ACTUATED INNOVATIONS

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January 30th, 2017

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
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Re: ENSC 440 proposal for an Actuated Display System

Dear Dr. Rawicz

Attached to this document is Actuated Innovations formal proposal for *Relevo*, a pin actuated 3D display system. Our teams consist of 6 engineers spanning multiple fields: Brian Hanley, Alec Lu, Anthony Fung, Dennis Huebert, Zachary Wong, and Jonathan Wong. Our goal with *Relevo* is to create a multimedia tool that combines tactile feedback with existing audio visual technology to aid in data analysis and communication. *Relevo* features a matrix of small pins and LEDs that can vary in height and color depending on intended application. In this way, it can be applied to situations such as data geovisualization, or as a modern way to communicate with individuals suffering from visual impairment.

This paper covers our overall system design as well as specific features we intend to implement and the risks associated with such an undertaking. In addition, this document addresses target markets, discusses the project budget, and presents an estimated project timeline. As the primary contact for Actuated Innovations, feel free to contact me by email at bhanley@sfu.ca, or by phone at 778-877-0144 if you have any questions or concerns. We appreciate your time and consideration of this proposal.

Sincerely,

Brian Hanley
Co-founder of Actuated Innovations

Enclosed: Proposal for a Pin Actuated 3D Display System

PROPOSAL

"RELEVO" PIN ACTUATED 3D DISPLAY SYSTEM

ACTUATED INOVATION INC.

Issue Date: January 30, 2017
Revision: 1.2

PROJECT TEAM:
Brian Hanley
Alec Lu
Anthony Fung
Dennis Huebert
Zachary Wong
Jonathan Wong

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EXECUTIVE SUMMARY

Today, multimedia is generally dependent on two sensory components: visual and auditory. Modern digital multimedia generally serves as both a powerful method of communication between people and a medium for entertainment. With each passing year, we see the advancement of both audio and visual quality in retail products. As such progress accelerates, we are quickly approaching the limits of human perception. Eventually, engineers in the multimedia industry will be forced to look towards new innovations in order to continue to improve upon the human sensory experience. At Actuated Innovation, we believe that the next step the industry must take is uniting tactile feedback with traditional audio visual systems. Our firm belief has led to the design of our first commercial product: *Relevo*.

Relevo is what we refer to as an pin actuated 3D display. Like a traditional display, it's mainly used to communicate information with the end user. What makes ours different is that it changes shape in addition to color, so users not only interpret meaning visually but through touch as well. While users can interact with it using the traditional computer setup, *Relevo* also allows individuals to interact with it using gesture based commands. Users can manipulate height or alter surface color through simple and intuitive hand movements. Altogether, *Relevo* is a new way for people to visualize or communicate ideas in three dimensions.

Actuated Innovation envisions a wide range of applications for our actuated display. One of the main fields we hope to approach is big data. *Relevo* offers researchers a new way to perform geovisualization, which would otherwise be limited by the traditional computer monitor. We also hope to provide a new, modern alternative/addition to Braille for individuals suffering from visual impairment.

The Actuated Innovation team consists of a young group of engineers. Thanks to a diverse set of specializations, our team is fully capable of bridging the gap between hardware and software. Each member not only brings knowledge and experience to the team, but also a passion for technology. Our goal is to provide a profitable new means for users to communicate ideas or to visualise otherwise difficult problems. In this document, we aim to clearly demonstrate both the value of *Relevo*, and our ability to complete it within our 16 week schedule and $1500 budget. In addition, we discuss the potential markets for such a device, and the problems Actuated Innovation plan to solve.

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TABLE OF CONTENTS

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LIST OF FIGURES

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LIST OF TABLES

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GLOSSARY

Geovisualization	Short for Geographic Visualization, refers to a set of tools and techniques supporting the analysis of geospatial data through the use of interactive visualization
3D	Three Dimensional Image
Potentiometers	Three terminal resistor with slides or rotating contacts that form an adjustable voltage divider
Geospatial Data	Information about a physical object that can be represented by numerical values in a geographic coordinate system
Braille	Tactile writing/reading system used by people who are blind or visually impaired
LED	Light Emitting Diode
MRI	Magnetic Resonance Imaging
CTI	Computerized Tomography Image
MIT	Massachusetts Institute of Technology
Bus Factor	Minimum number of team members that have to suddenly disappear from a project before the project stalls due to lack of knowledgeable or competent personnel
Agile Development model	Hardware and Software development style under which requirements and solutions evolve every iteration through adaptive planning and evolutionary development
Kanban Board	A work and workflow visualization tool typically using tickets to communicate status, progress, and issues
PCB	Printed Circuit Board

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1 INTRODUCTION

Today, innovation in the multimedia industry typically involves improving on auditory or visual aspects of a product. Engineers look to see how high they can make a TVs resolution or how far they can stretch the bandwidth of audio output. Product audio and visual quality continues to slowly approach the limits of human perception, requiring designers to look for new ways to improve a user's sensory experience [1]. Actuated Innovation sees the next step in interactive multimedia to be the inclusion of the tactile sensory system in the user experience. Our company's first product, *Relevo*, is a direct consequence of this belief.

At its core, *Relevo* is an actuated 3D display mounted to a surface. It features a matrix of small pins that can be raised up or down and/or held at varying levels. In addition to height, a layer of LEDs allow it to relay visual information through a combination of color and depth. Each pin itself is mounted onto a basic linear actuator to supply its driving force. The matrix of pins and linear actuators are then controlled by an integrated computer system implemented using one or more microcontrollers. These microcontrollers have the ability to raise or lower the pins, set pin LED colors, and poll the actuators for current pin heights.

Behind the scenes, *Relevo* uses a raised camera to support gesture input in real time to the actuated display. The camera can read in depth information and use it to react to objects that may be placed on top of the surface. In addition, it allows the user to interact with the actuated surface through gesture based commands. These features are to be implemented using presently available computer vision algorithms.

Our initial goal with *Relevo* is to develop a product that would see wide application in the geospatial analytics field [2]. These days, a lot of research and design revolves around the analysis of large data sets. Engineers are often forced to adopt multiple methods of data visualization when it comes to working with a conventional computer (where information is presented to the user in 2D). *Relevo* provides another route for researchers and engineers to perform geovisualization by using a 3D tactile approach.

In addition to geovisualization, Actuated Innovation sees *Relevo* as a revolutionary multimedia tool for individuals suffering from visual impairment. The Braille writing system is binary in nature, making the rate at which information can be relayed to readers rather limited. Since its pins can be actuated to varying levels of height, *Relevo* allows for more detailed forms of tactile communication.

The following proposal will explore the features and overall system design that we plan to offer with *Relevo*. It will also discuss the challenges we expect to face, design risks, product market, budget concerns, and estimated project timeline.

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2 SYSTEM OVERVIEW

Figure 1 describes the architecture of *Relevo* and the interaction between each different module and sub system. *Relevo* will support 2 types of user inputs, real time input via a 3D camera and manual data input. The real time input uses a 3D camera to capture three-dimensional data provided by the user. This could be in the form of hand gestures or placing a 3D object into the field of view of the camera. Whereas, the manual data input allows the user to bypass the real time input and supply the data themselves. This will allow for modelling of collected geospatial or mathematical data.

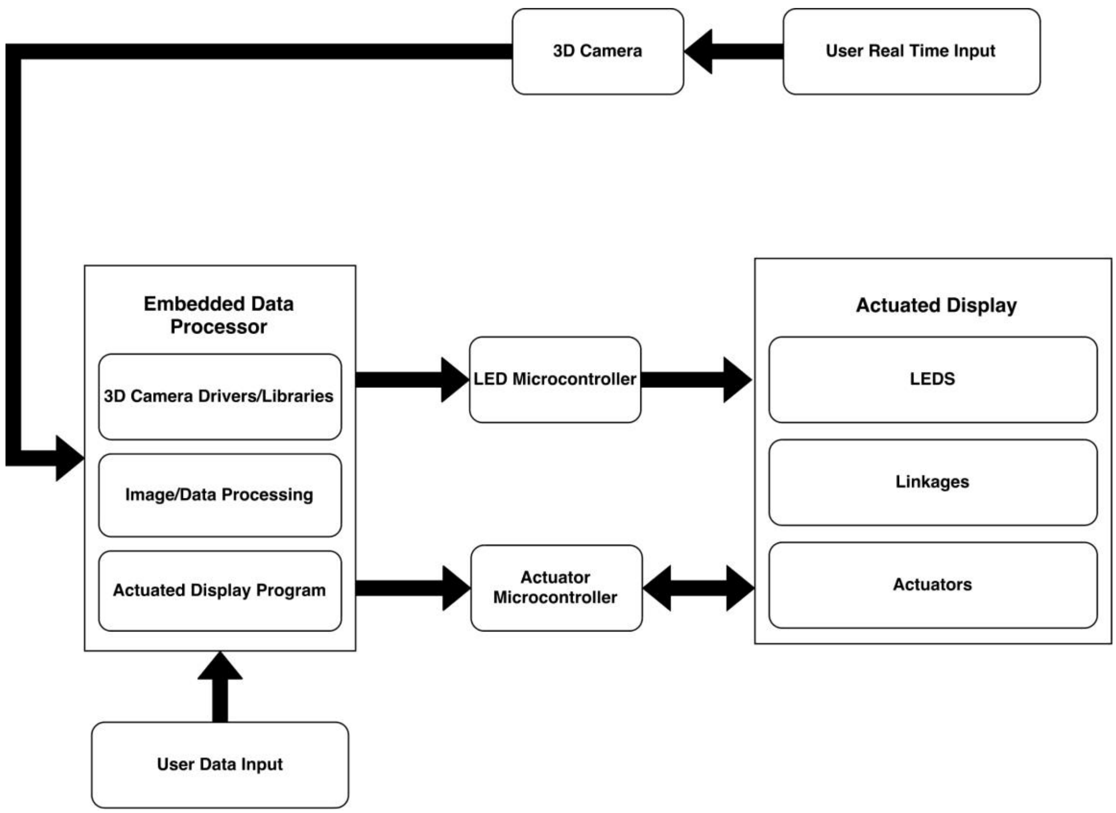

Figure 1: High Level System Overview of Relevo

This provided data from either the real time input or the manual data input is then fed into the embedded data processor where it is analyzed using image and data processing algorithms and supplied to the main program driving the actuated display. There it is translated into movement for each of the motorized linear potentiometers as well as intensity and color for each LED that make up the surface of the actuated display.

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The data generated from the main program is then fed into the actuator and LED controllers that will supply the required voltages to the motorized linear potentiometers and LEDs respectively. These supplied inputs cause each potentiometer to rise to the required level and the LEDs to turn on to the required intensity and color, effectively modeling the desired 3 dimensional image.

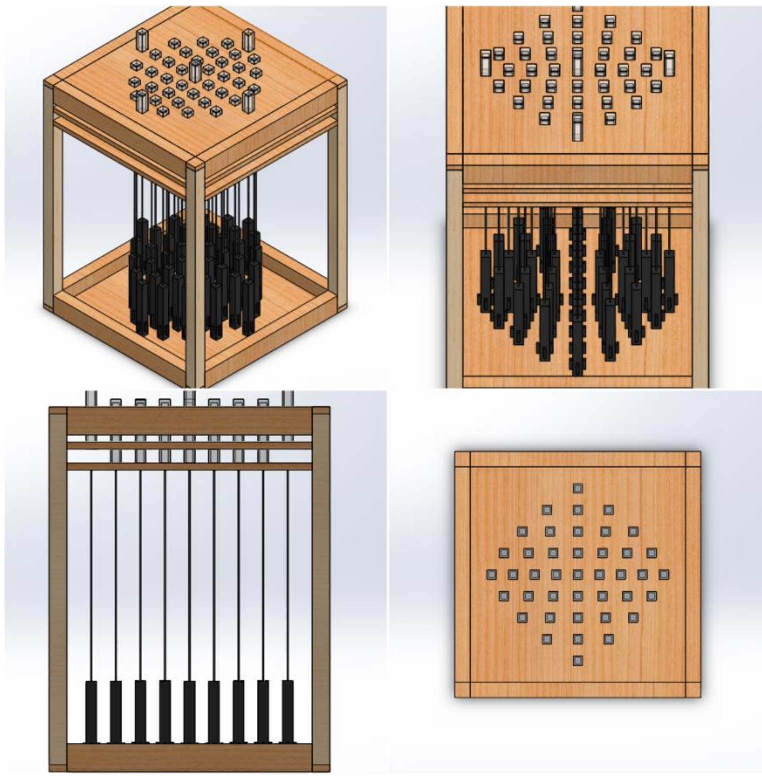

Figure 2: Mock-up of Relevo at 4 different angles

Figure 2 above shows a mock-up of *Relevo* from various angles. From the images you can see the 3 distinct layers of the display table. The top layer consists of the array of pins which display the 3D object, while the middle layer depicts the linkages that couple the motorized potentiometers to the pins. The last layer is our array of potentiometers which drive the pins.

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3 DESIGN SOLUTION

Relevo's pin actuated 3D display system was conceived as the solution to two major problems: improving the user experience beyond the limits of audio visual and helping the visually impaired interact with information in the world around them. As such, *Relevo* includes a core group of features aimed at attaining these two goals simultaneously.

3.1 SCOPE

The core group of features included in *Relevo* consists of an array of pins on a table sized surface as seen in Figure 2. Each pin is actuated by motors that can adjust position in the vertical axis based on user input from either a data file or intuitive user gestures. *Relevo* will utilize a motion detection camera to capture the user gestures and relay the information to a microcontroller which will then control the pins. A single piece of covering material can be attached to the top of the pins to allow a smoother feel for the visually impaired.

Relevo has the intuitive touch aspect of Braille which allows information to be conveyed in a physical format while including the dynamic capabilities of a shape changing display to change the information with a single device. *Relevo's* smaller pin size will allow greater resolution in the future and thus greater detail. Although it is limited in size due to budgetary and time constraints, it will be able to display at minimum, mathematical functions that do not have inconsistencies as well as Geospatial data. Our long term vision is to expand *Relevo's* capabilities in order to display highly detailed 3D renderings of prototype designs as pin resolution is increased.

The remainder of this section will be dedicated to discussing and justifying the design solutions chosen for the major components of *Relevo*.

3.1.1 PINS AND BOARD SIZE

One of the most important factors in this design is determining the dimensions and quantity of the pins. The choice to use smaller pins (< 1cm) allows for greater pins per area and thus increased resolution. In turn this increases the monetary cost and complexity of the electrical design, as more pins are required to achieve a certain board size compared to larger pins. Conversely, larger pins cover more area allowing for a larger board and less components with lower cost at the sacrifice of resolution. As the goal of an interactive 3D display can still be met at a lower resolution, the larger pins are ideal due to budgetary and time constraints. In addition, a larger interface for the user is preferred as it is easier to see visually and more can be depicted to the visually-impaired albeit with lesser detail.

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3.1.2 SERVOMOTORS/ACTUATORS

There are multiple technologies for the choice of servomotors and actuators allowing for the movement of the pins. The solution we have chosen is to go with is potentiometers with integrated servomotors. Each potentiometer is a single integrated piece where the position of the slider is easily determined by the output resistance. In addition, potentiometers have a lower cost compared to traditional linear actuators and higher robustness compared to 3D printed actuator arms. Since the actuators and servomotors are integrated together they provide simplicity for implementation.

3.1.3 MICROCONTROLLER

Our design of *Relevo* will utilize a microcontroller to ensure a marketable product. As there are multiple pins in our design, controlling them all at once in a manner fast enough for real time usage is extremely difficult. Also, in order to provide a compact and standalone product, the use of a microcontroller is essential and preferable.

The specific microcontroller to be integrated into the system will be chosen at a later date after highly detailed analysis of the system requirements has been conducted. Provisionally, we have chosen the Arduino DUE as it provides the input/output pins and hardware power to control the system and is suitable for an initial prototype.

3.1.4 LEDS

Though they are not crucial to the mechanical workings of *Relevo*, the LEDs add increased display functionality which is determined by their specific color and intensity. Utilizing RGB LEDs as opposed to single color will allow *Relevo* to display more complex information. The LEDs could be replaced by a projector but the costs and setup/calibration of such a design are beyond the scope of this project.

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3.2 RISKS

As with any system that contains a large amount of mechanical and moving parts reliability is always an ever-present risk. As *Relevo* incorporates the synchronized movement of up to 30 motorized linear potentiometers the risk of just one of these devices failing, malfunctioning, or becoming inaccurate is a certain risk. In addition to this, as the design scales up in both size and resolution, as currently planned, this becomes a greater and greater risk. The result could be a culmination of unintended costly repairs and replacement of parts whose cost would unfortunately have to be borne by the end user over time. In order to mitigate this risk, the design choice for which motorized linear potentiometers will be used will draw into consideration the trade-offs between both quality and lifetime over cost. This is essential in order to meet our stringent cost requirements without compromising the quality of our product.

Cost reduction is another considerable risk to the success of *Relevo*. Many of the components in our product are costly, and as the product is scaled up in both size and complexity cost overruns are a significant risk as well as they could drive the market price of our product out the target market price range. In order to mitigate such a risk, careful considerations must be made when choosing materials and components, as the balance between ascetics, performance, quality, and cost are paramount to the success of *Relevo*.

Component integration and complexity is another apparent risk, which has drawn serious concern. *Relevo*'s design incorporates various sub systems including actuator control, LED control and 3D camera input all integrated together by an embedded data processor. This poses some major challenges in getting each system up and running as well as integrated correctly with the other systems of the design. Unexpected difficulties are a real possibility and must be accounted for with major time overheads in the project planning phase in order to mitigate this risk.

Finally, project timeline risks are present in the undertaking of any project and *Relevo* is no exception. Time overruns due to unexpected delays and challenges with components, writing software, and expertise risks must be accounted for. Possible delays in the purchasing and delivery of critical components are also a reality and must be accounted for in the allotment of time given for the completion of each task in the project timeline. In general, our project must allow for headroom in the worst case scenario where parts are delayed or unforeseen challenges arise.

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3.3 BENEFITS

Relevo is a display system that allows users to intuitively visualize 3D data through a physical medium. For a visually-impaired individual our display allows them to understand complex information such as images or graphs through physical touch. This technology will open up new possibilities and improve quality of life for people who struggle daily to interpret, learn about, and analyze the world around them. Our product could also prove to be highly beneficial for industries such as geospatial, medical, and product design by allowing for volumetric visualization and 3D design representations. *Relevo* has limitless potential and applications and Actuated Innovation believes that once our device is delivered to customers, the users will explore the endless possibilities of displaying information in the third dimension and discover more unique applications.

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4 MARKET RESEARCH AND ANALYSIS

The common phrase "A picture is worth a thousand words" speaks to the information differences between auditory and visual channels. *Relevo* will be the first tactile user interface available on the market allowing users to experience and engage with digital models in an intuitive manner.

Our product is a dynamic, actuated tabletop display which can render and animate 3D content, physically allowing users to interact with information in a physical medium. *Relevo* aims to move digital modeling into the physical space.

4.1 TARGET DEMOGRAPHIC

Relevo's actuated display technology can be applied beneficially to a number of target demographics. A large target market we hope to penetrate with this product is the geospatial industry. Geospatial data is a major driving force of today's analytics with broad applications including, but not limited to: optimizing shipment deliveries, positioning emergency responders, boosting food production, city planning, and retail advertising [3]. Utilizing our display, companies can experience geospatial data in a more intuitive manner.

Our product can also be used to help the visually impaired gather information and empower them in the world around them. With our tabletop display, we have created a new method of collaboration between blind and non-blind people. One of the major deprivations due to blindness is the access to information. Visualization of information helps individuals see patterns in structured information and to understand complex data such as graphs or 3D plots. Current techniques for displaying information to the blind rely on speech and Braille which cannot easily convey visual data (Figure 3).

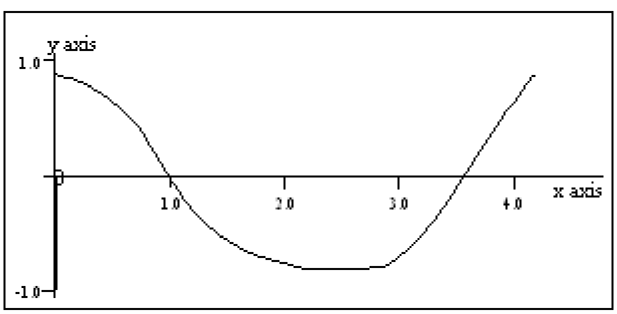

Figure 3: A typical line graph. Conveying this data in speech or Braille is extremely difficult.

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Relevo can solve this problem through its innovative way of projecting digital data into physical space. Art no longer needs to be explained in a long slur of confusing dictation, but instead can be displayed and tangibly felt.

Because this type of device is new to the market we are continuing to explore more application domains such as volumetric visualization of medical images (MRI and CTI) and previewing 3D prototypes.

4.2 EXISTING COMPETITION

The kind of product we are creating is currently not found on the market. There exists a variety of products which aid the visually-impaired but are largely based on Braille and sound [4].

The Tangible Media Group at MIT have developed a dynamic shape display similar to our product called inFORM [5]. However, their product is too expensive for the market and solely used as a research tool. MIT has been exploring the potential of their display table and found many novel applications: visualizing sound waves, modeling material properties, and adaptive furniture. This gives us confidence in the marketability of *Relevo*, the tabletop-sized actuated 3D display.

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5 BUDGET AND FUNDING

5.1 BUDGET

Actuated Innovations proposes the following budget for its eight-month development of *Relevo* (Table 1). An anticipated 25% cost contingency is appended taking into account uncertainties in design and component acquisition.

Table 1: Itemized Budget

Hardware Component	Estimated Cost (CAD)
Pins x 30 @ 5 inch each	45.88
Wood for frame (60 feet)	35.40
Motorized Slide Potentiometer x 30	779.61
Nylon rod (1.5 feet per pot)	36.00
Wood Top (MDF) 5/8 x 49 x 97	29.98
Arduino DUE	50.66
PCB Fabrication	100.00
Spandex Fabric	10.00
Neodymium Magnets	2.58
Electrical Wiring and Components	50.00
RGB LEDs	58.50
Subtotal	1198.61
Contingency (25%)	299.65
Total	**1425.14**

5.2 FUNDING

At the present time, Actuated Innovations has not received any funding. We are in the process of finalizing our application for submission to the IEEE and the Wighton Fund. In addition, we are also planning to pitch *Revelo* to the ESSS within the next four months. If our company is unable to generate enough capital to fund the completion of *Relevo*, each member of the team has agreed on equally sharing the remaining project costs.

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6 PROJECT TIMELINE

Relevo will follow a strict eight-month development timeline with a proof of concept prototype delivered in the first four months. Shown below in Figure 4 is the milestones chart which marks the significant stages in development.

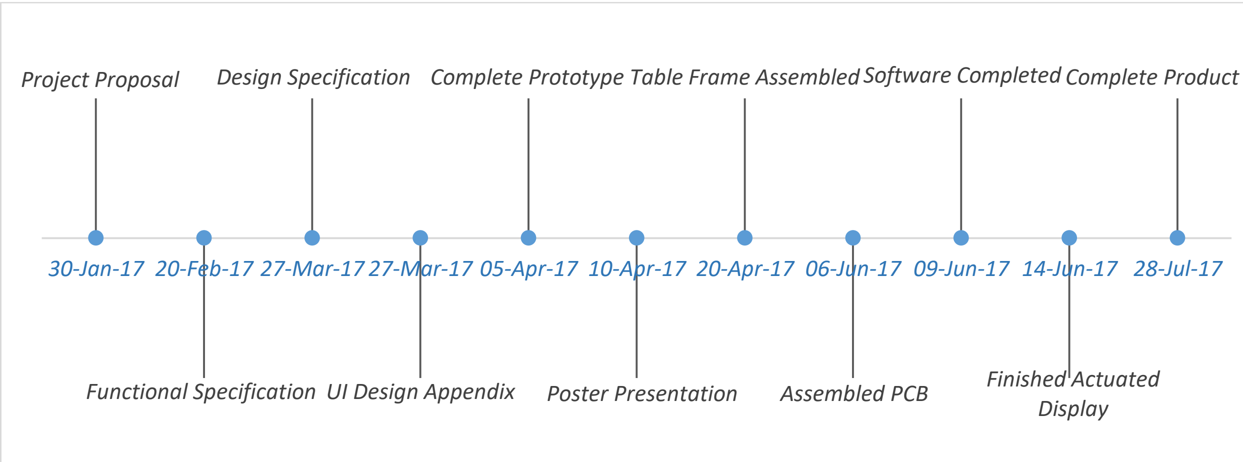

Figure 4: Milestone Chart

To ensure we adhere to deadlines, our team will adopt an Agile Development model with a sprint duration of 2 weeks. Meetings will be held 2-3 times a week to communicate status, progress, and issues with the addition of a Kanban board to track workflow. This tactic will allow us to continuously re-scope, integrate, validate, and deliver hardware and software components every iteration.

As stated above, a working, small scale prototype will be delivered on April 5th. For the following four months, development is scheduled as follows: fully assembled frame on April 20th, custom PCB on June 6th, software finished on June 9th, and a full scale actuated display on June 14th. Development wraps up with final integration and testing which is expected to be completed by July 28th. A more detailed overview is available in the Gantt chart on the following page (Figure 5).

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Task Name	Duration	Start
Documentation	**66 days**	**Mon 1/9/17**
Project Proposal	16 days	Mon 1/9/17
Requirements Specification	16 days	Mon 1/30/17
Design Specification	26 days	Mon 2/20/17
UI Design Appendix	26 days	Mon 2/20/17
Poster	11 days	Mon 3/27/17
Hardware Design	**99 days**	**Tue 1/31/17**
Actuated Display	**97 days**	**Tue 1/31/17**
Research	14 days	Tue 1/31/17
Prototype	34 days	Fri 2/17/17
AutoCAD Model	4 days	Wed 4/5/17
Ordering Parts	30 days	Tue 4/11/17
Assembly	10 days	Tue 5/23/17
Testing	7 days	Tue 6/6/17
Table Frame	**58 days**	**Tue 1/31/17**
Research	14 days	Tue 1/31/17
AutoCAD Model	7 days	Mon 2/20/17
Ordering Parts	30 days	Wed 3/1/17
Assembly	7 days	Wed 4/12/17
Printed Circuit Board	**91 days**	**Tue 1/31/17**
Reseach	14 days	Tue 1/31/17
Prototype	34 days	Fri 2/17/17
Eagle Design	4 days	Wed 4/5/17
PCB Fabrication	7 days	Tue 4/11/17
Ordering Parts	30 days	Tue 4/11/17
Assembly	4 days	Tue 5/23/17
Testing	7 days	Mon 5/29/17
Hardware Integration	5 days	Mon 6/12/17
Software Design	**94 days**	**Tue 1/31/17**
Kinect 3D Image Acquisition	**87 days**	**Tue 1/31/17**
Research	14 days	Tue 1/31/17
Prototype	34 days	Fri 2/17/17
Writing Code	19 days	Wed 4/5/17
Testing and Debugging	23 days	Mon 5/1/17
Pin Control Code	**87 days**	**Tue 1/31/17**
Research	14 days	Tue 1/31/17
Prototype	34 days	Fri 2/17/17
Writing Code	19 days	Wed 4/5/17
Testing and Debugging	23 days	Mon 5/1/17
Software Integration	8 days	Wed 5/31/17
Final Integration of Software and Hardware	**30 days**	**Mon 6/19/17**
Testing and Debugging	30 days	Mon 6/19/17

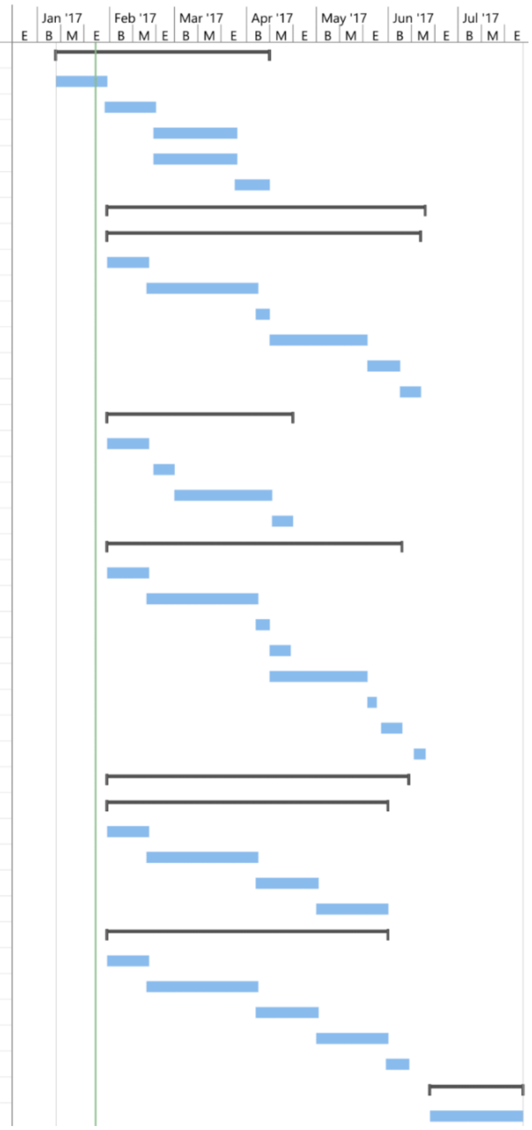

Figure 5: Detailed Gantt Chart of expected completion dates of tasks associated with the project

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7 TEAM ORGANIZATION

In bringing such a unique product to market, Actuated Innovations was founded in December 2016. The team consists of six intelligent and engaged Simon Fraser University Engineering Students: Brian Hanley, Alec Lu, Anthony Fung, Dennis Huebert, Zachary Wong, and Jonathan Wong.

The implementation and success of this project is heavily team oriented, with each member's diverse strengths being our greatest asset. Consisting of three computer engineers, two electronic engineers, and a systems engineer, Actuated Innovations aims to develop a high quality end product.

The *Relevo* project will be split into 3 core sections: software, hardware, and integration. Project tasks will be divided evenly between members based on their fields of expertise and interests. However, member responsibilities are overlapped across multiple sections to speed up product integration, improve team communication, and to increase the bus factor of this project (Table 2).

Table 2: Breakdown of Team Roles

Team Members	Task
Anthony, Zachary	Design and Construction of Chassis
Jonathan, Zachary, Brian	Kinect 3D Reconstruction Algorithm
Dennis, Alec, Anthony	Construction of mechanical and electrical components for the actuated display
Brian, Jonathan, Alec, Zachary	Pin control system
Jonathan, Brian, Alec, Anthony, Zachary, Dennis	Documentation and Testing

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8 COMPANY PROFILE

Brian Hanley – Actuated Innovations Co-Founder, Primary Contact

Brian is a 5th year engineering student at SFU. He spent a year working for the company DemonWare as a co-op where he performed data analysis for the capacity planning team. While working at DemonWare he led the creation of a suite of tools for the bulk collection and analysis of cluster metrics. He also created a set of tools that attempted to estimate the hardware costs per cluster in production. Brian has received credit for his work in many video game titles such as Call of Duty and Skylanders. His interests include digital communications, data compression and communication networks.

Alec Lu – Actuated Innovations Co-Founder

Alec Lu is in the 4th year of his Bachelors of Applied Science – Systems Engineering option. He has completed a sixteen-month R&D software developer co-op at Canadian Nuclear Laboratories working with world-class ultrasonic testing and eddy current testing analysts to develop the next generation nuclear reactor inspection system. Through many course projects and other sources, he has also become well oriented in RTL design, SW/HW co-design, and 3D modelling.

Anthony Fung – Actuated Innovations Co-Founder

Anthony Fung is in the final year of his Bachelors of Applied Science – Electronics Engineering program. He has spent a year at EIC Solutions as a co-op student learning and creating control systems for industrial applications. His area of expertise focuses on the hardware element of electronics along with the necessary skills to physically build them. He is also well practiced in MATLAB and technical document writing and editing. Anthony's strong written and oral communication skills have allowed him to seamlessly fit into project groups in the academic and work environments. He plans to acquire his P. Eng. after gaining more post-school work experience.

Dennis Huebert – Actuated Innovations Co-Founder

Dennis Huebert is a 5th year Computer Engineering student who has completed eight months of co-op at PNI Digital Media as a Quality Assurance Analyst. He was responsible for writing and running test cases on many large websites for major clients including: Costco, Tesco, and Staples. During his academic carrier, Dennis has had the opportunity to experience software and hardware development using C, C++, Python, Swift, VHDL, MATLAB, and Java. His personal projects, such as a scrolling LED sign and a variable DC power supply, have allowed him to apply his wide skillset to real world applications.

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Zachary Wong – Actuated Innovations Co-Founder

Zachary Wong is in his final year of his Bachelors of Applied Science concentrating in Computer Engineering. His co-op experience includes one year working at Sierra Wireless in Richmond BC as a software validation and test engineer focusing on automated testing and test design. He has a wide range of skills in programming and design using languages such as C/C++, Objective C, Python and VHDL, as well as experience in GPS, Wi-Fi and other wireless technologies. His strengths in communication and role flexibility within a team are some of his strongest assets.

Jonathan Wong – Actuated Innovations Co-Founder

Jonathan Wong is a 5th year Computer Engineering student with one year of co-op experience as a Software Tester at Sierra Wireless where he was responsible for development, implementation and testing of scalability test systems. Throughout his academic career, he has built a strong background in C++, Python, and embedded programming in C and Assembly. Jonathan has completed many team projects including audio mixing on FPGA, iPhone application development, and microprocessor implementation. Furthermore, Jonathan has exceptional communication and organizational skills demonstrated by his educator-oriented background.

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9 CONCLUSION

Relevo is an exciting new design that aims to provide users with simple and exciting ways to both communicate ideas and interpret information. Through the synthesis of actuators, LEDs, simple computer systems, and modern computing algorithms, our design delivers a new multimedia tool for various industries. As we have demonstrated in this document, our product can be profitable in a wide range of industry settings. From data science to healthcare, *Relevo* can adapt to different user requirements through its software backend and its intuitive interface.

Actuated Innovation is excited to start work on *Relevo*. Each member of Actuated Innovation has the expertise, knowledge, and passion to complete this project while adhering to our set milestones. We are fully committed to making our vision a reality while keeping project costs at a minimum.

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