FINAL YEAR PROJECT

Sports Analysis System
Loughborough AU Archery Club

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Abstract

An application, named AU Archery, was created for the Loughborough University Athletic Union Archery Club, known as The Club, in order to help them with general life regarding records of and maintenance of all things archery. The application would have six different aspects to help them. The first would be to enter and track every single time they shoot arrows. They have a list of the different type of rounds they could shoot, and upon selection of one, they simply enter the individual arrow scores, or they only enter the key values which are required. They can enter as many rounds as they can and it is encouraged to enter their shooting history up to three years back. The second aspect would allow them to view all of the rounds they have submitted to the app, showing key values only, with the option to select a row of the table and have a full view of every detail of that round. The third aspect would allow users to sign up to the weekly training session which take place, simply responding "Yes" or "No" to the date and time. If you have an admin account, you are able to set the date and time of each session, as well as see who has said yes to attending, and the number of people that have responded. The fourth aspect is for the "Blank Boss" sessions which run on Tuesdays and Thursdays most weeks. These take place on Squash courts so have a maximum of six people per session. The sign up process is the same, but due to access levels not all users can sign up to this training. The penultimate aspect is the "Performance Program" table view. This analyses all of the numerical information in the applications database and displays it to show those that have the highest response rates, scores, attendance and other factors. This table will rank all archers and help to decide who will be on the program for the following semester. The final part of the application would be for admin users to change the access level of any other archer on the app. This would generally be used at the end of semesters when the Performance Program has a turnaround, or when the First Years are no longer novice archers.

This application will benefit The Club as it reduces the need for all of the administrative tasks which the committee currently undertake. Additionally, it congregates all of the information from members shooting history for them to keep a better track of it, as they are currently just using whichever application they want to. The numerical analysis behind the Performance Program will enable them to focus on the aspects which only humans can take note of, such as etiquette at competitions and punctuality, which the committee can focus on more now that the other analysis is generated for them.

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CHAPTER 1

INTRODUCTION

All applications are created for one purpose. Their purpose is to perform a distinct task, whether that be to entertain people while they play a game, keep track of health and fitness or to help with organisation. These are only some uses, and when created properly and efficiently, they are hugely beneficial to the users of the application. The greatest benefit of an application is when an institution or company can scale and use it across their entire organisation.

This was the objective when trying to create a mobile application for the Loughborough University Athletic Union Archery Club ("The Club"). The application ("AU Archery") will allow the club to bring together all aspects of members' archery lives into one place. They can use it for all tasks related to archery, as well as cutting out a lot of the manual work for committee members regarding administrative tasks. This will allow them to save a lot of time, as well as increasing efficiency and accuracy by removing the chance for any human error. It would also hopefully create a greater community feel within The Club as they would all be using the same application and could compare their results to a whole new degree.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

While applications can have many benefits and uses, this report will outline and highlight what AU Archery can do and how it will be used. The main purpose will be to record regular training, while there will also be the option to sign-up for training, and to view the current standings for the Performance Program. This report will focus on the benefits of AU Archery and why it would have a positive impact on The Club.

2.2 BACKGROUND WORK

It was decided early on to partake in a project which was related to sport due to a lifelong bearing towards all sports. Upon being given the opportunity to work with a sports club, and provide them with something which could benefit and better them, it was an easy decision for what needed to be done. Although there could have been the choice of many projects within the sporting bracket, to work directly alongside and very closely with a particular institute, club or team was an offer that could not be turned away. When the project was offered the next step was to select a client.

The initial idea was to create a system for a popular team sport where many people and teams could use the system, however it became apparent rather quickly that this would not really be feasible to make due to the complexity. It was therefore decided to focus on finding a client within an individual sport, where the benefits would be more direct and the process of creating the system would be more personal.

2.3 ARCHERY

Archery is a sport where an individual would use a bow and arrow, attempting to hit the center of the target which is directly in front of them. While originally, and historically, archery was used for hunting and in combat, it is now a sport and recreational activity.

In most cases, the target will consist of ten rings, with a score of ten in the middle decreasing out to a score of one on the outermost ring. The distance from the target and the number of arrows shot per end depend on the type of round that is being shot. Most rounds which are shot at university standard in the British Universities and Colleges Sport (BUCS) consists of either three or five arrows. Each round has a total, which is scored to compare each archer depending on distance and wind, however, the summation of every arrow in an overall score is used for placings.

Archery requires "skills of precision, control, focus, repetition and determination" [**worldarchery**]. It is a very technique-oriented sport and requires immense concentration in short, regular intervals.

2.4 CURRENT ANALYTICAL SYSTEMS

There currently are two main categories of analysis systems for archery: technique focused such as Hudl Technique [**hudltechnique**] and result focused such as Archery Scorepad [**archeryscorepad**] and iShoot 3D [**ishoot3d**]. The technique systems will have a series of cameras, or just one camera, which will record the movement of the archer during the draw and release. The systems then show the difference between what the archer did and/or how they can improve what they are doing. Video analysis applications are built for short term benefits, to view their errors and correct them immediately and bit by bit.

Results focused systems are based on long-term tracking of and viewing of rounds. They allow users to input all of their scores and then they keep a record of them to show how their scores change with time. Some systems will show the values while others can produce graphs for a visual aid. Currently, no such system exists which incorporates both analysis techniques into one application.

2.5 APPLICATION BUILDING

The need for an application was due to the fact that it would be the best way to show the users everything they need to in order to keep up to date with their archery lives. It would provide them with a fast, efficient and pain-free process to quickly input, view or edit any information. Since AU Archery is a mobile

application, they can do it whenever they want to, without the need for space or time to launch any PC or tablet.

It was decided to develop a mobile application as this would be the most accessible and used option by students, the target audience and the ones who will be using the application. They can use their portable devices at any given time, even when they only have a minute or two. Also, they would be able to use the application in any given place, assuming they have charge on their device and a working network connection. In addition to this, it is safe to assume that every student has a mobile device which can store applications,whereas some do not have PC's or laptops, meaning that there is a platform for every member of The Club to use this analytical system.

2.5.1 STANDARD PROCESS FOR CREATING AN APPLICATION

In general, creating an application has a step-by-step process which could be followed. One such process is "1. Sketch your app idea 2. Do some market research 3. Create mockups of your app 4. Make your app's graphic design 5. Build your app landing page 6. Make the app with Xcode and Swift 7. Launch the app in the App Store" [**learnappmaking**]. Whatever the number of steps are and how exactly they work, the typical process goes from the individual that came up with the idea, to developing sketches and prototypes, before creating the final version and scaling the application out to the wider community.

Sketching the application idea could be as simple as just getting pen and paper and moving your ideas from your head onto the paper to visualise the idea. Typically, the creator of the application will have a sketch of every screen and know the flow of the application, how a user will move between the screens and use the application in full. It is very critical to think about what aspects of the application are vital, which are added benefits, and also which you could remove as they are not needed or would not give any benefit. Remember that an application has one main use, and should focus on this, and every other feature is a benefit.

Market research is doing the research into what already exists regarding what your application will be. For example, if you are creating a new text file, you will need to do research into what aspects of the currently used software, such as Microsoft Word, users like and dislike so that the application you develop will have maximum satisfaction. This is a very important step so you can ensure you are not copying what anyone has or are using any of their unique tools or benefits. You can also use certain parts of other applications as inspiration for design ideas, a basic yet vital part of any application. It needs to be simple and aesthetically pleasing, while not patronising users. In this step, you also need

to find out about any technical requirements of your application. You find out what you can actually do, as well as what it is you need to do in order to achieve your goal. Generally, this is where you would find out and generate an idea of the cost of your application. An analysis would need to be done of how much your application provides an end user and how much they may be willing to spend on it. The most important thing to remember is you will need to sell it for low enough that people will download it, but have it expensive enough that you will make money back from it, if that is what you want to get out of the application.

Creating mockups does not require any exact details, colour or design. They are more commonly referred to as prototypes. The main purpose of these is to see the functional flow of the application, finding out the connection between your screens and how a user would navigate around your application. To aid you with this, you need to create multiple versions with different features and flows, to compare which features and aspects would work the best. It is very common here to perform some questionnaires or surveys to get the opinion of other people. You then take all of the better parts of the different versions and combine them to come up with your application flow. This is important as you will decide the final look of your screens and their flow, how the users will see it.

Making the graphic design is the reverse of the prototypes to an extent. Here you make the exact details, colours and designs. Now that you have the foundations of the screens and flow, you need to make them all have high-resolution versions. Finalise any effects, pictures, visualisations or motions, so that they are completed and do not need any more tampering or adjustments. You need to make sure that all aesthetics are taken care of.

For a lot of applications, the landing page, either the homepage or login page, is one of the most vital ones. It is what a user is greeted with when opening the application, so needs to embrace what your application is trying to achieve and show them the ethos of your company/application. You need it to be in line with what you want the rest of the application to look like, so there is consistency across every part of it. If there is a login page try to keep it as plain as possible, having the colour and layout in the style you decided to use. For the homepage, try and have the option to access any important page directly from there, rather than a process of looping though every screen until reaching the desired page.

A deviation from this could be to create a website with some information about the application before it is released. This is very useful for very large companies or institutions that have a wide user base for other products. It can allow them to show what they are planning to do, keeping customers as up-to-date as possible. This also provides you with an opportunity for informal feedback, allowing you to edit and alter certain aspects before you begin to code

Arguably the step where you could spend the largest amount of time, where you actually code the application. This is split into two sections, the front-end and the back-end. The front-end is the part that a user would see and interact with, from layout and buttons to graphics and data processing. This is the aesthetics aspect of the app, ensuring that it looks good and the users can easily see what to do and how to do everything. The back-end mainly concerns databases, with data management and user management. This is where the app will actually do things and work, rather than showing screens and moving between them. For this you will need API's, storage solutions and servers. It is common to code the front-end first, so you understand the look and feel and then you can add in the back-end easily as you can visualise it.

The final step is to launch your app on a server. This moves the application into the cloud so that it can be downloaded, and more importantly so that the database works in unison rather than per device. You can select which application marketplaces you want it to be on, but they all differ with how they allow that to happen, e.g. Google Play store allows it to just go up and be downloaded whereas Apple has the right to review and approve the application. Once it has gone online on the store, it is available for download so that people can use and enjoy it.

2.5.2 Process undertaken for AU Archery

The above steps are the process which was followed for creating AU Archery. The sketches were drawn out, with three final versions, all different from the other two. This was to have an idea of what was and was not possible, with many adjustments being made to the original idea. The first sketch had one of the tab options as the first page, where a user would enter scores of a round shot, with a menu button in the top-left hand corner. Once pressed, the rest of the screen would fade and a menu would appear down the left side of the screen. Here, the user would select the menu option they wish to navigate to. The second option uses tiles to represent the different options to select on a homepage. Once an option is picked, the user will navigate to that page, and would then need to click a menu button in the top left hand corner to revert back to the homepage. The final sketch also had the first tab option as the landing page after logging in, however the menu was as a bar along the bottom of the screen. This third option could have a slight variation on it, where the menu bar would almost be hidden along the bottom of the screen, and the user would tap it to indicate they wanted to navigate to another page. These are shown below in Figure 2.5.1 in the respective order.

Once the preliminary idea was solidified, the market research was performed. Here it was found that there were a lot of analytical system applications already in place, for both types of systems. Commonly used applications for score tracking are "iArcher" [**iarcher**] and "Sport:80" [**sport80**] while technique focused ones

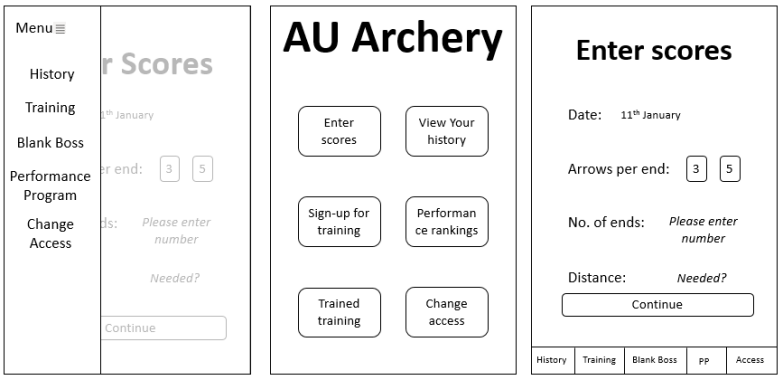


Figure 2.5.1: Three different sketches of the applications homepage

are “Coach’s Eye” [**coachseye**] and “Kinovea” [**kinovea**]. All except for Kinovea are mobile applications, showing that this is what the consumers tend to want to use, however Kinovea was still used as an example to see the major differences between mobile and desktop applications. The main thing to note is that most desktop video analysis applications are created for multiple sports, as the space and storage they can occupy is a lot larger so developers put more into the applications. Since computers have a higher computational power than mobiles, desktops applications also provide a much finer level of detail, both with what is being done by the athlete as well as how they can make improvements. It was noted that the preliminary ideas for AU Archery had not been created in a single application, mainly due to the aspects which will be specific to The Club.

As prototypes are not the final product, and the main idea is to see the flow and layout, the prototypes were created in Microsoft PowerPoint. Each of the sketches from the first step had a prototype created for them. Although the layout of the individual pages was almost identical, the navigation between the screens and overall flow had large differences. Once these had been completed, they were sent to The Club for analysis and their opinion. Since the application would be created for them, it was critical for them to select what they preferred and enjoyed using the most rather than using the sketch which would be quickest or easiest to create. All of the prototypes were created so that Microsoft PowerPoint could be used in full screen mode and they would be able to click and interact with the prototype. This was done to create the effect of actually using the application, rather than just seeing what the screens would look like.

In the response from The Club, they had made it clear that they wanted to use the sketch which has the tiles on it. Their reasoning was that it would be easiest to navigate and know what aspect they are using, as well as the fact that it was what Loughorough University use for their other applications, so this would keep the layout and flow consistent for The Club’s members. Additionally, The Club

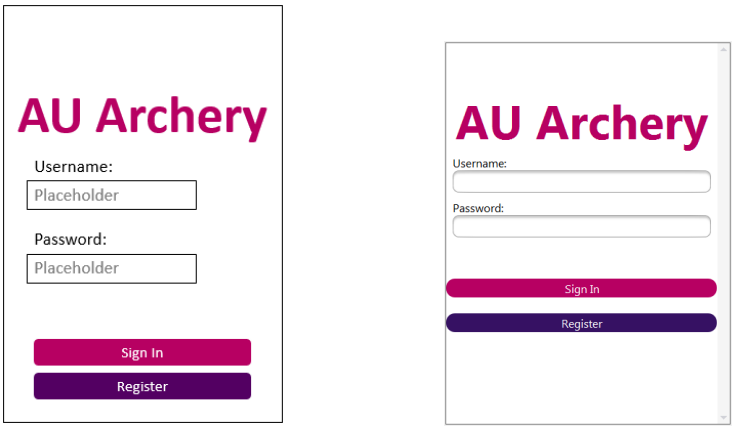
gave feedback on the prototype, indicating aspects they did not like, any features they needed added, or slight adjustments which needed doing to wording or positioning.

This feedback was then acted upon, making adjustments and corrections where needed, such as adding a button if a shot had been missed, giving a score of 0. Some other slight changes were made to accommodate the new layout and structure, for example, clarifying a few word and round classifications. As The Club had made their selection of a version to use, these corrections were only performed on that version. This improved prototype was then sent to The Club again in order for them to assess the new version. As with the first time, it was crucial to allow them to assess the prototype again for them to give any additional changes or further alterations which need to be made. However, when they reviewed this second version, it was agreed that the prototype was of a good standard, and that The Club would accept if an application was made to that standard for them.

The next stage of creating AU Archery was to decide the graphic design, giving the sketch some colour and detail. It was a simple decision to use the Loughborough University approved colours, found on the "Our Visual Identity" [**luffvisidentity**] document. This was chosen to be used as AU Archery is for a Loughborough University Athletic Union club, so the themes and colours should be in line with what Loughborough University adhere to. As people would typically only want to perform a small action on the application, it was decided not to use animations or effects for navigation, only some slight effects for accessibility. It was ensured that the details were finished here so that when it came to coding the application, the simple action of coding it without the need to tamper or design anything, which saved a lot of time. Figure 2.5.2 on page 10 shows the final design in the prototype of the login page.

As AU Archery is for one specific client, there was not a need for a landing page as a website to market the application, as the client is aware they will be able to use the application. Therefore, as a landing page the login page was used and created. It simply has two text boxes, each with a label for the Username and Password, to enter your combination of the two, and then a login button to then proceed into the application. Below this, there is a register button, in case an account has not yet been created. This was added for security so that not just anybody could add information to the databases and use the applications servers. The final Login page can also be seen in Figure 2.5.2.

The first step in coding AU Archery was to set up all of the screens and the navigation between them. As they had already been finalised in a previous step, it was not difficult, ensuring that clicking a button would navigate to the correct



(a) Prototype Login Page (b) AU Archery Login Page

Figure 2.5.2: Login pages

page, and that it had the most aesthetically pleasing result while being as close as possible to the final prototype. Once the front end of the application had been finished, the first part of the back-end was to create a database in order to store all of the information that would be required. As SQLite is a very simple database, when selecting or creating a table it automatically creates a database in the background to store this. This table would include basic profile information, to log in and to store things such as names, as well as all of the tables of the rounds that an archer had shot and a table for each of the training types. One aspect of the application would be that different users would have different access levels, with The Club's committee having admin rights, Performance Program archers having an access level and the rest of the club being defined as "standard" archers. The first aspect was to allow admin users to change access levels, as this would be simple to do, yet necessary on a yearly basis as a minimum. A SQL statement was used to pull a list of every accounts name and their current access level, with the option to change their access level to one of the other two, shown in Figure 2.5.3. This value was then updated in the database where the name was the one which had been selected, with this being the only way to change access for security within the application. When an account is created, it initially has an access of "0 - Standard Archer".

The second page to be created was to enter scores for a round shot. This would have ten different sub-pages, one for each of the different rounds that The Club needed to be recorded. First they are presented with a list of the different rounds, and they pick the one which they wish to record values for. This selection sends them to a sub-page, as each round has different variations and options for number of ends or arrows per end. They then have two options: one to input their individual arrows from a group of buttons, and then a second option to

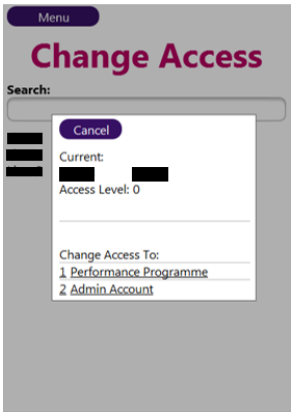
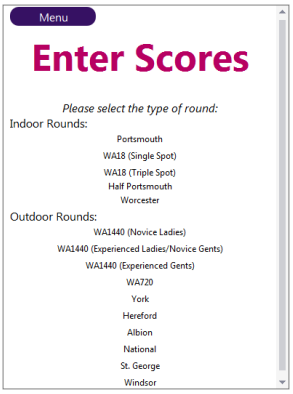


Figure 2.5.3: Change access of a user from “0 - Standard Archer”

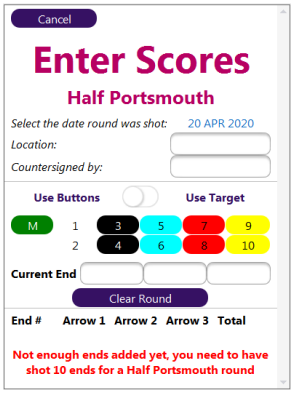
only input the total score and any other required, key information such as the location the round was shot in. When adding the scores with arrow values, they add arrows per end, then add each end into a temporary table, which is displayed in Figure 2.5.4. This table is displayed with each end that has been added, and the archer can only add ends depending on the type of round that they selected, as they have different requirements. The information that is required is the date, location, a countersignature of someone that is not the archer signed in, the total score, the number of hits and the number of highest value (which can be an X, ten, nine or 5). All of the values except for the date, location and countersignature are automatically generated as the archer is entering their round values. Once the archer has added all of their ends, they can add the round to the database, which uses the date and archer ID as the key for referencing. When a round is added to the table, it occupies one row of that table for clarity of storage, and the temporary storage table is cleared of all values, as this will be used again next time.

The next page that was coded would allow the archers to view all of the rounds they had submitted, showing a list for each of the rounds individually, with the option to select one and view the in-depth analysis of the round rather than an overview of them. On the initial page, they see all of the key values except for the countersignature. This was done for quick overview of that round type, as that is the minimum information they could need to see for comparison. Upon selection of a round, they get a window pop up which shows them all of the values associated with that round, which is done using an SQL statement to pull all of the information from that row of the table, with all key values and the values of each individual arrow displayed, in a table where each line is a different end.

The penultimate pages to be added were to give the archers the ability to register their attendance at the training sessions. A date and time would be

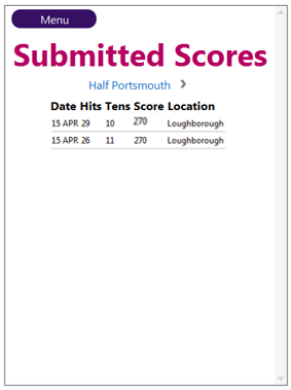


(a) Selecting the round to record

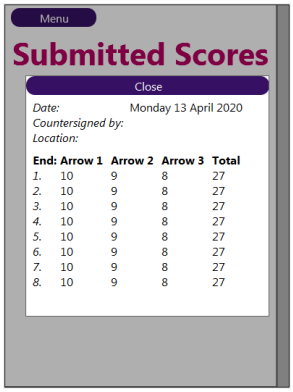


(b) Entering the scores

Figure 2.5.4: Process of entering a round to database



(a) Viewing the key values



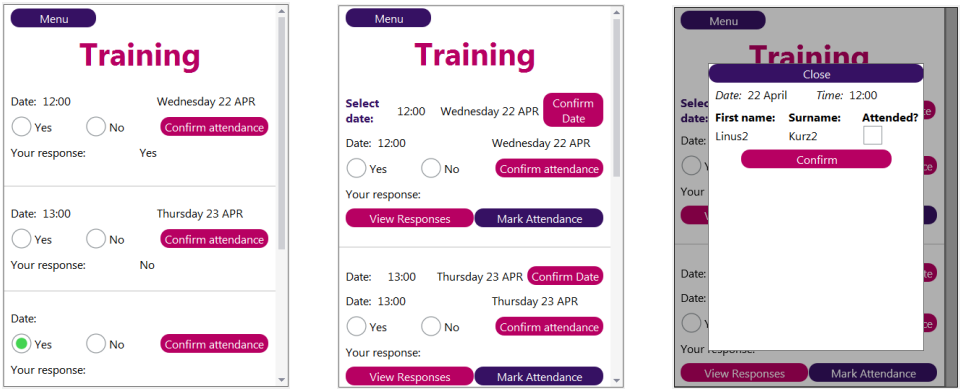
(b) Viewing an individual round

Figure 2.5.5: Viewing scores entered into the database

displayed and they can either reply with “Yes” or “No”. The idea of this was to get them to respond whatever their decision as The Club would like to be aware of every archers involvement and engagement with every aspect of archery life, including courtesy of saying when they can not attend sessions. They have the option of responding to training for five different sessions on the “Training” page, one for each of the different training types they have in a regular week, shown in a demonstration in Figure 2.5.6 (a). Alongside this, The Club run “Blank Boss” sessions for non-amateur archers, which are sessions that run on separate days and times and are more individual. These have the same layout as the regular training, but have four sessions per week. The way in which these differ is that they take place in a smaller environment, so there is a maximum of six archers per session. This means that it works on a first-come-first-served basis, where AU Archery will no longer accept responses to that session once six people have said they will attend. Admin users have an additional job here, where they need to set the date and time for each of the nine mentioned training sessions. They simply select the date and time from a date and a time input, and click a button to confirm the new date and time. When they confirm this, a notification is sent out to users of AU Archery to alert them of the new training session they should respond to. Furthermore, on an admin account, you are able to see the number of people that have singed up for any given training session, by simply selecting the ‘View Responses’ button on the training page shown in sub-image (b) of Figure 2.5.6. This produces a smaller pop-up window which would list the archers which have responded with a “Yes” to the training session, which is doen using a simple SQL statement to search for a response of “Yes” to the training at that particular date and time. The other option seen is to mark whether or not those archers which said they would attend training actually turned up. In a similar style to viewing responses, there is a list of those archers which said yes to that given session, and an admin account then needs to tick the check box if a person turned up to the session. Upon clicking the box, it updated the table depending on the alue of the box, either with a “1” if they were present and leaving it as a “0” if they did not show up.

The final page created would display a table of the Performance Program rankings. This is an additional program within The Club where they take their top twelve archers for extra sessions and give them extra advice, guidance and help. The table takes a range of criteria, such as training attendance, round scores and response rate to training to rank the archers. This table is reviewed on a semester basis for who the next twelve archer will be that will be a part of the Performance Program.

Launching AU Archery onto a server has not yet been completed. This is due to the fact that The Club has not yet returned to university as Loughborough University is currently closed due to the global pandemic occurring with COVID-



(a) Responding to training as a user

(b) Training screen as an admin account

(c) Marking attendance to training

Figure 2.5.6: Training screens on different access levels

19 [**covid19**]. Once The Club resumes as normal, they will be given the code for AU Archery in order for them to activate the server for them to use the application. Which server they use will be up to The Club, but they have begun negotiations with Loughborough University in order for them to host it as they are a club within the university's Athletic Union organisation.

2.6 Software used for development

Altova MobileTogether was used to develop AU Archery. The two driving reason for this was that it was compatible across every mobile platform, so once the application was complete it could be installed on IOS, Android and Windows devices. This was a critical requirement as the application needs to be available for every member of The Club, in order for it to be most effective and be an accurate representation of the whole archery club. Furthermore, since it uses SQLite, it would be very simple to create a lot of the back-end features which were needed for AU Archery, it was not needed for a very powerful system behind the software as the application being developed does not require a lot of computational power. In addition to this, the device being used does not have a lot of storage or computational power. This was a very restrictive condition as this cut out a lot of potential applications such as Corona [**corona**]. A final point which made it difficult to find a very powerful software to use, was the restriction that the software had to be free; AU Archery was developed as a dissertation final year project, so therefore could not have an investment go into it.

There were many aspects of Mobile Together which made it easy to use, such as the drag and drop options for designing the layout and user interface. Throughout the design and coding, it was simple to make alterations, changes and additions

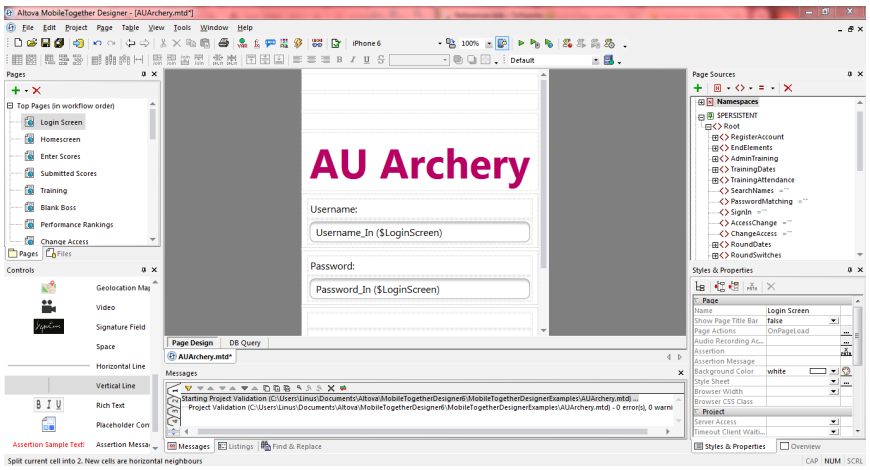


Figure 2.6.1: Layout of Altova MobileTogether

to the pages as they could be easily moved rather than having to hard code everything. Another positive aspect was the directly incorporated use of SQLite, meaning creating, using and altering tables and the database was very simple as actions could be added onto buttons and changes could be done on a by-page layout. **??**

While there were some benefits, MobileTogether also has some drawbacks, for example, even though it made it easier to set everything up, using SQLite was very challenging due to its simple nature, and lack of detail in the design of how it can be used. This was shown when the tables to store round information needed to have a different column for each arrow, meaning soe tables have over 150 column just to store one row of information, which is a lot of information. Furthermore, due to the nature of the ssoftware, an aspect of inputting scores was not included. This was due to the use of diagrams and how they can imported into the application, it is only possible to select a whole image, and no way to input images on top of each other to create the effect on an archery target, so this functionality was scrapped. Additionally, even though The Club are not practising now due to the global pandemic [**covid19**], it was attempted to set up AU Archery on a server for download for the committee to see it and for access to a mobile device, however this aspect costs. Something which Altova did not make clear until the thirty day free trial ran out and disabled everything online. This then also made it extremely difficult to export the code so that it is set up like normal code rather than in a UI software.

2.7 Conclusion

The purpose of this literature review was to give the necessary background knowledge to understand the rest of the report regarding the development of AU Archery. Although this was a very in-depth introduction, the information given was needed for reading and understanding of the rest of the report. While there are aspects that would be changed with hindsight, such as the software which was used, an important note is the process that is followed for creating an application. The research and information regarding archery and what systems are currently being used are for educative purposes to be able to follow the report with clarity.

CHAPTER 3

REQUIREMENTS AND ANALYSIS

For this project, the only requirement given was that the outcome needed to be a sports analysis system. The Club was selected as they did not have any system in place to help them with admin and analysis, but also because having a client would greatly benefit the project as a whole, both with reaching the objectives as well as creating a system of a higher standard as it would physically be used. The initial idea was to create a video analysis application, for them to improve their technique, however this would not be the most beneficial application for The Club. It was agreed to therefore change the application completely from a video analysis to a scoring analysis application. All of the aspects and aims of the application were agreed, and the only one The Club was explicitly informed of that could not work would be to input scores using a target. Due to the software used this was not going to be possible. The only other aim which was not met was to finish displaying every criteria of the Performance Program table. Some of the criteria would not be able to add into the table, as it cannot be displayed in any form, such as training behaviour, punctuality and competition etiquette.

3.1 WHAT NEEDS TO BE DONE FOR A PROJECT?

For this project to be viable it needed to have clear aims and objectives and a path where those could be achieved. The objectives needed to be ones where there was an end goal of something having been proved or disproved, or ones where there was a working solution in the end. In this case, it was an application, AU Archery, which helps The Club to better keep track of their archers scores and improves time and efficiency of their admin as it can all be in one application rather than on five different paper registers. The main objective was to give them an application which would bring together all of their aspects into one place, which AU Archery has been able to accomplish to the best degree that it can.

3.2 What does the client need?

Upon the first meeting with a representative from The Club, it was agreed that the application would incorporate both analysis techniques. The most important factor of the application would be to reduce the amount of administrative work for the committee of The Club. They currently open up a Doodle form for responses to training, and then manually transcribe this onto their master document. In addition to this, they use a paper register for training attendance, which then also is manually transferred onto their master document. Regarding shooting rounds, they already keep a separate manual, paper log of competitive rounds shot, however they do not have a way of tracking members training, and they let them use whatever application or method they want to, if it is their desire to track their scores. The underlying issue they wanted addressed was the amount of administrative work, from general tracking as well as duplicating information onto their master document. The application created should make this aspect easier, and if possible, remove the need for it completely. The main aspect they wanted from the application would be to have the video analysis, using a side-on camera of the archer, and there would be a grey line following the draw and release of the archers, from their hand, to elbow to shoulder. This grey line would then be compared to an optimal green line which showed what that particular archer should correct in their technique to improve. Alongside this, the application would also track their scores of their rounds, so they would be able to see the technique of their shot, with the scores they achieved with those shots in the same screen. The representative then took this information to the rest of The Club's committee to discuss what it is they all wanted from this application for them. The Club came to a decision that they would not require the video analysis, as it would be too complicated for the project due to slight variations in technique from each archer, and also due to the fact that they felt they would be able to benefit more from other specifications of an application. A further meeting was then set up with the representative, for this decision to be passed on for the application to be developed accordingly. The Club's committee wanted an application to track scores, incorporate their training in the specific way they run it, and if possible, to include functionality regarding their Performance Program. It was after this meeting that the ideas started to come to life and the sketches were drawn out for the application that would become AU Archery.

3.3 What functionality was included?

Logically, all of the requirements from The Club could be met to some degree at least. Inputting, viewing and tracking scores would be more than possible, as that only requires a database to write information to, and then the need to be able to re-call this information again. Using SQL this was accomplished, both for adding rows into the relevant tables, as well as for viewing any submitted scores, sorted by

date. The initial idea for the training page was to only have two or three possible entries to respond to. Once the current date and time reached within an hour of the training start time, users would no longer be able to respond to the session. Additionally, once the training had begun, the database would automatically edit the values to then display for the next available session, either exactly a week later, or at the next date of a session which would be pre-programmed. Unfortunately, this would not be possible as the dates can only refresh at the same time and date, without being altered, due to the software. Therefore, the programming decision was reached, where the admin accounts would be able to select the date and time. This ended up being a positive for The Club as the times and dates can change between weeks, months, semesters and years, so an admin can always set it to when they have a session booked.

The Performance Program table was going to be the main aspect which could not be completed. Due to limitations of a mobile application and human inspection and knowledge on certain aspects such as conduct in training, the table would not be able to fully incorporate the entire list of criteria. However, an amount of these was added into the functionality of AU Archery, including but not limited to training response rate, training attendance and hit percentage. These values were all ranked and helped to build toward an overall ranking of the archers that use the application, to aid in the decision making process of selecting the participants in the Performance Program.

CHAPTER 4

DESIGN

When coming to a decision regarding the design of an aspect of AU Archery, the intent was to have consistency across the other Loughborough University applications. Although this would not officially be connected or associated with Loughborough University, The Club is a part of that institution so it would be wise to keep similarity for the members. In addition to this, another aim was to keep the layout and flow as simple as possible, keeping the number of screens to a minimum, the number of clicks as low as possible and the time needed to perform any action as short as it could be. The intent was to have the use of AU Archery to be as efficient as it could be, from opening the application to whatever task it may be to be completed.

4.1 USER INTERFACE

The user interface was designed in order to keep it as simple as possible, while making it very clear what each of the different pages are and how to get to them. To incorporate this, wherever there are buttons the background colour alternates between the two approved colours (listed in the following pargraph), to highlight there is a difference between them. The buttons were also created so the text within them is completely surrounded with white text so everybody is able to read them, as well as having the buttons small enough so there is clear white spacing between them all. Navigating between pages was intended to be as fast as possible, so no animations were used, with the user being sent to pages immediately, as it was decided animations would only irritate users after some time. Additionally, when only a small action will be performed, or data is only viewed and not edited, a small window opens on top of the page as a sub-page, to save computational power and speed up the process of performing the action.

4.2 Colour

Only six colours have been used throughout AU Archery: black, white, green, red and the use of two of the approved colours from Loughborough Universities "Our Visual Identity" [**luffvisidentity**] document, #B70062 and #361163 in hexadecimal, most closely referred to as pink and purple respectively. Every screen has an all white background to keep them plain and clear, so it is obvious when there is something to interact with or something to see. If there is text on the pages, it is written in black to have the most contrast with the white background, and so that every user could read them. When text is on a button, then it is in white for more contrast with the background of the buttons, and the only other deviation is the titles of pages, written in the pink approved colour and in bold font for emphasis and clarity of what the page is.

4.3 Layout

The tiled approach of the home-screen was used to replicate what Loughborough University do for their other applications, to keep it most similar for the students of that institution who are the members of The Club. This was to keep familiarity for them, so that they make the connection between the different applications and recognise that the application is only for them and was created for a single purpose, for The Club to use. In addition to this, using tiles would make it very clear what page the user is on, and also would make it very difficult for the user to accidentally navigate to a wrong page, as they need to click the cancel button at the top of the page rather than clicking a menu button along the bottom or side unintentionally. Finally, humans interpret visuals better and easier than text [**thermopylae**], so using buttons will be more beneficial and speed up the process.

4.4 Font

The font used was a standard for many popular applications, including Microsoft Word, "Calibri (Body)". This was used for familiarity for users as they will be able to read it and use it. The font is consistent throughout the entirety of AU Archery. The only slight deviations are when the text has been modified to be bold or in italic for emphasis, which is mainly used when there is text the user does not need to interact with. For example, page titles were put in bold to be very clear and stand out, while instructions were put in italic to draw the attention of the user to ensure they read it and understand what they need to do, shown in Figure 4.4.1 with the title "Registration" near the top and the instruction just below beginning "Fill in every...".

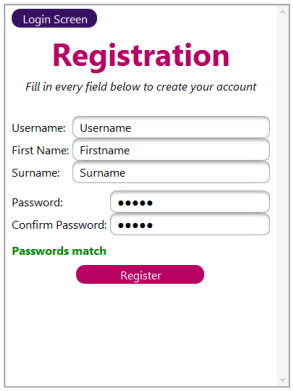


Figure 4.4.1: Screen to register a new account in AU Archery

4.5 Accessibility

AU Archery was created in order to aid every member of The Club, whatever disadvantage they may have for whatever reason. Therefore, AU Archery helps any individual that may have any accessibility issues, such as creating clear divides between buttons by alternating colours and using horizontal and vertical lines for clarity. Another clear identifier is using appearing and disappearing text which is coloured for password matching and the total number of ends added to any round. When typing in passwords to register an account, text will show underneath the boxes in red if the passwords do not match, whereas there is green text confirming they match if the are identical, which is visible near the bottom of Figure 4.4.1. Throughout AU Archery, the text size has been set so that it is always large enough to be read by any individual as the text size is the same as or larger than standard popular applications such as Twitter and Facebook. The only occurrences when text is smaller is when displaying numbers as these are listed a lot of times potentially, so more information can be displayed, for example, when viewing all submitted scores. A further method to help every member is with clear visuals in the form of message boxes. When anything is confirmed: responding to training, submitting a round to the database or setting the training date and time, a message box appears to confirm what has just happened, see Figure 4.5.1. The last way AU Archery helps accessibility is by having large buttons, while simple it is important these are big enough so they can be pressed while not taking up too much space, and also having a large enough gap between them that the wrong one is not pressed.

4.6 Security

As it should be with every app, AU Archery has multiple barriers in place to aid with security and protection of information and data. Firstly, every time AU Archery is opened, the user needs to log in using their credentials, using their

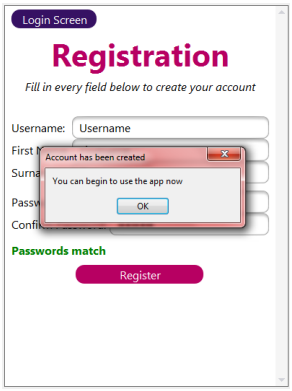


Figure 4.5.1: Message box to confirm the account has been created

unique username and a correct username and password combination. At the same time, another security measure is that the password fields, wherever they are entered, always have hidden text, and when clicking out of the edit field, it always shows it to have a length of five characters. This ensures their security so nobody else can use their credentials and access their account. Arguably the most important security measure is the use of different access levels. Only the people who need to can see certain parts of AU Archery, such as changing someones access level, viewing and marking attendance to training and setting the date and time of training sessions. This creates an environment where the admin have a clear hierarchy in which to organise and run The Club as they see will benefit it, without anyone causing chaos. A final method in which the data of users is kept safe is that every aspect of AU Archery only uses internal data, and does not allow anything to be exported, printed or copied into another place. This keeps the data in the one place where it is safe and cannot be edited or corrupted.

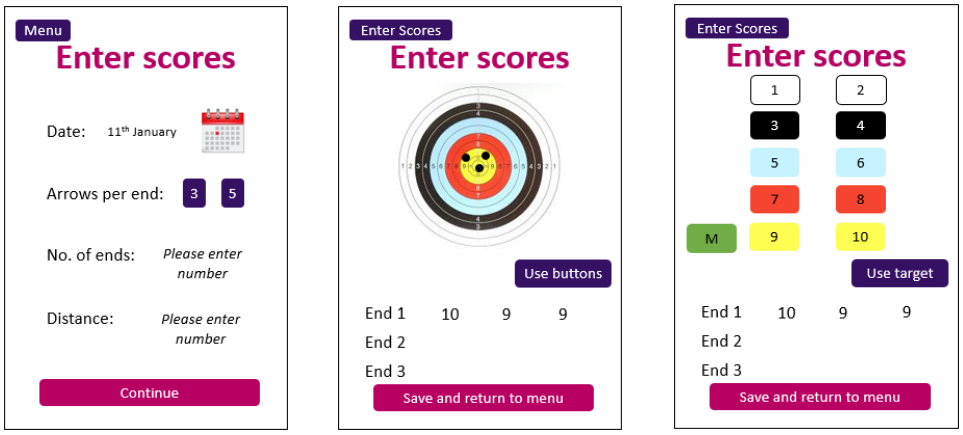
CHAPTER 5

IMPLEMENTATION AND TESTING

Throughout the project, there were multiple instances where the application was implemented from one system to another, the first time being when the sketches were drawn out on paper, using the visualisations and research knowledge to create them. Doing the market research beforehand was part of the natural process of creating an application, but this needed to be implemented onto something visual to have a physical version. Once the sketches were finalised these had to then be materialised into prototypes, which were created in Microsoft PowerPoint. After these were refined and corrected, the final application, AU Archery, was constructed using the software Altova MobileTogether. Even though the next step has not yet been completed, the final step in the implementation process is to move AU Archery onto a server so every usage of AU Archery is on the same server and database for everything to work effectively.

5.1 THE PROTOTYPES

The decision was made to use Microsoft PowerPoint to create the prototypes. This was because it would be straightforward to create the screen designs and layouts using shapes and lines, as it is be possible to move and drag and drop all of the objects very easily. The idea of a prototype is to create a quick version of the front-end of the application, so it is best done in the way that allows it to be created in the fastest manner, while showing every aspect of the initial sketches. The prototypes were created so that the PowerPoint could be used in full screen mode and the user could click, interact and navigate their way through the prototype as if it was a working application, without any back-end aspects. The initial idea was to give a user the options to select the criteria they had for their round to shoot, i.e., shooting three arrows per end, for ten ends from a distance of fifty metres, review Figure 5.1.1 (a) for reference. Furthermore, (b) and (c) can be used to show how it would be possible for there to be two different screens for options to add an end, one for using buttons and another for clicking on a target.



(a) Using a target to enter scores

(b) Using a target to enter scores

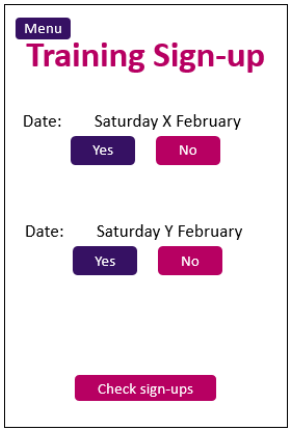
(c) Using buttons to enter scores

Figure 5.1.1: Method to input scores in the tiled prototype

The option to sign-up for training would have two dates, with the user having the option to respond “Yes” or “No” for their attendance. Once this training date and time had passed, it would automatically renew with the next date for the following session. This would allow this page to run by itself, without the need for any changes, cutting out the need for The Club’s committee to manually open training sessions on a Doodle form. Additionally, since a Doodle form is only used for this within The Club, they have been manually tracking who has and has not responded, and turned up. The application would automate this, tracking responses within the database and allowing the attendance to be registered within the application, so it is simpler and faster, and removes duplication. Figure 5.1.2 shows how this would work.

With all of the data being stored in a single database, it would be possible to pool together a lot of this to display it in the Performance Program rankings table. The different criteria would be totalled per archer, in a different column for each criteria. Before the table is displayed, the table would be sorted by overall score so the highest person is at the top. This table would be a read-only view without anybody being able to edit anything, it would simply be for members to see their rank and what areas they need to improve on.

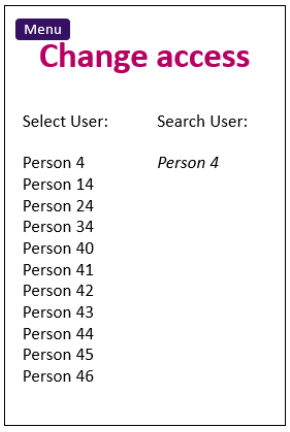
The final aspect of the prototype was an option to change the access level of any user, if the user signed in had an access level of admin. They would have a list of every archer, sorted in alphabetical order, with their current access level listed as well. The admin user would then be able to select any user and change their access level, either higher or lower. Figure 5.1.3 shows how this would have been accomplished.



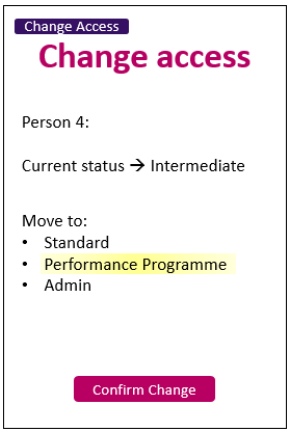
(a) View of training options

(b) After responses have been sent

Figure 5.1.2: View of the training page of the prototype



(a) View of every archers name



(b) Changing an archers access level

Figure 5.1.3: Process to change an archers access level

Once the paper sketches had been moved into the working prototype, they were sent to the representative from The Club for review. The response had some slight spelling changes, such as changing what was labelled as “Trained Training” to “Blank Boss Training” and the selection of which prototype to go ahead with. Another issue which was addressed is that it would be easier to programme different rounds into the application, rather than letting the user select different criteria. This would allow them to select the round they shot and then just select the values of each arrow, speeding up the process. Except for these fw alterations, The Club was very pleased with the prototype.

5.2 FINAL APPLICATION

Once the prototype was perfected, it was time to begin creating the final application. The screens were taken as they were represented in the prototype and transferred into MobileTogether, keeping the layout and colour as they had been approved by The Club. Everything from the final prototype would be able to code into the final application, so it was all kept as it was for the front-end. The first aspect of the back end which was put in place was to create a database, which would store all of the information from AU Archery. The first table to created was for general archer information, the information they give when registering an account, such as their names and username and password, which would be used to sign in. Next, all of the individual tables were created for each round, where the issue regarding SQLite databases came up. The tables could not only have a column for each end, as values could not combine digits and delimiters, meaning that the tables needed to have an individual column for each arrow, each end total and the key values, greatly increasing storage space required. Once this was created, it was simple to allow the rounds to be added into each table, by adding each arrow into the relevant column, and automatically causing key values to be generated while values were being added.

For regular training and blank boss session pages, they had their own tables, constructed in the same manner, but separate as they are tracked differently, due to not all archers having access to the blank boss sessions. These tables had a primary key combination of the date, time and archer ID, in order for each archer to only have one response to each session. Another issue of using the MobileTogether software was found here, as it was not possible to organise the training page for responses to be edited. To counter this, the fail-safe was to create a message box pop up asking the archer to message a committee member should response have changed, which only appears if they attempt to respond to the session again.

To change the access level of an archer it was set up exactly how it was interpreted to work in the prototype. The list of all archers is displayed using SQL to

fetch the first and last names and their corresponding access levels. Once an archer is selected, their archer ID is used to show more information in a separate pop-up, where the admin user can select one of the other two access levels to change them on to. When the confirmation button is selected, the database is updated to reflect the change that took place.

CHAPTER 6

EVALUATION

When evaluating an application, it is imperative that basic functions are assessed, and tests are carried out as to whether the application can perform tasks and benefit somebody in some way. In a heuristic approach, one would get every member of The Club were to download AU Archery to see if it would withstand the trial-and-error approach and the overload of data. If AU Archery can still perform tasks then it has passed that test. Another evaluator is whether a user would enjoy using the app, or whether it would be very difficult when it came to an archer actually testing and using it. When using AU Archery, as it is a centralised database, the user would need to be connected to the internet, to allow the data to be properly executed and updated.

The most important thing to evaluate is whether or not AU Archery performs its main task. At the beginning of this report it was stated that "All applications are created for one purpose". Now it is time to decide if AU Archery can carry out the purpose it was designed for. It needs to be noted that the restrictions of the software have meant that not all of the functionality has been implemented as it was initially conceived, however, the different aspects of the prototype do still work. A further point to discuss is that the Performance Program table does not fully justify the positioning and ranks of the archers within the table. This is due to the fact that there are some criteria which cannot be calculated by technology, and need a human mind, so the table is therefore merely a suggestion and an aid in calculating the final standings, rather than being the sole provider of facts and figures.

CHAPTER 7

CONCLUSION

A big bonus of AU Archery is that has been developed using cross-platform software, so it is available to every person with a mobile device, increasing the reach and potential use. When looking at the initial objectives that were set, and the functioning of AU Archery, it is fair to say that The Club is going to greatly benefit from the use for AU Archery. They will no longer have to perform administrative tasks, except for checking a box for whether people attended training, and will not need to manually perform any of the data manipulation which they currently have so much of, that they require the entire committee to help with the workload. This clearly meets the first objective of reducing the administrative and general workload of the committee of The Club. The second objective was to bring every feature of an archer's university life into one application. With AU Archery as it is, a user can download and use it without the need for any other application. They can input and track scores, view their submitted score, sign up to and see information regarding training and view the Performance Program table, proving that the second objective has also been met. Even though there are some slight infractions as to whether the objectives were completely met, it is safe to say that AU Archery will relieve a lot of people of stress and time, benefiting them in many ways and helping The Club to expand and grow by itself as a community.