# **Introduction**

# **Discussion**

# Web Application Documentation

This web application can be used by visitors to allow themselves to become more familiar with the Accident and Emergency Department. This application can also be used by authorized staff to update specific sections like the Frequently Asked Questions area. This web application was created using HTML, CSS, Bootstrap and Javascript/Node.js. Various features from Font Awesome and Google Fonts were also used. Bootstrap was the front-end framework of choice, since it design for responsiveness to varying screen sizes like mobiles, tablets and Desktops/Laptops. Node.js was the ideal choice used to enable back-end functionality like Login Authorization using the Access Control List and storing the record of each log in. This application was designed to be user friendly and functional for the requirements.

When a visitor starts the application, they are given the option to log in using a guest ID and password. In the case of an incorrect log in information being entered, the visitor will be notified and inferred to enter the correct log in details. Upon successful log in, they would be prompted to enter their name and the name of their child. The visitor will not be allowed to leave these fields blank. Upon successful submission of this information, a record of their name of time of logging on would be sent to a file on a server and the visitor is then taken to the homepage. Depending on what device they are currently using, the web application will have a different appearance. At this point they can view the information displayed on the homepage or navigate to another section. At any point, the user will be allowed to log out using the navigation bar.

Upon view of the Wards page, they will be shown varying procedures and rules of the department and information about the ward they would be staying in, if admitted to the hospital. Upon view of the Frequently Asked Questions page, the visitor can view all questions and answers pertaining to the department.

When an authorized staff member starts the application, they will be given the option to log in using the administrative page. They would also be notified of any incorrect details entered. Upon successful log in, a record of their name and time of logging in would be sent to a file on the server. The authorized staff member would be able to view the same responsive pages as the visitor, along with having similar features. The one difference would be the view of the Frequently Asked Questions page. On this page, the staff member would be allowed to update the page by entering new Questions and Answers. Upon successful submission of this information, the page would be updated for both authorized and guest users.

# Test Cases

# Unit Testing

# Test Scenario 1

# Equivalence Class Partitioning

Let Guest Name = G and Child Name = C

G = 0, C = 0 satisfies G < 1 and C < 1

G = 3, C = 3 satisfies G >= 1 and C >= 1

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 1-1 | Check if Guest Name and Child Name >= one character | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “Sam”  Child Name = “Gary” | User would successfully enter homepage | User successfully entered homepage |
| 1-2 | Check if Guest Name and Child Name < one character | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “ ”  Child Name = “ ” | User would never leave security page | The input boxes await at least one character |

# Boundary Value Analysis

G = 10, C = 10 satisfies nominal values for G and C

G = 1, C =1 satisfies minimum for G and C

G = 2, C = 2 satisfies just above minimum for G and C

G = 20, C = 20 satisfies maximum for G and C

G = 19, C = 19 satisfies just below maximum for G and C

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 1-3 | Check if Guest Name and Child Name = ten characters | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “Clementine”  Child Name = “Joan White” | User would successfully enter homepage | User successfully entered homepage |
| 1-4 | Check if Guest Name and Child Name = one character | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “S”  Child Name = “G” | User would successfully enter homepage | User successfully entered homepage |
| 1-5 | Check if Guest Name and Child Name = 2 characters | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “Sa”  Child Name = “Ga” | User would successfully enter homepage | User successfully entered homepage |
| 1-6 | Check if Guest Name and Child Name = 20 characters | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “Samantha Eve Jackson”  Child Name = “Chrissio Eve Jackson” | User would successfully enter homepage | User successfully entered homepage |
| 1-7 | Check if Guest Name and Child Name = 19 characters | User must have successfully entered their Guest ID and password | 1. Enter test data for Guest Name 2. Enter test data for Child Name 3. Await results | Guest Name = “Sam Annette Jackson”  Child Name = “Chrissy Eve Jackson” | User would successfully enter homepage | User successfully entered homepage |

# Test Scenario 2

# Equivalence Class Partitioning

Let A = Admin Name and P = Password

A = Valid, P = Valid satisfies A = Valid and P = Valid

A = Invalid, P = Invalid satisfies A = Invalid and P = Invalid

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 2-1 | Test when Admin Name and Password are both valid | The user must have Node.js running and have selected to login as an admin | 1. Enter Admin Name 2. Enter Password 3. Await Response | Admin Name = “Jake”  Password = “entering” | Admin User should have a successful login | Admin User should have a successful login |
| 2-2 | Test when Admin Name and Password are both invalid | The user must have Node.js running and have selected to login as an admin | 1. Enter Admin Name 2. Enter Password 3. Await Response | Admin Name = “Karl”  Password = “lake” | Admin User would be notified of a username or password error | Admin User would be notified of a username or password error |

# Test Scenario 3

# Equivalence Class Partitioning

Let G= Guess ID and P = Password

G = Valid, P = Valid satisfies G = Valid and P = Valid

G = Invalid, P = Invalid satisfies G = Invalid and P = Invalid

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 3-1 | Test when Guest ID and Password are both valid | The user must have Node.js running and have selected to login as a guest | 1. Enter Guest ID 2. Enter Password 3. Await Response | Guest ID = “Jake”  Password = “entering” | Guest User should be directed to security page | Admin User should be directed to security page |
| 3-2 | Test when Guest ID and Password are both invalid valid | The user must have Node.js running and have selected to login as a guest | 1. Enter Guest ID 2. Enter Password 3. Await Response | Guest ID = “Ruth”  Password = “klare” | Admin User would be notified of a username or password error | Admin User would be notified of a username or password error |

# Test Scenario 4

# Equivalence Class Partitioning

Let D = Database

D = Created

D = Not Created

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 4-1 | Test when Database exists | The user must have Node.js running | 1. Attempt to access Database 2. Await response | A select query to the Database | The Database is now available for use | The Database is now available for use |
| 4-2 | Test when Database does not exist | The user must have Node.js running | 1. Attempt to access Database 2. Await response | A select query to the Database | The database is created | The database is created |

# Test Scenario 5

# Equivalence Class Partitioning

Let A = Access Control List and L = User Logs Table

A = Created, L = Created satisfies A = Created and L = Created

G = Not Created, L=Not Created satisfies A = Not Created and L = Not Created

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 5-1 | Test when Access Control List and User Log Tables exist | The user must have Node.js running | 1. Attempt to access Control List 2. Await response | A select query to the Access Control List table | The Access Control List table is displayed. Once the Access Control List exists, then the User Logs Table also exists | The Access Control List table is displayed. Once the Access Control List exists, then the User Logs Table also exists |
| 5-2 | Test when Access Control List and User Log Tables do not exist | The user must have Node.js running | 1. Attempt to access Control List 2. Await response | A select query to the Access Control List table | Tables are created for the Access Control List and the User Logs | Tables are created for the Access Control List and the User Logs |

# Test Scenario 6

# Equivalence Class Partitioning

Let F = FAQ Table

F = Created

F = Not Created

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 6-1 | Test when FAQ table exists | The user must have Node.js running | 1. Attempt to access FAQ table 2. Await response | A select query to the FAQ table | The FAQ table is available for updating | The FAQ table is available for updating |
| 6-2 | Test when FAQ tables does not exist | The user must have Node.js running | 1. Attempt to access FAQ table 2. Await response | A select query to the FAQ table | The FAQ table is created | The FAQ table is created |

# Integration Testing

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| --- | --- | --- | --- | --- | --- | --- |
| Test Scenario | Test Case | Preconditions | Test Step | Test Data | Expected Results | Actual Results |
| 1-1 | Test when FAQ table exists | The user must have Node.js running | 1. Attempt to access FAQ table 2. Await response | A select query to the FAQ table | The FAQ table is available for updating | The FAQ table is available for updating |
| 1-2 | Test when FAQ tables does not exist | The user must have Node.js running | 1. Attempt to access FAQ table 2. Await response | A select query to the FAQ table | The FAQ table is created | The FAQ table is created |

# System Testing

# Decision Table

Let C

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Admin Name is valid | Y | Y | N | N |
| Admin Name is Invalid | Y | N | Y | N |
| Successful Login |  |  |  |  |
| Unsuccessful Login |  | X | X | X |

# 3. Rapid Application Development (RAD)

Our team chose to use the Rapid Application Development model to tackle the requirements of this Assignment. This model was ideal since it allows for rapid development of a smaller project like ours, whereas the Spiral Process Model would have been more ideal for a larger project which involved continuous enhancements. RAD allowed us to have more flexibility during our web application design and implementation. For example, we were able to build a rapid prototype of the web application, however quick changes were needed consistently, to allow the application to continuously adapt to the requirements of the assignment. Since our team was made up of a mix of developers of varying experience, this agile method was perfect to allow each other to compliment the lacking experience in each area, whether that being during design and implementation of the website, or during the testing and documentation phase.

Since we needed to have this project completed in a short period of time, RAD was the perfect choice. Without the restrictive spiral model, we were able to have a working prototype of the web application completed within a few days. Since the requirements allowed for flexibility in the design and look of the application, we were able to continually implement more user friendliness to our web application with each update. It was very important for us to have an application that was adaptable to changes. The RAD model usually has less risk associated with it than the Spiral Model, and considering that this is an application to be used in the Health industry, low risk web application development was a must.

One of the other reasons we chose to use RAD, was because it allowed us to quickly have a visual aspect of the requirements needed. This visual representation allowed us to identify the flaws easier, resulting in less flaws that needed to be addressed with each porotype cycle.

# 4. Rapid Application Development Phases

# Requirements Planning (Definition Stage)

First we analysed the requirements and was able to development a business model for this project. We identified what was the most vital and necessary information needed and made sure that a heavy focus was made. For instance, in an Accident & Emergency, the most important information to a patient would be how and when they would be cared for. We realized that it had to be made easily apparent to any guest using the website, and also for any authorized staff that needed to update that information.

We also continued to analyse the other requirements, making sure that they were clearly defined and understood amongst our team. It was vitally important that the goals were clearly evaluated, in order to have the most correct build of the first stage prototype. Although a prototype can be altered later, with Rapid Application Development, speed and accuracy are the defining attributes. The less errors that are apparent in the first stage of the prototype, the less time would be needed to have to fix them before addressing the actual, correct requirements.

# User Design (Design Stage)

During this stage is when we got the opportunity to take the defined requirements, and turn them into a visual display. Since realistically we were not able to meet with clients for this project, we all at some stage took on the roll as a client by sharing ideas with one idea and continuing to consistently improve the design. Our main focus was usability, mobile responsiveness and accuracy to requirements. It was at this stage that we continually tested and tweaked each design until we were able to settle on a design that best fit the requirements of the assignment. At the end, we believe that we came to the more satisfying design for this project.

# Rapid Construction (Development Stage)

During this stage we took the web application prototype and transformed it into a working model. Although at this stage changes could still be made, due to the iterative design phase, we were able to quickly and smoothly finalize the development of this application. It was during this phase that we were able to conduct unit testing of each function, then integration testing of each functionality. Finally, we were able to conduct alpha testing of the entire web application.

# Implementation (Deployment Stage)

At this stage the final tests were done to confirm full functionality before finally launching the web application fully. Upon completion, we had a functioning application that could be used with node.js to satisfy the requirements outlined in the assignment.

# 5. Maintenance

One of the main concerns of the development team after the application is fully launched is the subject of maintaining the application. Maintenance, as it applies to this specific instance, would be modifications and updates applied to the application to keep it up-to-date and tuned to the ever-changing world of technology and the environment it is operating in, this case being a web environment. In other words, we mainly concerning ourselves with **Adaptive Maintenance**. **[1].**

The development team had multiple discussions as to why an Adaptative approach would be best and our reasoning as to the importance of Adaptive Maintenance is as follows: The software ecosystem, especially those concerning web applications is in a constant state of flux. Regular maintenance is required to adapt to these never-ending changes. Whether it changes in work patterns of staff, software platforms, compilers, updating the hardware (servers, desktop machines, etc), they all affect the functionality of the application **[2]**. To ensure that the maintenance goes as smoothly as possible, we intend to do the following:

1. Study the current landscape in which the application operations for any sign of changes.
2. Analyze any changes to obtain a thorough understanding of their direction and timeline.
3. Deduce how our customer base will be affected at predictable points in the future or if they are being affected now. **[3]**

The most likely cause of maintenance would be updates to the web browser the application operates in. For example, say that our team discovers that the latest version of Google Chrome, Firefox or Safari released in developer-only beta is/will be incompatible with the current build of the application. Looking at the trend of releases in the past, we will know that within the span of a few months since the beta's release, our application will be incompatible with the latest versions of these web browsers when they go live. Thus we can work on updating our website to work with these new versions instead of waiting until they are released, customers run into issues, they complain and we have to spend extra time and resources performing Corrective Maintenance to develop a patch to solve these issues **[3]**.

# **Conclusions**

# **References**

[1] The Industrial Advisory Board of the Guide to the Software Engineering Body of Knowledge (SWEBOK) - Institute of Electrical and Electronics Engineers, Inc. *Software*

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[2] Adrion, W.R. , Branstad, M.A. , Cherniavsky J.C. *Validation, Verification, and Testing of Computer Software*. ACM Computing Surveys (CSUR), 14 (2), 1982. ACM Press.

[3] “4 Phases of Rapid Application Development Methodology,” *Lucidchart Blog*, 10-Aug-2018. [Online]. Available: https://www.lucidchart.com/blog/rapid-application-development-methodology. [Accessed: 21-Apr-2020].

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[5]