

Sep 22, 2014

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

RE: ENSC 440 Project Proposal for a Haptic Feedback Gaming System.

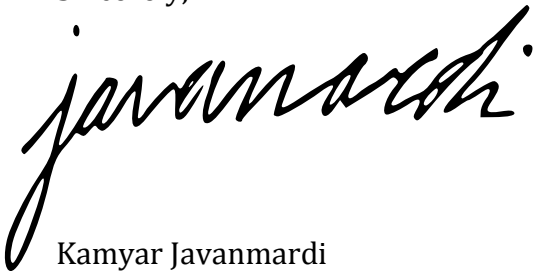
Dear Dr. Rawicz,

Enclosed in this letter is project proposal for our haptic feedback gaming system. The purpose of the product is to provide a realistic experience for people who have a passion for weaponry tag. The goal is to give feedback in the form of vibrations and lighting whenever a player wearing our product is hit with a projectile.

The proposal will outline a market overview, system overview, existing product designs, proposed product design. It will also include our budgeting, funding, scheduling, and team organization.

RealSim Tech has assembled a group of talented and ambitious engineers. They consist of four members in the Electronics and Computer concentrations: Kamyar Javanmardi, Nielven Jay Olis, Anthony Nguyen, and James Fong. Should you have any questions or concerns, feel free to contact us at 778-881-5751 or by email at kjavanma@sfu.ca

Sincerely,



Kamyar Javanmardi
Chief Executive Officer
RealSim Tech

Enclosure: Proposal for a Haptic Feedback Gaming System



Haptic Feedback Gaming System

Project Proposal

Project Team:

Kamyar Javanmardi

James Fong

Anthony Nguyen

Nielven Jay Olis

Primary Contact:

Kamyar Javanmardi

(kjavanma@sfu.ca, 778-881-5751)

Submitted to:

Dr. Andrew Rawicz – ENSC 440

Prof. Steve Whitmore – ENSC 305

School of Engineering Science

Simon Fraser University

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EXECUTIVE SUMMARY

This document will outline the proposal of a Haptic Feedback Gaming System (HFGS) that will be an alternative to paintball and laser tag. It implements Radio Frequency Identification (RFID) to provide feedback to the player. The system utilizes a vest that houses multiple vibration motors that rumbles when a RFID-tagged projectile hits the vest. The vest will be designed for ruggedness to be able to withstand rapid body movement and will provide a thrilling combat experience both indoors and outdoors. The system will provide a familiar, yet new experience to people who are active goers of paintball or laser tag.

The prototype system will be developed and completed within the next 4 month with an estimated cost of \$490. Potential funding for the project include the Engineering Student Society Endowment Fund (ESSEF), the Wighton Engineering Development Fund, and recreational fun centers. A development schedule is created in order to meet milestones and deadlines. The risks and benefits of the haptic feedback gaming system are discussed in details as well as the potential markets for it and the current competition.

RealSim Tech is a company with the thought of gamers, sports, and recreational enthusiasts in mind. The company consists of 4 senior engineering students who bring a plethora of electronics and software knowledge to the table as well as a common goal: To produce a system that will take the simulated combat experience to a new level.

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GLOSSARY OF TERMS

HFGS	Haptic Feedback Gaming System
RFID	Radio Frequency Identification
IR	Infrared
FPS	First Person Shooter
360-NS-HS	360 Nexus-Series Haptic-System

INTRODUCTION

Over the past decade the video game industry has been one of the largest expanding industries in the world. A research study report released by the Entertainment Software Association, ESA, showed that in 2012, the total consumer spending in the video game industry in the U.S is \$20.77 billion [2]. The report also shows that the shooter genre make up 21.2% of the video game unit sold, with Activision’s Call of Duty: Black Ops 2, a shooter game, being #1 in the top 20 selling video games of 2012. This can be seen Figure 4 and 5.

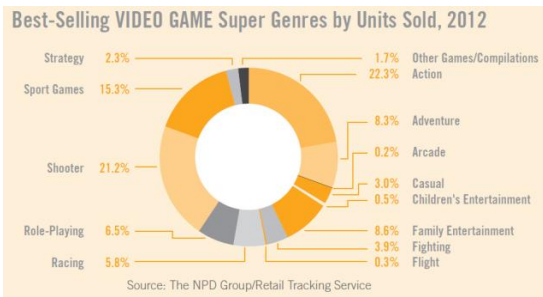


FIGURE 1: VIDEO GAME GENRE

RANK	TITLE
1	CALL OF DUTY: BLACK OPS II
2	MADDEN NFL 13
3	HALO 4
4	ASSASSIN'S CREED III
5	JUST DANCE 4
6	NBA 2K13
7	CALL OF DUTY: MODERN WARFARE 3

FIGURE 2: A RANKING OF SOME OF THE TOP SELLING GAMES IN 2012

With the popularity of the shooting genre growing larger as more first person shooting (FPS) games are being released for home consoles and personal computers, gamers would like to simulate this first person shooting combat in real life. Although these games are fun to play, there are numerous health concerns regarding playing these types of games [3]. Many physical consequences such as Carpet Tunnel Syndrome, migraines, sleep disturbances, backaches, and eating disorders have been associated with playing video games for extended periods of time [3]. Laser tag and paintball are two of the more popular sport activity that will allows gamers to experience a ‘Call-of-Duty-like’ scenario, with strategic planning, active movement, and team effort. Each sport has their advantages as well as their drawbacks in terms of gaming immersion.

The product 360-NS-HS stands for “360° Nexus Series Haptic System”. 360-NS-HS is an alternative gaming product that promotes active physical activities while capturing the engaging gameplay of FPS. Our objective is to give the user an immersive experience by utilizing rumbling features to simulate the realism of tactical warfare.

Our proposal will outline the overall design, implementation, market, risks, and benefits of the 360-NS-HS. A projected budget and tentative development schedule will also be outlined. We will discuss the current competition available and how our proposed design will enhance the gaming experience.

SYSTEM OVERVIEW

The HFGS makes use of 2 systems. The RFID System consists of an antenna and a reader module that awaits a transponder to enter its vicinity to read its ID [7]. The Feedback System takes its cue from the reader module to indicate a valid ID or successful reading. At this point, the Feedback System will drive the motors in the wearable to cause a rumble effect as feedback for the wearer of a successful hit. As well, a LED strip will light as feedback for the person that shot the ammunition to indicate a successful hit. Figure 3 displays the basic function of the HFGS.

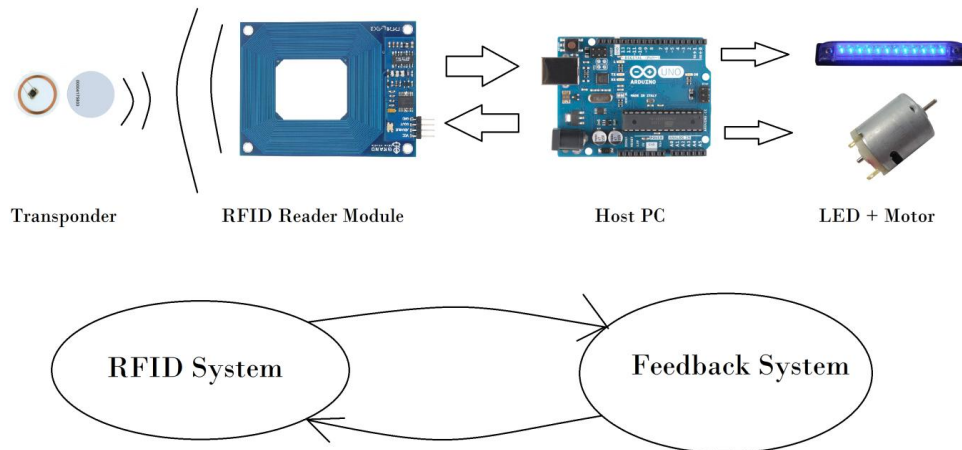


FIGURE 3: BASIC FUNCTION

MARKET AND COMPETITION

MARKET

Sports data shows that paintball is one of the most popular alternative sports in the US [5]. A 2006 survey showed that more than 10,357,000 played the sport at least one time in that year and 1,891,000 of those people played at least fifteen times [5]. Moreover, it's amazing to know that laser tag escaped severe blows during the recent recession and continued growing, although consumer expenditure reduced [5]. The latter two sports have been very popular in recent years, but they have shortcomings that range from being expensive to play to being dangerous and harmful. 360-NS-HS is a very affordable solution to meet certain standards that rival sports cannot promote. Improvements can be made to this product to evolve this fun sport into a more popular realistic combat game.

COMPETITION

There are currently several recreational activities one can participate in to experience the first person shooter action. Although each of them has positive aspects that appeal to certain people, each of them also have negative aspects that detract other people from playing it. The key goal is to create an activity that will attract all age demographic while keeping the realism and experience authentic. Finally, the activity should be relatively inexpensive so that continuously playing the activity does not take a substantial hit to wallet.

Paintball

Paintball is a popular recreational game where teams aim to complete an objective while avoiding being tagged by the opponent's "paintballs", a soluble solution encapsulated in a thin gelatin shell. One of the advantages of playing paintball is that it comes closest to the real life first person shooter experience. Paintball uses physical projectiles to simulate bullets and the player can feel the impact of getting hit by the projectile. In addition, paintball facilities are able to design their arena to replicate certain types of environment such as a forest or a desert, which creates variety for the players.

Despite the realism, one of the issues of paintball is the limited venues that can host it. Paintball requires a very large field if played outside or a very large facility if played inside. In addition, paintball uses a lot of resource because once the physical paintballs are shot from the gun, they become unusable afterward. Since people are allowed to buy paintball equipment, another issue that arises is that the paintball gun can be used as a real weapon and can pose a serious threat to the public. Finally, the cost of playing paintball at a facility can be expensive in the long run if one is an avid paintball player.

Laser Tag

Laser tag is another recreational game where the goal of each team is to complete an objective while avoiding elimination. Laser tag uses infrared (IR) technology to simulate the first person shooter experience. A body pack with a sensor is attached to a player body and whenever an opponent shoots their laser gun towards the player sensor, the sensor detects the infrared signal coming from the opponent gun and the body pack either lights up or creates a noise indicating that the player has been shot.

One of the advantages of playing laser tag is that it is relatively cheap compared to paintball. Playing laser tag at a local fun center is the most popular option but laser tag equipment can also be bought to be played indoors at home or outdoors, which provides a flexible environment for the game. Another advantage of laser tag is that it requires very little equipment and it is safe for kids to play, compared to paintball where the projectiles can be painful if it hits the part of the body that is not protected by safety gears.

The major drawback of laser tag is that it is not a very realistic way of experiencing the first person shooter action. Since laser tag does not utilize physical projectiles, being shot at by the opponent does not provide a real impact to the body. The buzzer and lights on the body pack provide some feedback but is very limited. Another drawback of laser tag, especially for home laser tag, is the scoring system. Laser tag systems at fun centers all connect wirelessly to a central computer system to keep track of scores and eliminations. Home laser tag system does not have this option and requires the player to keep track of the score. Finally, because the innards of the laser tag system are all electronics, disposing of the electronics is an environmental concern.

PROPOSED DESIGN SOLUTION

The goal for this project is to provide a design that will simulate a realistic gaming experience for the players. Designing a reliable, seamless, and comfortable product is the key to providing this experience.

To build a reliable product, communication between the projectiles and our receiver will likely be our most important system. If players are not receiving the feedback of projectiles hitting them, it will not achieve the realistic experience we hope for. We plan to use a RFID reader (Parallax RFID Reader Module) as our input device for our vest. For each projectile to be recognized as a hit, we need to attach RFID tags onto the projectiles. We found that using RFID disc sticker tags are the most suitable tool for this implementation because it is small enough and lightweight enough to not affect the trajectory of the projectiles. Both the RFID reader and the RFID tag are designed for low-frequency 125 kHz signal so communication between the device should be seamless [6]. We will have two readers stitched onto the vest, one on the chest area and one on the back area. This will provide players with two targets to aim at.

After the RFID reader receives a signal from the RFID tag, it needs to communicate with the output system. To act as a controller between the two systems, we will be using the Arduino Uno microcontroller board to receive the signal and send it out to the motors and LED lights. We chose to use Arduino because it is easily configurable with the Parallax RFID Reader. The Parallax RFID Reader has only four hardware connections wired to the Arduino which will simplify the whole process [1]. We will then attach output connections of the Arduino to the feedback system.

The feedback system of our product will consist of vibration motors and LED lights. The Arduino board will be programmed so that it will send a signal to these devices when the RFID receivers send an input signal. We plan to use motors placed at the front and the back of the vest. When the player is hit in the front part of the body, a signal will trigger the vibration motors in the front of the body. When the back part of the body is hit, the signal will trigger the motors in the back. The vibration motors we plan to use are the 3000RPM 3-6V DC 2 Wired High Torque Mini Micro Vibration Motor. We will be investigating the intensity of the vibrations these motors provide and if the feedback is insufficient, we may use an amplifier to magnify the intensity. The LED lights will be a feedback tool for other players. We plan to install these lights on the shoulder of the player where it is easily spotted. Depending on the game rules, we may program a life system where after a player is hit a specific amount of time, the LED will display red. Figure 4 displays a system flowchart for the system. To power the system, we are going to use a 9V battery along with a 9V adapter to power the Arduino board. This is a simple way to power the vest and the battery will be easily replaceable.

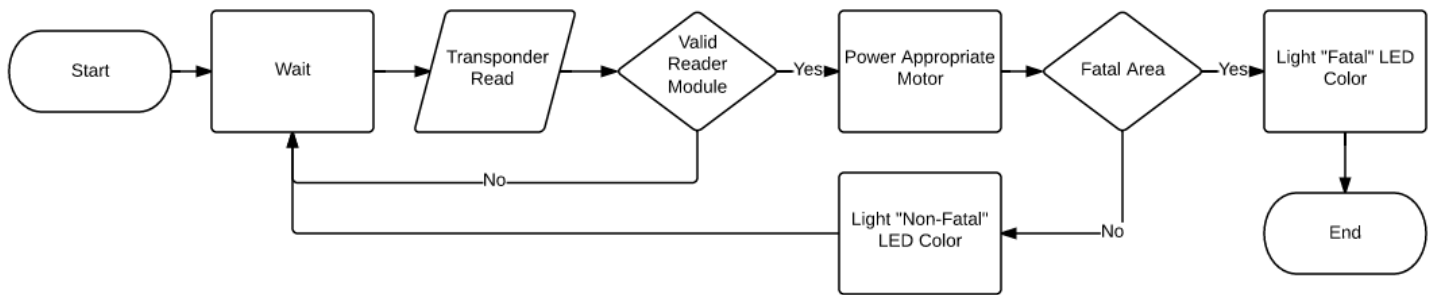


FIGURE 4: SYSTEM FLOWCHART

Comfortability is also another crucial aspect of our product. We do not want our players to feel weighed down by the vest and be a hindrance during their games. We want the vest to be an extension to their bodies so that it will provide the maximum game experience. Our research will include finding the perfect vest that will be suitable to incorporate the hardware so that the integrity of the devices will not be compromised.

PROJECT PLANNING

Figure 5 below shows the chart of our project, which indicates our tentative schedule for the execution of the product:

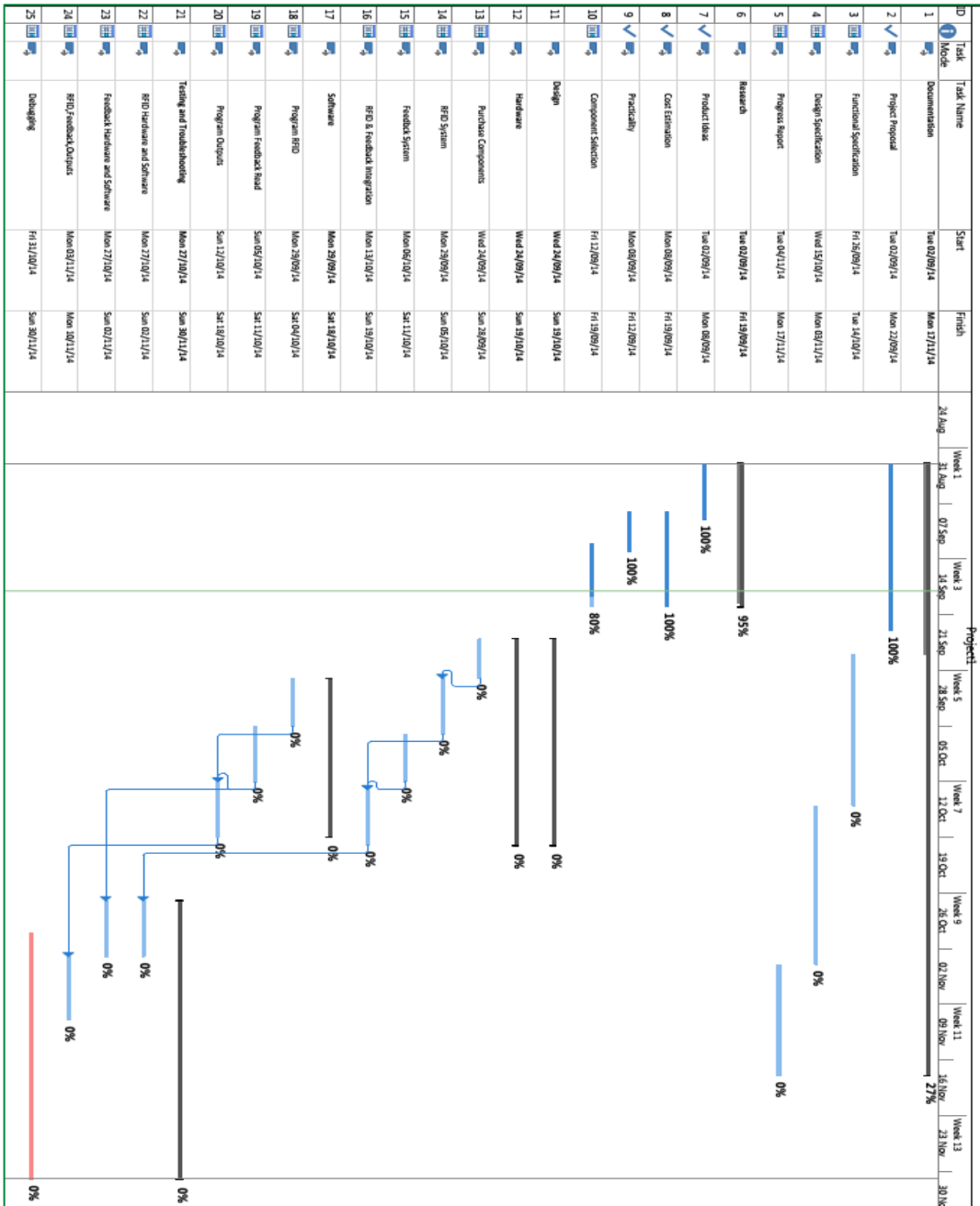


Figure 5: Gantt Chart

A milestone chart highlighting the important dates is displayed below:

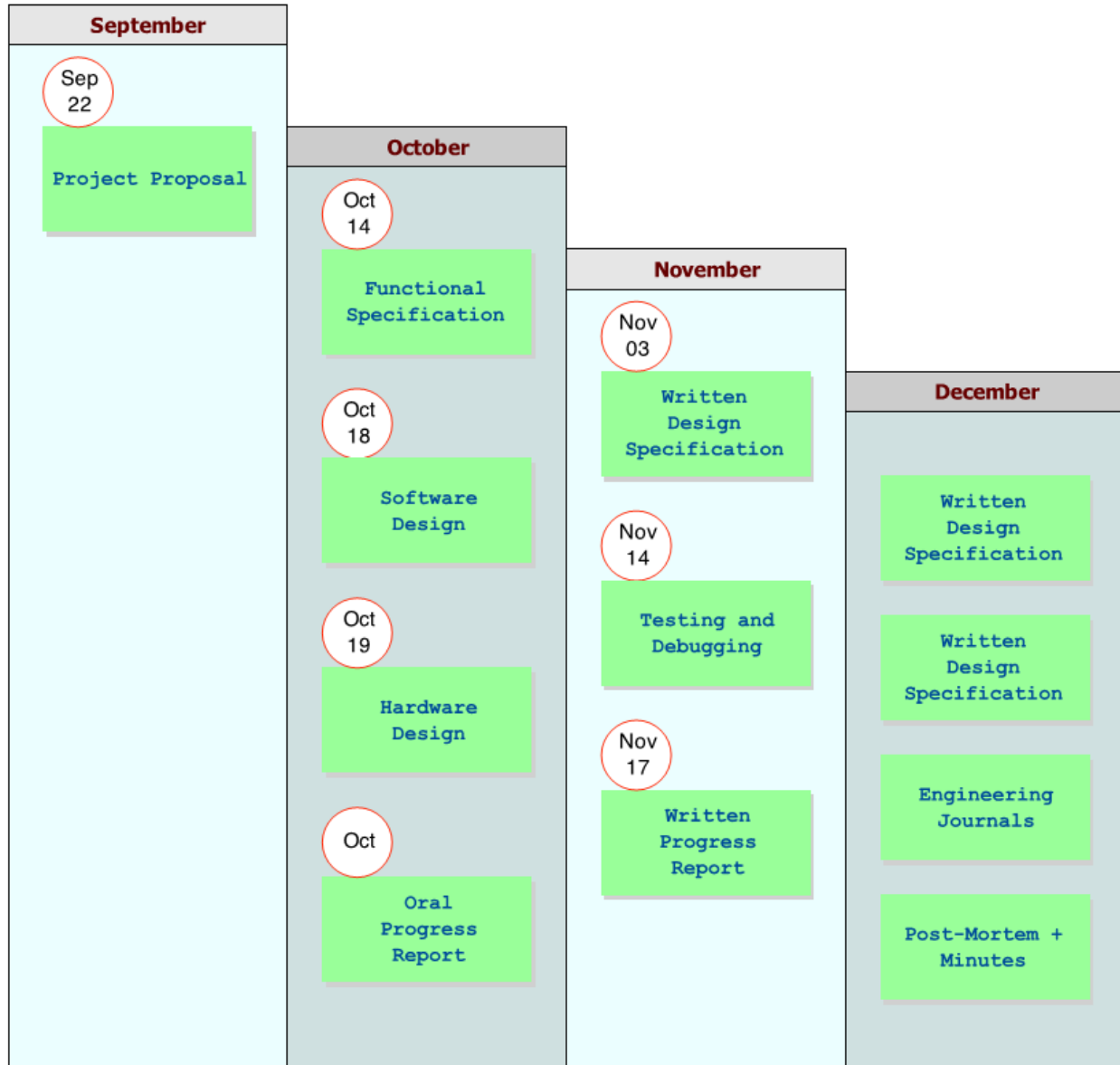


Figure 6: Milestone Chart

BUDGET AND FUNDING

BUDGET

Table 1 below outlines the tentative budget for the HFGS. The estimated cost is overestimated by 15% to account for tax and shipping cost. The budget will vary throughout the development and design stage. Components such as cases, wires, and additional electronic components are grouped together in the 'Miscellaneous' section. A contingency of 20% is included to cover any unexpected expenses.

Equipment	Estimated Cost
RFID readers + transponder tags	\$150
Microcontroller	\$50
Vibration Motors	\$50
LED strips	\$30
Vest + paddings	\$50
Foam blaster + ammunition	\$30
Miscellaneous	\$50
Contingency	\$80
Total cost	\$490

TABLE 1: TENTATIVE COST

FUNDING

Along with the allotted \$50 funding from the SFU Engineering Science Department, we have applied for the Engineering Student Society Endowment Fund (ESSEF) and we will also apply for the Wighton Engineering Development Fund. Also, we will continue to seek additional funding from outside sources during the next 3 months. Finally, if the funding does not cover the total cost of our project, the remaining cost will be split equally between the four members.

PROJECT RISK AND BENEFITS

RISKS

There are some hazards in the way of our products that pose as risks. The first is in the possible modifications of our product that can cause more harm than intended. The vibration motors can be changed into another device that can cause shocks or more harmful feedback than we intend. As well, the feedback that we apply may come as too strong for certain individuals and can cause them to lose balance or attention that could lead to injury. Third, the provided ammunition maybe small enough to be a choking hazard for smaller children or when projected onto open mouths. Lastly, our product will be rendered unusable when used in an environment where water can come into contact with the electronics. We recommend our products to be used by more mature individuals that can foresee these potential harm.

BENEFITS

Our product can be beneficial financially for certain companies and to the gaming community. Companies that manufactures toy guns or similar products may benefit in an added dimension with their product lines. As our company will provide the ammunition, the natural product to be in demand would be toy guns that are compatible with our products. The companies can expand its market to the gaming community which our product is targeted at. Our product hopes to provide a true cost/benefit element in gaming where getting shot is felt as a punishment and strategy is encouraged. This allows our product to be suitable as an activity in the same realm as sports which pushes our goal for active gaming and a healthy lifestyle.

COMPANY DETAILS

TEAM ORGANIZATION

RealSim Tech was established in September 2014 by four talented senior engineering students: James Fong, Kamyar Javanmardi, Anthony Nguyen, and Nielven Jay Olis. Each member of the team brings a unique set of technical skills, knowledge, and experience to the company in order to create a defining and innovative product. In-depth details of their expertise are presented in the 'Company Profile' section. With a diverse set of skills and the will to strive for excellence, the members at RealSim Tech are able to face the challenges that lie ahead and find creative and original solutions to them.

Kamyar Javanmardi, Chief Executive Officer (CEO), is responsible for overseeing all aspect of the project, ensuring smooth and efficient operation of the company, and resolving inter-organizational conflict. James Fong, Chief Operating Officer (COO), is in charge of monitoring the day-to-day operation, managing and recording team meetings, and ensuring deadlines are met. Nielven Jay Olis, Chief Technical Officer (CTO), is in charge of the technical aspect of the project, investigating and handling technical issues that may appear, and advising on the design of the product. Finally, Anthony Nguyen, Chief Financial Officer (CFO), is responsible for managing the finances within the company, tracking and recording all funding and purchases, as well as finding additional funding from outside sources.

Tasks are assigned to each member based on their strengths and weaknesses, with more demanding tasks being shared between 2 members in order to reduce time and increase efficiency. Members with weakness in one area will be able improve on it with the help of another member who has proficient knowledge of it. To ensure that up-to-date information and work is accessible to all members, Google Drive will be the main file storage service to use.

Meetings are held 2-3 times a week ranging from 30 minutes to 2 hours, with team members providing status updates pertaining to their assigned task and addressing any issues or concerns they may have about the project. Also, new tasks and deadlines are set during meetings to maintain efficient development progress. Each meeting is summarized and recorded for proper project documentation and passed to the members later in the day to ensure that everything said in the meeting is correct. Meetings will start to transition from 'discussion-based' to 'lab work-based' as the development cycle goes into the design and integration phase, with the hours increasing to accommodate for the debugging process.

The team is organized such that each member will be able to work to their full potential and will be able have their opinions heard by their fellow teammates. This will ensure that any conflict between members will not escalate and get out of hand.

COMPANY PROFILE

Kamyar Javanmardi - Chief Executive Officer (CEO)

Kamyar is a 5th year Electronics Engineering student at Simon Fraser University. He has completed one year of Co-op experience at Honeywell as an Automation Engineer, where he was involved in testing and implementing commercial HVAC and security systems. His Co-op work experience, along with the skill set he has obtained at SFU, has given him a strong knowledge of electronics lab equipment such as DMM and function generators, circuit design, and component testing. He also has a working knowledge of many software languages such as C++, Java, and Matlab. Besides his technical skills, his enthusiasm, teamwork, and documentation skills will contribute to the RealSim Tech project.

James Fong - Chief Operating Officer (COO)

James Fong is a 6th year Computer Engineering student at Simon Fraser University. His previous Co-op experience in Global Relay Communications and Linxoft Solutions provided him with skills in a wide range of software testing. Along with his software testing skills, he also had the opportunity to write plugins using C# coding. Throughout his time at SFU, he has completed projects using VHDL, C, and assembly language. His software experiences covers both the developing and the testing side of a project cycle which will be evident in his operation role in RealSim Tech.

Anthony Nguyen – Chief Financial Officer (CFO)

Anthony is a 5th year Electronics Engineering student at Simon Fraser University. He has completed a co-op term at Blackberry as Hardware Lab Assistant, and a full year co-op term at Sierra Wireless working as Hardware Designer. With previous co-op terms at Blackberry and Sierra Wireless, his industry skills include surface mount soldering, circuit/component testing, verification, schematic/PCB analysis, and strong working knowledge of lab equipment such as frequency response analyzer, 4-channel oscilloscope, and current probes. He also has skills in VHDL, assembly language, electronics system design, and micro fabrication, where he worked in a yellow room to fabricate multiple integrated circuit chips on a silicon wafer. His hardware skills and attention to details will be a great asset in designing our project.

Nielven Jay Olis – Chief Technical Officer (CTO)

Nielven is a 6th year Electronics Engineering student at Simon Fraser University. He has done a year of CO-OP for Blackberry as an intern for their Regulatory Testing Service team doing electromagnetic compatibility testing. His main strengths and interest are in projects involving the use of an FPGA or a Micro-Controller. Some completed projects include temperature sensing using a Motorola 68HC11 in assembly language, writing VHDL to implement simple computer game on a Altera DE2-70 board, and programming an xmodem protocol using QNX RTOS in C/C++. His experience in these projects will be relevant in completing our proposed project.

CONCLUSION

RealSim Tech is composed of resourceful and very capable engineers for this project. This proposal has outlined the basic function of our Haptic Feedback Gaming System but is also open-ended in terms of features. The proposed design solution is straightforward and uses only 2 systems. The project is fairly low cost which can be helpful in case of a contingency. Very little is in the way of completing this project on time.

The Haptic Feedback Gaming System aims to promote active gaming and helps gamers have a healthier lifestyle. It is meant as a competitor to activities such as paintball and laser tag while being an attractive product to PC/console gamers that want a greater experience in gaming by being extremely accessible and convenient for use. By examining our financial cost, the 360-NS-HS can be produced at or less than the cost of modern consoles and it can be used multiple times which would cost less than multiple trips to a venue for paintball or laser tag. The 360-NS-HS is a realizable and marketable product.

By producing a product that enables a realistic simulation of modern military tactics, RealSim Tech hopes to provide an accessible and immersive experience that transcends modern gaming systems in realism.

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