Business Proposal: **BraceALERT**

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Executive Summary

IndiQUESTion was founded by Drew Hamroff, Joshua Hubbard, Martin Kwan, Sameera Polavarapu, and Mingkai Xu to improve societal issues around the world through the creation of high quality products and systems. After analyzing the widespread issues involved with campus safety, IndiQUESTion began the development of the BraceALERT, a cutting edge piece of luxury jewelry meant to keep students safe through its integrated alarm technology.

Over the past decade, concern over campus safety has consistently grown in the United States. Additionally, campus safety concerns have begun to become synonymous with other pressing issues, such as sexual assault. The New York Times reported that one in every four women will be the victim of sexual assault during her academic career. (New York Times). However, the majority of students we interviewed were not willing to purchase products that compromised their fashionability and comfort to guard against potential threats. To combat these personal concerns, the BraceALERT was created as a method of providing protection through luxury products which are both stylish and portable.

The original design of the BraceALERT is a thin bangle with two attached wired charms which act to sound an alarm when activated by the user. The aesthetics of the BraceALERT are modeled after popular jewelry pieces currently on the market. This provides the opportunity for customers to purchase the product for the sake of fashion rather than solely the function of safety. Nonetheless, in a state of emergency, this stylish piece of jewelry can help draw the attention of people nearby to assist the user.

The BraceALERT taps into an untouched market of fashionable safety. Our thorough surveys indicated that the BraceALERT would be primarily utilized by college students who feel unsafe on campus, notably women.

We hope this product will start a conversation about campus safety and sexual assault while improving the status of students across the country.

Process to Solution

To reach our solution, we first created an empathy plan. This involved identifying an issue that resonated with our firm, in addition to considering the target market. We settled on the problem of campus night safety, a concern that is common among college students.

After identifying the problem, we conducted our first baseline of empathy interviews with college students here at the University of Maryland, as well as numerous other universities around the country. The results of these interviews led us to pursue product ideas which combine the features of safety and fashion so that our users would not think of carrying a defensive weapon as a nuisance. We then began the brainstorming process to come up with as many solutions as we possible.

After establishing the BraceALERT as the most viable solution, the team developed a Gantt Chart to display each task that needed to be completed. We created a formal critical path, which gave an indicator of our project's overall time frame. To improve efficiency, we divided tasks among the group.

We then began development of our initial prototype: a bracelet made of cheap materials (pipe cleaners and arduino electronics). We took this prototype to potential users and allowed them to interact with it and provide feedback on the functionality. From our follow-up interviews with focus groups, we were able gain a better understanding of what to focus on with future development. Specifically, we used this feedback to construct a House of Quality, in which we compared the customer's requirements with our technical requirements in order to improve our solution.

This process led us to the development of our product and helped us understand how to attract customers based on their own personal needs. Whereas other products may not reflect a user's desire for specific features or comforts, our process to solution allowed us to satisfy the consumer directly.

Description of Solution

The BraceALERT is an innovative solution to our problem area that combines functionality with fashion. It is a personal safety alarm that is seamlessly integrated into a fashionable charm bracelet with two hanging charms; one contains the battery and the other contains the switch and speaker element.

We decided that that the most effective way to ensure safety is a passive personal safety alarm rather than an active solution like pepper spray. Pepper spray has many cons that can be detrimental to the user. It can be used against the victim and it is not guaranteed to work based on the attackers tolerance to the spray and the user's accuracy (Lillis). We wanted to allow users to keep their options open when they use our device. Our bracelet would emit a blaring noise to cause the attacker momentary panic, giving the user an opportunity to get to an on campus blue light, reach a generally safer place, or alert someone that there is an unsafe situation occurring.

IndiQUESTion wanted to make the BraceALERT as easy to use and as inconspicuous as possible. The user simply removes the charm containing the speaker to sound the alarm and replaces the charm to silence it. Since our device would be located on the user's wrist, there is no need to have another item like a backpack to hold a separate safety device. The problem of accidental activation was brought up during our user interview process (Winter), so we have incorporated a twist and pull mechanism where the charm would need to be unscrewed ½ of a turn before being able to be pulled off.

This activation mechanism led us to choose brass as our bracelet material. It is relatively inexpensive and incredibly strong. Brass has an ultimate tensile strength of 50,000 psi and a shear strength of 34,100 psi which means it can withstand a substantial amount of force before deforming or yielding ("Brass",1). This allows the user to pull and twist the charm without any fear of breaking the bracelet as you would need to exert 243.5 pounds of force in tension or 166 pounds of force in shear to see deformation and this is not a realistic amount of force to exert in this scenario (*See **Figure A** for calculations)*.

$\sigma = Tensile\ Strength \qquad \tau = Shear\ Strength \qquad r = Bracelet\ Radius$

$$\sigma = \frac{Force}{Area} => \quad Force = \sigma * \pi(r)^2 = 50{,}000psi * \pi * .03937in^2 = 243.5lbs\ (Axial\ Load)$$

$$\tau = \frac{Force}{Area} => \quad Force = \tau * \pi(r)^2 = 34{,}100psi * \pi * .03937in^2 = 166.0lbs\ (Shear\ Load)$$

Figure A: *Load Calculations*

Aesthetics were a major design consideration, as many users said they wouldn't buy our product unless it was stylish. Our product is modeled after current charm bracelets on the market; our brass bracelet has a gold coating to satisfy this design constraint while keeping our product durable. You can see renders of our product in ***Figure B***.

Figure B: *Product Render*

Another major design specification was that our product had to be loud while also being small enough to fit in a charm. We decided that a piezo element would be the the best component to satisfy this design specification. This element acts as a transducer and has the ability to convert electrical inputs to mechanical outputs. Overall, the circuit draws

power from two lithium ion coin batteries which feed it into a piezoelectric horn driver. This driver takes the signal and converts it into a wave that the piezo element can output. Before reaching the element, the current passes through an autotransformer which uses inductance to step up the voltage, achieving a louder sound. Once this reaches the piezo element, the element vibrates at a frequency dictated by the wave outputted by the horn driver (*See **Figure C**)*. The element cannot produce sound so when it is attached to the metal casing, it vibrates the metal casing, turning the casing itself into the speaker, saving space. This whole circuit will be wired to a kill switch and the mechanics of which will allow the circuit to be on when the switch is in the up position, and off when it is in the down position. When the charm is attached the switch will be pushed into the off position and when the charm is removed, the switch will revert to the on position and sound the alarm.

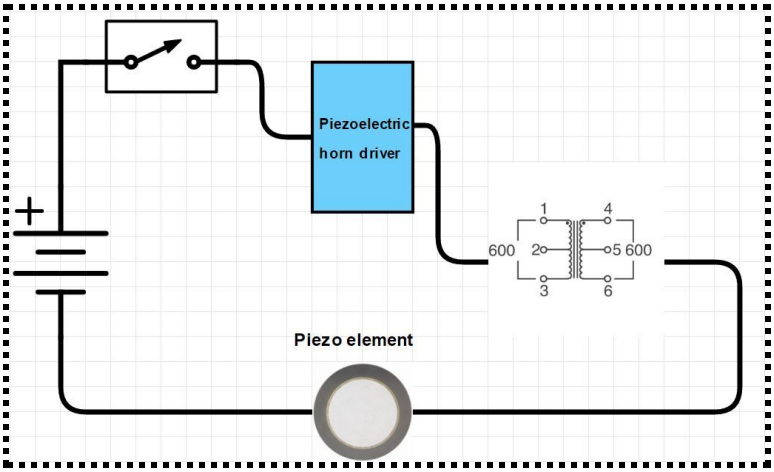
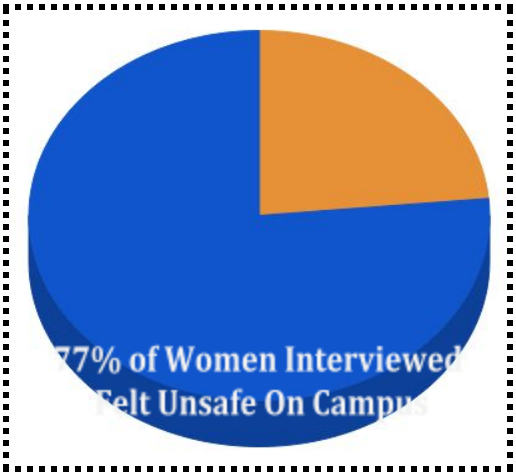


Figure C: *Electrical Schematic*

Overview of Target Market:

While college campuses are expected to provide a comfortable environment for students to thrive in, statistics show that there are still a large number of crimes reported at universities every year (Huffington Post). After conducting several interviews with students at fourteen schools across the country, it was extremely evident that campus

safety is a huge concern. Nearly 80% of women we interviewed described feeling unsafe at night, especially when walking alone. As this was by far the most responsive niche market, we decided to focus on addressing their specific needs.



We asked some of the individuals to describe the drawbacks of existing technologies. Jill Gelinas, a sophomore at the University of Maryland, said "It's easy to lose or forget things when you go out so carrying a larger purse or item is kind of a pain". Here she expresses the first of two major concerns we identified: the portability of a safety device. Many college students agreed that, to be effectively incorporated into their life, our product needed to be convenient and accessible without putting any additional strain on their daily routine (Chava). When going out for the evening, many college students do not want to carry extra items. Our interviewees brought up alternatives they seek out to make their life easier, such as attaching their keys and ID's to the back of their phones, something which they will carry with them everywhere (LaRosa). This shows just how important it is that the product be easily integrated into the consumer's life. Our solution specifically addresses the issue of portability by incorporating our technology into jewelry, something many college students wear every day.

The second feature we identified as necessary to our target market was fashionability. A major concern for students is the ability to feel safe, in a discrete way. Many young women we interviewed said that they would like to have some form of protection, but they weren't willing to compromise their outfit choice to meet that need (Brady). This especially applied to situations when students were going out to parties or social events. This problem was particularly important to rectify, because nights are the most common times for crime to occur.

The merging of style and portability in the BraceALERT directly addresses these concerns; it ensures that the needs of young college age women are satisfied by our

product. Today, there are about 11.7 million women attending college in the United States (National Center for Education Statistics), reaffirming both the market and necessity for the BraceALERT.

We would begin to advertise to this market through the college setting. In particular, we would focus on members of Greek Life to support the use of our product on campus. The versatility of our design allows for these organizations to customize the product in unique ways. Entering this market would allow for a diversity of population and a large consumer base.

Discussion of Competitors:

There are many products on the market for personal safety, however, none of them fully meet the needs of the consumer. As mentioned in previous sections, there are three functions of this product which are critical to the consumer: the portability, the style and aesthetics, and, most important, the functionality of the product. We will discuss three of the most prominent fields of competitors on the market.

The GPS tracking system, whether incorporated into an app or a small device on a keychain, is ineffective at meeting the needs of the consumer, only satisfying one of the three criteria above. While it is extremely portable, the product is not aesthetic and rather conspicuous. Furthermore, it acts as a passive form of protection. A GPS tracker or tracking app does not provide the consumer with in-the-moment safety.

Another product which is commonly used for self-defense is Pepper Spray. However, this product is often considered only more likely to escalate the situation (Las Vegas Review-Journal). Physical confrontation is a last resort for our consumer base, so forcing an individual to engage in this way decreases the effectiveness of the product. Apart from being unaesthetic,

pepper spray in not always allowed to be carried on airplanes and in certain bars and clubs, drastically decreasing the portability.

The keychain alarm functions in a similar way to the BraceALERT, however those on the market now are often large and clunky. Some of the "top" products on amazon have amature designs. It is hard to imagine a college student wearing a device like this on their book bag, let alone to a party or on a date. These devices are often too large to conceal easily.

Examination of Financials

The financial statements for our company show that we will be able to turn a profit after we sell at least 4,458 units of the BraceALERT at $30 per unit. This will cover the variable expense of $11.60 per unit, as well as the fixed costs of $82,000. This gives us a profit margin of 6.67% at 5,000 units sold and profit margin of 34% at 10,000 units sold (*See **Figure D***). However, we must keep in mind that after the first year of production, fixed costs are likely to decrease by $11,000 and increase by $1,000 for a net reduction of $10,000 (*See p.11 for more details*). This in turn, will reduce our fixed expenses to $72,000 and give us a break even point of 3,913 units, a profit margin of 13.33% at 5,000 units sold, and 37.33% at 10,000 units sold (*See **Figure E***).

One Unit Income/Statement	
Revenue	$ 30.00
	-
Total VC/Unit	$ 11.60
Unit Contribution Margin	**$ 18.40**
	-
Total Fixed Costs	$ 82,000.00
Net Income based off Units sold:	
1	-$81,981.60
1000	-$63,600.00
4457	$0.00
5000	$10,000.00
10000	$102,000.00

Figure D: *Y1 Contribution Format Income*

One Unit Income/Statement	
Revenue	$ 30.00
	-
Total VC/Unit	$ 11.60
Unit Contribution Margin	**$ 18.40**
	-
Total Fixed Costs	$ 72,000.00
Net Income based off Units sold:	
1	-$71,981.60
1000	-$53,600.00
3913	$0.00
5000	$20,000.00
10000	$112,000.00

Figure E: *Y2 Contribution Format Income*

(Break Even Point in Orange) *(Break Even Point in Orange)*

In order to determine a price for our product, we considered the two most important factors: how much our market was willing to pay for it, and the costs incurred during production. For the first factor, we interviewed 35 students (part of our target market) and 80%, or 28 said that they would pay at least $30 for a BraceALERT. In the responses we received, prices ranged from $10 to $60+ with most people responding within the $30-$40 range. For the other factor, we took a look at the current variable costs of $11.60 per unit and found that without fixed costs, we would have a profit margin of 61.33% for each unit sold given the selling price of $30. Aside from the surveys and analysis of costs, we also took into the consideration the price Alex and Ani bracelets, which are currently on the market and popular with women. These bracelets are similar in style to the BraceALERT but have no use other than for fashion. On average, Alex and Ani bracelets sell for around $28-$40. Because of this, our BraceALERT allows users to stay safe as well as fashionable for a competitive price. In the future, we plan to use more premium materials in addition to the currently used brass to make the bracelet even more fashionable, luxurious, and durable, which would also allow us to increase the price accordingly.

Variable Costs/Unit	
Speakers	$0.89
Wires	$0.10
Microswitch	$1.35
Chip	$2.66
Battery Holder	$0.60
Brass	$3.00
Variable MOH	$0.50
Direct Labor	$1.00
SG&A	$1.50
Total VC/Unit	**$11.60**

Figure F: *Variable Cost Breakdown*

Fixed Costs/Year	
Machines	$11,000.00
Labor	$38,000.00
Fixed MOH	$18,000.00
SG&A	$15,000.00

Figure G: *Fixed Cost Breakdown*

Both variable and fixed expenses are estimated numbers and are subject to change but should be in the ballpark of the amounts listed above. For variable costs, costs were broken down into four sections: Direct Materials, Direct Labor, Variable Manufacturing Overhead, and Variable SG&A costs (*See* ***Figure F***). The cost of direct materials was based off of the market price of pieces (or similar pieces) that we would need to make a BraceALERT. However, we took into account the wholesale price of materials which on average, was 12% lower than the individual costs.

The main material used, brass, is of durable quality, achieves the aesthetic the BraceALERT strives for, and remains relatively inexpensive in comparison to other metals of its caliber. The aforementioned Alex and Ani bracelets are created from entirely recycled metals; following this model, we looked to use a strong mid-range metal with a beautiful gold finish to keep costs relatively low but the quality and fashionability very high.

The other costs, including overhead, labor and SG&A were estimated based off of what we thought was appropriate and realistic for each unit. For fixed costs, (*See* ***Figure G***), the costs were also broken down into Labor, Machinery/Fixed Assets, Fixed Manufacturing Overhead, and Fixed SG&A costs. For machines, we estimated the cost by looking at various metal bending and cutting machines which were about $3,000-$4,000 each. So with two metal forming machines/engravers and one cutting machine, we ended up with a machine cost of $11,000 that is likely to go down after the first year since we will not need to acquire new machines every year, but instead expense $1,000 for machine maintenance and repair. Labor was calculated by hiring eight part time workers, each paid around $9.14 per hour for a 10 hour work week. In the course of a year, these wages totaled about $38,000. For the Fixed Overhead, it was calculated by summing the cost of Rent (including utilities), Depreciation costs, and quality assurance. Rent would cost us around $13,000 per year, or $1,083 per month to use a reasonably sized workspace for our company to start off with. Depreciation and quality assurance costs totaled about $5,000 for the depreciation of machines as well as the cost to prevent and fix defects in any of our high quality BraceALERT. For SG&A costs, we estimated that a small business would expense about $10,000 a year to advertise to college students, and $5,000 to cover administrative costs.

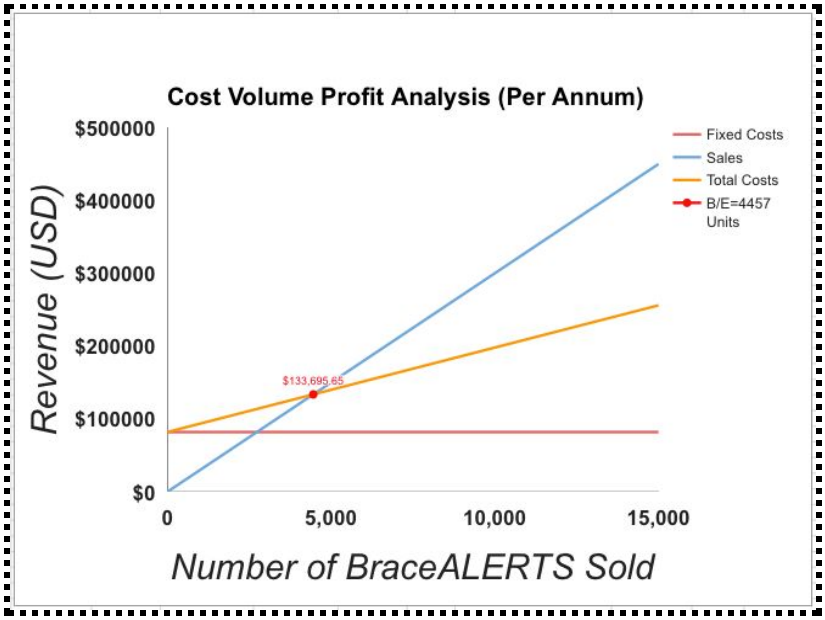


Figure H: *Cost Volume Profit Analysis (CVP)*

For our first year of sales, we project that we will sell at least 10,000 BraceALERTs. This is roughly 0.085% of our target market of 11,685,000 women aged 18-24 attending college. This allows us to generate $300,000 in sales and $102,000 of net income ($300,000-$198,000) which gives us a profit margin of roughly 34% ($102,000/$300,000) in our first year of production. In the second year of production, we project that we will generate twice the amount of sales due to the growth of our brand and adjusting advertising techniques, designs, and materials after receiving feedback from the first year of users. This means that we will generate $600,000 in sales and a net income of $286,000 ($600,000-$314,000) which gives us a profit margin of roughly 47.67% ($314,000/$600,000).

Analysis of Return on Investment

We are looking for an initial investment of at least $512,000 in order to cover our projected costs for the first two years. With this investment, we will be able to produce our

BraceALERT comfortably for two years, generating $900,000 in sales which means $388,000 of Net Income. This means that our ROI, if given $512,000 for our first two years of production is 0.76, or 76% (($900,000-$512,000)/$512,000). This ROI of 76% signifies that for every $1 that is invested into our company's idea, we will generate $1.76 in earnings for the first two years. Because of the BraceALERT's high growth forecasts, low funding costs and a generous ROI, our company is a superior investment for investors looking for high returns with a low risk.

Conclusion

The BraceALERT is an innovative product that hopes to be on the forefront of both safety and luxury trends. By bringing together the effective technology that has been proven through age-old safety methods and the trendy designs in current jewelry, we hope to create a product that is effortless in its protection of today's students. Today, rape whistles prove too large, pepper spray can be dangerous, and alarms are seldom portable. College students often go out at night carrying only their phones. A BraceALERT affords the opportunity for students to stay stylish, carry no excess items, and still have protective measures. In efforts to accommodate our initial market of college students, the BraceALERT is not priced higher than jewelry items of the same quality, despite its added features. It is our hope that through our affordable, portable, and fashionable product, we can keep students safe. In the future, we know the BraceALERT is the perfect product to protect people on not just campuses, but also in cities around the world. Safety is a byproduct of fashion with the BraceALERT, and an investment in our company only serves to help make the world a more secure place for all.

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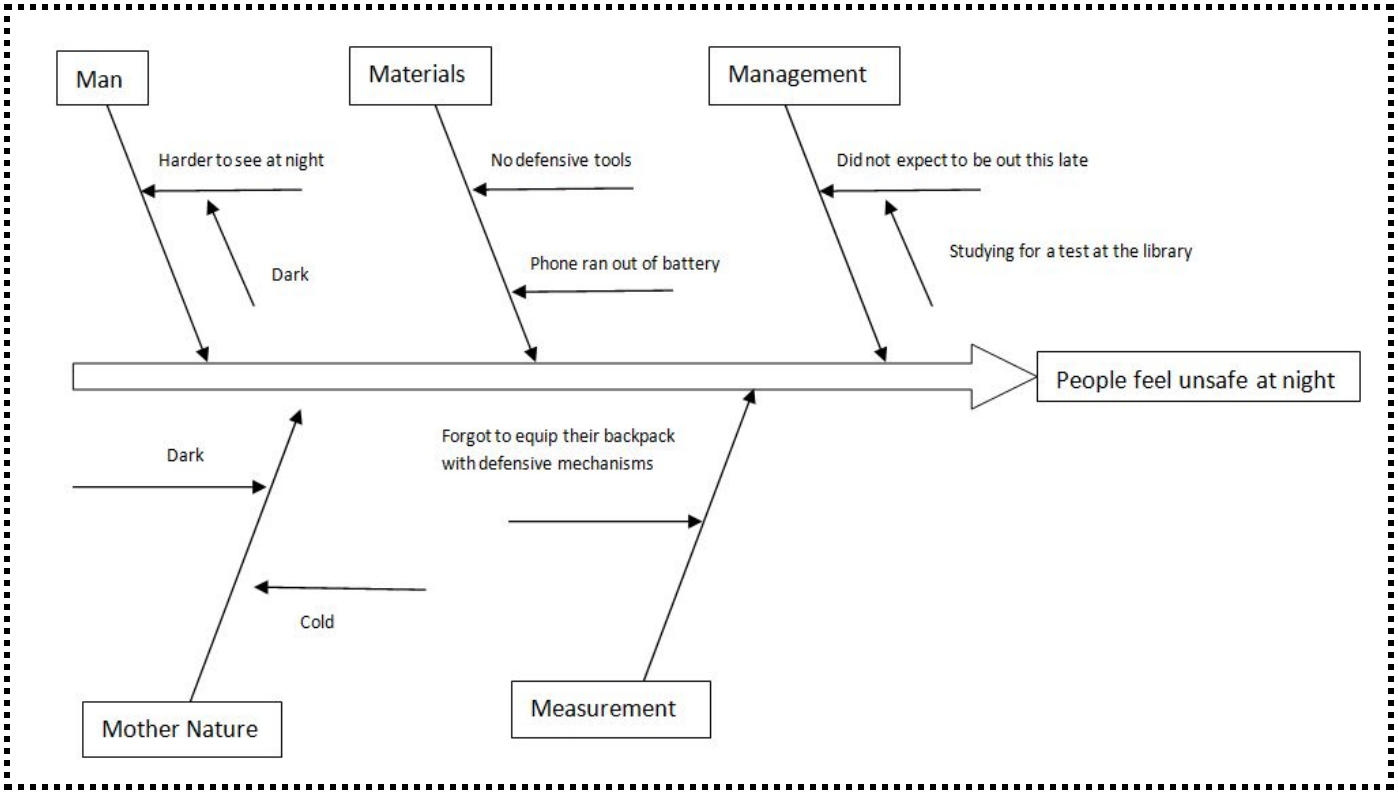
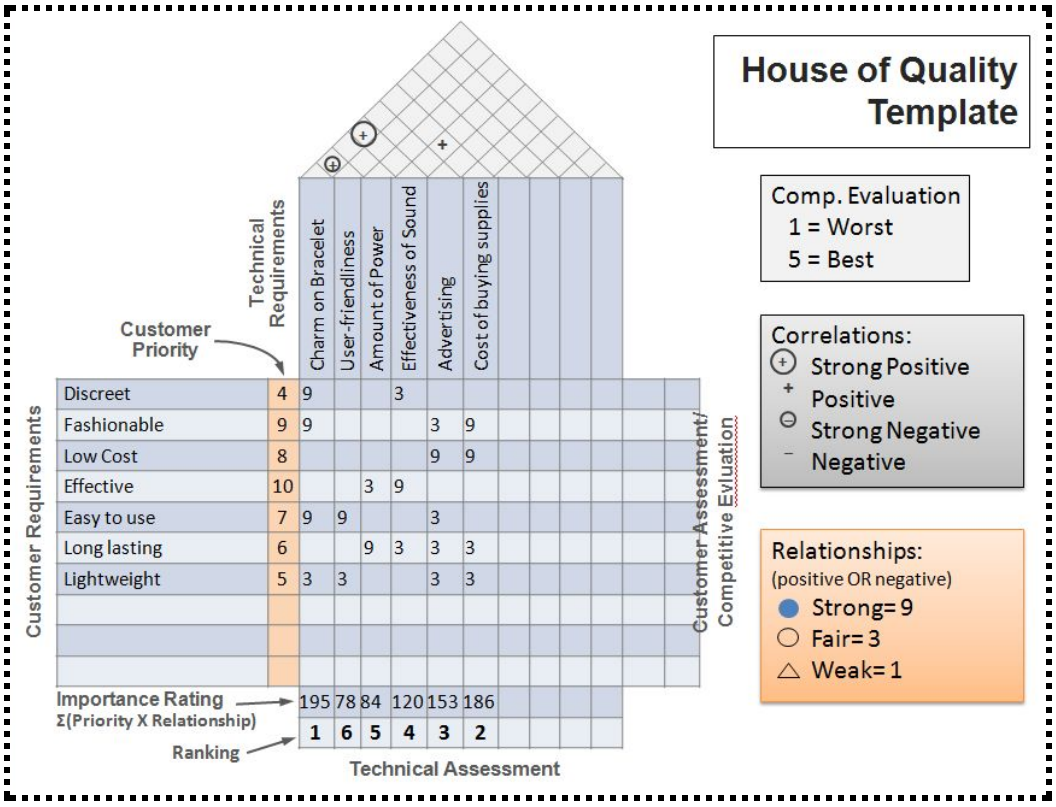
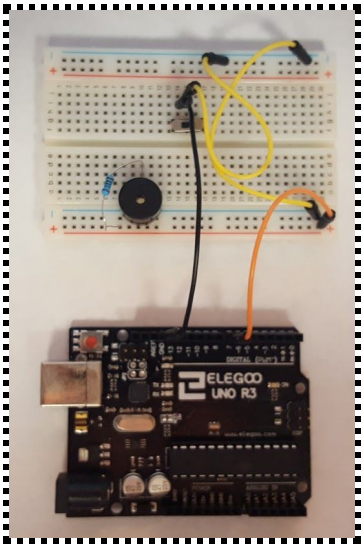
Appendix A: Fishbone



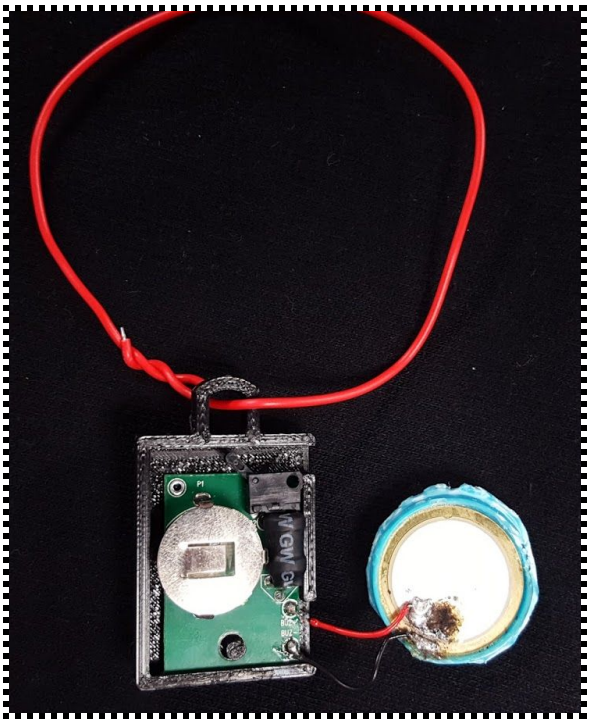
Appendix B: House of Quality



Appendix C: Preliminary Prototype

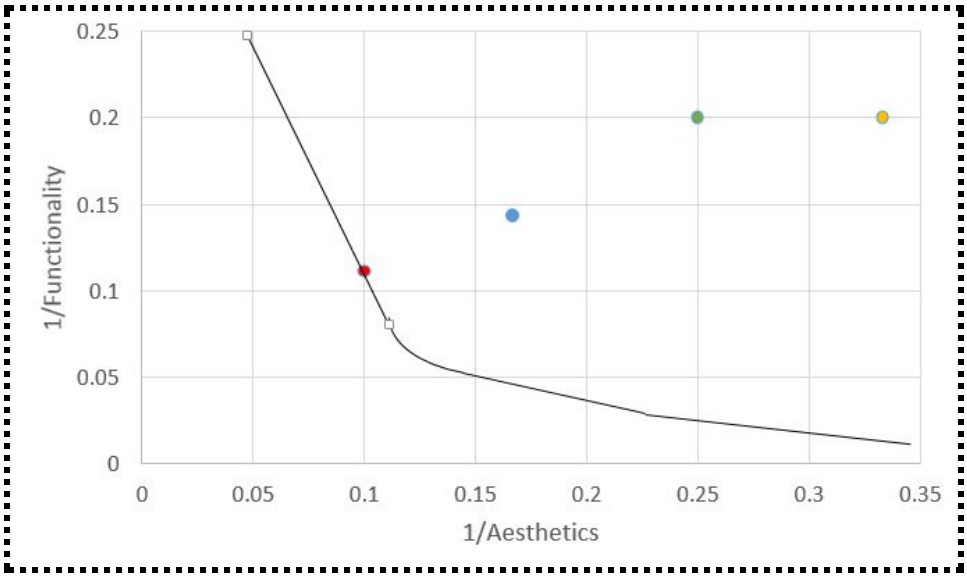


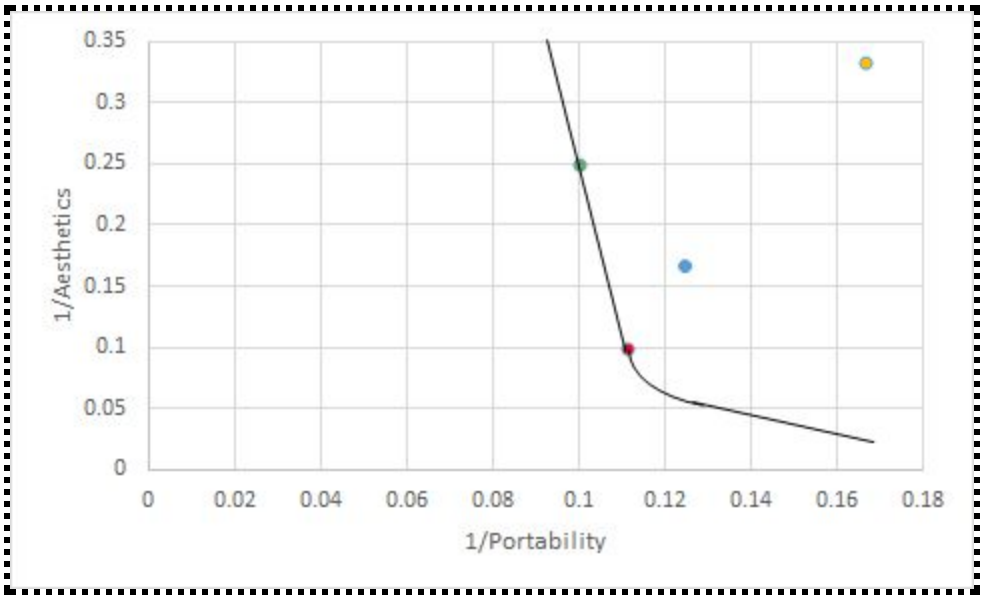
Appendix D: Final Prototype



Appendix E: MAUA

	Portability	Aesthetics	Functionality	1/Portability	1/Aesthetics	1/Functionality
GPS Tracking System	10	4	5	0.1	0.25	0.2
Pepper Spray	6	3	5	0.16666667	0.33333333	0.2
Keychain Alarm	8	6	7	0.125	0.16666667	0.142857143
Our Product	9	10	9	0.11111111	0.1	0.111111111

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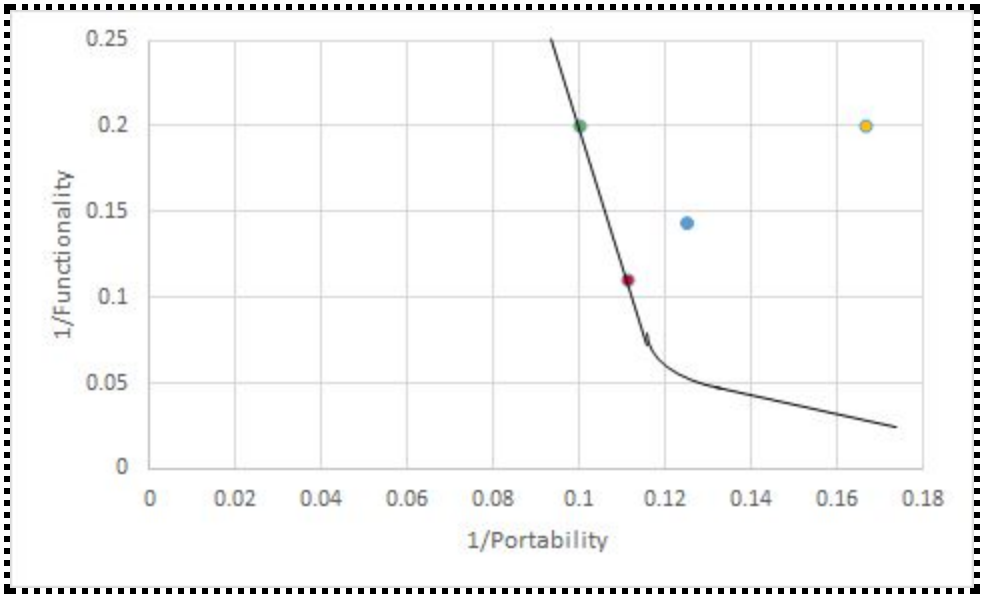
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Appendix F: Gantt Chart