

BOOSTER - ARCHERY PERFORMANCE TRACKING APPLICATION

FUNCTIONAL SPECIFICATION



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1. Introduction

The purpose of this project is to create a cross platform application for archery coaches and archers alike. It should help perfect form, track performance, scores, grouping and give suggestions on breathing, Strength & Conditioning techniques. The application should be used as a tool to help enhance the archery performance and be an easy to use, user friendly experience. It should be able to keep a record of scores, grouping, and heart rate of the archery to set goals that, based on previous performance, are attainable with some extra training.

2. Project Description

BOOSTER is an application aimed at Archery coaches and archers alike, designed to improve the overall performance of an archer, track metrics associated with archery and act as a training aid for coaches to maximise the potential of their students. It stands apart from other archery applications on the market by offering multiple metric tracking and the use of wearables to assist the user. This project will give the user the ability to improve their form via a live camera feed and utilising the Movesense sensors. Currently there are no applications specifically for the sport of archery that offers all the functionality of the BOOSTER application. Coaches must have multiple applications on their device to offer the same range of functions that BOOSTER can offer. Similarly, archers must have multiple applications on their device to utilise score tracking, progress tracking and other functionality that BOOSTER incorporates. The BOOSTER application will include functionality to track scores, groupings, training sessions, visualise progression based on input data over time, set draw form and follow through form which are essential for an archer to improve in the sport. It will also give suggestions for breathing techniques and Strength & Conditioning exercises based on heart rate while shooting.

3. Users

There are two main users of the BOOSTER application, Coaches and Archers. While these are not mutually exclusive, most coaches are archers or have been at some stage, the functionality they require differs sufficiently that they may be classified as separate entities. Some commonalities that exist between these two demographics are their shared passion for the sport, desire to progress in their field, dedication to this goal and a good understanding of archery equipment and basic shooting techniques.

3.1 Coaches

Archery coaches can be distinguished from coaches of other sports for the sheer wealth of knowledge they possess of the sport, general sports performance, coaching techniques, physiology and an amount of psychology. Archery coaches not only have an in depth knowledge of multiple shooting technique but also must possess the knowledge to select, tune and maintain equipment, understand the phenomenon of the archer's paradox with the ability to convey this to the uninitiated, how the human body and mind act under stress, as well as many other aspects too various to detail in this document.

Archery coaches, as well as being a venerable fountain of knowledge, are first and foremost concerned with the form of an archer and their physical and mental wellbeing. As such BOOSTER offers a unique opportunity for coaches to easily adjust the form of their student, power lines being one of the most important aspects of this. The ability to track an archers heart rate over the course of a training session or competition also sets BOOSTER apart from the fray, as this will allow the coach to suggest breathing techniques to slow heart rate and suggest strength & conditioning techniques to build the archers stamina and endurance. The mental aspect of the sport is a challenging area to cover as it varies greatly from person to person, this will be discussed in Section 3.2.

3.2 Archers

Archers are a very diverse demographic with people of all ages, genders, creeds and religious backgrounds coming together to partake in the sport. Archers learn the basics of the sport from qualified coaches during their initial months of practice. They also obtain tips, tricks and advice about the sport from other archers. A determining factor as to whether they continue with the sport is their interaction with their coach and any applications the coach may suggest. This forms a general mental image of the sport, to the archer which may influence them for the duration of their archery career.

Whilst there are many applications on the market that have useful functionality for archers, few prove simple enough to use to garner sufficient interaction from those new to the sport. Whilst tracking scores and grouping is offered by many, none show progress in the manner that the BOOSTER application will. The ability to visually display the progress one makes provides a massive boost to the mental fortitude and attitude the archer has toward the sport. As stated above the ability to track one's heart rate whilst training or in competition will enable the archer to determine what additional exercise to undertake or if they need to implement the use of a breathing technique to reduce heart rate at the given time.

4. Use Cases

4.1 System Use Case

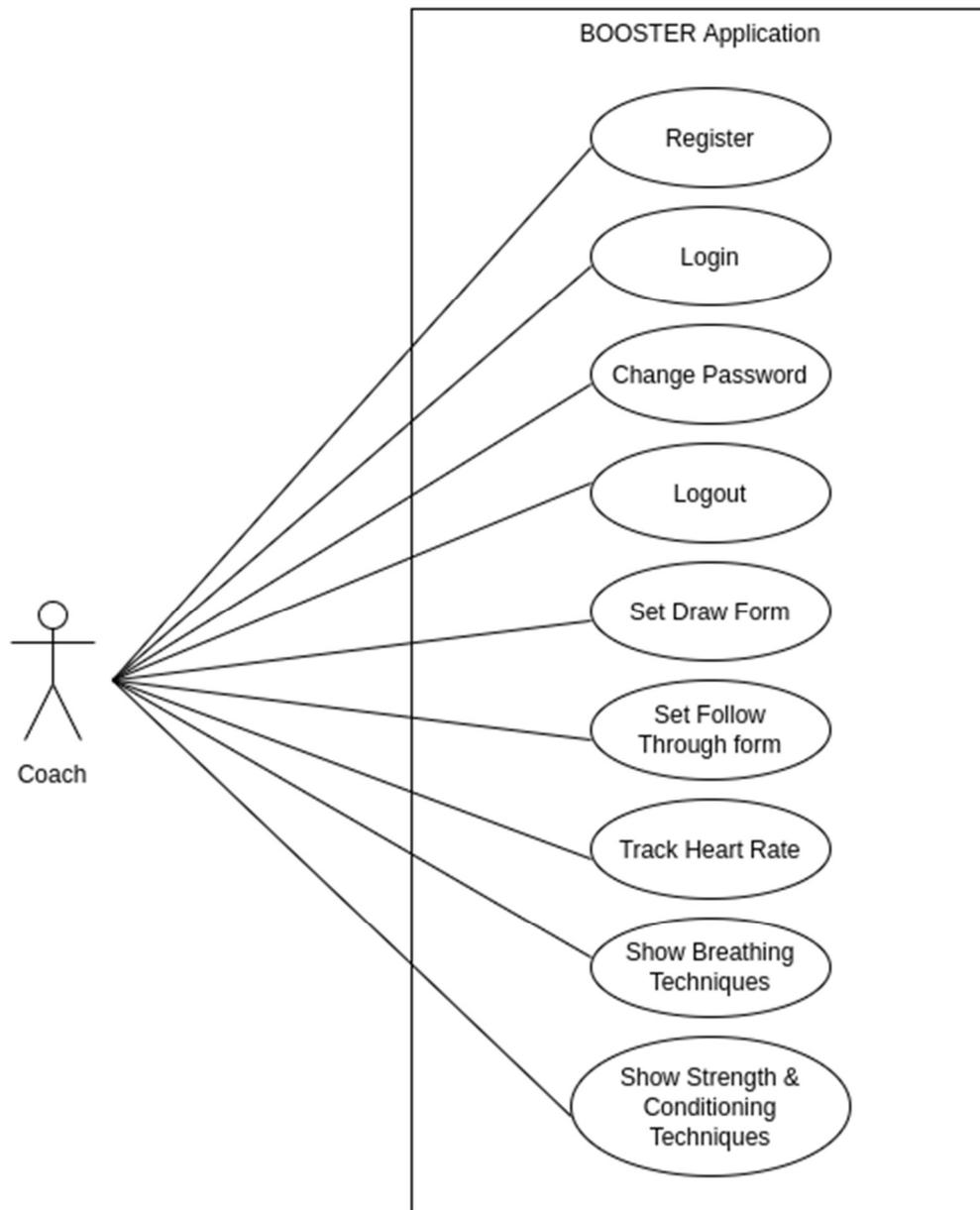


Figure 1. Coach system use case

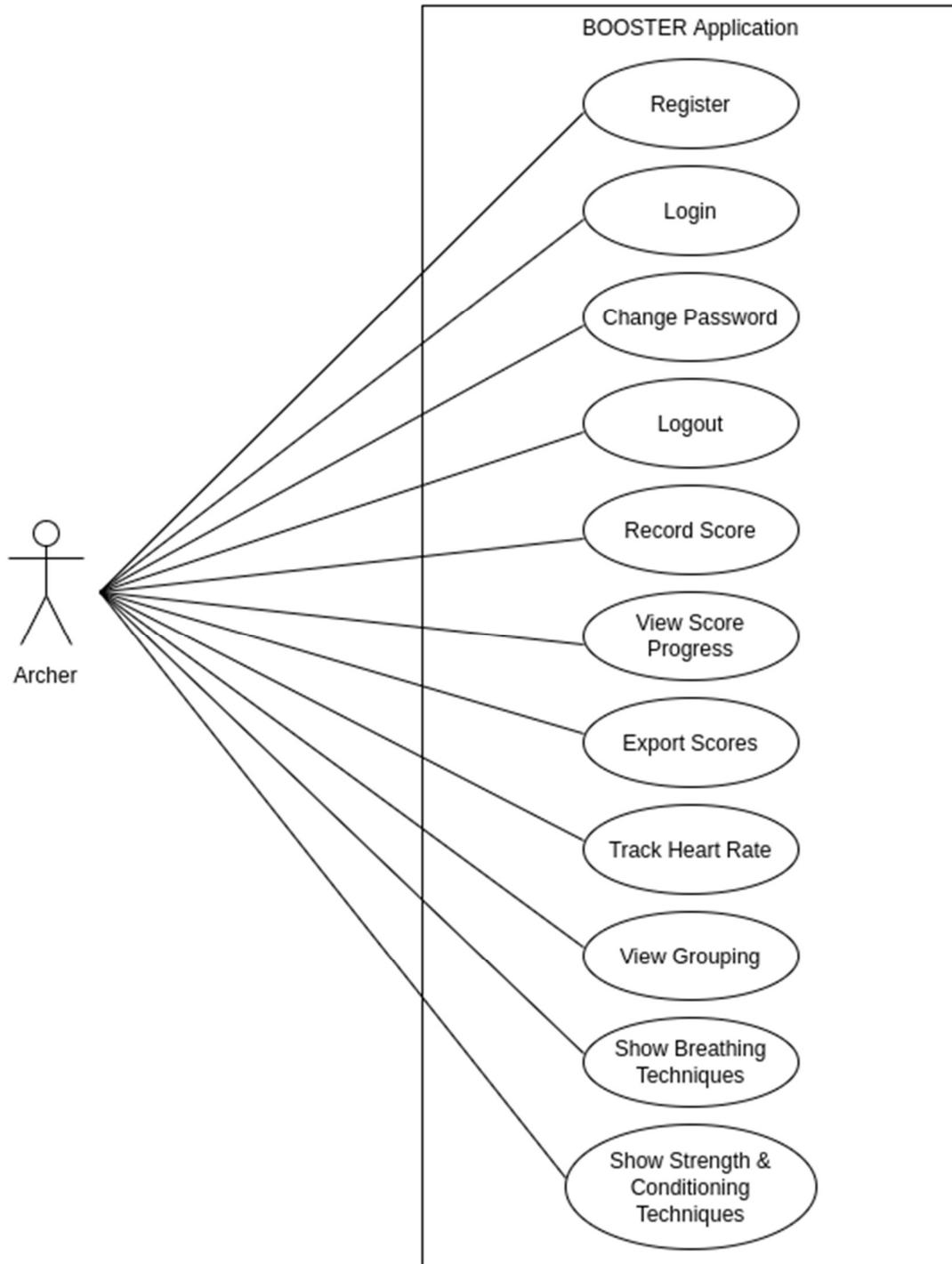


Figure 2. Archer system use case

4.2 Individual use cases

Name	Register
Actors	Coach, Archer
Preconditions	The user has installed and opened the application
Activity	This use case begins when the user opens the application and is prompted to either log in or register their details. The user will select log in if they have previously registered. If they have not registered, they will select the register option. They will be prompted to enter their username, email, password and to confirm the password and choose whether they are a coach or an archer. The user will then submit their information which will be stored in a secure database so any future activity can be referenced to their profile
Postconditions	The user has successfully registered their information with the application.
Alternative	<ol style="list-style-type: none"> 1. The user enters an invalid email address <ol style="list-style-type: none"> 1a. The user is prompted to enter a valid email 2. The user enters a password that is too short <ol style="list-style-type: none"> 2a. The user is prompted to enter a password of sufficient length 3. The passwords entered do not match <ol style="list-style-type: none"> 3a. The user is prompted to enter matching emails

Figure 3. Register use case

Name	Login
Actors	Coach, Archer
Postconditions	The user will be directed to the home screen
Activity	This use case begins when the user opens the application and is prompted to either log in or register their details. The user selects the login option. They are prompted to enter their username and password. Upon entering their details, they will submit said details. The input is validated via the database and the user is redirected to the home screen
Preconditions	The user has successfully registered with the application
Alternative	<ol style="list-style-type: none"> 1. The user enters their username or password incorrectly 2. The user enters their username or password incorrectly 3 times <ol style="list-style-type: none"> 2a. The user will be locked out of their account temporarily for a certain amount of time or until they verify their details via email.

Figure 4. Login use case

Name	Change Password
Actors	Coach, Archer
Preconditions	The user is logged into the application
Activity	This use case begins with the user already successfully logged into the application. The user selects the change password option. They are prompted to enter their old password, a new password and confirm their new password. The user's old password is confirmed via the database and on successful confirmation their new password overwrites their old password.
Postconditions	The user has changed their password
Alternative	<ol style="list-style-type: none"> 1. The user enters the wrong old password <ol style="list-style-type: none"> 1a. The user is prompted to enter the correct password 1b. After 3 attempts the user is locked out of their account for a certain amount of time or until they verify their details via email 2. The users' new passwords don't match <ol style="list-style-type: none"> 2a. The user is prompted to enter matching new passwords 2b. After 3 attempts (see 1b.)

Figure 5. Change Password use case

Name	Logout
Actors	Coach, Archer
Preconditions	The user is successfully logged into the application
Activity	This use case begins when the user is logged into the application and selects the logout option. The user is logged out of the application and redirected to the login screen.
Postconditions	The user is logged out of the application and cannot access any aspect of the application apart from the login screen
Alternative	N/A

Figure 6. Logout use case

Name	Set Draw Form
Actors	Coach
Preconditions	The Movesense sensors are paired with the application device, the archer is wearing the Movesense sensors, one on the wrist of the bow arm, one on the forearm of the draw arm. The coach is logged into the application
Activity	<p>This use case begins when the coach selects the Form option. The coach then selects the Set Draw Form option. The coach is redirected to a screen containing a live feed from the device camera, an overlay for the horizontal power line and a button to record the coordinates sent by the Movesense gyroscope. The coach gets the archer to come to full draw, aligns them with the overlay and presses the set button. The y axis coordinates are recorded from the sensor and used, via the use of an audio prompt, to assist the archer in keeping the draw arm at the correct height. The overlay then changes to the one for the vertical alignment. The coach moves to the rear of the archer and aligns them with the overlay again, an audio prompt will tell the archer if their arm is dropping. The coach then, upon aligning the archery with the overlay and no audio prompts, pressing the set button which will record the x, y and z axis from the sensor. This can then be used, in combination with an audio prompt, to practise the alignment of the archers draw form.</p>
Postconditions	The coach has set the sensor so that the archery can practise their draw form
Alternative	<ol style="list-style-type: none"> 1. The Movesense sensor will not pair with the application device <ol style="list-style-type: none"> 1a. The coach will be prompted that the sensor is not paired 2. The coach wants to reset the sensor readings <ol style="list-style-type: none"> 2a. The coach will press the reset button to clear the readings from the sensor and begin the process again.

Figure 7. Set Draw Form use case

Name	Set Follow Through form
Actors	Coach
Preconditions	The Movesense sensors are paired with the application device, the archer is wearing the Movesense sensors, one on the wrist of the bow arm, one on the forearm of the draw arm. The coach is logged into the application
Activity	This use case begins when the coach selects the Form option. The coach then selects the Set Follow Through Form option. The coach will get the archer to come to full draw and press the set bow arm button, this will record the x, y and z coordinates of the sensor. This then, with the aid of an audio prompt, can be used to ensure that the archer does not have any excessive drop in the bow arm on release.
Postconditions	The coach has set the sensor so that the archery can practise their follow through form
Alternative	<ol style="list-style-type: none"> 1. The Movesense sensor will not pair with the application device <ol style="list-style-type: none"> 1a. The coach will be prompted that the sensor is not paired 2. The coach wants to reset the sensor readings <ol style="list-style-type: none"> 2a. The coach will press the reset button to clear the readings from the sensor and begin the process again.

Figure 8. Set Follow Through use case

Name	Record Score
Actors	Archer
Preconditions	The archer is successfully logged into the application
Activity	<p>This use case begins when the archer is logged into the application and selects the Score option. The archery then selects the record score option. The archer is redirected to a screen with two options, 1. Scorecard, 2. Target Face.</p> <p>If the archer selects option 1, they are redirected to a screen containing an archery scorecard that can be filled in with information and their score. On completion of scoring for the training session the archer can press the save button which will save their scores for that session to a database.</p> <p>If the archer selects option 2, they are redirected to a screen containing the rings of an archery target face. The archer can tap on the screen to set where the arrow hit the target, this will update their overall score and keep a record of the coordinates of the arrow on the target face. On completion of scoring for the training session the archer can press the save button which will save their scores for that session to a database as well as the coordinates of the arrow hits on the target.</p>
Postconditions	The archer has recorded and saved their score for the training session.
Alternative	<ol style="list-style-type: none"> 1. The archer wants to edit their scores on the score sheet <ol style="list-style-type: none"> 1a. On the scorecard they can tap into the score they wish to change and edit this. 2. The archer wants to edit their score on the target. <ol style="list-style-type: none"> 2a. The archer should be prompted to confirm placement and score before the score is recorded.

Figure 9. Record Score use case

Name	View Score Progress
Actors	Archer
Preconditions	The archer is successfully logged into the application
Activity	This use case begins when the archer is logged into the application and selects the Score option. The archer then selects the view score progress option. The archer is then redirected to a screen that displays a graph of their scores over their total recorded training sessions.
Postconditions	The archer is displayed a graph of their scores
Alternative	1. The archer has no previously recorded scores 1a. The archer is prompted that they have no previously recorded scores

Figure 10. View Score Progress use case

Name	Export Scores
Actors	Archer
Preconditions	The archer is successfully logged into the application.
Activity	This use case begins when the user is logged into the application and selects the score option. The archer then selects the export scores option. A .csv file is created from their score data in the database and sent to a "BOOSTER_SCORES" subfolder in the "BOOSTER" folder on the device.
Postconditions	A .csv file is stored on the user's device
Alternative	1. The archer has no previously recorded scores 1a. The archer is prompted that they have no previously recorded scores.

Figure 11. Export Scores use case

Name	Track Heart Rate
Actors	Coach, Archer
Preconditions	The user is successfully logged into the application, The Movesense HR+ module is paired with the user's device, the archer is wearing the Movesense HR+.
Activity	This use case begins when the user is logged into the application and selects the Heart Rate option. The application redirects to a screen with a blank graph and a start button. The user presses the start button and the screen updates and graphs the users heart rate every second. This process will continue in the background until the stop button is pressed or until the application is exited. This graph may be stored via a save button and sent to a "BOOSTER_HEART_RATE" subfolder in the "BOOSTER" folder on the device.
Postconditions	The heart rate of the archer is recorded for the duration of their training session or competition and displayed in graph format.
Alternative	1. The Movesense sensor will not pair with the application device 1a. The user will be prompted that the sensor is not paired

Figure 12. Track Heart Rate use case

Name	View Groupings
Actors	Archer
Preconditions	The archer is successfully logged into the application and has previously recorded scores via the target face scoring option.
Activity	This use case begins when the user is logged into the application and selects the score option. The archer then selects the export groups option. They are redirected to a screen prompting them to select a previous training session. Once selected the overall grouping of their arrows will be displayed on an identical target face to the one, they recorded their score on.
Postconditions	The archers grouping for a training session is displayed.
Alternative	1. The archer has no sessions recorded via the target face option 1a. The archer is prompted saying they have no grouping scores recorded.

Figure 13. View Groupings use case

Name	Show Breathing Techniques
Actors	Coach, Archer
Preconditions	The user is successfully logged into the application.
Activity	This use case begins when the user is logged into the application and selects the Breathing option. The user is then redirected to a screen displaying multiple breathing techniques.
Postconditions	The user is displayed breathing techniques
Alternative	None

Figure 14. Show Breathing Techniques use case

Name	Show Breathing Techniques
Actors	Coach, Archer
Preconditions	The user is successfully logged into the application.
Activity	This use case begins when the user is logged into the application and selects the Strength & Conditioning option. The user is then redirected to a screen displaying multiple Strength & Conditioning techniques.
Postconditions	The user is displayed Strength & Conditioning techniques
Alternative	None

Figure 15. Show Strength & Conditioning Techniques use case

5. FURPS+

FURPS is a model used to describe the functional and non-functional requirements of software. The original concept was developed by Robert Grady and Deborah Caswell at Hewlett-Packard (HP). FURPS is an acronym for Functionality, Usability, Reliability, Performance, Supportability and is used to outline the functional requirements of a project. The '+' was added to outline any additional considerations for non-functional requirements such as design, implementation, interface or physical constraints. FURPS+ is used widely in the Software Development Industry as it may be used easily to outline many of the requirements quickly.

5.1 Functionality

Functionality refers to the main features of the application and its associated functionality. These can be further divided into two categories, Core functionality and Secondary functionality.

5.1.1 Core Functionality

Core functionality refers to the main features and functions of the application. The BOOSTER application has the following Core functionality.

5.1.1.1 Set draw form

The ability to set the draw form of the archer utilising the Movesense gyroscope readings, live feed from the device camera, screen overlays and audio prompts to indicate when the archer has strayed outside of the tolerable variance allowed.

5.1.1.2 Set follow through form

The ability to set the follow through form of the archer utilising the Movesense gyroscope readings, checking for large drops in the bow arm whilst executing the follow through section of the archers shot cycle screen, audio prompts to indicate when the archer has strayed outside of the tolerable variance allowed.

5.1.1.3 Track scores

The recording and saving of scores shot during a training session or competition. Using either a standard archery score sheet layout in the application or a target face-based system.

5.1.1.4 Display score progress

Graph the progress of scores recorded over time and display this to the user to show progress. Display achievable goal scores based on trends of previous scores.

5.1.1.5 Track heart rate

Display heart rate as a graph over the entire training session indicating to the user if they must work on stamina or general fitness level.

5.1.2 Secondary Functionality

Secondary functionality refers to the features and functions of the application that are of lower priority, meaning the application can function as a standalone without them.

5.1.2.1 Display grouping progress

The ability to view the grouping of arrows on the target of a given training session.

5.1.2.2 Export scores

Scores can be exported from the database and emailed to the email address input by the user when prompted. This requires internet access.

5.1.2.3 Display breathing techniques

Display a set of breathing techniques that the user can read and adopt.

5.1.2.4 Display Strength & Conditioning exercises

Display a set of Strength & Conditioning techniques that the user can read and adopt

5.2 Usability

Usability refers to the user experience (UX) with the application. The UX design can and does change over time due to continuous user feedback. The application should be easily accessible and traversable across both Android and iOS operating systems. The users should be able to login to the application within 10 seconds 99% of the time. The users should be able to change passwords within 45 seconds, 95% of the time. The users should be able to successfully logout within 3 seconds, 99% of the time. Registration should take no longer than 40 seconds, 80% of the time. The application should be intuitive to use and easily navigable between screens in less than 20 seconds, 95% of the time. Progress view screens should display within 15 seconds, 95% of the time. A coach should be able to pair the Movesense sensors within 1 minute, 75% of the time.

5.3 Reliability

Reliability refers to the stability, durability and availability of the application at any given time. How long it should take to recover from a failure and how it deals with these failures. The applications features should all work without internet access. Any failures should be recoverable, 95% of the time. The application should load without issue, 99% of the time.

5.4 Performance

Performance refers to the systems response time, transmission and retrieval of data speed, the systems overall ability to handle multiple users simultaneously and scale for new users. Using MySQL via a cloud-based database will make the application extensible and scalable. Data transmission and retrieval should take no longer than 15 seconds, 95% of the time.

Data should be stored locally until a save option is selected then sent to the cloud database.

5.5 Supportability

Supportability refers to the flexibility, sustainability, compatibility and maintainability of the system. The application will be cross platform, supported on both Android and iOS devices. Comments and well-structured code are essential, for maintainability and any new features need to be added in the future. The application should be able to take updates without encountering failures.

5.5 '+'

5.5.1 Security

The cloud database and connection to the application should be secured as to not allow unauthorised access. The application takes no sensitive data from the user yet should still be secure enough as to not allow the users data in any form to be accessed by external influences.

5.5.2 Implementation constraints

All code used should meet current standards for each language respectively. This means the HTML5 and CSS3 will comply with W3C standards, PHP will comply with PSR standards and Python will use the PEP 8 coding standard.

5.5.3 Interface constraints

The application will be mostly self-contained and will have only two external interfaces, one to the cloud database the other via Bluetooth to the Movesense sensor module.

6. Metrics

Metrics in the context of this project describes how the success of the application may be measured. The below criteria outline the metrics by which this project will be measured.

- The application should run on the chosen platforms (Android and iOS phone and tablet).
- The user should be able to register for an account.
- The application should allow secure login.
- Score recording should be possible in the methods mentioned.
- Score progress visuals should be viewable
- Movesense sensor module should pair with the device and transmit data
- The application should receive the data from the Movesense sensor modules, process and store the data as required.
- The application should allow for form setting, as described, from a live feed of the device camera and the use of a screen overlay
- The application should handle multiple users.
- Heart rate data should be displayed and be able to be saved as described.
- The score data should be able to be exported as a .csv file.

7. Testing

Testing of the application will be done in conjunction with the Institute of Technology Carlow Archery Club. The club will allow the use of the application by the coach and volunteers for a period of 2 hours per training session, on completion of the application. Volunteers will wear the Movesense sensor modules while the coach tests the use of the application. All aspects of the application will be tested from registration and password change to heart rate tracking and form setting. Archers of the club will also test the use of the application for recording scores, checking progress of scores and all other aspects of the application associated with archers. Initially single users will test the application at a time, once any issues that arise have been fixed, multiple users will be asked to test the application. This is to aid in the debugging process and not to overload the system initially.

Appendix

i. Plagiarism Declaration

- I declare that all material in this submission e.g. thesis/essay/project/assignment is entirely my/our own work except where duly acknowledged.
- I have cited the sources of all quotations, paraphrases, summaries of information, tables, diagrams or other material; including software and other electronic media in which intellectual property rights may reside.
- I have provided a complete bibliography of all works and sources used in the preparation of this submission.
- I understand that failure to comply with the Institute's regulations governing plagiarism constitutes a serious offense.

Student Name: Brendan Browne

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Signature:



20/04/2020