IDENTIFICATION AND JUSTIFICATION OF IDEAS AND RESOURCES

Human Resources:

Selection of Resources:	Justification of Resources:
Krystian Bacewicz (Teacher)	The justification behind using my teacher as a resource in this project is because throughout the entirety of this project, he has not only provided me with support and guidance, but he has also stepped out of his way to help me with certain things on solid works or how to use a specific machine or how to properly write a section in my portfolio. Therefore, my teacher has provided beneficial help to my project and product.
Hasaan Rasheed (Javelin coach)	The justification behind using Hasaan Rasheed as a resource in this project is because not only is he a very experienced javelin coach but out of the three javelin coaches I chose as mentors, Hasaan uses the most technology at his training sessions. Thus, Hasaan was able to provide me with his view on this area and what he would expect the javelin to measure and do in its function. As well as this, Hasaan provided me with information to do with his current use of technology and what he likes and what he would like to see more of. Therefore, Hasaan has immensely helped with my project and product as he was able to give his own perspective.
Jeremy Lewis (Engineer)	The justification behind using Jeremy Lewis as a resource in this project is because he is an engineer and provided me with knowledge and instructions to do with the technological and functional side of my product. He also has his own factory in Port Hacking which provided me with another huge resource as his factory. His factory contains a lathe machine and a milling machine which was a massive benefit to me as the school doesn't offer these machines at school. Therefore, Jeremy has contributed significant help to my project and product due to his ability and knowledge in this industry and because of his factory allowing me to produce more prototypes and experiments.
SparkFun (Electronic store)	The justification behind using Spark Fun as a resource in this project is because they are an electronic store that provides all sorts of technology parts and is where I purchased all of my technology from. In addition, I was able to send multiple emails to them regarding what technology I should use and they replied back with their insight on what technology I should use and not use as they are extremely educated in this area compared to myself. Initially, I thought I only had to purchase a GPS that would of costed me $500. However, after consulting with spark fun I found out that I had to purchase 6 pieces of technology and the total cost for all of the technology is under $100. Therefore, Spark Fun has significantly helped with my project, product and finance.

Justification of Ideas:			Justification of Resources:		
Selection of Ideas:		To create a hollow javelin tip that will hold the main electronic devices in	**Selection of Resources:**	- - - -	Calliper (Tool) ABS Plastic (Material) Solid Works (Program) 3D Printer (Machine)

This idea was helpful because I wanted to figure out whether the main technology could fit into the javelin tip as I believed this was the area on the javelin where the technology would be least damaged by. This was also an easy area to break apart, whereas placing the technology somewhere along the javelin body would be difficult to break apart. I also wanted the material to be transparent so the user could view the technology from the outside. However, this idea was not chosen for my final product because the material was not transparent enough and also the technology was unable to fit inside.

A calliper was used to attain the measurements of the actual javelin tip. I initially tried using a ruler but I had to use my own judgement to attain the measurements which is not as accurate as the calliper. The tip was created out of ABS Plastic from the 3D Printer. ABS Plastic was used because it has no negative impacts on the environment when compared to other types of plastic. Solid Works was needed in order to transform the 2D design of the javelin tip into a 3D design. Solid Works was used over any other program due to its advanced machinery and high tech tools. A 3D Printer was used to produce my design. A 3D Printer was used rather than making the product myself out of wood as the tip requires extreme accuracy.

Selection of Ideas:		To create a hollow javelin tip that will hold the main electronic devices in	**Selection of Resources:**	- - -	Calliper (Tool) Nylon (Material) Lathe Machine (Machine)

This idea was helpful because I wanted to test a new material for the javelin tip as I was not successful with the ABS Plastic due to its lack of transparency. I also found that the ABS Plastic was not strong enough but nylon is to survive an impacted landing and protect the technology. However, this idea was not chosen for my final product as I didn't get to make the tip hollow as during the manufacturing phase the material was too weak. Also, the technology was still unable to fit inside and thus the idea of the main technology being inside the tip was eliminated.

A calliper was used to attain the diameter of the actual javelin tip. This was used rather than a ruler as a ruler is unable to attain accurate and precise measurement of a cone shape. Nylon was used due to its extreme strength and transparency. Whereas other materials such as aluminium are strong but not transparent. A lathe machine was used to manufacture the javelin tip. I used this machine due to the fact that my mentor who has been a mechanical engineer for the past 22 years believed that the lathe machine is the best possible machine to reach the goal I wanted to achieve.

Selection of Ideas:		To create the hollow body of a javelin tip that will hold the LED's in	**Selection of Resources:**	- - - -	Calliper (Tool) Resin (Material) Solid Works (Program) Resin Printer (Machine)

This idea was helpful because after figuring out that the main technology could not fit inside the javelin tip, I still wanted to create some type of mechanism in the tip. Therefore, I decided to place LED's and a micro switch in the javelin tip. So that when the javelin tip hits the ground, the force from this impact will turn the micro switch on which will then turn on the LED's. This will notify the thrower and other athletes, coaches and officials that the throw was a valid throw and had landed correctly. However, I found that the sizing of this idea was poorly measured and therefore for my final product, the measuring had to be re-done in order to gain more precise measurements.

A calliper was used to attain the measurements of the javelin body. As it was quite difficult to use any other measuring tool due to the shape being a cone. The material of resin was used because it is both strong and transparent. Even though the material of nylon has the exact same qualities, resin is able to be produced from a 3D Printer, whereas nylon can not be. Solid Works was used to create the design of the javelin body. Solid Works was chosen as my teacher understands this program well and so he was able to help me. A Resin Printer was used in order to transform the 2D design from Solid Works into a 3D design. A Resin Printer was used because it was the only printer that could print the material of resin out of.

Selection of Ideas:		To create a solid tip of the javelin tip that will connect to the body of a javelin tip	**Selection of Resources:**	- Calliper (Tool) - ABS Plastic (Material) - Solid Works (Program) - 3D Printer (Machine)

This idea was helpful because after figuring out that I wanted to create a LED tip, I figured I could also make it into a safety device. Hence, I created a bright coloured javelin tip that would attach to the previous idea of the javelin tip in order to signify not only the user but also other athletes when the javelin is in the air as people are more likely to see something that is brightly coloured than monotone.

I used a calliper to obtain the dimensions of the actual javelin tip. This was used as opposed to a ruler as I was unsuccessful with getting accurate measurements with the ruler. ABS Plastic was used in order to produce the tip from the 3D Printer. This material was used over others as it could be printed in colour. Solid Works was required to create the 2D design of the javelin tip. This program was used because it was highly recommended by my teacher and other students. A 3D Printer was used to transform my 2D design into a 3D design. This machine was used rather than a lathe machine as ABS Plastic could only be printed in a 3D Printer.

Selection of Ideas:		To investigate whether a GPS is able to measure motion while in flight mode	**Selection of Resources:**	- GPS (Technology) - Drone (Technology) - SD Card (Technology)

This idea was helpful because after researching about motion measuring, most articles, documents and videos claimed that motion measuring was unable to be performed. This idea was not used in my final product because it did not provide the true flight mode of a javelin nor its impacted landing.

A GPS was used to gain measurements of distance, speed and altitude in flight mode. After conducting research on a GPS, RFID's and LRF, I found that the GPS was the smallest device and would obtain the best outcome. A drone was used to mimic the flight mode of a javelin. I did not want to damage the GPS and so I used a drone over just throwing the GPS. An SD Card was used to obtain the measurements collected. I found difficulty with using bluetooth and so a SD Card was the next best option.

Selection of Ideas:		To investigate whether a soldering iron will work to connect the Arduino Board and the GPS Shield	**Selection of Resources:**	- Arduino Board (Technology) - GPS Shield (Technology) - Break away headers (Technology) - Soldering iron (Tool)

This idea was helpful because I wanted to understand and gain the skills on how to solder electronics as I have never done it before. I also wanted to figure out the dimensions of the electronics when they were connected together. I used this idea as a tester for my final product as I actually soldered some parts poorly. For my final product, I purchased new electronic devices and soldered it again but this time being more careful.

An Arduino Board was required as it is a circuit board for all the electronics to connect too. I chose an Arduino Board over a regular circuit board because it was the more advanced option. A GPS Shield was used to connect the GPS Receiver to the SD Card. I used a GPS Shield because no other technology could achieve the task I wanted. Break away headers were used to attach the devices together. This was chosen because it was recommended by SparkFun. I used a soldering ion to connect the devices. I chose to use a soldering ion because it was convenient for me to get and universally used for tasks like this.

Selection of Ideas:		To determine whether the main electronic devices can connect together and attain a signal with an impacted landing	**Selection of Resources:**	- GPS receiver (Technology) soldered to Arduino Board (Technology) - GPS Shield (Technology) - SD Card (Technology) - Lithium Ion Battery (Technology) - Pillow (Material)

This idea was helpful because I wanted to figure out if my technology could connect together and attain a signal from being thrown. So that I could determine if my technology can work while in flight mode and has an impacted landing. The idea of soldering the electronics together was used in my final product, however, I need to use thinner cables. Also, I will be placing the electronics in the javelin rather than a pillow. I only used a pillow for this idea because it was only early stages and I did not want to damage the technology.	A GPS Receiver was used to obtain the measurements of the throw. I chose a GPS Receiver because of its 1mm range accuracy compared to a regular GPS with a 3m range accuracy. An Arduino Board was used to read the inputs from the GPS Receiver. An Arduino Board was used because it was soldered to the GPS Shield. These inputs were then converted into a GPS Shield which boosts the signal. A GPS Shield was used because it was soldered to the Arduino Board. An SD Card is attached to the GPS Shield so that when it collects the results it could then be inserted into a phone or computer to be displayed. I found difficulty with using bluetooth and so a SD Card was the next best option. A Lithium Ion Battery acts as a power source for all the electronics. This battery was recommended to use by SparkFun. A pillow was used to protect the technology for an impacted landing. I chose a pillow over an actual javelin because it provided cushioning for the technology.

Selection of Ideas:		To create cutout sections in the javelin so the main technology can be placed inside and be taken outside	**Selection of Resources:**	- Javelin (Material) - Milling machine (Machine)
This idea was helpful because I wanted to determine whether the technology I had soldered together was able to be inserted inside the javelin and then taken out of the javelin. I also wanted to figure out the amount of strength lost in the javelin due to it loosing some material. However, this idea was used in my final design but I recreated one of the cutout sections because it was not the same size as its technology.			A javelin was used in this idea in order to determine whether a milling machine can work properly on a javelin. If I had used a different material such as a dowel, it would not be hollow and also doesn't give determine whether a milling can work or not on a javelin. A milling machine was used to cut out the sections. This machine was used over other machines as it was the only machine that provided a space for the javelin shape to properly fit into.		

Selection of Ideas:		To test the technique of threading on the material of aluminium	**Selection of Resources:**	- Aluminium (Material) - Lathe machine (Machine)
This idea was helpful because I wanted to investigate if the technique of threading could work on a piece of aluminium before completing it on the actual javelin. This idea was successful and was used in the next idea but on an actual javelin rather than just a rod of aluminium. The next stage is where I decided whether or not I was going to use threading.			The material of aluminium was used in order to conduct the technique of threading onto it. Aluminium was used over any other material as my final product is made out of aluminium. A lathe machine was used to actually do the technique of threading onto it. This machine was recommended by my mentor.		

Selection of Ideas:		To use the technique of threading on the actual javelin body	**Selection of Resources:**	- Javelin (Material) - Lathe machine (Machine)
This idea was helpful because I was able to use the technique of threading on the actual javelin. However, this idea was not used in my final product because after completing this, I found that there was no way for the casing to be twisted on the javelin even if the casing did have threading on the inside. This is due to the fact that threading is extremely difficult to work as it has to be precisely accurate.			A javelin was used in order to provide a better demonstration and visualisation of what the technique of threading would look like on my final product. I did the threading on a javelin rather than doing more threading on an aluminium rod because I was questionable if the javelin was too thin to have threading done on it. A lathe machine was used to hold the javelin and do the actual threading on it. This was used as my mentor recommended it.		

Selection of Ideas:		To check whether the Arduino IDE program can obtain the results	Selection of Resources:	-	Arduino IDE (Program)

This idea was useful because I was able to determine whether a computer program can collect and splay the results gathered from my technology. However, this was not used in my final product as I wanted the electronic device to be on a phone and not on a computer.	I used the Arduino IDE program to collect the results obtained from my technology and to display them in a proper format. The reason why I chose this program is because I have an Arduino Board as one of the main pieces of technology in my circuit and therefore this program was able to properly connect to it.

Selection of Ideas:		To create metal casing that will protect the technology with the proper javelin grip	Selection of Resources:	- - - -	Aluminium rod (Material) Lathe machine (Machine) Rope (Material) Super glue (Tool)

This idea was beneficial because I was able to figure out if a solid aluminium rod can be transformed into a hollow aluminium rod and whether it can be slid onto a javelin. This idea was extremely successful and therefore was done for my final product. But, for my final product I had to make it a slightly thinner thickness and therefore had to drill more since the shape of the javelin for my final product was 1mm bigger than the prototype version of the javelin.	An aluminium rod was used to create the metal casing. I chose aluminium because its the same material used in a javelin and therefore provided extra support to it. A lathe machine was used to drill a hole in the casing to make it hollow. I used a lathe machine as opposed to a drilling machine because I was able to attach larger drills to the lathe machine which was needed for the large diameter I wanted to cut out. Rope was used in order to mimic the javelin grip. Rope was the best option for this as this is the material they use for javelins. Lastly, super glue was used to connect the rope to the PVC Pipe. Super glue was used rather than a screw as screws can cause damage to the users hand.

Selection of Ideas:		To create a locking mechanism that will connect the javelin to the casing	Selection of Resources:	- - - -	Javelin (Material) Milling machine (Machine) Screw (Material) Screw driver (Tool)

This idea was helpful because it determined whether a locking mechanism could work for the connection between the javelin and the casing. This exact idea was mimicked in my final product because of its success. However, I did have to use a smaller sized screw since I had some difficulty when placing the screw into the lock.	A javelin was needed to drill the screw into. I used a javelin as opposed to other materials because it gave me the most reliable results for my final product. A milling machine was used to drill a hole into the javelin. I used a milling machine rather than a lathe machine because I had to drill on the javelin side on which is much easier to do on the milling machine. I inserted a screw into the hole. I chose a screw because it was the same material as the javelin. I also used a screw driver to drill in the screw. I chose to use a screw driver because I had used a screw.

Selection of Ideas:		To create a locking mechanism that will connect the casing to the javelin	Selection of Resources:	- -	Aluminium rod (Material) Milling machine (Machine)

This idea was useful because I was able to gain an idea on whether a locking mechanism could work for my final product. I found that parts of the cutout were too large so for my final product I slimmed down the sizing of the cutout.	An aluminium rod was used because this is the material I was going to use for my final product. Hence, other materials wouldn't provide me with the best results. A milling machine was needed to cutout the section. I chose this machine over a lathe machine because of the difference in accuracy.

Selection of Ideas:		To determine whether foam tape could work for the cushioning of technology	Selection of Resources:	-	Adhesive foam tape (Material)
This idea was beneficial because I investigated what material would be best to cushion my technology and I found that foam tape was the best option and because of this success, I used it in my final product.			Adhesive foam tape was needed to attach the technology onto a soft surface. I initially chose insulation foam but I found the foam too large and compact inside the javelin, whereas the tape was much smaller and more flexible.		
Selection of Ideas:		To create a smaller scaled version of the locking mechanism between the javelin tip and body	Selection of Resources:	- -	ABS Plastic (Material) 3D Printer (Machine)
This idea was helpful because I just wanted to focus on the locking mechanism between the tip and body and not on the entire to scaled version of each part. This idea was not used in my final product because it was only a small scaled version and not the proper measurements.			ABS Plastic was used to create the javelin tip and body. I chose ABS over resin because since this was only a prototype, time was a crucial aspect and ABS is much quicker to print than resin. I used a 3D printer to print my 2D design into a 3D model. Similarly to above, I chose to use a 3D printer because of its time efficiency.		
Selection of Ideas:		To determine whether LED's can be retrofitted inside a javelin tip and can be seen through resin	Selection of Resources:	- - - -	LED's (Technology) Resin (Material) Solid Works (Program) Resin Printer (Machine)
This idea was useful because it highlighted to me that the material of resin could be a possible candidate for my final product as it was strong enough to withstand impact but also transparent enough to see the LED's from the outside. However, this product was not used in my final product due to the resin printer at school breaking down. Otherwise, I had planned to manufacture this idea for my final product.			LED's were used to create a source of light. I chose LED's over other lights due to its insignificant size and malleable material. Resin was used to print the javelin tip. I chose the material of resin over ABS plastic because of its extreme transparency. Solid Works was used to design the 2D design of the tip. Solid Works was recommended by me teacher and hence I used it. A Resin printer produced my 2D design into a 3D design. I had to choose a resin printer since that was the only machine that could print the material of resin out of.		
Selection of Ideas:		To create an app mockup of what my final app interface should look like	Selection of Resources:	-	Keynote (Program)
This idea was helpful because it provided me with a visualisation of what my final product of my app interface could look like. I experimented with different designs and functions. However, this idea was not used in my final product because I found that some functions were slow and I needed to use an actual app creator.			The program of Keynote was used to physically create an app mockup of what I hope to be my final app interface. I chose Keynote over other programs such adobe Illustrator because Keynote could actually transform my mockup into a real functioning app. Whereas for adobe illustrator, you could only view the app and not edit it.		

Ongoing Evaluation:
My identification and justification of ideas and resources benefitted my final product because through these ideas and resources listed I was able to create my final product. Therefore, without these ideas and resources I would not have been able to create my final product which highlights the importance of this section to my final product as I believe it had a significant impact on the functions and aesthetics of my final product. Throughout this section, I was able to navigate on what idea or what resource should be used in my final product and thus increased the viability and reliability of my final product.