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Riget Zoo Adventures – Task 1 – Project Proposal

The following document is the project proposal for the solution to be developed for our client, the company `Riget Zoo Adventures`. This document contains the required content that is needed for the development of the proposed solution. This content includes the various hardware, software and (non-)functional requirements, along with the data overview, Key Performance Indicators, User Acceptance Criteria, among others.

Throughout this document the terms “solution”, “project”, “system” and “application” are intended to be used interchangeable and convey identical meanings. This variation in terminology has been used to enhance the document’s readability.

In this document the term “client” is intended to reference the company `Riget Zoo Adventures`, unless stated otherwise, it has been used to shorten text and streamline document writing and readability.

Within the context of this document any references to “we” is related specifically to the software house responsible for proposing and developing the outlined solution.

Project Proposal

The client, Riget Zoo Adventures, has contacted us as they wish to produce a digital solution for their company, the client currently provides a range of services not limited to, operating a safari-style wildlife zoo, operating an on-site hotel in within the zoo, handling of educational visits to the zoo itself. For the proposed digital solution, the client has specified several requirements along with some prior market research they have completed, from which they have specified some additional features they wish to be incorporated into the proposed solution.

From the requirements the client has specified alongside the research they have collected and requested implementation of, it has been determined that a web application is the best way to implement their required digital solution, as it allows for the application to be used by anybody with an internet access and a device that can use a web browser, which most modern devices such as laptops, desktops and mobile devices can easily do so, as such it is the best and most optimal way for the application to be designed and interacted with.

The client has specified several feature requirements that the digital solution must implement, the first of these features being a method to provide customers with help and information about the attractions and facilities that are within the zoo the client operates. To do so several pages will be implemented that allows for an individual to easily see any attractions within the zoo, each page will be specialized for what it is to implement such as showcasing the zoos map or for giving explanations / information about attractions.

The client has also specified that the digital solution needs to provide materials for individuals to learn from and to support educational visits, the information would be about animals that are within the zoo the client operates. For this to be implemented several pages will be implemented that provides explanations and research on the animals on the zoos premises so an individual can easily view this content and learn from this, additionally there will be appropriate links to external resources that can be used as further educational materials as support as required.

The client has also specified that the digital solution must have a system that allows for an individual to book tickets to the zoo along with allowing them to check availability and book a stay at the on-site hotel. To do so several pages will be implemented that allows a customer to view all the rooms and ticket types on offer from which they can then choose from, and upon making their choice they can then book these items as required, allowing for them to visit the zoo and for them to stay at the on-site hotel.

Additionally, the client has requested for additional features they have determined from market research to be implemented within the proposed solution. They have requests for an account system that allows for a user to register and manage their own individual accounts and any bookings that the user has completed through the application.

The client has also requested for various accessibility features to be implemented so the application can support, and is useable by, a wide range of users no matter their personal situations such as what disabilities/limitations they may have. To ensure that this is done several features can be implemented within the application, one feature is via themes that allows a user to swap between premade versions of the application, two common themes is light mode and dark mode which make it much easier for individuals that may have problems with using screens due to bright and blue light, additionally high contrasts modes/themes can be implemented to make text easier to read and images easier to view, the ability to increase all text sizes should also be implemented to make it easier to read the applications text for individuals with bad eyesight. Another accessibility feature that can be implemented is alternative

text, which is adding descriptions to images so users that rely on screen readers to use the application can still understand the image without having to see it. Of these features, all should be considered and planned to be implemented within the project's final solution as is appropriate.

The client has also proposed a loyalty and reward system for the application, this system would as a result make users more likely to return to the application and the clients zoo, increasing revenue, this can be done by giving users incentives to return such as earning points by booking tickets or for other activities, and these points can then be exchanged by a user for free items such as discounts, merchandise or possibly free bookings of tickets/hotel rooms depending on the amount of points the user has and exchanges. This feature must be heavily considered and designed so that it can operate efficiently along with having a good balance to encourage users to keep returning and performing activities to earn points for a chance to get free items such as by visiting the zoo, which would as a result directly increase the zoos revenue from admissions but also indirectly increase it from other attractions such as events, exhibitions, food options or the gift shop, all of this will result in increased revenue for the client in the long term as long as it is properly implemented.

In conclusion, from all the information that has been received from the client, alongside the plans stated above for the proposed solution, the following solution will be a web based application that incorporates mass amounts of content related to the zoo and the animals contained within, that allows users to create accounts, book tickets to the zoo along with booking hotel room stays, it will also have a loyalty and reward system built in to encourage users to return in the long term by giving them incentives to return. In addition to these features that all users will be using, several additional support features are to be implemented to allow users that require additional accessibility support receive the help they require so they can effectively and efficiently use the application as if they did not have access these accessibility options.

Legal and Regulatory Requirements

For the design, development and operation of the proposed application special and specific care must be taken to ensure that the various different legal and regulatory requirements the application, the client and us, the software house, have been subjected to are in accordance with the various laws within the Application Development industry and the Tourism and Leisure industry.

With regards to the Tourism and Leisure industry Legalities and Guidelines, there are 6 important laws that have been researched and found, and it has been determined they are important laws and must be focused on to ensure that the application and the client follows the laws correctly to prevent any legality issues.

- Data Protection Act (v2018) – This act has a set of laws that ensures that we gather consent for data gathering and data processing. It also requires that we secure any personal data / information that we gather on individuals, it further states that any data we hold is relevant to the application and that no storage of excessive or non-required data without the user's consent, it also further restates that the data must be kept securely. As such it is important to ensure that all data, we gather related to the user follows the Data Protection Act.

- Equality Act (v2010) – This act contains a set of laws and guidelines that prevent discrimination, harassment, and victimization on the grounds of individuals protected characteristics such as race, size, weight, disabilities, etc. This is done to ensure that everyone is treated equally and fairly, and as such the client must follow these rules when operating their business.

- Health and Safety at Work Act (v1974) – This act specifies the duties an employer, the client, has regarding health, safety and welfare of its employees and customers. It mandates that the employer performs risk assessments of their working environments to ensure that they are up to standard and are safe to work and operate in, alongside this it requires the employer to provide appropriate training to the employees so they can effectively and safely perform their job duties. It also requires the employer to manage and maintain the safe working environment, and to perform new risk assessments periodically or when a major incident occurs.

- Consumer Rights Act (v2015) – This act sets out several laws, guidelines and regulations in relation the protection of consumers/customers rights within various sectors, including the Tourism and Leisure sector the client operates in. This act specifies that the customer has several rights included when the consumer purchases goods and/or services from a company, it states they have the right to expect the work to be provided and performed with reasonable care and skill, the right to receive goods and/or services that match any description the consumer has been provided, and the right to a refund or equivalent compensation for substandard goods and/or services the company has provided to the consumer.

- Package Travel Regulations (v2018) – This act provides various protections and rights to customers who purchase package holidays, it specifies the specific rights, responsibilities and obligations of the tour operator/provider and the customer. Included within this is laws and regulations in relation to refunds, procedure of handling package changes, and for liability responsibility for any issues that may occur during the package holiday.

- Zoo Licensing Act (v1981) – This act specifies several laws and regulations that dictate how a zoo is supposed to operate within the UK, this information includes direction on how to apply, manage and renew a license to operate a zoo. It also includes regulations on how animals are to be managed and handled during their stay at a zoo. Furthermore, it includes a requirement for a zoo to have appropriate educational resources related to the zoo and to the animals, such as biodiversity, habitats, behaviour, etc.

For the legality within the Application Development industry, there are also various laws, regulations and acts that must be followed by both the application and by us, the following laws have been listed below.

- Data Protection Act (v2018) – This act ensures that any personal data we gather on individuals is kept securely, and safely. It also ensures that any data we gather about individuals is relevant to the applications operations, and that no storage of non-required data is occurring unless the user explicitly gives permission. As such to follow the rules any data we have about a user will be stored securely in a database on a secured server, along with the relevant data being encrypted and/or hashed where applicable as a further security measure.

- Equality Act (v2010) – This act has a set of laws and guidelines to ensure that developed systems are easily useable and accessible to all and ensure that everyone is treated equally and receives equal treatment and opportunities compared to everyone else. We must follow these rules when we are designing and implementing the proposed application, as such care must be taken to ensure that anybody can use the application as is, or with an accessibility tool that is built into the application itself.

- Intellectual Property Act (v2014) – This act ensures the rights of intellectual property, by providing legal protection for the content and its creator. It states that the creator of the intellectual property has exclusive rights over the content, they can then decide whether others are allowed to use their intellectual property and if they are required to follow specified guidelines such as, being credited or being financially compensated. As such to prevent any legal problems we must strictly comply with this act, and refrain from using content in an unauthorized manner, and in the case, we do use protected content we must follow the guidelines the creator has specified.

In relation to the laws and regulations that have been listed above, there are also many different guidelines that should be followed for appropriate business operation and application development. However, we are not legally required to follow them, but it is highly recommended to follow them, and as such we will attempt to follow these guidelines as best as possible. Within the Application Development industry these guidelines specify how the application can be designed, developed and implemented to make it much more useable, accessible and equal to all no matter their physical status, or whether they are disabled or not.
One guideline that we don't need to legally follow but will follow as it helps ensure the applications usability and overall application success. This guideline is known as the `Web Content Accessibility Guidelines v2`, WCAG for short, this guideline set out a variety of recommendations and rules that have been developed and considered by the World Wide Web Consortium, W3C, and are designed to make the web a much more accessible place to all individuals, including those with disabilities. WCAG provides recommendations and success criteria's to ensure that a website/application is inclusive and accessible to all, including individuals with disabilities that affect their visual, auditory, cognitive or motor functions.

Project Requirements

In the following sections below, it states the various requirements that is needed for the project to be efficiently and effectively implemented, it includes information related to what type of hardware is required to run the application, what software is used to produce and operate the application along with what systems need to be implemented within the application to fulfil the requirements that has been specified by the client.

Hardware Requirements

In the following sections, an overview of the type of hardware that is required to operate the application on both the user's own device along with the hardware required to run the applications backend/internal software. Each of these points are explained and expanded upon in the relevant sections below.

In this section, and appropriate sub-sections, references to `Client-Side` hardware refers to an individual's device such as a smartphone or laptop. Whereas `Server-Side` hardware refers to the hardware that runs the backend/internal software of the application.

Client-Side Hardware

For the effective utilization of the proposed application, a device with a moderately sized monitor such as a desktop pc or a laptop should be used, as this is the native resolution the proposed solution has been designed for and developed for. This resolution was chosen due to the prevalent usage of computers worldwide which are directly and consistently connected to the internet, along with this the devices usually have stronger hardware compared to mobile devices, as such being able to run the application with less computing power.

However, the application will also offer support for devices of smaller screen sizes and resolutions such as tablets and phones, as there is also a lot of individuals that may use these devices due to them being easy to carry around with them. This will specifically go well for individuals that may be in the area temporarily and wish to book a ticket to the zoo so they can visit it, it will also be useful guide to showcase a map of the zoo along with showing information about different enclosures as they can simply see the information on their own device without having to search for a physical map or a physical plaque that explains the enclosure.

Server-Side Hardware

The required hardware for the server-side is going to be much more compared to the client-side. This is due to the server hardware having to run all the required software and code for the back-end portion of the application operates correctly, efficiently, and stably so that it can handle all the concurrent users that are using the application at the same time. Failure to do so could result in the application slowing down for the end user, and possibly going down due to the hardware/system failing.

During the development of the proposed solution, lower end/cheaper hardware can be used during the initial development and testing process. But upon completion of development and it is being prepared for deployment and operation, stronger hardware must be used as it would result in better application stability, speed, and security due to the hardware being up to date/newer.

The exact required specifications for the hardware to run and operate the application cannot be known until closer to the deployment time, however we can attempt to predict what type of hardware would be required during development by performing tests and analysing data to determine how much computing power it is using during that time, and then performing calculations to scale it up for when it is to be

deployed, from which they can determine a rough estimate of what type of hardware is needed along with the price range of the hardware.

For this we could either purchase this hardware and manage it in house, allowing for better control and upgradability, but this method has large upfront costs along with the costs of having to hire and pay an individual/multiple individuals to constantly manage and maintain the server and hardware. As such we could also offload the hosting of the application to a cloud hosting provider such as Google Cloud or Amazon's AWS, this would result in lower/cheaper costs along with having very high uptime/stability, but would result in having less control and upgradability of the server, this method also has the potential problems of vendor lock-in which as a result could result in the operational costs increasing overtime as the hosting provider charges us more as we cannot easily swap from one provider to a different provider.

Software Requirements

The implementation of the proposed solution is for a web-based application/software/website. This method was chosen so the solution can be easily accessed from any device, allowing customers to use the solution and interact with it, such as booking holidays. It was also chosen as it allows for the application due to it being easily manageable and scalable in the future as is required according to the customer demand.

In the various sections and tables below are lists of various systems, items and software that will be used to develop the proposed solution and are required to make it possible.

Frontend

In the table below is a list of programming languages, frameworks and libraries that are required and will be used to implement the project's frontend interface. Each of the items listed below are well tested and developed pieces of software, allowing for easy development of the front-end portion of the application.

Name	Type	Information
HTML	Markup Language	Hyper Text Markup Language, also known as HTML, is a core component for the application to be developed and for it to operate, as it specifies the structure and layout of the page. As such it is an absolute requirement for web-based system, as all web browsers rely on HTML to structure the site.
CSS	Stylesheet Language	Cascading Style Sheet, also known as CSS, is a core component to specify how the site visually looks, and what the various part of the site's layout visually look along with what effect they have when they are interacted with such as when hovered, clicked, focused, etc. Another absolute requirement for modern web-based systems that are to be shown via web browsers.
JavaScript (JS)	Programming Language	JavaScript, also known as JS, is a core component to ensure the application's frontend operates and functions correctly. JavaScript allows for easy and efficient code to be developed on the websites frontend to add further functionality to the application, an example of this would be making a popup appear

		when a button is clicked/interacted with. It is another requirement for modern web-based systems.
JQuery	Programming Library	JQuery is a JavaScript library that allows the code that runs on the application frontend to be much more efficient, readable and understandable then normal, plain JavaScript code. It is commonly used throughout the application for various reasons, such as data input validation that occurs before any request is sent to the server, which reduces network traffic, network delays, and the load on the server itself.
Bootstrap	Frontend Framework	Bootstrap is a front-end frame that helps speed up the applications development and implementation process. This is due to its several pre-built classes that already functional with both JavaScript code and CSS styling, although the framework is mainly used for its CSS capabilities. It allows for rapid prototyping and development along with producing end results that have a clean, consistent and good look along with the underlying code itself being very efficient. This also results in not having to constantly write custom CSS classes and custom JavaScript code, speeding up the overall development process.
Font Awesome	Icon Library	Font Awesome is a large icon library contains thousands of icons that can be used, and as such is commonly used throughout projects for showing pre-designed and standardised icons on a page, common examples would be social media brands/logos. Font Awesome streamlines the method of showcasing these icons, instead of having to manually download the images and set them up with the required code, you simply need to add in the reference to the specified icon with the Font Awesome library and it will automatically show the correct image, along with the icon being updated in the future in the scenario the brand's logo changes.
Freepik	Image Asset Library	Freepik contains tens of thousands of images that can be used for the application during its designing and development process, it has been chosen due to the relative ease of image usage as all that is required is attribution to the image author when the image is used. These images are meant to be used until the client can provide us with their own images that can be used in place of the ones from Freepik.
Stripe	Programming Library (Payment Handler)	This library is a JavaScript library that runs on the applications frontend, it will be used in locations that handle any payment / purchases within the application, this has been chosen due to stripe being a company/provider that allows for easy integration with payment systems to allow users to pay for their purchases in a variety of methods such as debit cards, credit cards, PayPal, etc. As such this library is used due to it managing all the frontend logic to get stripe implemented and working within the applications frontend.

Backend

In the table below is a list of programming languages, frameworks and libraries that are required and will be used to implement the project's backend. Each of the items listed below are well tested and developed pieces of software, allowing for each development of the back-end portion of the application.

Name	Type	Information
C#	Programming Language	C#, also known as C Sharp, is a core component for the back-end development of the application as it is the programming language that will be used for the back-end portion of the application/code. As this code must handle all the user requests, and make sure everything functions as it should do while maintaining its speed, as such C# was chosen. This is due to it being easy to use, being very well developed, having efficient and fast operating code, having many premade libraries/code that can be used to speed up development process, along with it being easily scalable for any future developments of the application.
ASP.NET	Backend Framework	ASP.NET is the underlying web framework that will be used for the proposed solution, this framework was chosen as it is a highly efficient and developed framework with a long history of handling back-end webservers. It can also be easily expanded upon with other frameworks or custom code for the development of the server due to it being a very expandable framework. ASP.NET is also well tested and optimised framework as it is used by many large companies and businesses to host their own custom webservers/applications. By using this framework, it will provide a very stable foundation for the rest of the solution to build off.
ASP.NET MVC	Backend Framework	ASP.NET MVC is a framework that builds upon ASP.NET by adding support of the Model-View-Controller (MVC) coding pattern. This coding pattern allows for highly efficient and modular code to be written for ASP.NET. As such this framework extension was chosen as it has seamless integration with the standard ASP.NET, along with being efficient and promoting code separation and modularisation, which will make the project easier to manage, maintain and scale in the future as the application requires.
Razor Pages	Backend Framework	Razor Pages is a core component on how MVC was integrated within ASP.NET, it allows for a simplified process in the creation and development of dynamic web pages and content. This is done by having a core layout page that renders all the constant and consistent data of the site such as the header and footer sections, it then renders the actual content you are viewing in between this. Which as a result makes the entire application look clean and integrated due to consistency across the different content/pages. Razor Pages also have support for pre-rendering the pages HTML on the server, speeding up loading times and

		reducing the required computing power for the end-user's device, as they are not required to process and render raw data, it is instead handled on the much stronger servers via the Razor Page.
ASP.NET Identity Framework	Backend Framework	ASP.NET Identity Framework is a framework for managing registration for accounts, along with each user's current logged in session for the site. It also has further integrated support for features such as roles, which can then be used to determine what type of features a user can access. As this framework is easy to work off and expand upon as it allows for custom code to be easily integrated within this system to implement further functionality, such as allowing the storage of additional data it does not store by default. This framework was chosen as it is a very well trusted and tested framework, including various feature such as being highly efficient, high security via data encryption and hashing for sensitive information via a Key Derivation Function, specifically the algorithm PBKDF2, the type of data that would use this would be for information such as the user's password. As such all these features ensure that it will keep all data secure in the event any data is somehow leaked, stolen or access by an unauthorized individual. These security features also follow the required regulations such as the GDPR and the UK's Data Protection Act on how to keep data confidential and secure.
Microsoft SQL Server	Database	Microsoft SQL was used due to its ease of setup and integration within ASP.NET. This sever allows for easy storage and retrieval of structured data from its database via SQL, Structured Query Language. It is a very secure database, along with being easy to scale as required due to its various features such as data replication. As such in the case the application needs to expand the database to make it bigger, or possibly host it across multiple servers to increase efficiency, this can be done due to the already implemented support with ASP.NET, the database and its related inbuilt features and tools.
Entity Framework	Backend Framework	Entity Framework, also known as EF, is an Object Relational Mapping (ORM) framework for .NET. This framework allows for simplified database operation and management, as it allows for the code and developer to interact with the database in a more efficient and easier manner. This framework removes the need of having to write raw SQL commands, as it allows for the code to interact with the database as if it was a C# object, this as such allows for much easier and safer data access and data manipulation to be performed, making code much more efficient to write and run.
NuGet	Package Manager	NuGet is a package manager for .NET that allows for the easy installation, addition and management of third-party libraries and frameworks within the application development environment. These third-party assets are blocks of code that is commonly used

		throughout development, and as such recommended to use pre-written code instead of remaking it yourself, which could introduce unexpected problems and bugs. This helps speed up the project's development process, along with increasing stability due to packages having hundreds of individuals who have looked over the specific code, and maintained it, as such making the code much more efficient, secure, and easier to use and implement.
Stripe	Package – Programming Library (Payment Handler)	This library manages most of the back-end actions related to getting the stripe payment system implemented, integrated, and working within the application. This allows for the application to successfully receive payments for the items that the user purchases. Stripe was used as it is a well-known company and package that is very trustworthy alongside having built in support for various payment methods such as debit cards, credit cards PayPal, etc. There is a downside of using stripe though as they take a small fee for managing the payment for you, this fee scales depending on how much the user pays, it always contains a £0.20 transaction fee alongside a 1.4% fee for European cards and a 2.9% fee for non-European cards.

Functional Requirements

The following section outlines the functional requirements for the proposed solution, these are system that must be developed via code and integrated within the system. In the table below the index is used to identify the relationship between different requirements, such as points being sub-points/further explanations of an overarching index/point, while the priority indicates their importance to the solution.

The priority values are as follows: LOW -> MEDIUM -> HIGH -> CRITICAL

Any requirements that have a priority level of CRITICAL must be prioritised within the projects planning and development process.

Index	Description	Justification	Priority
1	Account System	For the individuals to use the application, an account system is an absolute requirement. It is also a feature that has been requested by the client to be implemented.	CRITICAL
1.1	Account System – Roles	To efficiently and securely separate access to sections of the application depending on the user's role and corresponding permission level, i.e. User or Administrator, is a critical part of the security system to prevent any data leaks, and to increase application usability.	CRITICAL
1.2	Account System – Registration	The user must be able to make and register an account with the application, so they can use it. A critical part of the project.	CRITICAL
1.2.1	Account Registration – Email Verification	To ensure the user has provided the correct details during registration, the user must verify their email address with the application. This can be done by sending them a verification link to their provided email address, which upon being clicked/interacted with lets the application known the email is valid, and to verify the account. This ensures the user is a valid user, and in the case the user needs any sort of support we can verify who they are by contacting them via their verified email address.	HIGH
1.2.2	Account Registration – Social Media / External Services	By allowing the user to register with the application via other services such as Google/Microsoft/Twitter/etc, it will streamline the account registration process, and as such making it more likely for a user to sign up and use the application as it is easier to create an account.	LOW

1.3	Account System – Login	The user must be able to login to the application, so they can continue to re-use their created account along with giving them access to the entire application.	CRITICAL
1.3.1	Account Login – Locking on failed login attempts	For the security of the application and each user's individual account, a system should be implemented that will temporarily lock accounts after several failed login attempts occur, this is done to prevent unauthorized users from iterating over a user's account and potentially brute forcing and breaking their way in, this as such prevents unauthorized individuals from gaining access to the account and seeing sensitive information related to the account.	MEDIUM
1.3.2	Account Login – Password Reset	In the case the user forgets their password during a login attempt, having a system to reset their own password after email verification should be implemented. As it will prevent users from permanently loosing access to their own accounts in the case they forget their login details.	MEDIUM
1.3.3	Account Login – Social Media / External Services	By allowing the user to login to the application via other services such as Google/Microsoft/Twitter/etc, it will streamline the account login process, and as such making it more likely for a user to login and continue using the application as it is much easier to login.	LOW
1.4	Account System – Settings	The user must be able to modify their individual accounts settings, this is to ensure application and account security, alongside giving the users further access and control over their own accounts.	CRITICAL
1.4.1	Account Settings – Profile	The information with the profile will be information such as the user's name, etc. By allowing the user to change these parameters, it will ensure that any information we have on the user is kept up to date.	CRITICAL
1.4.2	Account Settings – Email	By allowing the user to change their provided email address will increase the application and accounts security, as they can modify their information as required and in accordance with any security incidents such as changing emails in case their own has been breached. It will also ensure that any information we have on the user is kept up to date.	CRITICAL

1.4.3	Account Settings – Password	By allowing the user to change their current password, it will result in an increase in application and user account security.	CRITICAL
1.4.4	Account Settings – Personal Data	To be able to operate the application, we must legally give the user access to their own personal data we collect about them, by allowing them to download it as they wish to do so alongside giving them the option to delete their personal data which would as a result cause the deletion of their own account. If we do not, we would be breaking the laws such as the Data Protection Act and GDPR. As such they must have these options open to them.	CRITICAL
1.4.5	Account Settings – Two-Factor Authentication	By allowing the user to setup Two-Factor-Authentication (2FA), It will increase the users account security as there is more security mechanisms on the account hat is required to be completed before the user can login to the application.	HIGH
1.4.6	Account Settings – Manage External Logins	By allowing the user to connect their account with other services, it will allow for their accounts to stay further connected and secure, along with increasing the likelihood they will continue to use the application in the future.	LOW
2	Booking System	The booking system is an important feature so the application can work and function as intended. It is also a feature that has been requested by the client.	CRITICAL
2.1	Booking System – Generic	There are generic features that are to be implemented for all booking systems that are to be implemented, no matter whether it is the ticket or hotel room booking system.	CRITICAL
2.1.1	Generic Booking – Shopping Cart	The shopping cart allows the user to book multiple different items at once, this allow for easy booking of specific ticket and hotel rooms for each individual user, and in the case the booking system is expanded to feature other options such as shows and events, the shopping cart allows for the user to easily book tickets to them.	HIGH
2.1.2	Generic Booking - Discounts	The ability for a user to apply a discount is an important feature, as by giving out discount codes to users it will encourage them to use said code before it runs out, this makes them subtly think that they are getting a cheaper deal, but they must do it quick, increasing chances of a booking occurring. The discount system	HIGH

		can also be used by the loyalty system, which could generate one time discount codes for users.	
2.1.2	Generic Booking – Stripe/Payment Integration	The ability for the user to pay for the booking they wish to purchase is a critical feature, as if not setup the user cannot book any tickets and the application cannot make money, as such integration with a payment system such as Stripe is a critical feature that needs to be implemented.	CRITICAL
2.2	Booking System – Tickets	The booking system contains several sections related to the ticket booking system, which contain appropriate features that are to be implemented.	HIGH
2.2.1	Booking Tickets – View available tickets	The user must be able to view all the tickets that are available for booking, so they can decide on which ticket they wish to book, alongside when the ticket will activate.	HIGH
2.2.2	Booking Tickets – Add to cart	The user must be given an option to add said ticket to their shopping cart so they can then go through the process of booking the tickets.	HIGH
2.2.3	Booking Tickets – Text Search	The user should be given the option to search for tickets that contain a specific piece of text within either the tickets name or explanation, so they can effectively and efficiently find the specific ticket they are searching for.	MEDIUM
2.2.4	Booking Tickets – Search by Type	The user should be given further control over their search for tickets by giving them a method of filtering their search result for specific types of tickets that have been setup within the application that are available for booking.	MEDIUM
2.3	Booking System – Hotel Rooms	The booking system contains several sections related to the hotel room booking system, that contain appropriate features that are to be implemented.	HIGH
2.3.1	Booking Rooms – View available rooms	The user must be able to view all the hotel rooms that are available for booking, so they can decide on which hotel room they wish to book, alongside what times they wish to check in and check out.	HIGH
2.3.2	Booking Rooms – Add to cart	The user must be given an option to add said hotel room to their shopping cart so they can then go through the process of booking the hotel rooms.	HIGH
2.2.3	Booking Rooms – Text Search	The user should be given the option to search for hotel rooms that contain a specific piece of text within either the	MEDIUM

		hotel rooms name or explanation, so they can effectively and efficiently find the specific hotel room they are searching for.	
2.2.4	Booking Rooms – Search by Parameters	The user should be given further control over their search for hotel rooms by giving them a method of filtering their search results for specific parameters that rooms may contain, such as containing an electric safe, having accessibility features installed, being pet-friendly, etc. All of these parameters are important points that a user may consider when they are searching for a hotel room to stay in, as such giving the option to filter by these parameters making it much easier for the user to find a room that features their criteria, as result increasing the chance of them booking a room.	MEDIUM
2.4	Booking System – Administrator Control	To ensure that the applications administrators have sufficient control over the booking system and its content, various features are to be implemented that allows for viewing of data, and the creation/management of hotel rooms and tickets	HIGH
2.4.1	Administrator Control – View Estimated Visitors	To determine how many visitors are estimated to be in the zoo at any one time, an option to see an estimated number of visitors alongside why they are arriving, i.e. tickets or hotel rooms, is a useful datapoint as it can be used to determine if there is any need of temporary staff increases, or for further business decisions.	HIGH
2.4.2	Administrator Control – View Orders	By giving the administrators, the option to view orders that have been created, it will allow them to provide any support to a customer that requires any information relating to the order to be confirmed and ensure that the information is correct.	MEDIUM
2.4.3	Administrator Control – Manage Orders	Furthermore, by giving them access to manage and modify orders will allow the administrator to assist the customer further as they can help them modify their order such as adding notes to the order for custom/special requests.	MEDIUM
2.4.4	Administrator Control – Add Ticket	By integrating the method of adding tickets to the application within the application will ensure it is easy for administrators to add new tickets according to market research and business decisions, such as creating seasonal tickets.	MEDIUM

2.4.5	Administrator Control – Add Room	By integrating the method of adding hotel rooms to the application within the application will ensure it is easy for administrators to add and configure new hotel rooms that are available at the zoo, as such allowing for the application and zoo capacity to be expanded as there are more rooms available for booking.	MEDIUM
2.4.6	Administrator Control – Add Discount	By giving the administrator, the option of creating discount codes for the application within the application, will allow for the administrators to make temporary discount codes that can be used for events and/or promotions, it will also allow them to make temporary codes that can be used for customers as a part of compensation if it is required.	LOW
2.4.7	Administrator Control – Manage Tickets	By having the ability to manage tickets that can be booked allows for the administrator to easily manage the tickets that are on sale, such as allowing the administrator to manage what ticket types are for sale during specific period of times such as for seasonal tickets/events. This control allows them to fine tune the application and the business strategy.	MEDIUM
2.4.8	Administrator Control – Manage Rooms	By having the ability to manage hotels rooms that can be booked allows for the administrator to easily manage what hotel rooms are available for booking and which rooms are not, this control allows for them to temporarily make rooms unavailable due to any reason that is required, such as the room is under maintenance. This control allows them to fine tune the application and the business strategy.	MEDIUM
2.4.9	Administrator Control – Manage Discounts	By having the ability to manage the discount codes that are useable within the application allows for the administrator to easily manage what discount codes are active/useable depending on various factors, such as the season, event or the business strategy that is being implemented.	LOW
3	Loyalty and Reward System – Points-based system	To implement the Loyalty and Reward system that has been requested by the client, the following points-based loyalty/reward system has been designed for implementation, it allows for effective and fine-tuned control over the points an individual can collect alongside what rewards can be exchanged for these virtual points. Alongside this by making	CRITICAL

		the feedback of points being given for doing an action we deem as `good` such as booking tickets/stays, recommending people, visiting the zoo etc, will hopefully result in the individual returning to the application to exchange these points as if they do not use them these points go to waste, as such making it more likely for an individual to spend more money on the application on booking items.	
3.1	Points-Based System – Earning points	To ensure the users of the loyalty system receives enough points for the system to be a viable source of getting free items several different ways of earning points should be implemented, the primary ways of earning points should be via booking tickets/stays to encourage the user to spend more money on the application to receive more points, while several secondary methods should be implemented that give points but at a lower rate to encourage the users to continue to interact with the application and perform actions that would result in increased point counts.	HIGH
3.1.1	Earning Points – Booking	The primary way of earning points within the loyalty system should be via the booking of tickets/hotel stays. This is done as it is the way the application generates revenue and profit alongside it being a high chance this is the first method the use to interact with the loyalty system. As such this method of earning points should be more than other methods, alongside scaling the number of points earned according to the amount of money was spent on the bookings.	HIGH
3.1.2	Earning Points – Recommendations	An additional way of earning points would be by recommending new users to the application, and in the case this user books a ticket/hotel stay you get a reward for their first booking, this is done to as an incentive for the user to invite other individuals they know so they can experience the zoo alongside earning points as an additional bonus.	MEDIUM
3.1.3	Earning Points – Exploring	Throughout the application and the zoos' physical location, codes should be hidden in safe locations that upon redemption would result in the user receiving extra bonus points for exploring, these codes can be hidden just as an individual plaque around the zoo or inside educational resources such as plaque or leaflet explaining an animal as a secret and reward to individuals that	MEDIUM

		take their time to understand the animal. This would as result make individuals to stay within the zoo for longer periods of time, which would as such result in an indirect increase in profit from other services such as from the gift shop or food vendors in the case the zoo takes a proportion of the vendors profits as payment.	
3.1.4	Earning Points – Participation	To encourage individuals to interact with events and shows that take place within the zoo they should also receive a point code upon the end of an event to encourage them to visit each event, and as it is likely for every event to occur on one day visit for multiple day. They could also receive additional point redemption codes by participating in these events such as answering questions or coming first in a quiz, all of which is done to encourage the user to participate in the zoo and as a result stay within the zoo for a longer period of time.	MEDIUM
3.1.5	Earning Points – Redeeming Codes	As stated previously the feature of being able to redeem codes that reward the users with free/additional points is an important feature that need to be implemented so several other earning points method can be successfully implemented, upon implementation it would result in individuals staying within the zoo for longer periods to do more activities and to explore the zoo, alongside the possibility of them coming over multiple days to participate in events that are only operated on them days. All of this will result in them staying in the zoo for longer periods of time, generating more revenue from ticket and hotel bookings alongside indirect revenue such as from food vendors.	HIGH
3.2	Points Based System – Exchange	To encourage the user to spend their time in earning points, these points need to have an equivalent monetary value, so that the points can be converted into rewards that can be exchanged by the user, there are many types of rewards that can be exchanged but they all work under the same premises of encouraging the user to spend more time on earnings points which would result in more profits for the client while also making the user feel like they received a good reward. This is a finely tuned balance so market research and data analysis must be	HIGH

		constantly performed so the business strategy can adapt.	
3.2.1	Point Exchange – Discounts	By allowing the user to exchange discounts as one of their reward options would result in a higher chance of them returning in the future for future bookings of tickets/hotel stays, while at the same time these discounts can be given to other so they could visit the zoo, no matter how the code is used it will result in an overall increased revenue.	HIGH
3.2.2	Point Exchange – Free bookings	By allowing the user to exchange free bookings of tickets/hotel stays as one of their reward options would result in them spending more time within the zoo, which would result in increased profits from other revenue sources such as food options. Although, this reward should not be given out commonly and should have a very high price point for free bookings as if set too low people could exchange free bookings without spending little to no money within the application, which could result in the application and the client in losing money instead of gaining money.	MEDIUM
3.2.3	Point Exchange – Free items	By allowing the user to exchange free items/merchandise at the gift shop will result in them having to enter the zoo to do so, and to enter the zoo they either need a ticket or hotel booking, which as such would offset the price of the free merchandise alongside allowing for additional revenue to be generated while they are within the zoo.	LOW
3.3	Points Based System – Administrator Control	To ensure that the applications administrators have sufficient control over the loyalty and reward system alongside the points-based system, various features are to be implemented to allow the administrator to manage this system and to ensure that all users are operating within regulations, alongside this allow for the administrator to perform checks to ensure nobody is getting free points due to an oversite in the system.	HIGH
3.3.1	Administrator Control – View users' statistics	By giving the administrators the option to view user statistics it allows for them to monitor users points and how they are being used, from this data they can then ensure that all users are behaving correctly alongside collecting important information such as what items are being exchanged more than others, allowing for	HIGH

		a modification in business strategy such as increasing or decreasing the amount of points required to exchange an item according to analysis.	
3.3.2	Administrator Control – Manage users' statistics	By giving the administrators, the ability to access and manage user statistics it allows for them to assist and provide support to customer as needed, such as giving them points in case they somehow lost it or cancelling a reward in case they accidently selected the wrong item.	MEDIUM
3.3.3	Administrator Control – View Point Earning Log	By allowing the administrators to view how users are earning points it allows for them to collect important business data about the primary channels users are interacting with the applications loyalty system, and from this data they can use it and analysis it to determine the best way it can be used, such as how to encourage more individuals to booking tickets/hotel stays.	LOW
3.3.4	Administrator Control – View Point Exchange Log	By allowing the administrators to view how users are exchanging their points for rewards they can collect important data that can be used to determine what items are in high demand and what items are in low demand, from this they can then determine if an item is priced too cheaply or too expensively for a user to exchange for it, allowing them to adapt their business strategy.	LOW
3.3.5	Administrator Control – View Point Redemption Log	By allowing the administrators to view what codes are being redeemed commonly allows for them to determine what actions they should perform in relation to these reward codes, such as checking if it has been published online and in that scenario changing the code itself to prevent people from using this code for free, or if it is simply being found very often determining whether the item should be moved to make it more hidden, all of which is to be considered for the continued success and operation of the loyalty system.	LOW
4	Explore	To ensure the user can easily access any content that is required, an explore feature will be implemented within the application that will list all the important content that a user may need when researching the zoo or booking tickets/stays.	CRITICAL
4.1	Explore – Attractions	The attractions section of the explore feature will list information related to the content within the zoo itself alongside	CRITICAL

		providing information related to this such as its location within the zoo.	
4.1.1	Attractions – Interactable Zoo Map	The Interactable Zoo Map will showcase a top-down map overview to the user so they can see how the zoo is laid out, alongside this it will provide various features within that will ensure the user can perform research relating to the zoo and what type of content/animals are contained within.	HIGH
4.1.1.1	Zoo Map – Pins	On the map will be pins that are used to represent important points within the zoo, these pins will showcase information about locations within the zoo, this includes zoo specific information such as animal exhibits locations and short explanations alongside a link that will direct the user to a page for further information as required, it will also show generic information points about the zoo such as locations for parking, the hotel, restaurants/food, the gift shop, toilets, etc. All of which is important to understand when going to the zoo.	HIGH
4.1.1.2	Zoo Maps - Filter	Due to the amount of information and pins that could be on the map when it is complete it could make it hard to find specific pins/locations, as such an option to filter by specific types should be implemented so the user can easily only see pins they are interested at that time, such as animal exhibits when exploring while they could also see pins related to toiletry in the case they need to use one. This will make the users experience while using the map and exploring the zoo much better.	MEDIUM
4.1.2	Attractions – Animal Exhibits	The animal exhibits page will showcase each animal that is contained within the zoo alongside a short description about the animals itself, and the animals stored within the zoo about any unique information such as names, personality, age, etc. Alongside this, sub-pages will be made for each animal type which will contain much more detailed explanations about the animals and various information about them.	HIGH
4.1.3	Attractions – Shows and Events	The shows and events page will showcase any shows or events that will take place in the zoo in the future, from which the user could then potentially participate and/or view, and by having a constant stream of events it will make the zoo much more unique making it	MEDIUM

		more likely for individuals to return multiple times to see different shows and events that are to take place.	
4.1.4	Attractions – Conservation Areas	The conservation area page will showcase the conservation areas that are within the zoo, alongside this it will also explain their role in preserving and researching endangered species and their habitats.	MEDIUM
4.2	Explore – Visitor Information	The visitor information of the explore feature will list important information related that an individual would have to consider when booking a visit/stay, it will include information such as operation hours, directions amongst other information points. By having all this information in one section will allow for a user to easily to research the zoo and make appropriate plans.	CRITICAL
4.2.1	Visitor Information – Operation Hours	The operation hours page will specify the various operating hours of the various attractions and facilities that are contained within the zoo itself. This is information such as when the zoo beings and end operation, alongside this information for the hotel, restaurant, gift shop, etc. All of which is important information that needs to be considered when planning a booking.	HIGH
4.2.2	Visitor Information – Directions and Parking	The directions and parking page will specify the zoos' location alongside how to physical arrive at the zoo's location, this is done so any individual can easily understand the zoos' location and make appropriate travel plans to get to the zoo's location. It will also give information related to parking of vehicles/transportation, such as where they need to support the vehicle and how much it costs to temporarily store a vehicle over a specified period if there is a price.	MEDIUM
4.2.3	Visitor Information – Food Options	The food options page will specify where individuals can obtain food alongside what type of food and its pricing, this will include information related to any restaurants that operate on the zoos ground alongside any sort of food vendors that may also operate on zoo premises. This is done so the user can easily determine where they can eat in consideration to their lifestyle choices and dietary needs, and in the case no options provide appropriate food options	MEDIUM

		they can plan accordingly by bringing their own.	
4.2.4	Visitor Information – Gift Shop	The gift shop page will specify what merchandise is for sale within the shop, alongside what the user could expect to see within the gift shop inside the zoo. His page exists to encourage the user to visit the gift shop and to potentially spend money inside it. On this page it could also make references to the loyalty and reward system and state that an individual can get free merchandise /items by exchanging their points they may have received.	LOW
4.2.5	Visitor Information – Accessibility Information	The accessibility information page will specify what accessibility options are available in the zoo so that individuals with potential disabilities can easily and freely visit and interact with the zoo as an equal when compared to any other individual no matter their own status/disabilities. As such having a page listing the various types of accessibility amenities that are within the zoo allows for the individual to be reassured, that they will be appropriately assisted, while allowing them to make plans for their booking.	HIGH
4.3	Explore – Education	The education section of the explore feature will list information related to educational content that can be used by an individual to research information related to the animals contained within the zoo, alongside providing links to resources they could use to further their own studies as they wish to do so. There are also other pages for handling of the organization of field trips, workshops and classes by a third-party organization such as a school if they wished to do so.	CRITICAL
4.3.1	Education – Learning Resources	The learning resource page will specify several different resources that can be used to learn various pieces of information in relation to zoos and the animals contained within the zoos, it will provide appropriate resources and links to resources so individuals can further their studies as they wish to do so.	HIGH
4.3.2	Education – Field Trips	The field trips page will specify how a field trip could be organized and operate on zoo premises by a third party such as a school for a trip, it will provide appropriate information that would be required for the organization to plan,	MEDIUM

		prepare and operate a field trip to the zoo.	
4.3.3	Education – Workshops and Classes	The workshops and classes page will specify what types of educational workshops and classes that are taking place on zoo premises, whether it is by the zoo itself or by a third-party organization and how to get access to attend this event. It will also provide information to organizations on how to contact the zoo in the scenario they wish to host their own workshop or class on the zoo's premises.	LOW

Non-Functional Requirements

The following section outlines the non-functional requirements for the proposed solution, while these may not be literally implemented as stated, they are required as they will determine how the entire project and application is designed and implemented overall. In the table below the index is used to identify the relationship between different requirements, such as points being sub-points/further explanations of an overarching index/point, while the priority indicates their importance to the solution.

The priority values are as follows: LOW -> MEDIUM -> HIGH -> CRITICAL

Any requirements that have a priority level of CRITICAL must be prioritised within the projects planning and development process.

Index	Description	Justification	Priority
1	Security	The security of the system is particularly important, and a critical factor of the application that must be considered during the development process. This is due to the strict laws and regulations of various data protection acts within the UK and Europe as a whole. As such data security must be heavily prioritised during development to prevent unauthorized access of the system or a user's account. Failure to implement effective security measures could result in various types of sanctions from government and regulatory authorities, there are many types of sanctions, but the primary ones would include fines, interventions and forceful suspension of operation depending on the severity.	CRITICAL
1.1	Security – Data Encryption and Hashing	Any data that is stored within the application must be kept securely and protected, depending on the type of data itself extra protection methods such as data encryption and data hashing can be employed. Data encryption means that through a specific way the original value can be found via a very specific	CRITICAL

		decryption algorithm, whereas hashing is meant to be unreversible and would be used for data we do not want to store the original value of, such as passwords. This results in increased data security, and under the scenario an unauthorized individual gains access to the data, they cannot use any of the data as it is unreadable. Failure to implement this could result in sanctions previously mentioned.	
1.2	Security – Content Login Locking	By implementing a system to lock content and make it only accessible to a user that is logged into an account, we can improve the apps security, as we can now prevent external scrapers/robots from accessing our data and reducing the chance of the content being stolen and copied. It also allows us to monitor user behaviour on the site, from which we can track suspicious behaviour, and, in the scenario, they attempt to cause harm to the application we can prevent them before they can.	CRITICAL
1.3	Security – Content Role Locking	By restricting access to portions of the application we can improve the systems security and prevent chances of unauthorized user's gain access and viewing potentially sensitive internal data. This feature can then allow us to easily implement systems that only authorized users can access, from which they can monitor sensitive data without having to worry about an unauthorized user viewing this data as well.	CRITICAL
2	User Experience	The user experience of the application is very important and must be carefully considered during the design and development process. This is due to it having a direct impact that determines whether the application was an overall success or failure when it is deployed and released publicly. As such the application must have a good UX design so that people will, stay and continue to use the application.	HIGH
2.1	User Experience – Load Times	When using the application, new content should loud quickly and efficiently, so that to the user using the application it seems fast and up to date. As if the application is too slow to load its new content the end user may get frustrated and look for an alternative application or company, as such it must be kept fast to	HIGH

		ensure the user does not look for an alternative application / company.	
2.2	User Experience – UI Design	The user interface, UI, must be considered heavily as well, as a bad UI layout will also result in a bad user experience. As such the UI must be easy to use and learn for any individual that may use the application, if done correctly the user will see the application as good and trustworthy, increasing the chance the user re-uses the application and potentially purchase tickets for the zoo or hotel on site.	HIGH
2.3	User Experience – UI Responsiveness	By making the UI itself responsive to the users' interactions, it will subtly affect the user and make them feel they are interacting with the application more than they are. This can be used to show the user that the application is functioning as intended. This can be implemented on various types of interactions by adding animation on hover/focus/click/etc, all of which subtly show the user the application is working and responding to their most recent interaction with the application.	MEDIUM
3	Accessibility	The accessibility of the application is another very important factor that must be considered throughout the design, development, and deployment process. This is due to it having a direct impact that determines whether the application was an overall success or failure when it is deployed and released publicly. As if individuals that may have disabilities use the site, and it is not accessible to them there is a much lower chance for them to continue using the application, and even less chance of them booking a zoo visit or a hotel, as they could safely assume that if the application is not accessible to them, what is the chances of the location they would be visiting also be accessible to them? As such accessibility must be considered so that people with potential difficulties can use the application, allowing it to reach a wider audience and bring in more potential customers.	HIGH
3.1	Accessibility – Themes	By implementing pre-made themes into the application, we can ensure the site works correctly on these themes, and that any users that use these themes can still effectively use the application. There are many different theme types to implement, but the standard themes that	MEDIUM

		are usually implemented is `light` mode/theme, and `dark` mode/theme, as they are simple to implement being colour inversions of each other. This feature not only helps individuals with visual impairments, but it also helps users who use screens a lot, as they would most likely use dark mode as it results in less blue light being emitted reducing eye strain.	
3.2	Accessibility – High Contrast	The high contrast accessibility option would ensure that all text that is being displayed will have a contrasting background colour, resulting in the text being much easier to read and make the text stand out. This helps individuals with visual impairments that may have a hard to differentiating the difference between the text and background.	LOW
3.3	Accessibility – Alternative Text	By providing alternative text options for the images and videos throughout the application, it would help individuals that rely on screen readers to understand what an image/video is attempting to showcase and display without having to see it themselves, this as such allows individuals with visual impairments to easily use the application along with gaining a further understanding.	LOW
4	Maintainability and Scalability	The maintainability and scalability are a very important factor to consider for the application, as it ensures the long-term viability of the application. By ensuring the application is easily maintainable and scalable it will allow for further modifications and additions to the application as it grows. It will also ensure the application remains fast and stable throughout its life cycle without any major problems/bugs and without any major technical/code debt.	HIGH
4.1	Maintainability – Comments	By implementing comments within the code itself, it will make it much easier for a new developer to learn how the application and its underlying code works from which they can then expand upon to implement new features as required. We can also use a type of comment known as a `document string` or a `doc-string` for short, this is a special type of comment in a specific format that is put before custom functions that allows for you to explain what it does, what arguments it takes and why, and what type of data is	HIGH

		returned. This comment provides a lot of information by itself, but by having in a specific layout it allows for the IDE/coding tool the user is using show the user this related information by simply hovering over function calls, and without having to search through the code to find it, making the development process much easier and efficient to perform.	
4.2	Maintainability and Scalability – Modularisation	The applications code should be split into chunks of code depending on its functionality or what data it internally contains, this allows for it to be easily reused in multiple different ways throughout the application, without having to constantly rewrite code which could potentially implement unpredictable bugs as each implementation of a well-used feature is slightly different. This as a result, makes the code be much easier to maintain and scale in the future as to implement new features they can simply re-use the old already made modules in different ways, or as required simply add a new module.	HIGH
4.3	Maintainability and Scalability – Documentation	There are many ways to implement documentation that explains the applications underlying inner workings, the simplest way would be a text file, while more complicated ways would be having an interactable/searchable internal application/website that showcases the information you need. No matter which way is used, this documentation will allow for future developers to easily search the entire codebase for what type of code/modules they may need, reducing the chances of code being rewritten and introducing unexpected bugs. As a result, the application will be much easier to maintain and scale in the future as the code within is more efficient and understandable.	MEDIUM
4.4	Maintainability and Scalability – Testing	Automated testing is important to ensure the application stays easily maintainable and scalable during the long-term development of the application in the future. There are many different ways to implement automated testing, but most are implemented within the application itself and upon attempting to build the application for deployment, these tests are ran to ensure that all sections of the code works properly and as intended, in	MEDIUM

		the case a test fails it will alert the developer to the problem so they can investigate the issue and fix it. This results in code remaining stable and functioning and intended over long periods of times, and by automating it, it makes the testing time much faster than what would be required when an individual had to manually test the system, increasing the efficiency of the building and deployment process of the application.	

Key Performance Indicators

The Key Performance Indicators, KPIs, are several statistics that need to be tracked and analysed throughout the applications deployment lifecycle to determine how the application is performing, this data is gathered from several points such as how the software runs, how many users are using the application, user feedback, etc. Below are the main points that need to be tracked and analysed alongside this there is an explanation why each point was considered an important point that needs to be tracked and analysed.

- Concurrent Users – With the statistic about how many concurrent users are logged into the application at one time, we can use this information to determine how the application is performing by plotting out this data that has been collected over a period of time such as several days, weeks or months. From this we can determine if the average concurrent users are increasing, decreasing, or plateauing. This information is very important as it can help the company decide what the business should focus on next according to the data collected, as they can decide to add new features to bring more individuals in or fix problems within the application to prevent current users from leaving.

- New Users – The data point on how many new users have signed up for the application over a period of time provides valuable data related to the applications growth and expansion of its user base and the application itself. By monitoring, analysing and applying this data it can be used to assess the effectiveness of various factors such as marketing, design, new content, etc, allowing for better business intelligence and business decisions in the long term.

- Load Time – This statistic can be used to determine if there is any bottleneck within any portions of the applications backend or frontend implementation, this is done by recording how long sections of the application take to load from which this data can be further analysed to determine problematic sections of the application that take a long time to load. From this an investigation can occur into the problem and attempt to fix it and decrease the total loading times. During the collection of this data, we can also collect additional data related to the user if they have given permission to do so, this data includes information such as internet speed, resolution, etc. This data can be used to predict any possible issues that users may face when using the application, allowing us to design and implement new features with these factors in mind, and as such allowing us to fix problems before any user comes across them. This as a result, makes the users experience better and as such increases user satisfaction.

- Revenue Made – This is an important statistic as it showcases how much money the application has made from the selling of its services of hotel bookings and zoo ticket bookings; this data is important as it can be used to determine whether the application was a success or not depending on whether it was able to break even or make profit over a specified period of time. Furthermore, this can be used by business analysts to determine future business decisions in relation to the application.

- Amount of sales – This is another important data point that must be considered, as it showcases how many sales has occurred, by using this data in correlation with the previous point various conclusions can be drawn such as where the main money makers are, is it from a small set of people all purchasing high priced items, or from many individuals purchasing low priced items. This data can be used to determine how the application and the company moves forwards with its business strategies.

There are many more data points that can be further tracked, collected, analysed and learnt from, but the ones listed above are the core points that have been determined for this application, and as such will be used in the future to determine how the application is performing and to determine whether the application was successful or not. This data is also to be used to support any future business decisions related to the operation of the application and the company overall such as marketing, content, expansion of system architecture, etc.

User Acceptance Criteria

To ensure that both users and administrators can effectively and effectively use the application, various points relating to the application must be heavily considered such as the applications overall User Interface (UI) and User Experience (UX), these must be carefully considered alongside accounting for various factors about the end user, such as considering whether the user has good technical knowledge/skills, possible disabilities, amongst other factors. Alongside this the administrators also need to be considered, primarily about what extra features and data they can access which a standard user would not/should not have access to.

After consideration, the following points have been chosen as the core points and features that must be implemented within the application to ensure it is efficient, that the users who use the application can effectively perform their tasks such as looking for educational resources, booking tickets/hotel rooms, etc.

- Layout – The layout itself must be easy to navigate and use so that the end user can easily learn and understand the usage of the application so they can explore its content, as such the applications layout must be kept clear and concise while also remaining consistent throughout the application, this is done so that the user can easily understand, learn and use the application. An important layout factor that must be heavily considered is the navigation/header, as it is to be accessible on all content pages of the application, as such it must never change so the user can easily interact with the header.

- Remote Access – To ensure the ease of access to the applications and its content, the application must be easily accessible by anyone from anywhere via digital services such as the internet, as such the proposed solution has been proposed to be a web application/website, as it allows for the easiest way to access this application for a wide variety of individuals worldwide, as all they are required to have is an internet connection and an up to date web browser they can use to interact with the proposed application.

- Booking – The application must allow for the user to be able to easily book a zoo ticket or hotel stay within the application. This is done so the user can visit and explore the zoo itself. Alongside this it must also provide appropriate tools to manage their bookings themselves, alongside this it must also provide appropriate tools for administrators/staff to manage customer bookings so they can support the customers with relation to their booking/the application as is appropriate.

- Zoo Resources – The application must provide appropriate resources related to the zoo so the user can research the zoo itself, this information is related to how the zoo operates such as the operation hours and location alongside this it must provide appropriate resources on what types of attractions and facilities that are within the zoo itself. All this information is important to be shown appropriately within the application so the user can understand the zoo, and gain interest in the zoo which would eventually result in the individual either booking a zoo ticket or a hotel stay.

- Educational Resources – The application must provide appropriate educational resources relating to the animals, attractions and facilities that are within the zoo itself. This information must be kept accurate and factual to ensure that individuals that wish to learn more about the zoo and what it contains can do so correctly, this is also a legal requirement according to the Zoo Licensing Act of 1981 and as such this feature must be effectively, correctly and properly implemented according to the clients wishes and according to the law.

Above are the points that need to be heavily considered when designing, implementing and deploying the application to ensure that the User Acceptance Criteria is correct according to the clients wishes and the end users wishes.

Project Risks

The proposed solution has several risks that have been identified, these risks are potential problems towards the solutions development process, and for when it is to be deployed and released. These problems do not only affect the client but also us as well, the software development house providing the project, as such it is of high importance that several measures are taken to mitigate any possible problems and risks during the design, and development process.

The type of problems that have been identified are listed below and organized into sub-sections for easier categorization.

Cybersecurity

One of the major risks with this project is the possible cybersecurity risks/attacks we may encounter. There are many different ways a cybersecurity incident may occur, but usually they all follow a similar format of a malicious actor somehow gaining access to private sensitive data/the internal system in an unauthorized manner, from which they spend time collecting information related to the project/application itself, but also related data such as employees and users that are registered with the application, from this data they collect they could either attempt to ransom off the data and demand payment for the data they have collected to be deleted/not released, or they could sell this data onto other individuals or groups who are interested in using this data for various different reasons, such as attempting to hack into the users riget zoo account or into another account linked to the same email address.

In either scenario there will be various legality problems occurring, as there will be several investigations, inquiries, fines and possibly sanctions from governments and regulatory bodies to determine the level of the cybersecurity incident, what was affected, what data was stolen among other points. There is also a high chance of the users taking us to court and demanding compensation in the case that the data is leaked/sold to somebody, in which we would have to pay out a sum of money to each individual customer that had their information leaked/sold because of the data breach.

There are many other possible scenarios a cybersecurity incident may occur in, or which direction it takes. A list of the major and more common cybersecurity incidents/attacks are listed below, including a description on what they are, what damage they could cause, how they occur, how this incident/attack can be prevented, and how to mitigate the damage in the case it does occur.

- Unsanitized User Input – SQL Attack – One of the most common ways for a cybersecurity incident/attack to occur is due to an unsanitized/improperly sanitized user input, from which the attacker can them perform various attacks depending on the type of input field, how the input field is implemented in code, where the result of the input field is and how the input of the input field is stored within the application. Many factors including the ones listed previously are considered by an attacker to determine the type of attack they will implement, as each type of attack has different rewards to them and damage to the application. The highest risk attack that could occur due to this problem is known as an SQL injection/attack, this attack occurs when a specific string of code and keywords are inputted, to bypass an unsanitized user input fields is simple as putting in a couple of characters which would then allow them to perform an attack, but for more complicated bypasses the strings are much more complicated as the attack has to consider where each individual character goes, whether it is capitalized or not, among other factors, which if done correctly could potentially bypass an improperly sanitized user input field. After bypassing the security, the attacker can then run any SQL code they wish on the servers database, which contains the entire applications data, given enough time a malicious actor could iterate over the entire database and steal all the content within, this content then contains sensitive data such as individuals' names, passwords and other personal information along with

potentially stealing sensitive internal company data. To prevent this, all inputs that interact with the database must be sanitized before it can be used, along with this a secondary security measure can be implemented which keeps all the data inside the database secure via encryption and hashing where applicable, as such in the case a malicious actor gains access to the data, they cannot use any of it as it is encrypted/hashed. To further increase security segmentation and modularisation of the database and tables can be done, by keeping data in separate tables, database and even servers where required, this would result in less of an impact in case of a successful SQL attack as they would have stolen less data/information.

- Unsanitized User Input – XSS Attack – Another common attack that can occur from an unsanitized user input is an attack known as a Cross Site Scripting attack, also known as XSS, although this attack is not as damaging as an SQL attack, this attack can still cause a lot of damage overtime and depending on what type of XSS attack it is. There are two versions of an XSS attack, the first version is an reflected/dom-based XSS attack which is only temporarily and requires social engineering for this attack to successfully work, as it requires convincing a user to click on a link, whereas the second version is much more dangerous as it is known as an stored XSS attack, the user doesn't have to do anything all they have to do is be on the same page as this attack and they have been affected by it, making it a silent attack and very damaging. There are many different types of XSS attacks, but the more common versions are either making a fake popup appear asking the user to login again to steal their login credentials, or simply stealing the user's current session data and then sending off this stolen/collected data to a third-party/malicious actors' server. To prevent this any external fields that could possibly be from a user or possibly be tampered with by a malicious actor must be sanitised before it can be handled to remove any possible XSS attack, although this is not perfect as some malicious actors may bypass the sanitisation. For further security, the implementation of sandboxing can be done which would result in any content that is loaded dynamically be in its own environment, which would prevent any malicious code from automatically stealing any user data, but this does not prevent the popup method stated previously. For further security different Content Security Policies (CSP) can be implemented alongside implementing Cross-Origin-Resource-Sharing (CORS) can also be implemented, specifically the CORS will prevent any data from being leaked/being sent to a third-party/bad actor if properly setup as it prevents any requests to untrusted third-party sites.

- Malware – Malware is a common way of gaining access to systems, accounts, etc. There are many different types of malware that exists such as spyware, keyloggers, trojans amongst others, these types of malware are commonly attached to legitimate software that has been modified by a bad actor and reuploaded online commonly on insecure/incorrect location, from which an unexpecting user could then download it and use the software although it still works as intended, as they use the application the malware within uses this time to infect the users system and to attempt to implement whatever instructions the malware has been given. In the scenario an employee gets infected with malware, it can allow for the bad actors to use that employees device as a springboard to further infect the systems they have access to, along with hacking into the system to elevate their privileges and gain further access, in this case the bad actors could cause significant damage to the company and application by stealing internal data from which they could possible use to sell it to an individual/group or to possible blackmail the company and demand money for the data to be deleted/destroyed or in the case of a trojan/ransomware it will encrypt the entire system and demand a ransom payment for the decryption key, which if the user does not pay all the data will be deleted and destroyed permanently. To prevent any of this occurring we must implement keep both employee devices and internal systems secure by maintaining up to date software versions and security measures such as running, updating anti malware programs, firewalls, etc to keep the system secure, and with the software we install we must operate them such as running scans to monitor for suspicious activity within the system. To

reduce the chance and risk of an employee being infected with malware, training must be given to all employees, so they know how to keep themselves and their devices secure and threat free. To mitigate the possible impact and damage in the case a successful attack does occur we must keep backups of all important system setups and data in several different locations to ensure that we can quickly and efficiently take down infected systems while bringing new systems online, for storage of the data there should be first localised backups that is not connected to the internet along with having a secondary backup at an offsite undisclosed location that is also not online the case the local one somehow is infected or destroyed. With this we must make sure backups are taken routinely to ensure that they are kept up to date as possible, alongside this we must also run drills for the security teams themselves to ensure they are trained on how to handle the during and after effects of an attack, these drills would require for them to take down infected systems while loading new systems up with the data from either the localised backup or the offsite backup, during which they must ensure that systems are brought online quickly with all related data.

- (D)DOS – (Distributed) Denial Of Service Attack – This is two different attacks that run off of the same principle, the only difference between a DDOS attack and a DOS attack is the scale of the attack and the amount of devices used to perform the attack, during a DOS attack it is simply one device that is sending a lot of traffic to overload a system and bring a system offline, or one device that is exploiting a vulnerability to bring a system offline, whereas during a DDOS attack is the same as a DOS attack but on a marge larger scale as instead of using one singular device, a botnet is used to perform the attack resulting in thousands of devices for a very small scale DDOS attack whereas millions to tens of millions are used for large scale DDOS attacks, during which the total network traffic coming in rapidly increases with reports from companies that have faced this attack of receiving 1 terabit of data per second. These attacks can result in entire systems crashing or going offline due to overloading server resources, which will result in a disrupted ability to use the application as the attack results in service outages, which can then directly result in financial loses as the application is offline and as such user's cannot book anything, along with this it will also result in reputational damager and customer dissatisfaction which can make new, potential and current users less likely to use the application as they don't see the system as secure compared to a competitors system. To prevent a (D)Dos attack various security measures can be implemented such as traffic filtering, rate limiting to prevent the number of requests coming in, etc. Content delivery networks (CDNs) and load balancers can also be used to distribute network traffic over several different servers, reducing the overall stress on a singular server as multiple servers are helping it. In the scenario a successful (D)Dos attack is occurring/has occurred, various temporary security measures can be put in place to make the application useable to most users, however it is not recommended to keep these systems online permanently as they could cause disruptions or blocks to innocent users, and as such should only be used as they are required to.
  One of the ways is via traffic filtering, this can be done by an administrator who is managing/has access to the firewall, as upon finding a pattern amongst the requests such as all requests having the same user agent or that they are coming from one location/country, a rule can be implemented to block any requests that match these criteria, while this does help block the attack, it can also accidently block innocent users that are attempting to use the system.
  Another way is via blackholing, this effectively cuts off the server from any incoming network traffic by rerouting all network, both legitimate and malicious, to a null route commonly known as a "blackhole" as it is dropped from the network, although this is not an ideal solution as it still effectively achieves the attacker's goal of making the system unavailable/inaccessible. The most common way is via a Cloud-Based DDoS protection service such as Cloudflare, it monitors network traffic coming into the system and upon detecting a (D)Dos attack it implements several security measures dynamically, the way it does so is similar to traffic filtering but much more complicated, as the protection system analyses all the incoming requests and finds common

patterns between the attacks, from which a signature is generated and then checked against any other incoming requests which can then be used to block only malicious requests from coming in, effectively protecting our system and blocking the (D)Dos attack.

- MITM – Man In The Middle Attack – These attacks are less frequent than the used to be in the past, but it is still a commonly used method to listen into network traffic, and to steal data. This is very bad for a normal user as the attacker can listen into their network traffic, and in the case they use the application they could potentially steal their login credentials or current session data, but this danger is further expanded upon in the scenario the attacker was able to get the login credential/session data of an administrator account. To prevent this from occurring, all network communications must be held over secured networks such as HTTPS and if the user attempts to use an insecure network such as HTTP, the application should forcefully redirect them to the secured network. Although this works in some scenarios the attacker may be able to decrypt the HTTPS secured network traffic, so further security measures such as encrypting all communications via encryption algorithms should also be introduced, these algorithms should use dynamic data such as the current time as a part of the encryption/decryption method to prevent the attacker from reusing this data in a replication attack. By implementing this any network data, they may intercept or attempt to understand it, but it is useless as they cannot do anything with the data they intercepted/collected via the MITM attack.

Humans

Humans are another major risk factor that needs to be accounted for during the development, deployment and operation of the application, as humans are relatively unpredictable in with what they do. However, many common risk incidents have occurred in the past, allowing us to make some predictions on what could occur. Below is a list of potential human incidents that can occur, and how to prevent it and mitigate damage in case it does occur.

- Sabotage – Individuals/Employees that are upset with the company may purposefully sabotage their own work, other individuals/employees work, or potentially the application itself. This is usually done in retaliation against the company due to an incident, such as having disciplinary action taken against them, being fired, or for simply having a bad day. There are many ways of sabotage that could occur, but the main concern is with them possibly stealing information within the application and its database, as such to mitigate this problem access to the database credentials must be kept a secret and, on a need-to-know basis. Along with this all actions an individual takes that could potentially affect the application such as viewing/downloading or deleting data should all be logged, of which the user cannot remove/modify. To further mitigate the severity of this in case an individual somehow does gain access to the database, all data must be contained securely within the database by applying appropriate security measures about the data itself such as data encryption and data hashing.

- Absence – Due to various reasons employees can temporarily be absent from their job, which as a result will then result in whatever they are managing/working on to be down an employee, as such this disruption will result in other employees having to perform more work along with potential delays of the work itself, potentially reducing the company and the applications revenue. As such to mitigate this disruption to make it as minimal as possible other employees must be trained beforehand to perform other individuals work, so that they can temporarily take over the work until the original employee has returned and can take over their tasks once more.

- Leaving – Similar to absence, leaving is in the same vein but much more complicated to handle as the employee has permanently left and will not be returning. As such the previous method of

having other employees temporarily cover the work the original employee was managing/working on can also be implemented temporarily until a new employee can be hired. As such the process of hiring a new employee must be complete quickly so they can take over this work again, however they would most likely not be able to jump right in as they would need training as such the training method/guides must be well designed, efficient and take a minimal amount of time so the overall disruption of an individual is lessened as much as possible, as failure to do so could result in potential interruptions to service which would as a result potentially result in lost revenue.

- Resistance to Change – As individuals are used to how their current implementations of booking zoo tickets or hotel rooms, they may be resistant to change and wish to use the old method/implementations, to prevent this we must encourage individuals to use the application via several ways such as implementing unique features, being more accessible, being more user friendly along with implementing the loyalty system to encourage users to use the application. To minimise the disruption from switching from the old system to the new system, the application, both should operate at the same time temporarily, from which the old system will slowly be taken offline and will encourage users to move to the new system to perform the actions that have been taken offline.

UI/UX

The UI/UX (User interface/User Experience) is another factor that must be accounted for during the designing and development process of the application, as if the UI is poorly implemented it will result in a bad UX as such, making the process of using the application much harder as such there is a higher chance of the user not using our application, and to potentially go to a different application/competitor. As such to mitigate this problem as much as possible, user research must be done during the initial development process, along with further research done during any future development of the application. This information can either be gathered from performing market research, or by directly asking individuals for feedback related to the application, which will allow for more direct feedback as such making the application be improved further when this feedback is implemented into the application.

Another common problem that can occur during the development process of the application is inconsistent UI elements, as consistency is very important so that users feel like the application is well designed and secure, along with this by keeping UI elements consistent it will make it much easier for a user to easily learn how to use the application and more likely to use it long-term, which as a result increases the chances of them purchasing services from the client, such as booking tickets or hotels. As such the UI must remain consistent throughout the application.

Accessibility is also an important factor to considered when considering the UI and UX of the application, as if it is improperly/poorly implemented it could result in less customers from individuals that may rely on this feature as it does not support the sufficiently or effectively, as such to prevent the risks of users and potential customers leaving, accessibility must be heavily considered on how it is to be implemented along with implementing it as designed.

Bugs

When implementing digital solutions on the scale that is being proposed, bugs are an inherit reality, not an exception. This is due to the complexity of the underlying application/system making it nearly impossible to test all possible iterations/scenarios which could potentially cause bugs or related problems, as such automated unit tests must be designed and implemented to make sure that sections of the system work as intended and are performing efficiently. However, some systems cannot be

automatically tested, as such manual testing must also be performed to ensure that the application works and operates correctly. Failure to do so could result in these bugs/errors being displayed to the end user which could cause potential frustration, confusion and annoyance to them resulting in a bad user experience.

Overtime certain features may break or stop working as it originally was intended to do so, the automated unit testing and manual testing should catch most of these problems, but sometimes these problems are missed, especially in very old or obscure features. As such by implementing a way for the user to report bugs and potential issues to the developers should be implemented, this will result in the developers being alerted and then spending time to fix the problems that have been reported, afterwards further additional testing can be implemented to prevent any further bugs with the feature.

Scope

Due to time not yet being controllable, the 30 hours that has been allocated for the development timeframe is very short, as during this time we must fully implement all the previously stated features, security, and designs. As such there is a heavy limitation on how many, and what specific features can be fully or partially implemented within the specified time frame.

Along with the heavy time frame, a staff constrain of a singular employee was also implemented, of which they must propose, design, develop, implement and test all by themselves within the very short timeframes they have been given, reducing the overall quality of work, analysis of problems and implementation of code than if a longer time frame was given or additional members were allocated to this project.

Due to these heavy time and staff constraints, it is highly possible, and likely, that not all features will be implemented fully or partially within the allocated 30-hour period. As such to minimise the impact of this constraint, certain functional and non-functional requirements have been prioritised over other features, while more complex feature may have been temporarily put aside for further/future development.

Additionally, there is a high chance of bugs occurring throughout the application and underlying system, as there is not a sufficient amount of time to write the code, design tests, and perform them on the application. As such this could result in unexpected and/or incorrect outputs from the code due to insufficient testing due to the time and staff constraints.

Project Design

The projects User Interface (UI) and User Experience (UX) must be considered during the applications designing and implementation processing and ensure the application is easily useable and accessible to all users regardless of their technical knowledge or skill, along with accounting for individuals with possible accessibility concerns due to personal health issues such as disabilities. To implement this, various methods will be used such as using common icons along with text to make the UI simpler to understand, along with providing accessibility options into the application itself such as different themes, high contrast made and alternative text for images and videos within the application.

The projects colours and theming are based off the client's logo and branding they provide us with. However, the client has yet to provide this information, as such to allow for further progression of the proposed solution a temporary colour scheme has been chosen during the applications design and development process. Due to this, a feature to allow for the colour scheme to be easily changed out will be implemented, which can then be used to add the clients branding once they provide us with the aforementioned information.

Additionally, all UI elements will be implemented to be easily modifiable, changeable, and scalable so that various accessibility features can be implemented to assist the users of the application.

To see the visual representation of these designs, please see the file named the following, ` Task1_DesignDocs_Document_LL-000013271_Whittaker_A.docx`. This document contains the various visual representations of the design, along with various diagrams such as the Use-Case-Diagram, Hierarchy Diagram, and the flowchart representation of various algorithms to be implemented within the proposed application. It also contains the project data and its entity relationship diagram, along with the projects testlog.

Project Security

Within the sub-headings below, an overview of how the proposed solution will be protected alongside what security implementation that will be implemented are listed below. Each section contains relevant information relating to securing a singular part/topic of the project.

Hardware Security

To ensure that the device and the hardware that runs the backend system of the application stays secure, and stable. Various security mechanisms are to be implemented that protect the devices security.

- Anti-Virus Software – In the scenario malware somehow gets onto the system, this software will detect it and prevent it from executing itself, this is done by constantly scanning the system for suspicious files while checking files against several criteria to determine whether it is an already known piece of malware, or potential malware due to dangerous internal code. As such this software must be installed onto the server, alongside any devices that may connect to it to ensure everything is kept secure. Additionally, the software must be kept up to date so it can prevent and block future malware.

- Firewall – The firewall acts as a barrier between the internal network traffic of the system and the network traffic from external systems, the firewall monitors all incoming and outgoing network traffic. This is done to prevent any dangerous files or unauthorized access to the system, while at the same time prevent any sensitive data from leaving the system. It also helps protect against cyber security attacks such as a (Distributed) Denial of Service attack, (D)Dos.

- Intrusion Detection (IDS) – An IDS system monitors network traffic for suspicious activities and for potential security breaches. It analyses the network packets, logs, and system events to find patterns that could possibly indicate an attack or intrusion. In case it is detected it will alert administrators, allowing for them to investigate the issue and respond to the issue in case of an intrusion or attack.

- Physical Security – To ensure that the physical hardware itself is not compromised, first any hardware we purchase must come from trusted sellers and come in sealed boxes, and upon arrival any possible devices must be wiped and flashed with new data from the manufactures to prevent any sort of attack where malware may be hidden within the hardware itself. Alongside this to secure hardware once deployed several other measures are to be implemented, such as secured server rooms with limited access to the rooms, it must also include video cameras and alarm systems to monitor and alert for any physical intrusions. This is done to restrict the physical access individuals to the hardware and prevent unauthorized tampering or theft of the hardware.

Application Security

To ensure that the application itself is secure, stable, and operates without any security issues, various measures are to be taken to ensure this.

- Sandboxing content – By isolating all content from third-party sources, it prevents potentially malicious code or untrusted content from individuals. By sandboxing it prevents it from affecting the rest of the system, or the pages content. As by confining the code exaction to a restricted area, without any access to data such as user session tokens, it prevents the malicious code from stealing this data. As such sandboxing must be implemented as it provides and additional layer of protection against code injection attacks, and unauthorized access to system resources.

- Cross-Site Request Forgery (CSRF) protection – CSRF is a feature built into web browsers that prevent attackers from impersonating users into performing actions on the application. A common way is via the usage of CSRF tokens, which are unique tokens embedded into web forms or requests, which the server verifies the presence and validity of to ensure that the request originated from a legitimate user.

- Input validation – To ensure that all user-provided data input is properly validated and sanitized before being processed further by the application. By validation and sanitizing input, it can prevent common vulnerabilities and attack vectors such as SQL injections and cross-site scripting (XSS) attacks. There are many ways to validate it says as data type validation, length checks and the usage of serialization code/libraries to ensure that provided text is clean and cannot affect the operation of the system.

- Secure coding practices – We must ensure we follow secure coding guidelines and best practices when developing the application to ensure that the application is secure, and efficient. This includes avoiding insecure functions, validating any input and output text to prevent any attacks from coming in, and prevent any data from going out in case of a successful attack along with this implementation of proper error handling to ensure the application does not break when an error occurs. To ensure this regular code reviews and security testing can occur, which will help test and address potential vulnerabilities within the code.

- SSL/TLS – To ensure that all communications between the end user and the application remain encrypted and secure, the implementation of an SSL certificate for the applications web domain must be done as it allows the browser to remain private and protected from unauthorized access and prevents potential cyber-attacks such as a MITM attack. In addition to this whenever the user is detected of using an insecure link, one that starts with `http://`, the application should forcefully redirect them to a secure link, one that starts with `https://`.

Data Security

To ensure that any data we collect is stored securely, various security measures can be implemented to confirm this.

- Secure Database – By setting up a secure database configuration which includes access controls, strong authentication systems and regular updating and patching of software to prevent against unauthorized access and data breaches. It is also crucial to restrict access to the database, allowing only trusted authorized personnel being able to interact with the sensitive data that is stored.

- Encryption – This is the process of converting data into an unreadable/understandable form of data, that can only be understood when put through a specific decryption algorithm with the correct parameters, such as a decryption key. To protect sensitive data both in network traffic and when stored in the database, encryption algorithms such as AES (Advanced Encryption Standard) should be used to ensure the data is encrypted. Alongside this secure management of the encryption and decryption keys is essential, as in the case this key is stolen the individual who potentially stole the data could decrypt the data given enough time.

- Hashing – Like encryption this is the process of converting data into an unreadable/understandable form of data, but this time it is one way, and cannot be reversed to get the original result. Within ASP.NET MVC Identity, the passwords are stored this way, by using a hashing algorithm known as PBKDF2, Password-Based Key Derivation Function 2), is used

alongside various parameters to ensure its security, such as using HMAC-SHA256, a 128-bit salt, a 256-bit subkey along with performing 10000 iterations. All of this is done to ensure the password is secure, and that nobody can get the original password.

Authentication and Authorization

Authentication and Authorization are also important factors that need to be considered within the application itself, alongside the access to the development systems.

- Multi-factor authentication (MFA) – This adds in an extra step during the login procedure, by asking for a confirmation of the login attempt on a different device. This as a result makes it much harder to get into an account by infecting a device, as you also must somehow infect this other unrelated device that can confirm the login attempt.

- Role-Based Access Control – By segmenting system access depending on user roles, it increases the applications security alongside the development system security, as individuals can only access content related to their role. As such users can only access the systems to use the application, while administrators can access internal information related to this system, this is done via the role-based access method.

Overall Security

Above are various methods that can be used to ensure the security within several locations including the physical hardware itself alongside how it is stored, how the application is implemented and interacts with external data, how the data itself is stored securely via various methods, along with different ways to ensure that unauthorized individuals can't gain access to accounts or unrelated content.

However, this won't work if you do not also consider the most basic of security measures, and that is keeping all software and hardware that operates on the systems up to date, as overtime security vulnerabilities may be discovered, and if you do not update the software you leave these security vulnerabilities wide open for a potential attacker.

Alongside this, it is hard to test your own systems as you subconsciously do not test features that could be vulnerable, or don't test features that you believe are not vulnerable but could possibly be vulnerable. As such hiring an external firm to perform security tests and audits on the application should be done to ensure that the application is secure, these test would most likely be via penetration testing which is getting individuals to attempt to hack into the system with limited knowledge of how the application works internally like a real external malicious actor, then afterwards repeating these tests after understanding how the system works internally like a malicious actor that potentially has access to the code.

Appendix

Source 1 – Research Document

The document attached below is the research document that was made during the designing and planning of this task.

Table of Contents

Riget Zoo Adventures – Task 1 – Research Document

The following document contains research related to the proposed solution and design for the client, Riget Zoo Adventures, it contains surface level information related to what type of hardware and software is used within the Tourism and Leisure sector, potentially what newly emerging technology can be implemented within the clients infrastructure to make it more modern, and more interesting to potential customer along with the specific legal and regulatory guidelines we and the client must follow during the development and operation of the proposed solution.

Within this document any references to the term `client`, is intended to reference the company `Riget Zoo Adventures`, the term `client` is used to improve readability within the document, along with improving reader experience.

Within this document any reference to the term `we`, is intended to reference the software development house that has been contracted for the proposal, designing and development of the requested application from the client, the term `we` is used to improve readability within the document, along with improving reader experience.

Hardware used within Tourism and Leisure sector

There is a variety of hardware that is used within the Tourism and Leisure sector, some of these devices have been listed below, in which it explains what the device is, what its use is for, and any notable examples of these devices being used within the Tourism and Leisure sector prior.

- Point of Sales System Hardware – these systems are used throughout various sectors and industries including the tourism and leisure sector. This hardware is usually in devices such as tills that an employee operates and are commonly used in various establishments so that payment can be received such as in purchase tickets, sales in shots, food, and beverage sales amongst various other sale points.

- Self-Service Kiosks – these kiosks have two primary uses, the first being to showcase information relating to the facility they are currently located at, these kiosks then show appropriate information relating to the facility. Within a zoo they could be spread throughout the location and contain an interactable map, so that individuals may use it to find specific attractions and facilities within the location. These kiosks are also used in food locations that have a permanent building/housing, these kiosks can be used by the customer to place their order through it without having to interact with anybody, making it easier for the customer to specify what food they wish for alongside any requirements, in this case these kiosks are also usually have some sort of payment system as well to accept card payments.

- Digital signs – these signs can be used to display short pieces of information and promote events/services that are currently operating. Within the tourism and leisure sector these signs can be seen in various location showcasing upcoming events, showtimes, offers or directions to attractions. During emergencies, these signs can also be changed to information on how to stay safe during an emergency.

- Security Systems – several different security systems are used within the tourism and leisure sector, the primary ones are cameras to monitor and to protect property within the location by the monitoring of crowds, detection, and prevention of unauthorized access to restricted access and to deter theft and vandalism. Other system such as keycards may also be implemented to segment access of the location depending on one's access level, a standard user would not have a card whereas staff would have a low-ranking card to access the facilities they need, and as their security level increases, they get access to cards with further access to the location.

- Audio-Visual Equipment – Many different types of equipment's can be used such as projects, sound systems, screens, etc, for many reasons such as to showcase presentations, performances or to provide information. Within a zoo it can be used to engage with visitors while also providing educational opportunities to individuals.

- Internet of Things (IoT) – The Internet of Things is used to simplify operations within the location and to enhance visitor experiences. Within the tourism and leisure sector a well-known and good example of IoT being integrated is with Disney's MagicBand system, this technology allows visitors access to appropriate areas such as hotel rooms, make purchases through the band along with using to get access to attractions seamlessly through a wearable device. Make it much more convenient to explore the location. This also gives Disney a lot of information about how individuals move around and interact with the location, which can be used for further business strategies.

Software used within Tourism and Leisure sector

There is also a variety of software used throughout the Tourism and Leisure sector, below is a list of different types of software with explanations of what the software does and is used for, and if there is any notable examples that we could possibly use for reference/guides or to be implemented within the proposed solution.

- Point of Sale Software – for the PoS hardware to work equivalent software must be used, this software allows for the process of payments, management of inventory and the ability to generate reports from collected data. This streamlines the operations of the system improving efficiency in both frontend and backend operations. An example of a PoS system is Stripe, it is commonly used for online purchases as it allows for a wide range of payment processing for low fees along with being easy to implement with systems.

- Travel and Tourism Management Software – This software is designed to help manage bookings, reservations, and other travel-related operations. This helps streamline the process and ensure smooth, efficient operation of the infrastructure within the tourism and leisure sector.

- Online Booking Systems – These systems allow for customers to easily make reservations and purchase tickets for hotels, zoo access, experiences, and other services from anywhere while they are online. This makes it much easier for visitors to book trips to the location, increasing revenue.

- Customer Relationship Management Software (CRM) – This software is used to manage and track visitors and customers interactions and preferences. It can then use this collected data to help the business make specific, personalized marketing efforts towards customers making it more likely that they book a visit, improve customer satisfaction and customer loyalty.

- Revenue Management Software – This software analyses the data the company collects and then gives optimized pricing strategies to maximize revenue and to make prediction on future demand of items. Commonly used to ensure that the company has the best prices compared to competitors so they can bring in more sales than others, increasing overall revenue and total profit.

Newly Emerging Technology

The following sections contains different types of newly emerging technologies being developed and tested, along with how they could be possibly implemented within the client's infrastructure to improve efficiency, and to bring unique experiences to the customer.

Artificial Intelligence (AI)

Artificial Intelligence is a rapidly evolving field of technology that is integrating itself within the interworking's of many companies worldwide, as such to ensure that the application and the company can stay up to date and efficient, the usage of AI must be considered.

There are many ways that AI can be implemented, but from research the primary way that it is being used is for data analysis and for customer support. For customer support, there is a front-facing AI chatbot that can help most users with their inquiries or problems, this allows for much faster and quicker response than a human while at the same time reducing the operational costs of the application, however there is still downsides as AI chatbots are not perfect, and if not prompted correctly could result in incorrect data it hallucinated or even potentially dangerous information, as such AI chatbots must be considered heavily and to be used sparingly.

For data analysis there are many tools that analyse customer data, of which this data is related to several different data points, such as direct feedback from customers while at the same time containing indirect data from the customers such as how long they spend on each page, what items a lot of people are viewing, etc. All of which can then be used to help business decisions related to the application and company, such as running promotions on hot selling/low selling items to encourage more purchases.

To make the company and application unique there are many ways to implement new features that are related to AI, however before they can be implemented heavy research must be done to determine the potential risks it could cause from bad AI generations/hallucinations as this could cause potential legal, physical and reputational damage if not handled accordingly.

Virtual Reality (VR)

Virtual Reality is being utilized within the tourism and leisure sector to enhance customer experience before and during visiting the location. Before visiting, visitors can use VR to have a virtual tour of the location, providing them with a preview of what attractions there are along with helping them visualize and plan their visit more effectively. VR can also be used while at the locations as specific attractions, such as in a zoo a VR headset could be connected to a 360-degree camera that is within an animal exhibition, so that upon wearing the device they appear to be inside the exhibition and can get a much closer view of the animals.

Augmented Reality (AR)

Augmented Reality is another technology that is being integrated with the tourism and leisure sector. AR can be used to provide real-time information related to the location and enhance the visitor experience while they are at the location. For example, in a zoo, AR can overlay digital information about attractions and exhibits, explaining factual statements about the animals contained within while also providing more personalized information about each specific animal, such as what its name is, how old it is, etc. This allows for visitors to learn and engage with their surroundings in a more interactive way.

Internet of Things (IoT)

The Internet of Things is a technology that allows for the connection of various devices and objects to the internet enabling them to easily communicate with one another and to share data. Within the Tourism and Leisure sector, IoT can be used to simplify customer operations while at the location and enhance customer experiences. A good example of this is Disney's MagicBand system as that is an IoT system. While using the IoT system data can be collected about the visitors so we can create personalized experiences or recommendations for them from the preferences we have determined from their data.

Legal and Regulatory guidelines in the Tourism and Leisure sector

There are various legal and regulatory guidelines that must be followed related to the Tourism and Leisure sector, several of the following specific acts and guidelines have been identified and outlined below.

- Data Protection Act (2018) – This act states various rules and regulations related to how personal data is kept securely, protected and private. As such any data that may be gathered about the individual needs to have appropriate data security measures, along with obtaining consent for further data collection and usage.

- Equality Act (2010) – This act was made to prohibit discrimination, harassment and victimization on the grounds of individual protected characteristics, as such ensuring that everyone is treated equally.

- Health and Safety at Work Act (1974) – This act specifies the duties an employer has regarding the health, safety and welfare of its employees and customers. It requires for them to perform risk assessments of their working environment, providing appropriate training to employees so they can effectively and safely perform their job duties along with requiring them to maintain safe working conditions.

- Consumer Rights Act (2015) – This act provides protection for the consumers/customers in various sectors, including the Tourism and Leisure sector, it specifies the right a customer has when purchasing goods and/or services from a company, such as expecting them to be provided and performed with reasonable care and skill, right to receive goods and services that match descriptions provided, and the right to a refund or equivalent compensation for substandard product/services.

- Package Travel Regulations (2018) – This act provides protection to customers who purchase package holidays, it specifies the rights and obligations of the tour operator/provider the and the customer, including refunds, package changes, and liability for any issues that may occur during the trip.

- Zoo Licensing Act (1981) – This act specifies how a zoo is to operate within the UK, along with how to apply for a license, renew it, how to manage animals among other various points. It also states that appropriate educational resources must be given according to the zoo's sizes, such as information about biodiversity, habitats, behaviour, etc.

Legal and Regulatory guidelines in the software development industry

There are various legal and regulatory guidelines that we must follow during the development and deployment of the further outlined proposed solution, the following specific acts and guidelines have been identified and outlined below.

- Data Protection Act (2018) – This act states the rules and regulations related to how personal data is kept securely, protected, and private. To ensure the proposed application follows these regulations, we would have to implement appropriate data security measures within the application, obtain the user's consent for data collection and usage, along with providing full transparency to any individual about how the collected user data will be used, processed, analysed and protected.

- Intellectual Property Act (2014) – This act states that individuals have control over the content they produce, as such they can determine how it is used, such as what credit/attribution must be given, along with any monetary compensation required for the use of the content within the application.

- WCAG (Web Content Accessibility Guidelines) – Although this act is not a legally binding one enforced by governments, it is a well know set of guidelines developer by the World Wide Web Consortium (W3C) and it is heavily recommended for all digital content on the web to follow these guidelines so individuals with disabilities can also interact with their application. Within these guidelines it provides technical and design standards to make the digital content on websites perceivable, operable, understandable and robust for all users regardless of their abilities and possible disabilities. These guidelines have been constantly modified and kept up to date with modern software standards since its initial release in 1999.

- Equality Act (2010) – This act has a set of laws and regulations that specify that developed systems must be easily useable and accessible to all and ensure that everyone is treated equally and receive equal treatment and opportunities.

Although the following are not specific legal or regulatory acts we must follow, we must heavily consider the following points within the application during its development process along with when it is eventually released a deployed publicly for real users and customers to interact with.

- User Privacy and Consent – We need to ensure that we respect user privacy and obtain their consent before any data collection or sharing has occurred. As such we need to provide clear privacy policies related to the user's individual data. From this we must also keep such personal data/information secure and private.

- Security – Although no direct law/regulation that states how a system must be kept secure, there are various types of fines and interventions that can be held against the application and the company operating the application from regulatory authorities in the case the application has poor security/management. As such to prevent this from occurring the application must be developed with security in mind to protect user data and prevent unauthorized access.