Winning Edge

G.A.A. Live Scores and Statistics Analyser.

Shane Galvin – X00096068
Institute of Technology Tallaght
BSc. (Honours) in Computing
4th Year Project

Supervisor: James Doody

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Research Document

Detailed Discussion

Modern G.A.A. has seen the introduction of statistical analysis as a way of adapting and improving a team's game. Inter-County sides use it as a vital part of building their strategy and tactics. It has had proven effect and soon club sides all over the country began to employ it to try gain an edge in matches. However, at inter-county level the funds available are far higher and the technology and experts which they have access to simply cannot be matched at club level. So most club sides who can afford to have an analyst as part of their coaching staff aren't doing any ground breaking analysis. As for the vast majority of clubs who may have a manager recording a few statistics, or just a volunteer from within the club, they simply don't have the resources to invoke such analysis. The Winning Edge Application is aimed at addressing this. The idea is to make a good standard of statistical analysis available for all clubs who which to introduce it.

Winning Edge is an application that will allow users to easily record G.A.A. match statistics and then view and analyse the data in an easy and presentable manner. The application will run on both mobile and web. The mobile application will be developed on the Android platform and the web application will run on a Bootstrap framework using HTML and JavaScript. Both these application will be linked together using a cloud backend. Microsoft Azure Cloud Services will provide this cloud platform.

Users will create an account which can be used to access both the web and mobile application. The mobile application will be used to record and then store data. The data they record will be stored to their account within the cloud infrastructure. This data can then be viewed using the web application.

The mobile application will be used to record the statistics with a well laid out and attractive user interface. This can be done while watching a game or afterwards if they have recorded the game. The user will first choose either hurling or football as the options will vary slightly for both sports. They then choose whether to do an individual player analysis or a team analysis. The application allows the user to record a variety of statistics. These statistics are then stored to their account using the cloud backend.

The web application will give the user allow the user to view recorded stats and compare them with previous matches to see how any changes they've made are working. All the information will be displayed in a presentable and easily interpreted manner meaning it makes giving feedback to the players much easier than just a spreadsheet of numbers. This information will allow managers to alter their tactics and perfect ways of playing. It also gives players an opportunity to see what they are doing right and what they are doing wrong.

The application can identify areas of a team's game in which they are struggling and provide feedback and suggested ways in which they can improve.

Existing Applications

	StatsCool GAA Football Stats	**StatsCool GAA Hurling Stats**	**Sports Stats Recorder**	**GAA Football Stats Recorder**
Both Hurling and Football included	No	No	Yes	No
Mobile App	Yes	Yes	Yes	Yes
Web App	No	No	No	No
Amount of Recordable Stats	Medium Level	Medium Level	Customizable – Ability to choose your wanted stats	Low Level
Adjustable Stats – Ability to remove data	No	No	No	No
Team and Player Stat Options	Yes	Yes	Yes	No
Visualization of Data	No	No	No	Yes, Basic graph can be viewed on mobile app
Tactical Feedback	No	No	No	No
Statistics Comparison	No	No	No	No
Free to download	No - €0.99	No - €0.99	Yes	Yes

Proposed Technologies

Android (Java)

The mobile application will be developed for the Android Operating System. The application will be developed in Java incorporating the Android SDK using the Android Studio IDE.

XML

Used in android development for the User Interface and declaration of String objects.

Microsoft Azure

The backend of the applications will be cloud based and hosted by Azure. Azure provides a vast variety of services which could be very useful including web deployment, database storage, notification hub and API management. Azure also has the benefit of being compatible with Scripting languages like Ruby and Python.

Bootstrap Framework

The web application will use the Bootstrap framework. Bootstrap allows for quick and attractive development.

HTML

Web application will be developed using HTML which is hugely versatile.

JavaScript

JavaScript will provide extra functionality within the HTML. Its extensive catalogue of libraries is also extremely useful and can be used for the visual presentation of data.

Ruby/Python

Ruby or Python will be used as the scripting language. Both come with a variety of useful libraries and support HTML.

Ruby on Rails/Django

Rails will provide the framework if Ruby is chosen as my scripting language. Rails provides a gem which allows the use of Bootstrap within a Rails environment. Django will be used if Python is chosen. It also has features to incorporate Bootstrap in development.

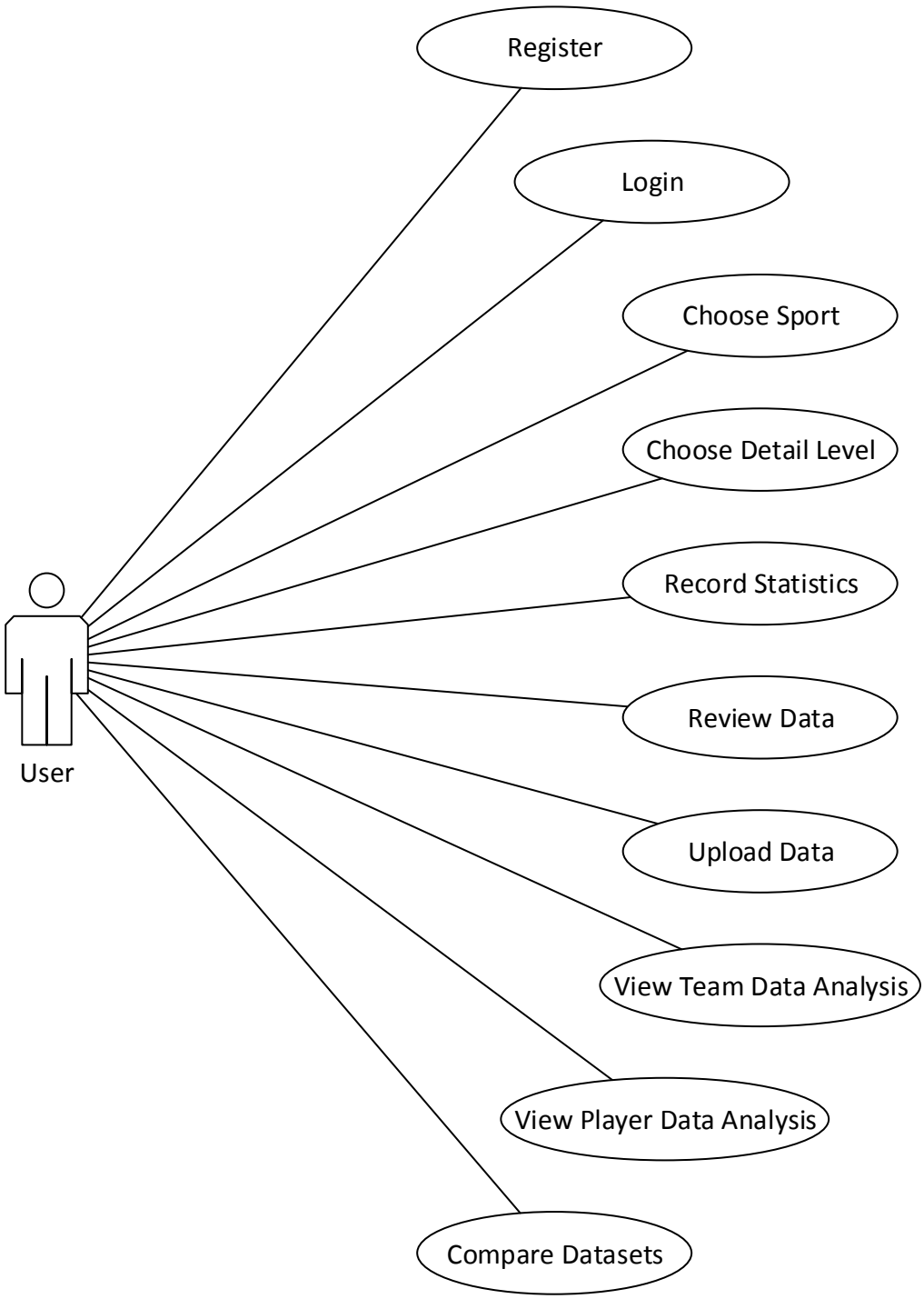
Potential Risks

- The need to create an account could discourage potential users from using the application.
- Limited to G.A.A. which means a smaller target audience. In the future could be updated to incorporate more sports.
- As this is a multi-platform system, which plans to use both a web and mobile application, there is a high-level of importance placed on having a functional system in place within the time frame.
- Due to a few competitor applications in the market, additional features must work well to improve on what is already in place. An attractive and easy to use user interface will also be vital.
- Ensuring the system can cope with the data being uploaded and downloaded from Azure while maintaining a quick and fluid application.

Technical Architecture

Use Cases

Diagram



Register

I.D.: 1 **Priority:** High **Primary Actor:** User

As a user I want to be able to register so that I can create and use an account.

Scope: Statistical Analysis System

Level: User Level

Brief Description: User enters details to create an account to store the data.

Success

- Account is created and user is displayed with their home page.

Failure

- Invalid character message displayed.
- Empty field message displayed.
- Account with that email already exists message displayed.
- Invalid password message displayed.

Login

I.D.: 2 **Priority:** High **Primary Actor:** User

As a user I want to be able to login so that I can access my account.

Scope: Statistical Analysis System

Level: User Level

Brief Description: User enters login details to sign into their account.

Success

- User accesses account successfully and their home page is displayed.

Failure

- Empty field message displayed.
- Invalid email or password message displayed.

Choose Sport

I.D.: 3 **Priority:** Medium **Primary Actor:** User

As a user I want to be able to choose which sport I am recording so that I can have specific attributes for my specified sport.

Scope: Mobile Application

Level: User Level

Brief Description: User chooses which sport to record data for.

Success

- Depending on choice either Hurling or Football Screen is displayed.

Failure

- Application unable to load page, error message displayed.

Choose Detail Level

I.D.: 4 **Priority:** Low **Primary Actor:** User

As a user I want to be able to choose my level of statistic taking so that I can tailor the amount of fields in which I'm recording.

Scope: Mobile Application

Level: User Level

Brief Description: User chooses the level of detail which they would like to use for recording the statistics.

Success

- If user chooses in-depth analysis, extra recording fields are displayed. Should the user choose a lower-level of detail, a less detailed variety of statistics can be recorded.

Failure

- Application unable to load page, error message displayed.

Record Statistics

I.D.: 5 **Priority:** High **Primary Actor:** User

As a user I want to be able to record in game statistics so that I can store and analyse them.

Scope: Mobile Application

Level: User Level

Brief Description: User enters details to create an account to store the data.

Success

- User touches on-screen icons which will add or take away from specific statistical counters.

Failure

- Application crash, error message displayed.

Review Data

I.D.: 6 **Priority:** Low **Primary Actor:** User

As a user I want to be able to review my recorded data so that I can verify it before uploading.

Scope: Mobile Application

Level: User Level

Brief Description: User reviews their recorded data before uploading.

Success

- All recorded data is displayed, user can verify or edit the data if a mistake was made.

Failure

- Application unable to load data, error message displayed.

Upload Data

I.D.: 7 **Priority:** High **Primary Actor:** User

As a user I want to be able to upload my recorded data so that I can analyse it on the web application.

Scope: Mobile Application

Level: User Level

Brief Description: User is happy with recorded data and uploads it to their account.

Success

- Data is successfully uploaded to user's account. Confirmation message displayed.

Failure

- No network connection message displayed.
- Data upload error message displayed.

View Team Data Analysis

I.D.: 8 **Priority:** High **Primary Actor:** User

As a user I want to be able to analyse team statistics so that I can develop new strategies and tactics.

Scope: Web Application

Level: User Level

Brief Description: User views analysis for team data.

Success

- Data for team is displayed using tables, graphs, charts etc..

Failure

- No network connection error message displayed.
- Unable to load data message displayed.

View Player Data Analysis

I.D.: 9 **Priority:** High **Primary Actor:** User

As a user I want to be able to analyse player statistics so that I can give constructive feedback for player development.

Scope: Web Application

Level: User Level

Brief Description: User view analysis for individual player data.

Success

- Player statistics from selected match are shown using tables, graphs, charts, etc...

Failure

- No network connection error message displayed.
- Unable to load data message displayed.

Compare Datasets

I.D.: 10 **Priority:** Medium **Primary Actor:** User

As a user I want to be able to compare various datasets so that I can monitor development and changes over time.

Scope: Web Application

Level: User Level

Brief Description: User chooses datasets to compare and data is displayed side by side.

Success

- Chosen datasets are loaded and shown successfully using tables, graphs, charts, etc...

Failure

- No network connection error message displayed.
- Unable to load data message displayed.

Technical Architecture

Software Components

Database: MongoDB using PyMongo

App Engine: RESTful API

Mobile Platform: Windows Phone 8.1

Platform Libraries

Windows Phone Application

Languages: C# and EAML

APIs: RESTful, DPAPI

Web Application

Languages: HTML, JavaScript, and CSS

Framework: Bootstrap

APIs: RESTful

Libraries: D3.js

RESTful Web API

Language: Python

Framework: Django-REST

Distribution and Deployment

RESTful Web Service

The mobile and web applications will communicate with the database through a RESTful web service.

Nokia Lumia

The mobile application will be deployed on a Nokia Lumia device to show its full functionality.

Security

- SSL Certificate for Web Services.
- Data Protection API – Windows Phone
- HTTPS – Web Application

Risks

System Scope

The system includes both a web and mobile application, both of which will be linked to a RESTful Web Service. The Web Service will provide the link between applications and a SQL database. The scope of the system and the variety across the various platforms will have risks.

Scalability

How the system copes with larger datasets being pulled down will be a risk. As the load increases it is vital that user experience is not dampened and loading speeds are not affected.

Target Deliverables

Due to the variety of technologies being implemented and the complexity involved keeping with time constraints will always be a risk to the project. The project will aim to meet strict deadlines to avoid problems in this area.

User Experience

As there are other existing applications in this are it is important that this system improves on them, adding new features combined with an attractive a user-friendly interface.

Prototype

Deliverable One (Week 8)

Aim: Deliver use case 1 (Register) and use case 2 (Login) for deliverable one.

Testing: Unit testing will be implemented for any logic in place for these use cases. Black box testing will be used to test field validation ensuring all fields are filled in correctly and to prevent any SQL injection attempts.

Deliverable Two (Week 11)

Aim: Deliver use case 3 (Choose Sport), use case 5 (Record Stats) and use case 7 (Upload Data) for deliverable two.

Testing: Unit testing will be implemented for any logic in place for these use cases. Black box testing of all functionality within choosing your sport and recording of statistics. Upload tests to ensure system can handle required amounts of data.

Miscellaneous Reports

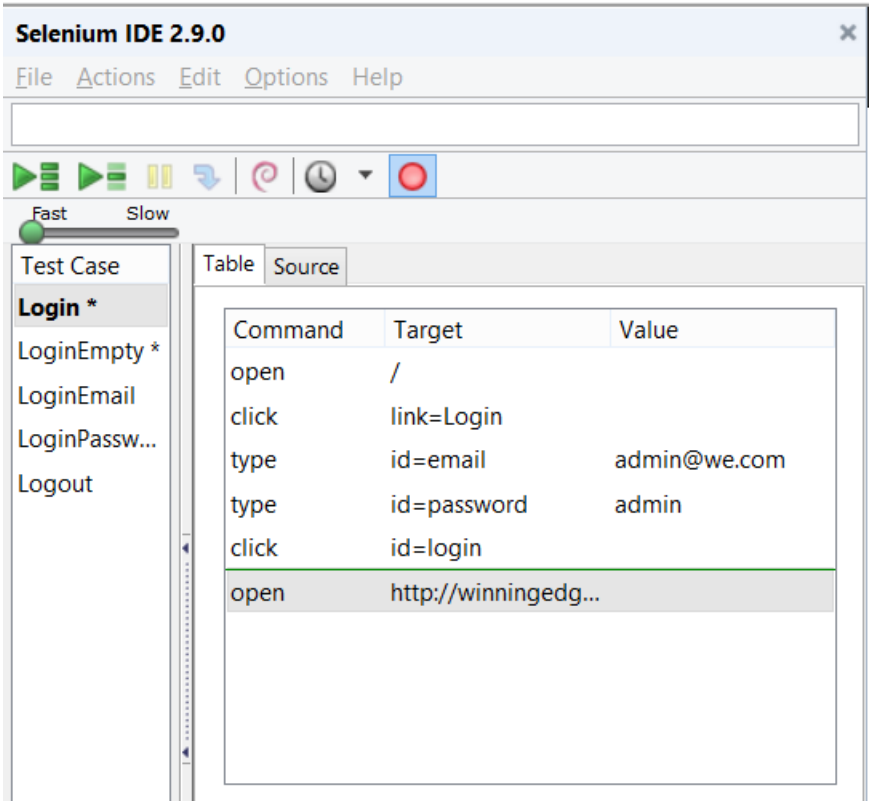
Test Report

Unit Testing

Black box unit testing was carried out extensively on the android application testing each component and piece of functionality. This enabled me to ensure that each component did exactly what expected and ensured the application ran smoothly with no bugs.

Integration and System Testing

Integration and system testing was carried out on the web application using the Selenium IDE Suite for Mozilla Firefox. This checked each piece of functionality and expected outcomes to ensure all aspects were functioning correctly.



Results

From analysing the results of the testing, I was able to ensure there were no bugs or underlying issues present in either the Android application or the web application. This test-driven method of development ensured the code constantly met a set standard.

Installation Manual

Prerequisites

To install Winning Edge the following software must be installed and conditions met.

- Android SDK
- Java
- Maven
- USB Debugging enabled for Android Device

Android Application

The Winning Edge Android application is available from the following GitHub URL: https://github.com/ShaneGalvin1/4thYearProject

It can be downloaded in a zipped file or by cloning the repository.

Once the project is downloaded, it can be installed via an IDE such as Android Studio or the Command Line.

IDE Installation

To install via Android Studio or another IDE, simply open the project in the IDE, run the project and choose your physical device to run it on.

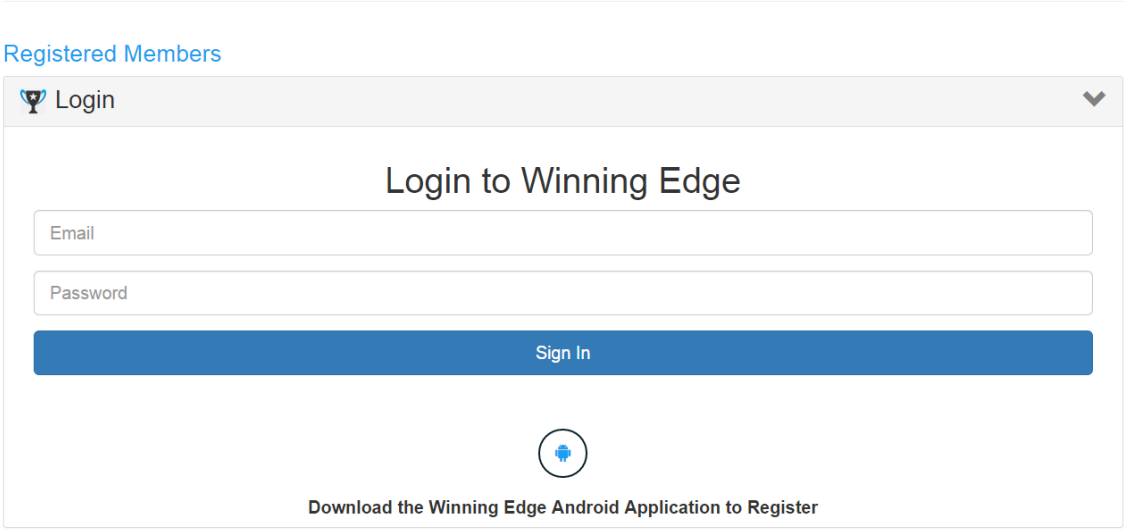
Command Line Installation

For instructions on how to install using Command Line on your machine visit http://developer.android.com/tools/building/building-cmdline.html and follow the steps shown.

Web Application

The web application does not need to be installed, simple visit http://winningedge.azurewebsites.net, where live scores may be viewed.

Registered users can make use of the login facilities.



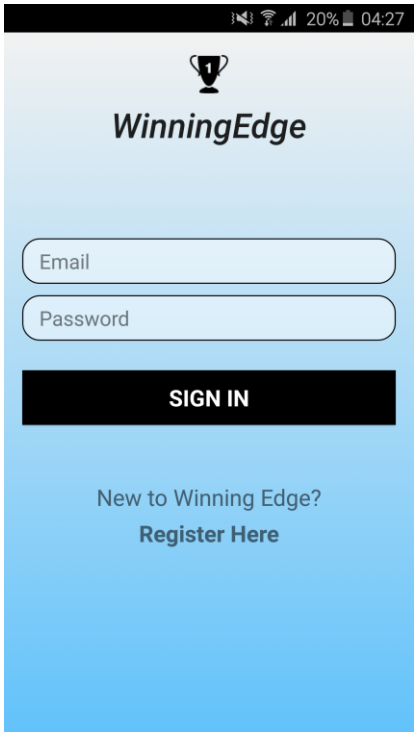
User Manual

Android Application

Once the Android application has been downloaded and installed to your device, navigate to the Winning Edge application icon on your device and press to load the application. When loaded the user will be greeted with the login screen by default.

Login

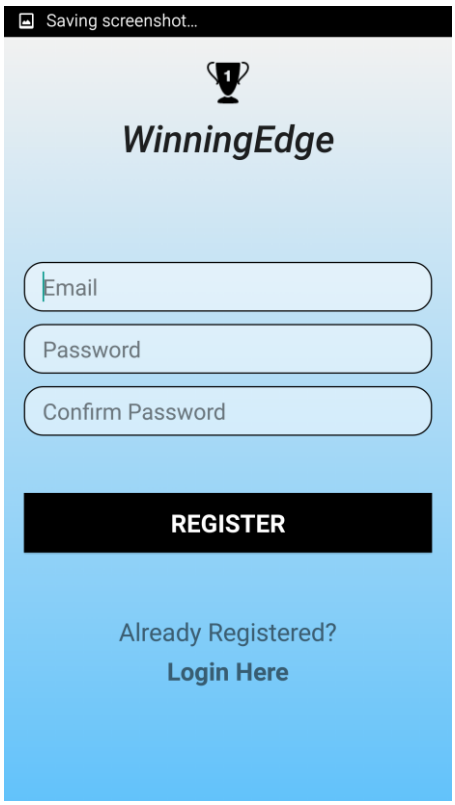
Registered users can log into the application by simply entering the email and password they used to register into the designated fields. If an error was made the user will be prompted to correct the error.



If the user is not registered they simply press the register here link at the bottom of the login page.

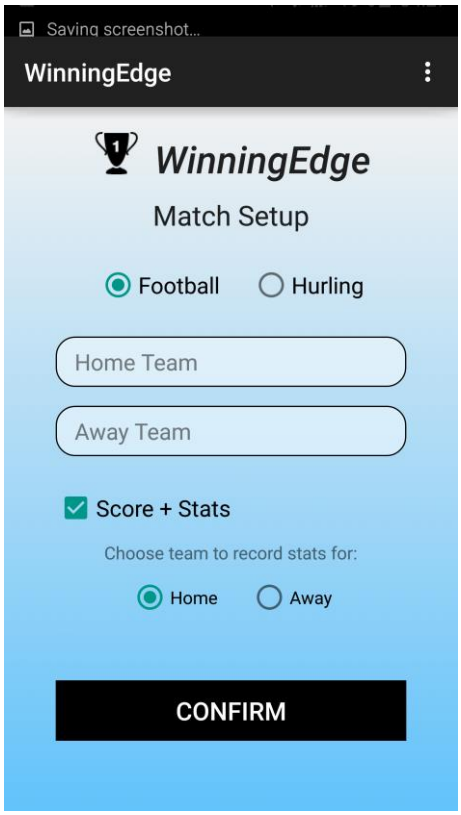
Register

The register screen requires the user to enter a valid email and password into the designated fields. The user must also confirm the password they have entered to ensure they made no mistakes while entering it.



Setup

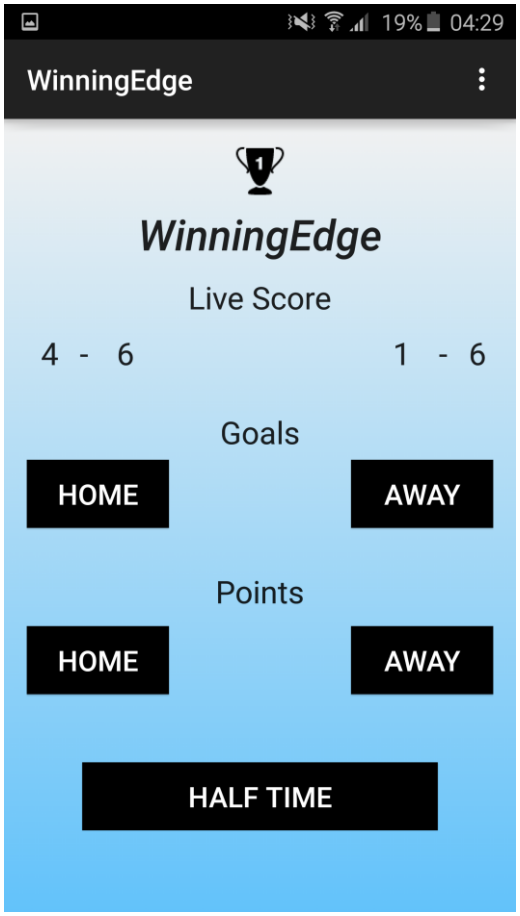
To setup a match the user simply enters the home and away teams in the fields provided. If the user wishes to record statistics for one of the team they can check the Score + Stats box and select which team they wish to record the statistics for. Once finished with this, press the confirm button which will take you to the match screen.



Record Scores

This screen is simply to record live scores for a match. Scores cannot be altered until the start match button has been pressed or the start second half button has been pressed.

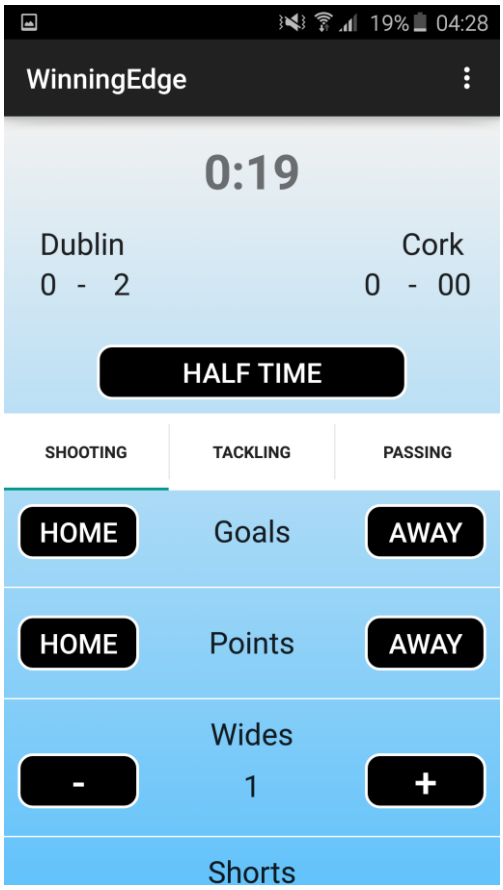
To increment the scores simply press the button associated with the desired score, for example if the home team scored a goal, press the home goal button.



Record Stats

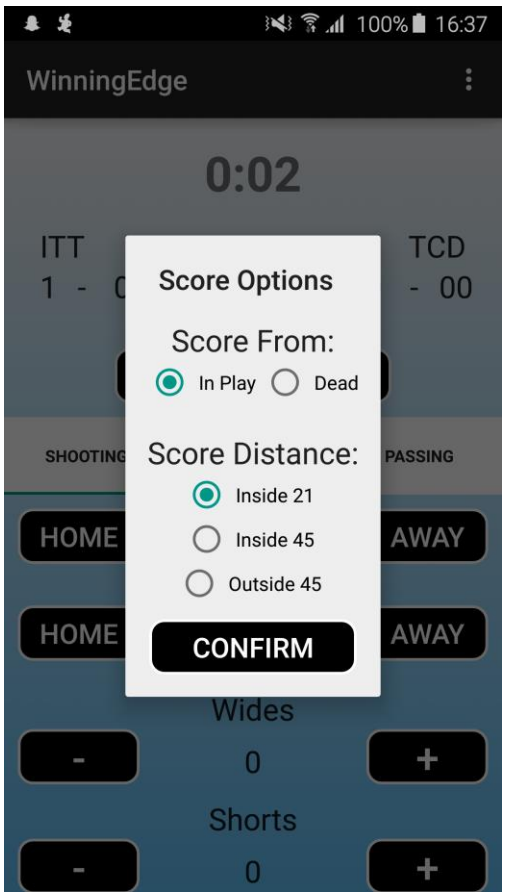
The record stats screen displays a timer, team names and scores in a fixed position at the top so they can constantly be monitored. The match must be playing in order to alter scores/statistics, this can be done with the start match/start second half button. The timer will turn red to indicate the current half is in additional time.

The statistics are broken into three categories, shooting, tackling and passing. These are represented by tab buttons. Click on the desired tab to display the statistics for that category.



Score Details

When incrementing the goals or points count for your chosen team a pop-up window will be displayed. Simply choose whether the score was from play or a dead ball and the distance of the score before pressing confirm.



Web Application

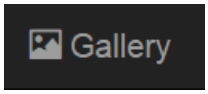
To access the full range of features of the Winning Edge system the user must be registered, if not registered users will only be able to access the home page of the web application where the live scores and contact us sections are located.

To access the web application, open your preferred browser and navigate to http://winningedge.azurewebsites.net. The page can be easily navigated using the navigation bar which is anchored to the top of the web page.

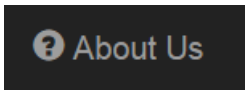
Navigation

The Home button will return you to the top of the page where the live scores and results are located.

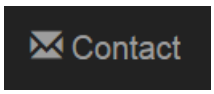
The Gallery Button will take you to the gallery section where you can find more information about the Android application and its functionality and benefits.



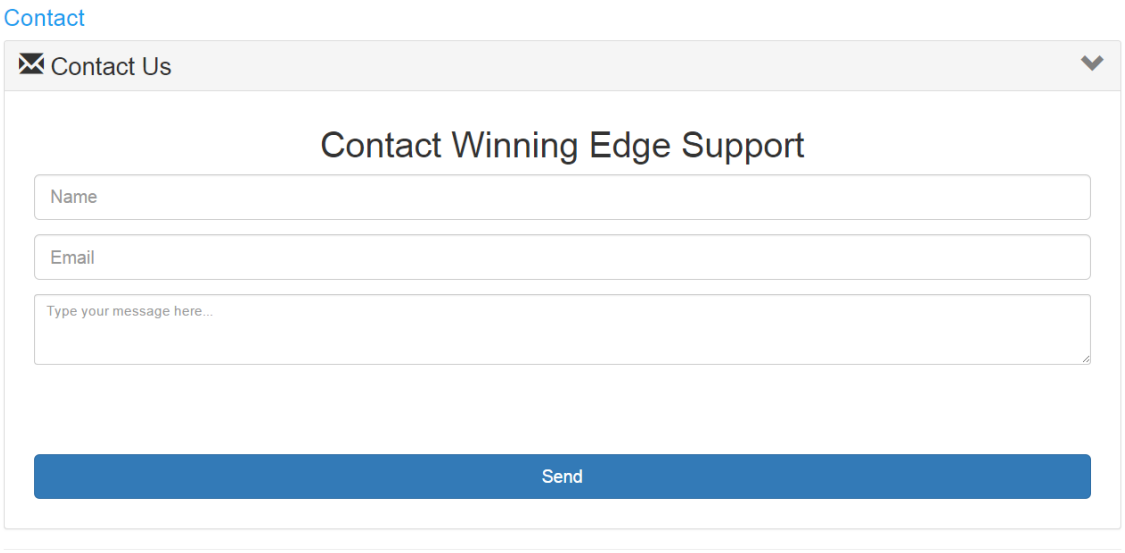
The About Us Button will take you to the About Us section. This section provides more information about the developer and how you can get in contact with him.



The Contact Button will take you to the Contact section, here you can report any issues with the Winning Edge system which you have encountered.

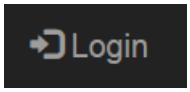


If you experience any difficulty using either the mobile or web application please use the contact us section located on the home page of the web application.

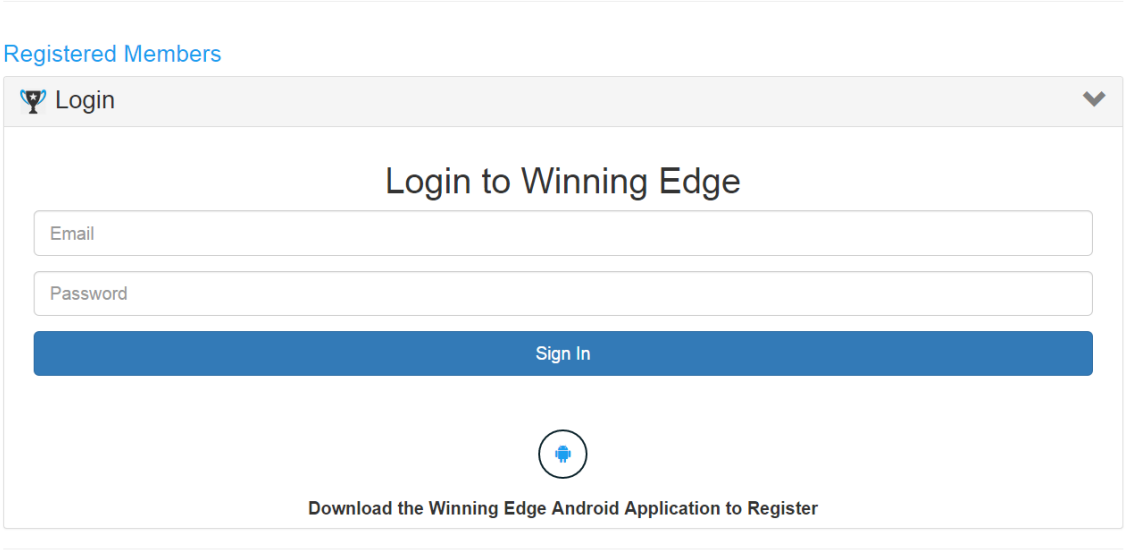


Login

The login button on the navigation bar takes you to the login section for registered users.



The login screen contains a simple form which requires your email and password to log into your account on Winning Edge. This is the email and password you entered when registering for the mobile application.

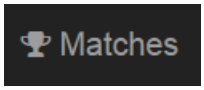


*Note: If you have not yet registered you must download the Winning Edge Android Application to do so.

Registered Users Area

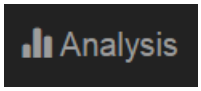
Once logged in you will be greeted by a new page which is only accessible to registered users. The page has a similar layout to that of the home page again using an anchored navigation bar for simple and effective navigation.

The Matches Button brings the user to the top of their list of matches.



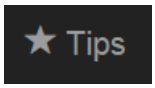
The matches section displays the user's recorded matches and the statistics for these matches. They are displayed in descending order, beginning with the most recent match.

The Analysis Button brings the user to the analysis section.



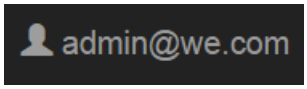
This section displays analysis for the most recent match you have recorded statistics for.

The Tips Button brings the user to the tips section.



This section displays tips which are generated based on the statistics the user recorded in the most recent match. They provide suggestions for training based on algorithms run on the statistics recorded.

The User Button opens a dropdown to display the log out functionality when clicked.



When clicked, the log out option is displayed. User is logged out when the user selects this option from the dropdown and the home page is loaded.

Post Project Review

Project Review

As a whole the project has been a successful one. Key to its success was a strong research and design phase which provided a great building block. This meant when issues were encountered I was confident in switching technologies to a more suitable solution as I had researched various possible solutions. I feel the project has been hugely beneficial for me academically, allowing me to gain valuable insight into a solo project, gaining vital experience in research, design, time management, source control and implementation. Despite issues during implementation I was successful in managing my time efficiently by prioritising more important functionality, so I feel the implementation and time management aspects were also a success.

Possible Extensions

I feel this system has endless possibilities for expansion and that the idea could be hugely successful with the right backing and support. Possible additions include:

- Individual player statistics.
- Inclusion of slider to record possession during games.
- Further visualisation of statistics.
- Dataset comparisons.
- Change password option for user.
- Password Recovery.

Review of Research, Analysis and Design

The Research and Analysis phase proved to be an important and strong starting point for the project. The variety of technologies researched allowed me to effectively assess the various possible platforms and technologies which were an option for the project. This meant that despite a change in technologies during implementation my overall structure remained the same and there was no delay in development. This allowed for more effective time management. Time management was also aided greatly by planning. The presence of use case with priorities and time frames allowed me to allocate time effectively and not dwell on unnecessary aspects of the project. This meant I continually had an end goal to aim for which meant the project came together within the time constraints.

Addendum

Due to issues which arose during the implementation phase I decided to revert to a Technical Architecture close to that of the one planned during the Research Phase of the project.

Revised Technical Architecture

Software Components

Database: Azure SQL

App Engine: ASP .Net RESTful API

Mobile Platform: Android

Platform Libraries

Android Application

Languages: Java and XML

APIs: RESTful

Libraries: Jackson (Spring)

Web Application

Languages: HTML, JavaScript, and CSS

Framework: Bootstrap

APIs: RESTful

Libraries: JQuery, Chart.js

RESTful Web API

Language: C#

Framework: ASP .Net

Security: Cors

Distribution and Deployment

RESTful Web Service

The mobile and web applications will communicate with the database through a RESTful web service.

Samsung Galaxy S6

The mobile application will be deployed on a Samsung Galaxy S6 device to show its full functionality.

Review of Implementation

Overall the implementation phase was very successful. Despite and early setback, my planning allowed me to reach goals and finish development within the time frame. This was achieved by breaking the project down in small layers of functionality. It began with developing a proof of concept to ensure end-to-end communication was achievable. Once achieved I began to implement my model for the database and ensure consistency across all platforms. The next phase was focussed on the Android client recording basic data and storing in the database, once this was completed I added to the level of detail being recorded. When the desired level of detail was reached, I put a simple U.I. in place for the Android Application and login and register functionality. The next step was to retrieve live data for the web application and update this data every few seconds. After this, I put a U.I. in place for the web application. I proceeded to improve the U.I. for the Android Application and introduce the ability to record statistics for matches. Once I had achieved this I developed a login functionality for the web application and a display of recorded statistics as well as analytics of these statistics. The implementation plan was a success as I stuck to the user case priorities and time constraints and did not allow myself to waste time on any one aspect.

I would have liked to include a greater level of security and authentication for my applications as well as more extensive testing, however, due to time constraints I was unable to achieve this.

Minutes of Meetings

Throughout the course of the year the project was managed through meetings with my project supervisor as well as panel meetings.

Individual meetings with my project supervisor took place every 1/2 weeks to discuss finer details of the project and ensure I stayed on track to complete it. These meetings were used to discuss any issues that arose as well as answer queries about project deliverables, my progress and targets for the next meeting. On weeks when meetings did not take place I provided email updates to my project supervisor.

Panel meetings usually took place once a month. These meetings were usually with 3 panel members and discussed ideas for the project, overall progress and feedback on this progress.