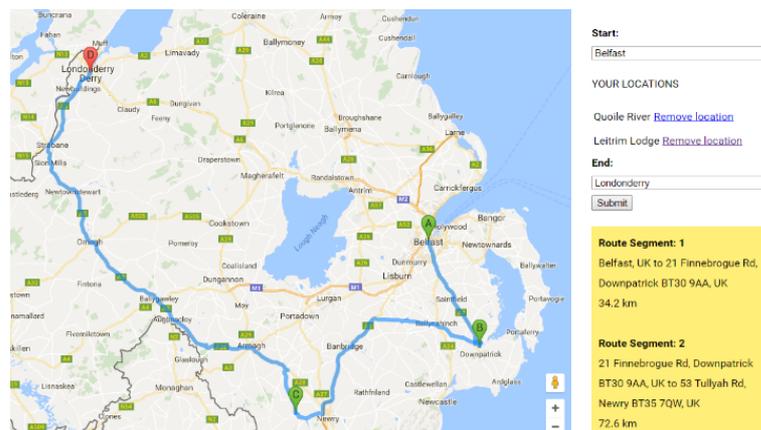


Fig 44: Static HTML version of Google Maps

For example, where the sample provided used hardcoded values in an HTML `<select>` menu as input, it was ascertained that start and end destinations must be entered manually in an `<input>` tag, thus taking advantage of Google Maps' ability to geocode locations from string input.

Slightly more challenging was the task of integrating the details of the individual locations which had been selected by the user, which were contained within the JS 'locations' array, as waypoints. While the correct values had been passed in to the page, they did not render onto the map. Further investigation revealed that this was due in part to the erroneous inclusion of an 'if' statement to check the validity of the value being passed, and in part due to uncertainty over how best to assign the lat/long coordinates to the 'location' parameter within the map object. Once this was corrected, however, the system was able to render the locations accurately.

Numerous further test cases were carried out, with changing search terms and locations each time, to ascertain that the correct locations were being rendered onto the map as they should.

The final route map (see Figure 45) displays the route accurately, with the start/end destination and the waypoints matching those as stored by the user. By default, locations are also given a label in alphabetical sequence, with the start destination as 'A'.

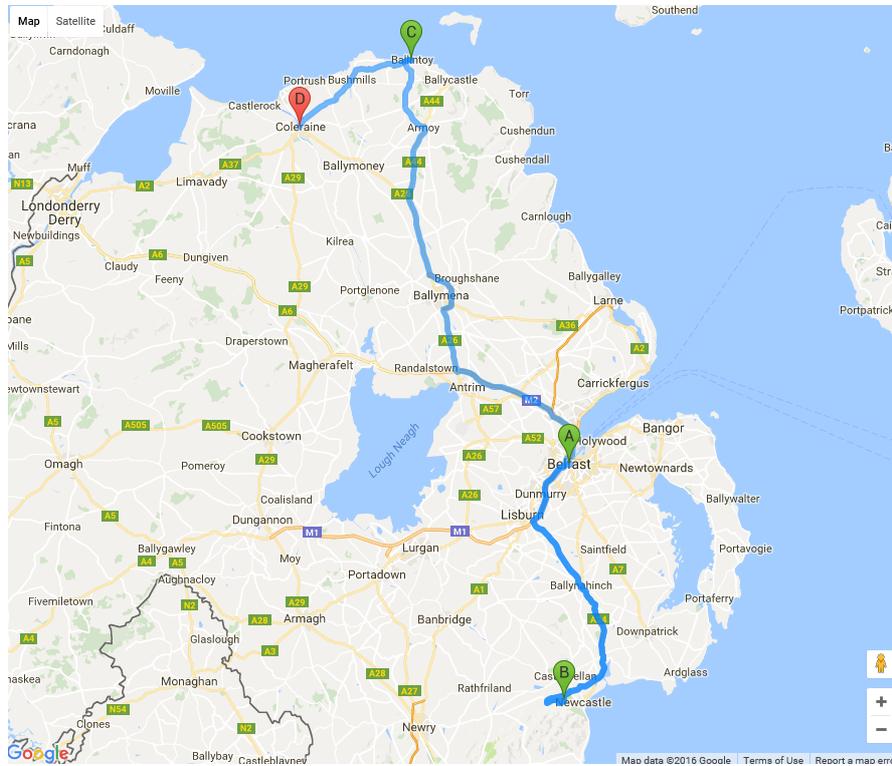


Fig 45: Successful plotting of route map

6 TESTING AND EVALUATION

6.1 Introduction

This chapter details the testing process which was applied to the Location Scout website both internally, by the developer, and externally via a focus group test scenario. Feedback from the latter was encouraged and, where viable, was implemented immediately and the system re-tested.

6.2 Hardware context

The system was tested on a range of devices, ranging from a Dell desktop PC, running Windows 8, and a Toshiba laptop computer, running Windows 7, to a Google Nexus 7 tablet and a Galaxy S3 Mini smartphone. The first three devices used a wifi network to connect to the site, while the smartphone used its native 3G capabilities to connect. This was to ensure that the system is capable of being accessed from a range of devices via a variety of delivery mechanisms.

6.3 In-house functional testing

To test the functional efficacy and integrity of the system, a number of key areas were outlined which were then applied to a range of system actions and functionalities to ascertain whether they met these criteria satisfactorily. These areas were:

Speed – the system responds quickly to the initiated function, and the process is completed within 1-2 seconds maximum.

Accuracy – the correct information (e.g. login details, search terms) is passed and processed, with the correct result returned (checks made against database for veracity).

Integrity – actions carried out and information passed do not disrupt any other information or data on the site, or that saved by any other user (checks made against database for veracity).

Security – sensitive data (e.g. name, email address, password) is passed and stored securely (e.g. via 'POST' method or via SHA function in PHP) and not visible to third parties during transit (checks made against database for veracity).

Error handling – erroneous actions are identified clearly to the user via error messages, along with appropriate remedy. Errors do not disrupt user interaction or experience and are easily remedied. They cause no corruption to other information or the functionality of the site itself.

The tests were applied on both the 'localhost' version of the system running on the XAMPP server, and a live version of the site running on the Dunluce server. Each test was awarded either a 'Pass' or 'Fail' status.

Results of the tests have been tabulated for easy reference (see Table 2).

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS*	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

*Issue detected and discussed below

Table 2: In-house functional test results

6.3.1 Issues arising

While functionally-speaking the 'Delete location' utility in the Admin Area was able to delete a location as expected, there was an issue with regard to data dependency within the relational database. If a saved itinerary contains a location which is to be deleted, this action is not able to be carried out due to the constraints within the database system, as the 'itin_loc' table contains a relational reference to that location. The administrator is then unable to delete that location and is instead presented with a blank screen. A potential

solution to the issue is to create further 'delete' queries within the 'del_locs.php' file, similar to those already contained within the 'del_users.php' file. While this would have the desired effect of allowing the location to be removed, however, it would also remove all evidence of an itinerary a user has created and saved.

After careful and extensive consideration it was decided that this would not be a professional or ethically sound action to take without direct consultation with a user. It was decided therefore that a suitable interim course of action would be to alert the administrator via a pop-up window that they should not attempt to delete a location until they had contacted users directly.

This issue was also referred for further consideration for a future iteration and development cycle of this system.

6.4 Cross-browser testing

This was considered important due to the wide number of browsers which are available to users. As well as ensuring the general performance of the website is good, it will allow issues relating to compatibility of software used (e.g. Google Maps) to be flagged, as well as highlighting any rendering issues which might present with the display of the website.

As well as the same criteria from the in-house functional testing being applied here, a number of additional key criteria relating to the display and rendering of elements were applied, as outlined below, with each being awarded a 'Pass' or 'Fail'. Results of the tests have been tabulated for easy reference (see Table 3).

Layout – heading, sidebar and main activity areas are all in correct positions, as are all elements within.

Colour – colour scheme is rendering correctly, with no loss of saturation or contrast.

Images – presenting properly, of correct size and shape and uncorrupted; no empty boxes or dead links.

Buttons – all present and showing correct labels and colours

Locations – each location result displays full range of information – title, image, description, links to productions. Text is legible, properly formatted and uncorrupted.

Maps – map objects present on page, at correct centring location, with labels, markers and functions.

Forms – input text is clearly legible and rendering correctly within confines of text box.

Scalability – page elements respond quickly and appropriately to resizing of browser window; stacking occurs as anticipated, with no loss of elements. Scrolling function activated.

Internal linking – internal pages link to correct destination page.

External linking – links to third party sites (e.g. location/production websites) open at correct URL and in new tab/window.

Search – results are returned from correct location and consistent with input entered by user

Form data – information sent via forms and requests consistent with that input by user.

	Google Chrome v51.0	Mozilla Firefox v47.0.1	Safari v5.1.7	Internet Explorer 11 v11.0.9600
USER INTERFACE				
Layout	PASS	PASS	PASS	PASS
Colour	PASS	PASS	PASS	PASS
Images	PASS	PASS	PASS	PASS
Buttons	PASS	PASS	PASS	PASS
Maps	PASS	PASS	PASS	PASS
Locations/Maps	PASS	PASS	PASS	PASS
Form text	PASS	PASS	PASS	PASS
Scalability	PASS	PASS	PASS	PASS
NAVIGATION				
Internal linking	PASS	PASS	PASS	PASS
External linking	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS
Form data	PASS	PASS	PASS	PASS
FUNCTIONALITY				
In-house test*	PASS	PASS	PASS	PASS

*Same criteria used as for Section 6.3. Individual test tables for each browser available in Appendices.

Table 3: Cross-browser usability test results

6.4.1 Issues arising

In terms of display and general accessibility, results of the testing were excellent, with the website rendering accurately across all browsers. In terms of functionality, there was an issue with an error handling message not appearing on the Safari browser (see test table in Appendices). When the 'start/end' destination input boxes were left empty prior to saving an itinerary, the alert message which had been coded into the HTML <form>, via a 'required' attribute, did not display and as a result empty values were recorded into the database. This is due to an existing compatibility issue with the Safari browser (*w3schools.com, August 6, 2016*).

This was remedied by means of the addition of a JavaScript code solution found online (https://jsfiddle.net/tj_vantoll/rFLxt/, August 5, 2016) into the 'itinerary.php' file which created an alert window reminding the user to enter these details before they were allowed to proceed.

6.5 Cross-platform testing

As this website is designed with user mobility in mind, it is important to ensure that it performs well across a range of devices. This is to ensure that the layout and accessibility will not be constrained by issues such as smaller screen size and more limited resources of connectivity, memory and processing capabilities.

Four platforms were chosen on which to carry out testing: a Galaxy S3 Mini smartphone; a Google Nexus 7 tablet; a Toshiba Satellite Pro C650-18D 64-bit laptop, and Dell desktop PC from the Ulster University laboratories.

The same criteria of both functionality and general rendering were applied as for the previous in-house and cross-browser tests. Again, each test criteria was awarded a 'Pass' or 'Fail', with results tabulated for ease of inspection (see Table 4).

	Galaxy S3 Mini	Google Nexus 7	Toshiba laptop	Dell desktop PC
USER INTERFACE				
Layout	PASS	PASS	PASS	PASS
Colour	PASS	PASS	PASS	PASS
Images	PASS	PASS	PASS	PASS
Buttons	PASS	PASS	PASS	PASS
Maps	PASS	PASS*	PASS	PASS
Locations/Maps	PASS	PASS	PASS	PASS
Form text	PASS	PASS	PASS	PASS
Scalability	PASS	PASS	PASS	PASS
NAVIGATION				
Internal linking	PASS	PASS	PASS	PASS
External linking	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS
Form data	PASS	PASS	PASS	PASS
FUNCTIONALITY				
In-house test**	PASS	PASS	PASS	PASS

*Issue detected and discussed below

**Same criteria used as for Section 6.3. Individual test tables for each platform available in Appendices.

Table 4: Cross-platform usability test results

6.5.1 Issues arising

Rendering of the Google Map object on the tablet device appeared smaller than ideal when the device was held vertically, which meant some confinement to the size of the map window. This was not an issue when the device was held horizontally. It was deduced that this was due to the limitations of the responsive functionality which had been applied to the different screen sizes from the Bootstrap framework.

A number of attempts were made to remedy this through the application of CSS commands in the 'Styles' folder. However, alteration of the confines of the map window caused issues

when the display was then rendered on the smaller smartphone device, as the map window exceeded the confines of the screen.

It was decided that this was an issue which required greater investigation and was referred for a future iteration of this system.

6.6 Focus group testing

Respondents to the previous focus group questionnaire were contacted to request participation in usability testing of the website. Of the 14 individuals contacted, ten agreed to take part. A task-based approach was devised whereby each respondent would be asked to carry out a scenario of typical functions within the website (See Appendix E). Once completed, they were also encouraged to spend time interacting with the system at their leisure, as this might identify other considerations or issues which may not have been covered by the test scenario.

Respondents were also asked to fill in a short questionnaire (See Appendix F) to offer feedback on their experience and the system in general.

In general, responses were favourable, with most agreeing that the website was easy to use, provided the information in a clear fashion and with a good balance of content. Comments included:

“A good site with an easy to use interface”

“(It) looks excellent on mobile ... overall the look and feel of the website is excellent.”

“I really liked the way the information was grouped so that you could choose which areas to visit as per production, or if you were already going to a county then to check out what was already there ... the accessibility feature was excellent.”

“A great tourism tool for each of the locations.”

“The process of creating an itinerary like this is very useful.”

“(A) great way to showcase all film locations ... useful tool to see where locations are.”

A selection of the results statistics are presented here (see Figures 46-49). (A full breakdown of the feedback and assessment offered by participants is presented in Appendix F).

User Interface: Please rate what you thought of the general layout of the site

(10 responses)

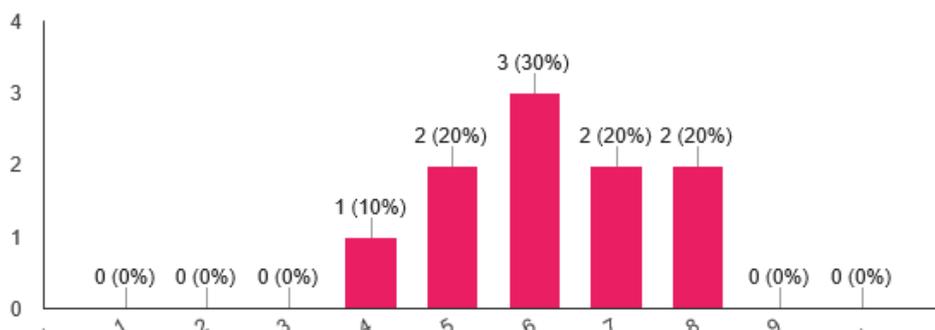


Fig 46: Sample of user feedback, (1=Poor 10=Excellent)

User Interface: Please rate the ease of use of the search bar and dropdown menus

(10 responses)

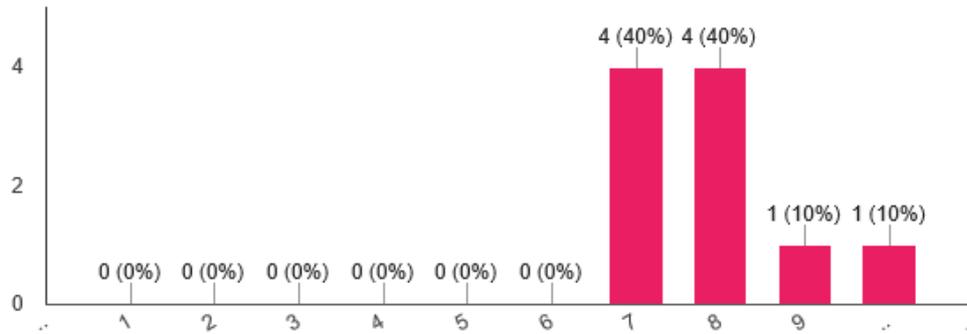


Fig 47: Sample of user feedback, (1=Poor 10=Excellent)

Presentation of information: "There was a good balance of images and textual information"

(10 responses)

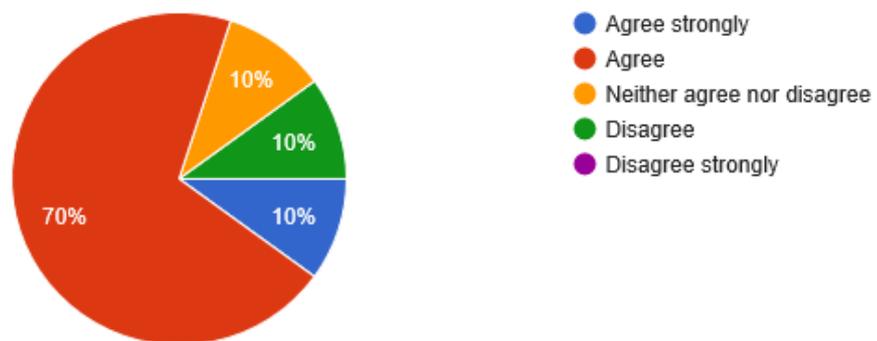


Fig 48: Sample of user feedback

"I would use this website myself or recommend it to others" (10 responses)

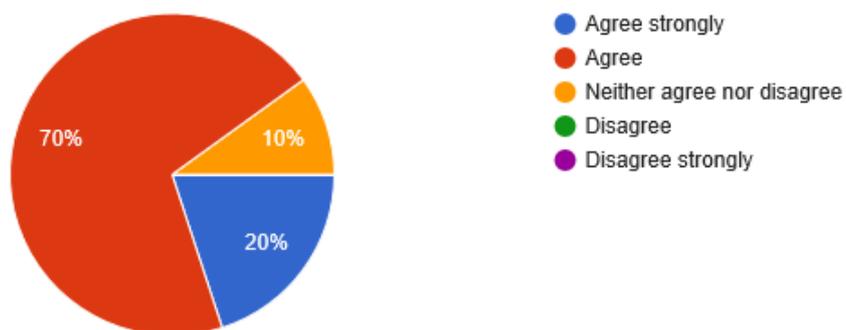


Fig 49: Sample of user feedback

6.6.1 Issues arising

A number of respondents raised the issue of being able to navigate more easily between pages, especially to allow them to return to their search results more efficiently after adding a location to their itinerary. Comments included:

“When adding a new itinerary it would be good if the page stayed on the search page but notified the user that the itinerary had been added.”

“If possible have a pop-up telling me that a location has been added to itinerary rather than a new screen.”

“Back button could be added once a location is added to the itinerary”.

This issue was immediately addressed and rectified by including a JavaScript ‘alert()’ window into the ‘Add to Itinerary’ function, in combination with a ‘history.back()’ function to ensure the user returned to the search page.

A JavaScript alert was also added to the ‘Remove Location’ function on the ‘Itinerary’ page, instead of bringing the user to a new page as before.

As an added measure, a ‘back button’ was also included on the map pages to allow the user to return to the list view of their search results.

Another idea raised was to allow users to amend itineraries which had already been saved into the database. How to achieve this within the sessions-based framework utilised in this system was not immediately apparent, as sessions, by their very nature, are volatile in terms of how they hold information. It was surmised that this might be possible with the inclusion of cookies into the development plan, and that this should be investigated more thoroughly in a future iteration of the development cycle.

One user reported being unable to retrieve their itineraries from the database for display, but did not elaborate on the specific nature of the problem i.e. if they had encountered an error message or other system malfunction.

Attempts were made, without success, to contact the user for further elaboration. The system was re-tested several times to ascertain if this issue was present on the site or could be particular to the user. Enquires were also made of other test users as to whether similar problems had been encountered but all reported that this functionality had worked as anticipated.

In the absence of further information it was surmised that as this user was testing the application alone, that this could have been a result of potential user error or local network failure.

6.7 Summary

Overall, this system performed well against a range of stringent tests of its functionality and usability. A variety of criteria were applied across a number of contexts, with a successful outcome. Results were recorded and tabulated to allow for easy reference and comparison between testing platforms.

Issues or limitations were identified clearly and subjected to an appropriate course of action. Issues which were not able to be remedied, or which required deeper analysis, were referred for action and consideration in a future iteration of the system.

In summary, this was a successful process which provided an excellent insight into the operation of this system.

7 CONCLUSIONS

7.1 Introduction

This chapter summarises the development of the project, from the research and analysis stage, to the design and implementation phase through to the testing and evaluation of the system. It will also examine the approach taken to developing the system and whether alternative approaches may have been appropriate in the light of issues encountered. The overall success of the project will be evaluated against the original objectives as outlined in Chapter 1 and the systems requirements as outlined in Chapter 3, as well as feedback from the testing and focus group survey. Possible recommendations for improvement will also be examined.

7.2 Summary

In-depth research was conducted into the viability and need for a system which could capitalise on the growing numbers of film tourists visiting Northern Ireland in recent years, but who are poorly served for web resources which allow them to research and plan visits to sites which may be of interest. The role of film tourism within the industry as whole in Northern Ireland was examined in order to provide context for this project.

Alternative or existing systems and websites were studied, with each being appraised on what it could offer visitors by way of contextual information and interactivity, as compared with the proposed project. Other non-technological alternatives were assessed as well to show the current state of the market and the limitations and costs involved in visiting film locations in Northern Ireland.

An outline of other potential ideas for development were discussed, as well as an examination of the business case which underpins the project as a real-world system. End-user requirements were identified through the use of a focus group survey, which was then used as a basis for 'user stories' for the system. These were then used to inform a comprehensive list of functional and non-functional requirements which should be factored in to the development process.

The principles of good website design were researched and established at an early stage in the design process, as these would be used as the general basis for the system. The Web Accessibility Guidelines, as published by the W3C Initiative, provided an invaluable tool in this regard, as they informed a consistent approach and structure to the implementation. Furthermore, the principles of good Human Computer Interaction, as outlined by Ben Shneiderman, were examined and utilised as the basis for the User Interface Design. From these, it was possible to create an outline of the layout of the web page, along with important considerations such as the colour scheme and typeface.

The navigation process was also detailed by means of a site map and storyboard which helped ensure that a simple and intuitive site structure was factored in from an early stage in the development process.

The system architecture was examined, with particular reference to the composition and structure of the database system which underpins the website, including the tables to be created and the nature of the entity relations between them.

Programming languages and software were identified and described individually, with emphasis on how each interacts with the other across the system; for example the relationship between PHP and the MySQL database, or the ways in which CSS determines the look and accessibility of HTML web pages.

The methodology adopted in order to implement this system was discussed, with the merits of the Agile approach being appraised and compared with the more traditional 'waterfall' system.

The creation and population of the database, one of the central structures of this system, was described. Particular emphasis was given to the manner in which data tables interact through the use of key constraints and how this affected the integrity of the data held in the system.

Migration from a static framework into a responsive Bootstrap-based user interface was implemented, with a detailed description of how the 12-column grid system can be used to achieve this when utilising the website on smaller screens or devices.

Implementation of key functionalities was examined at a detailed level, with descriptions of how a value is passed from the front-end through server-side processing to produce a result for the system user.

The interactivity of the system via user sessions was also examined in-depth, again with detailed analysis of how sessions function, as well as their benefits and limitations, especially as applied to this system.

Mapping of locations onto an interactive map took place, with an incremental, Agile-based approach adopted to ensure that stored latitude and longitude data in the database was rendering accurately. After initial plotting of locations was achieved, a route-mapping functionality was added to provide an enhanced user experience.

Robust and rigorous testing was carried out on the system. A total of four key testing cases were established – In-house functional; cross-browser; cross-platform and external user testing – in order to cover as wide and varied a set of variables as possible in detecting any issues or major malfunctions in the system. The same criteria as applied in the in-house testing – security, speed etc – were also applied to the cross-browser and cross-platform tests to ensure all functions worked across all possible combinations of environment. Issues arising were identified and if not able to be remedied immediately were referred for further investigation in a future iteration of the development process.

Respondents from the focus group survey were asked to carry out testing on the system via a pre-defined test case scenario as well as being encouraged to explore the system themselves. Feedback was solicited via an online survey, which allowed for usability issues to be identified and remedied.

7.3 Systems requirements

Upon completion of the project, each of the functional and non-functional systems requirements was re-examined in detail against the finished system to ascertain if they had been successfully met.

All of the key areas identified in the functional requirements were met successfully by this system. This was achieved by utilising the key benefits of the Agile approach methodology – i.e. regular testing and review of the development cycle of each component – in tandem with the overarching principles of the waterfall methodology, in which maintaining a clearly defined end goal for the system is encouraged.

Throughout the development process, the key considerations of the non-functional requirements were factored in to every design and implementation cycle, resulting in a system that is robust, accessible and functional across a range of platforms.

7.4 Aim and objectives

The overall aim of this project, as outlined in Chapter 1, was to create a 'one-stop' website which allows users to access the information they need.

“This should include details of individual locations, organised by category or theme; this should be able to be retrieved quickly and retained by the user; the locations should have geographic coordinates to allow them to be plotted as a route onto an interactive map. Users should be able to discover if locations have disability access, visitor facilities and/or accommodation nearby, are reachable by public transport or if there is a cost involved in visiting. Users should be able to save this information safely for future reference.”

A number of key objectives were identified in Chapter 1 as important stages in helping to achieve this aim. These objectives have been successfully met, as follows:

- A deeper understanding of the context of film tourism in Northern Ireland was achieved through in-depth research and investigation, including the potential benefits of a system such as this within the market.
- Industry professionals were engaged at an early stage in order to help identify key areas for attention and consideration during the development process. The same individuals were also key in helping facilitate improvements to the usability of the system during the testing phase.
- The benefits of and drawbacks of current technologies were examined in detail, in order to help inform how this system should be developed and which functionalities should be considered as key.
- A simple, usable website containing a range of information and functionalities was created. This system provides the necessary data to the end user in a clear and effective manner.
- A clear testing strategy was established and implemented across a range of key areas of functionality and usability, with issues and defects being identified quickly, remedied immediately where possible or flagged for further attention in future development cycles.

7.5 Recommendations

While the overall aims and objectives of this project were met successfully, there are a number of ideas and recommendations which could be implemented in order to add further value to the system in future. Many of these came from members of the focus group, whose opinion of the system was generally positive. While smaller ideas or issues identified during their feedback have already been implemented, some further areas for consideration include:

- Functionality to allow users to change or reset their passwords directly.
- More detail on locations should be provided in order for this to compete with other sites.
- Integrating YouTube or similar online streaming channels to allow clips relating to each location/production to be displayed.
- Addition of links to social media sites, such as Facebook/Twitter.
- Facility to allow users to upload personal photos of their trips or visits.
- More details on facilities available at locations, especially for younger children/families.

7.6 Developer appraisal

This was a challenging project in which a number of key areas of software development skills were tested. There was a considerable overhead in learning many of the programming languages required to carry out this project, although there are numerous resources available online and in print which proved of a high quality and which provided the starting points necessary to create and develop this system.

A more in-depth knowledge of the Google Maps API would have been highly beneficial to this system, as there is a large amount of functionality available for mapping which was not able to be explored in detail due to the demands of completing the earlier stages of the project. A future implementation of this project would allow for more time to be devoted to acquiring this knowledge, and at an earlier stage of development.

The Agile methodology proved to be successful in allowing issues with bugs or malfunctions to be detected early on, but the importance of having clear outline of the end system was also found to be highly beneficial in terms of creating and maintaining a robust development schedule.

7.7 Summary

This project was developed to offer a simple, efficient and cost-effective alternative to visitors wishing to visit sites related to Northern Ireland's growing film locations industry. It aimed to allow them to take the initiative in planning their own itineraries and offer them contextual information on the locations. It also aimed to allow them to visualise these on an interactive map, which could be accessed on a mobile platform.

Overall, this system was implemented successfully and provides the foundation for further enhancement with the addition of extra functionality and features in future design and development cycles.

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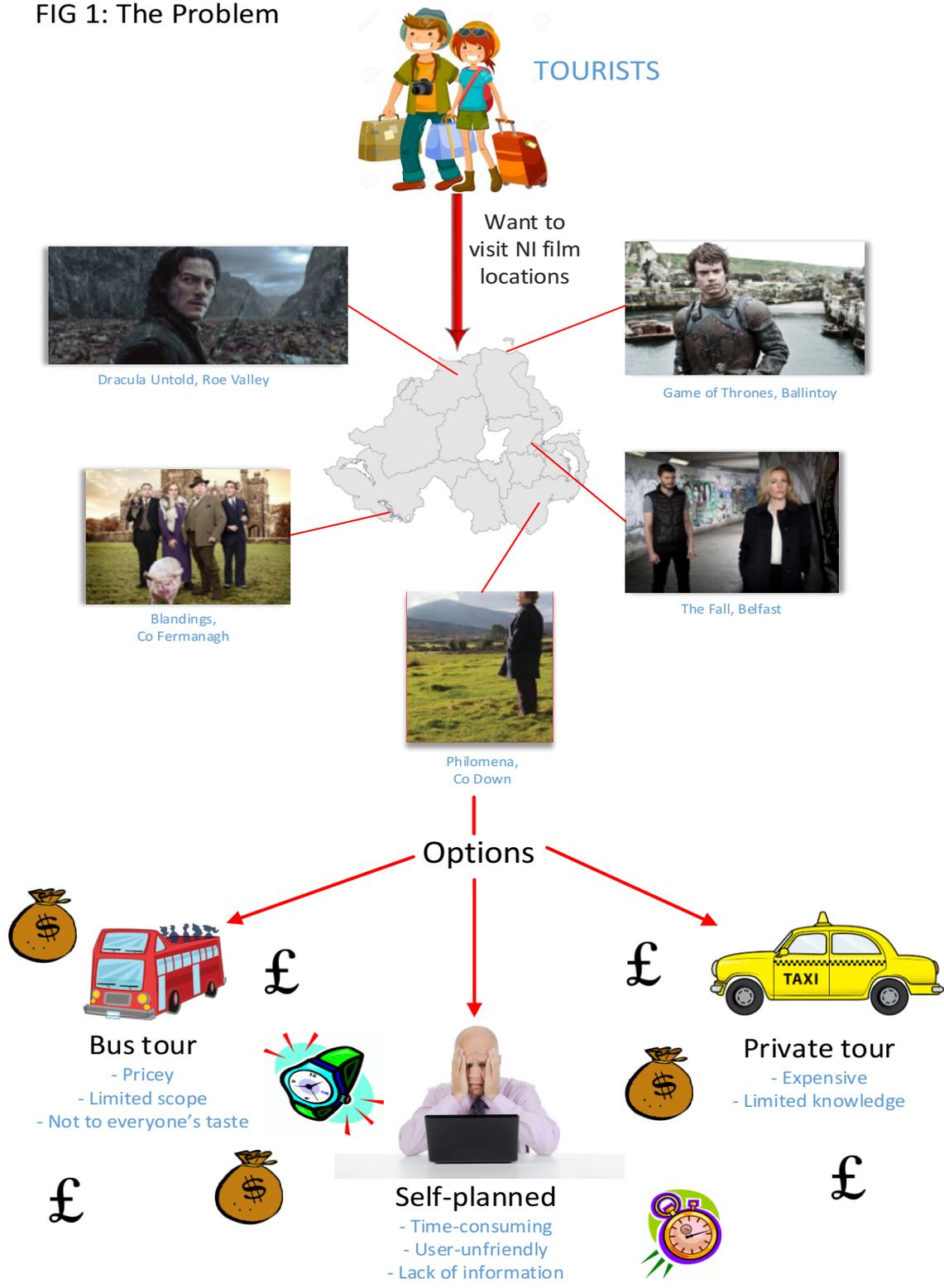
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9 APPENDICES

APPENDIX A: RICH PICTURE OF PROBLEM STATEMENT

FIG 1: The Problem



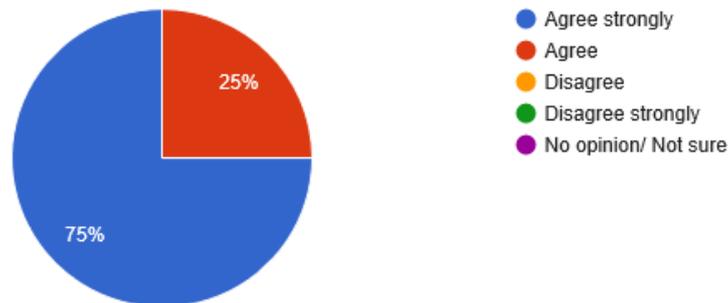
APPENDIX B: RISK TABLE FOR LOCATION SCOUT PROJECT DEVELOPMENT

RISK OUTLINE	Severity	Likelihood	Risk (\$ xL)	CONTINGENCY MEASURES
PHYSICAL				
Research phase involves site visits by car/foot/public transport	5/5	1/5	5/25	Adherence to safety guidelines at locations; forward planning of routes, consideration of road/weather conditions.
TECHNICAL				
Computer/hardware failure	4/5	1/5	4/25	Ensure access available to multiple workstations at home and university.
Internet connectivity issues	2/5	2/5	4/25	Utilisation of proven/reliable ISP from range of sources.
Data corruption or loss	5/5	2/5	10/25	Regular back-ups of all data to multiple sources – hard disk, flash drive, Cloud.
Suitability of programme for project	2/5	3/5	6/25	Discussion and agreement with supervisor on suitability of chosen programmes and possible alternatives/back-ups.
PROJECT MANAGEMENT				
Missed deadline	5/5	1/5	5/25	Proper scheduling of work week-by-week; establish targets and progress markers per day/week/month; Discussion of issues at earliest opportunity with supervisor/co-ordinator.
Loss of work	4/5	1/5	4/25	Regular daily back-ups to alternative sources e.g. secondary hard drive/computer; flash drive; Cloud.
Unforeseen circumstances/events	3/5	2/5	6/25	Early development of prototype and source code, plus design/UI; keep overall project as simple as possible to ensure these can be mitigated for.

APPENDIX C: RESULTS OF FIRST QUESTIONNAIRE FROM ANALYSIS AND DESIGN PHASE

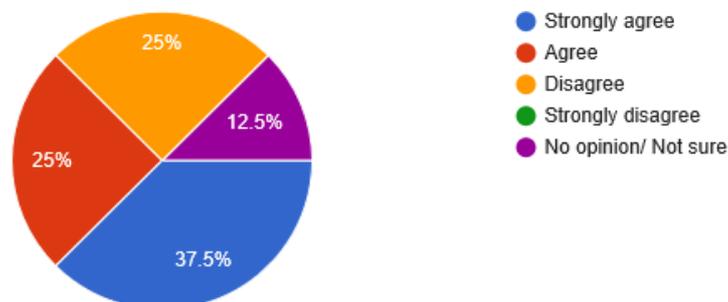
Film and television location shooting is one of Northern Ireland's most exciting emerging industries.

(8 responses)



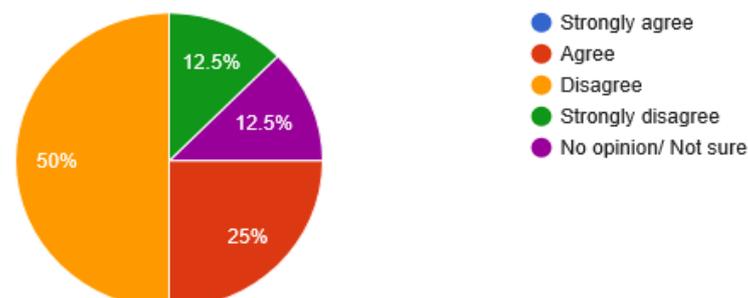
There are enough interesting movie/TV locations around Northern Ireland to engage and maintain the interest of visitors and/or film enthusiasts.

(8 responses)



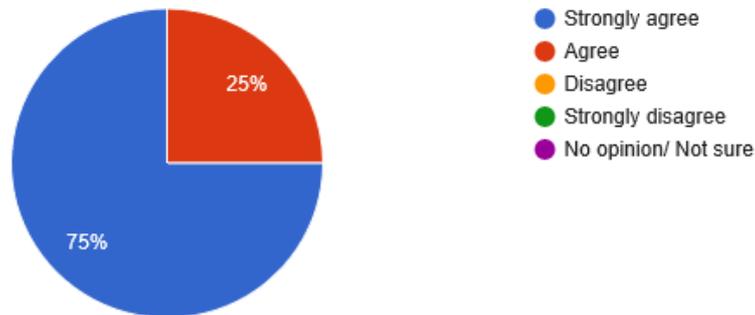
Visitors to Northern Ireland and/or film enthusiasts are well-served in being able to find clear and easily usable information online in order to effectively plan to their visit.

(8 responses)



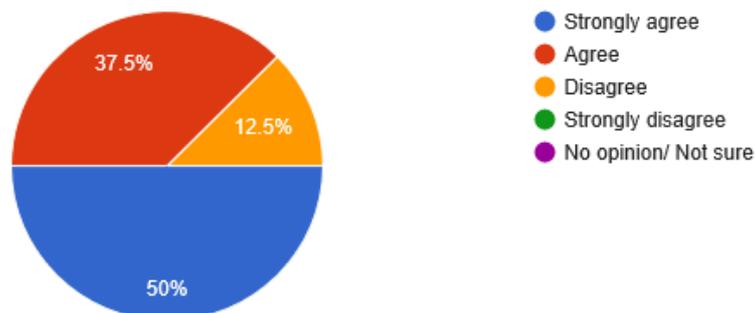
A dedicated website should include the facility for users to research their trip and plan out an itinerary in a simple, straightforward way.

(8 responses)



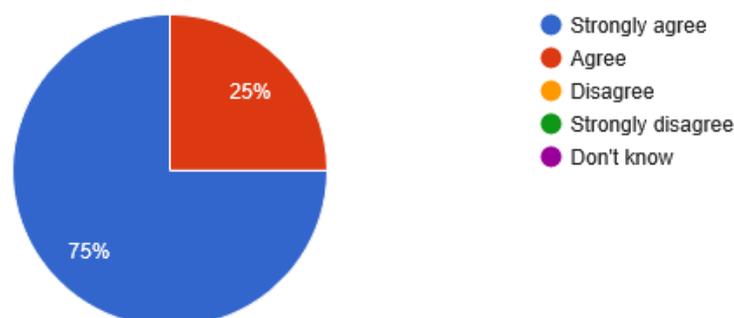
This facility should have an associated smartphone/tablet app to allow users to enjoy greater mobility once they have created their itinerary.

(8 responses)

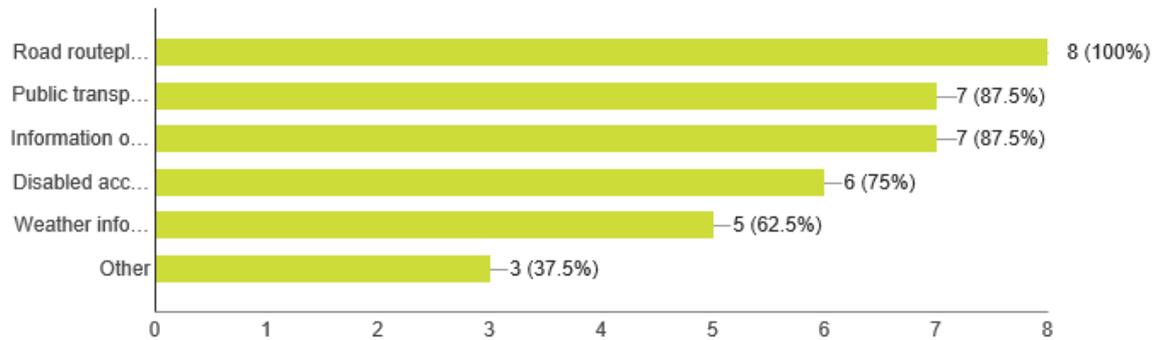


Visitors and/or film enthusiasts should be given the facility to discover more about the film/TV location industry in Northern Ireland in a straightforward, inexpensive way.

(8 responses)

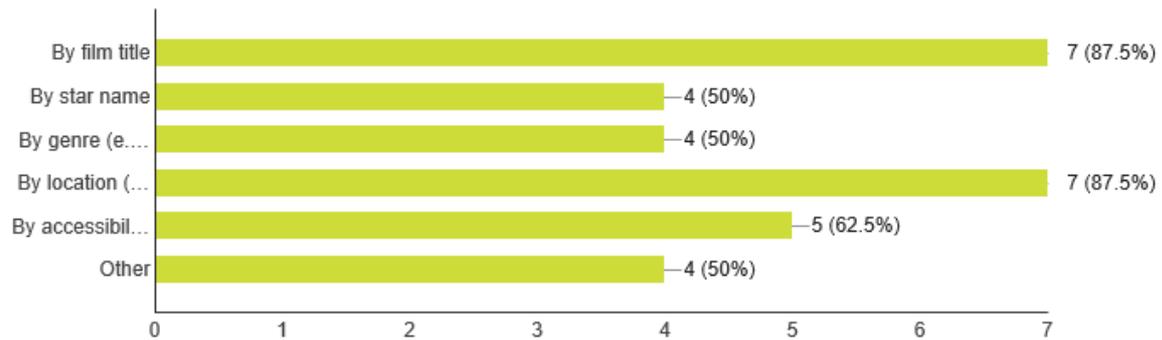


This website should offer the following facilities. (8 responses)



The following search options should be available on the website to help users choose their itinerary.

(8 responses)



APPENDIX D: RESULTS OF IN-HOUSE FUNCTIONAL TESTING ON LOCATION SCOUT WEBSITE

i) CROSS-BROWSER FUNCTIONAL TESTING

GOOGLE CHROME

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS*	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

*Issue detected over data dependency in 'itin_loc' table. Issue flagged for consideration in future iteration.

SAFARI

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS*
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

*Issue flagged and resolved over compatibility of error handling message

MOZILLA FIREFOX

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

INTERNET EXPLORER 11

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

ii) CROSS-PLATFORM FUNCTIONAL TESTING

GALAXY S3 MINI SMARTPHONE

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

NEXUS 7 TABLET

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

TOSHIBA LAPTOP

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

DELL DESKTOP

	Speed	Accuracy	Integrity	Security	Error Handling
USER FUNCTIONS					
Register user	PASS	PASS	PASS	PASS	PASS
Login	PASS	PASS	PASS	PASS	PASS
Search	PASS	PASS	PASS	PASS	PASS
Add to Itinerary	PASS	PASS	PASS	PASS	PASS
Remove location	PASS	PASS	PASS	PASS	PASS
Clear itinerary	PASS	PASS	PASS	PASS	PASS
Plot route map	PASS	PASS	PASS	PASS	PASS
Save itinerary	PASS	PASS	PASS	PASS	PASS
Retrieve itinerary	PASS	PASS	PASS	PASS	PASS
Map features	PASS	PASS	PASS	PASS	PASS
ADMIN FUNCTIONS					
View locations	PASS	PASS	PASS	PASS	PASS
Insert location	PASS	PASS	PASS	PASS	PASS
Edit location	PASS	PASS	PASS	PASS	PASS
Delete location	PASS	PASS	PASS	PASS	PASS
View users	PASS	PASS	PASS	PASS	PASS
Delete user	PASS	PASS	PASS	PASS	PASS

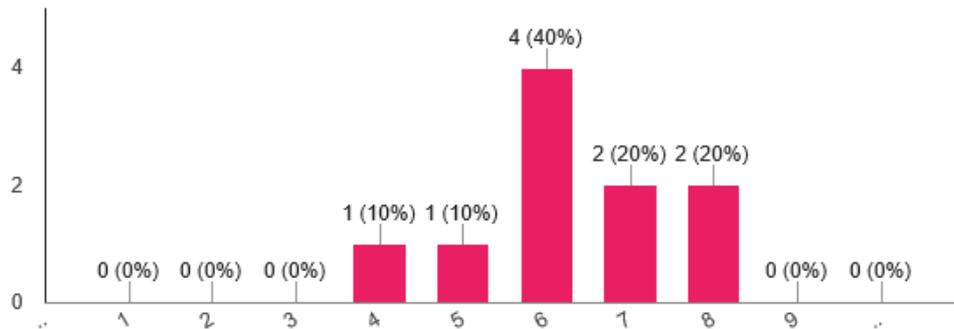
APPENDIX E: TEST CASE SCENARIO SENT OUT TO FOCUS GROUP DURING TESTING AND EVALUATION PHASE

Location Scout – Test Case

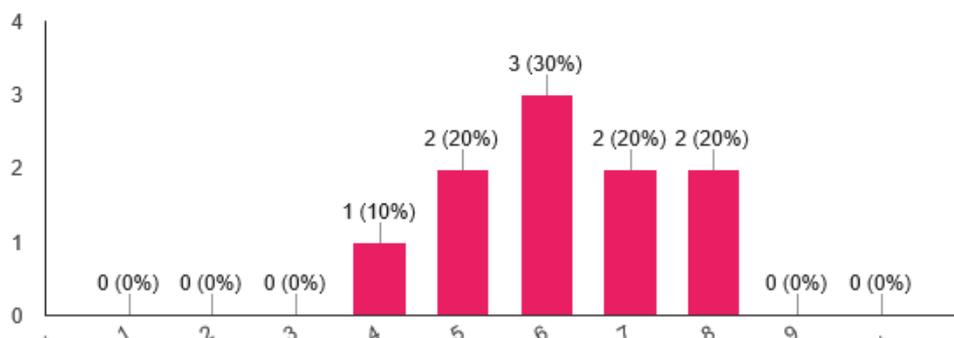
- 1) Log on to Location Scout at this URL:
<https://dunluce.infc.ulst.ac.uk/B00700869/COM810/LocationScout/index.php>
- 2) Create a user profile by clicking on the ‘Register’ button (**NB: you don’t need to use your real email, just a dummy one will do**). Then log in.
- 3) Find all locations in County Antrim via the dropdown menu on the right. Scroll through at will and examine the information provided. Click on the production name link and also the image itself to see further information on the location.
- 4)
 - i) Using the ‘search’ bar, find any three of the following productions: Game of Thrones, Dracula Untold, The Fall, Your Highness, The Frankenstein Chronicles.
 - ii) As you go along, add one location from each of these to your itinerary by clicking the ‘Add to Itinerary’ button beneath each one. Once this is done, from your profile page, click on ‘Your itinerary’.
 - iii) Enter a start and end destination (**NB: for some locations e.g. Bangor, Newcastle, you may need to enter the county name i.e. ‘Bangor, Down’**), and then click on the ‘Show route map’ button. Examine the route and make sure it is accurate.
 - iii) Enter a name for your trip in the text box and then click the ‘Save itinerary’ button to save your choices.
 - iii) From your profile page, click the ‘Retrieve itinerary’ button. Find the itinerary you have just saved and click on the ‘View locations’ button; once again click the ‘Show route map’ button. Check that the route is accurate with what was saved.
 - iv) Log out.

APPENDIX F: RESULTS OF SECOND QUESTIONNAIRE FROM TESTING AND EVALUATION PHASE

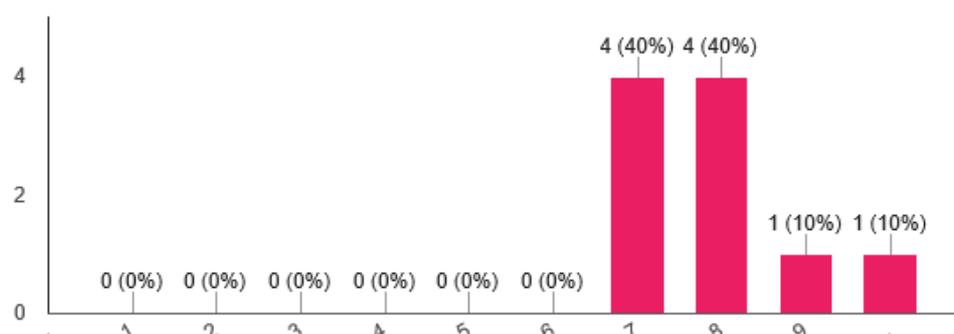
User Interface: Please rate what you thought of the colour scheme
(10 responses)



User Interface: Please rate what you thought of the general layout of the site
(10 responses)

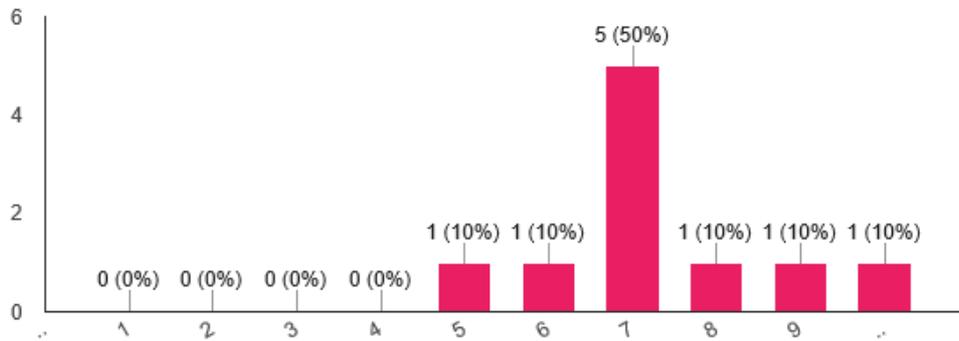


User Interface: Please rate the ease of use of the search bar and dropdown menus
(10 responses)



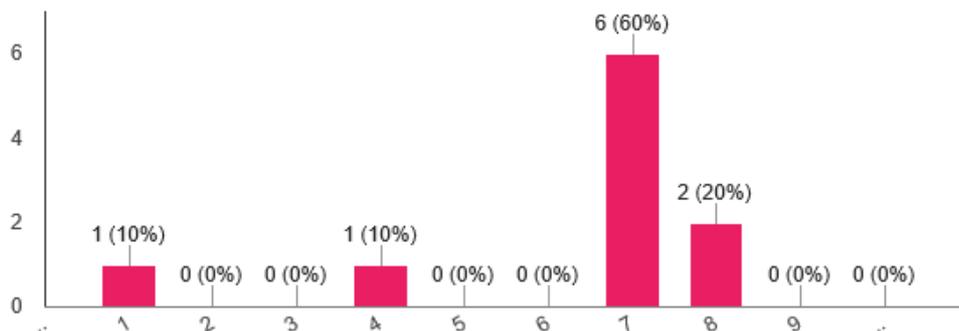
Functionality: How did you find the process of locating information?

(10 responses)



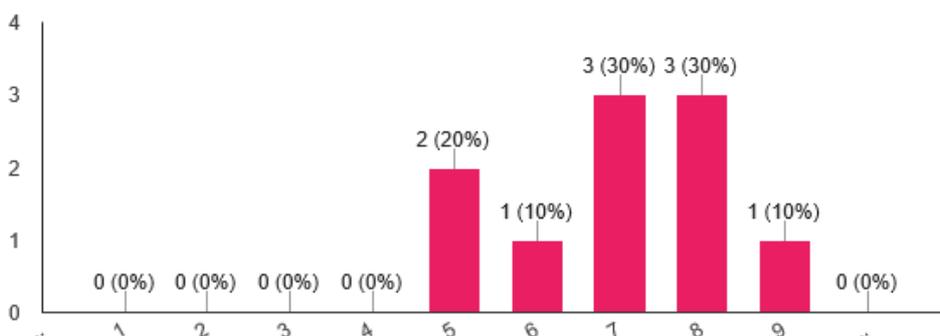
Functionality: Please rate your experience of creating/amending an itinerary

(10 responses)



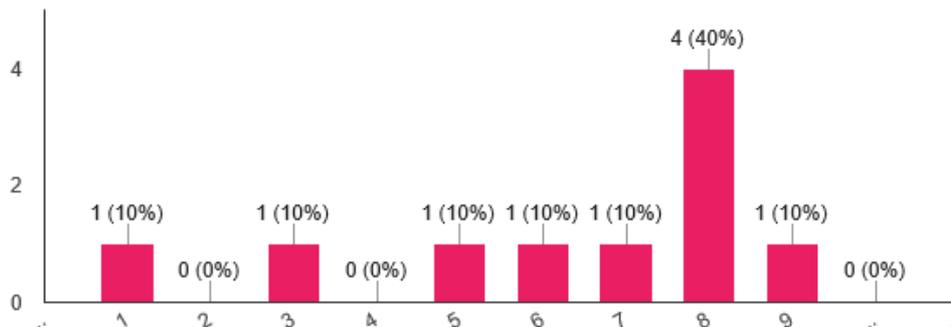
Functionality: How did you find the ease of navigation between pages on this site?

(10 responses)



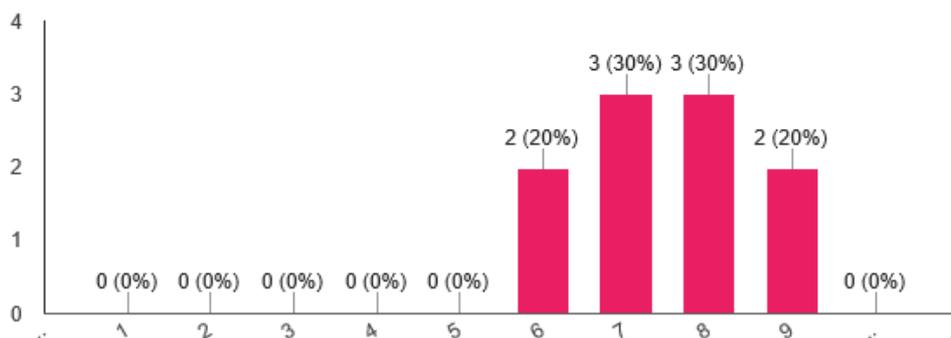
Functionality: Please rate your opinion of the mapping feature for your itinerary

(10 responses)



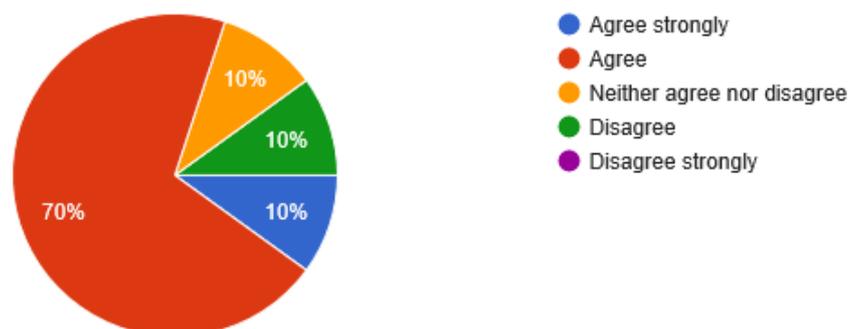
Presentation of information: How clear and informative was the information presented to you?

(10 responses)



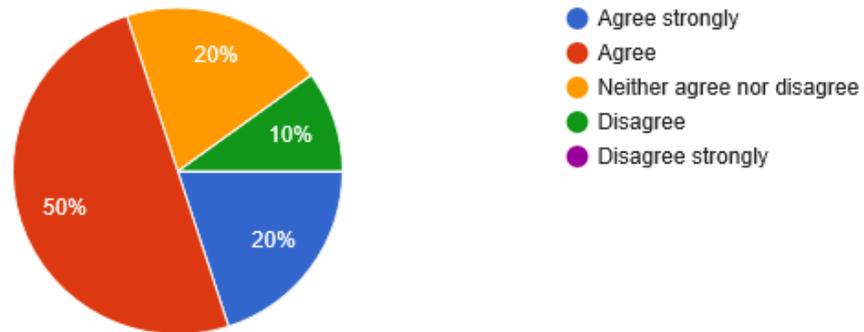
Presentation of information: "There was a good balance of images and textual information"

(10 responses)



Presentation of information: "I was able to understand how this website works very quickly"

(10 responses)



"I would use this website myself or recommend it to others" (10 responses)

