Business Proposal

Revo Stationary Bike with "Generciser" Technology

Team 12
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Executive Summary:

This proposal's purpose is to motivate upper management to fund the Revo stationary bike with "Generciser" technology project. The project is conveyed in its entirety throughout this proposal.

The beginning of the proposal is the introduction which explains the basic ideas behind the Revo stationary bike, including the need for the Revo stationary bike and how it will fill that need. The introduction also includes a background section that discusses the client's needs and requirements with detailed specifications. Following the background is a general purpose section. This section goes into detail about the need for the Revo stationary bike in society and how the Revo will fit those needs. This is followed by a section discussing previous work in the field. Research on current stationary bikes will be discussed in this section. Within this section the main competitors' products as well as patents are brought up.

The next area of the proposal is the project description. The project description provides an overview of the Revo stationary bike and all of its features. Upon completion of reading this section the upper management should know exactly what the Revo stationary bike has been designed to accomplish. All of the major components and creative innovations are briefly explained in this section.

Following the project description is the methods section. In the methods section a more detailed overview of the project is explained. This section is an expansion of the project description. The design figures and block diagrams of the Revo stationary bike are included in this section to give the upper management a visual of the project. Each of the components is also included here in full detail giving the total description of the Revo stationary bike.

The next area of the proposal is the budgeting section. This section contains the cost of building the Revo stationary bike in as much detail as possible. At this time it provides a rough estimate for production. A comparison is made against other stationary bicycles on the market. For the purpose of this proposal, the price of the Revo stationary bike is scaled to be 35% of the prototype costs.

The last section of the proposal is the conclusion. This is a brief summary of the Revo stationary bike, highlighting the important features that make this product unique. The conclusion also highlights points dealing with the market and budget issues.

Introduction:

1.1 Background

Current stationary bike designs make it difficult for elderly users or patients recovering from hip complications to step their leg over the machine and sit on the bike. These people may also have difficulty standing up from the seated position once on the bike. Being able to use the stationary bike and utilize the zero impact workout decreases recovery time and increases the stability of the hips and knees. The adjustability of current stationary bikes is also limited, for example pedals are at a fixed height, displays and grips are also fixed.

Stationary bikes also generate a great deal of power that goes unharnessed. Bikes will often use the power generated by the user to power the display board, but no further uses are implemented. This power has potential applications in space station technology. The power generated could be used to charge battery arrays or personal devices of astronauts who are using the device to maintain their muscular integrity in the micro-gravity environment.

1.2 Purpose of the Project

The project title is the Revo stationary bike and this machine serves three main purposes. The concept for the bike is a machine that makes it easier for disabled, elderly, or otherwise injured and recovering people to use a stationary bike. The second concept is a way for the bike to feed excess power generated by the user's kinetic energy back into the grid via an AC outlet. This ties into the third purpose which would be to use this bike in space stations as a method to provide power in outer space either to recharge station battery arrays or small devices directly.

By combining these three concepts a profitable product can be produced. However there will be numerous models of the product geared towards what the consumer is looking for. It can be said that a rehabilitation bike for someone recovering from hip surgery will certainly produce less power than one used by an avid cyclist. Therefore the rehabilitation bike will have a focus on rehabilitation and making the user comfortable to increase the rate of recovery and subsequent strength at the end of the recovery.

A second model can be used for larger gyms that are looking to gain from their patrons work out regiments. By having a large number of Revo stationary bikes running at once, all of the lighting in the gym could be powered, reducing the electric bill of the gym. If in fact there is enough power generated by the patrons to exceed the gyms power consumption, the gym could sell power back to the national power grid. This model will be marketed for sale to the average household. The concept would be to a have trendy stationary bike that can be used in a small space in a household which can provide a source of exercise as well as supplying power back into the household grid. This would follow in the wave of green energy options that are now entering the market.

The third model which has recently come into possible action is the idea of using the Revo in outer space on space stations. Design changes may occur in materials used and overall size of the device. This idea must be explored further to see what would be required of the device and how to best meet those objectives.

1.3.1 Previous Work Done by Others

There are hundreds of stationary bikes out on the market. However, very few of these are specifically geared towards rehabilitation. The rehabilitation devices related sets of pedals that can be set on the floor in front of a chair. These small bike substitutes that are just the pedal unit have no displays and are difficult to change resistance settings to increase difficulty levels. They also have no programs to aide the user in creating an effective workout. One of the models is a hand cycle that comes with the pedal attachment.

The Green Revolution Inc. © has developed some stationary bikes that generate power as one cycles, however on an individual workout basis the amount of power generated can light a light bulb for roughly an hour.

http://www.switched.com/2008/11/12/green-stationary-bikes-generate-power-as-you-work-out/
http://www.rehaboutlet.com/stationary_bikes.htm
http://www.shop.com/rehab+STATIONARY+BIKEs?g=1&t=2&p=225173340&k=24

1.3.2 Patent search results

The biggest patent concern is the "Generciser" technology. This is an issue that must be discussed further with Eric Knight, who contributed the idea to the group.

There are however some patents dealing with the basic designs of the stationary bike. The overall patent includes many other patents for the components of each part. The patent is very general and discusses the basic parts that make up a stationary bike such as the frame, display, pedals, and seat. Some of the companies with patents include Tonic Fitness Technolgy© and Brunswick Corporation©. Some of the other smaller patents include turning control devices for virtual stationary bikes, support frames for stationary bikes, and a centrifugal resistance device for stationary bicycles.

http://www.patents.com/Stationary-bike/US6913560/en-US/
http://www.google.com/patents?q=stationary+bike&btnG=Search+Patents

Project Description:

2.1 Objective

The Revo stationary bike will be made of two components. The device is separated into components for easier assembly during manufacturing and increased customizability. The most important unit is the head unit. The head unit is where most of the major components of the bike will be housed. This unit contains the entire pedal assembly, gearing, and "Generciser" technology. The entire user interface also anchors into the top of the head unit. Further details as to what displays are shown and what program options are available are discussed further in the methods section.

The second component of the Revo stationary bike is the rear unit. This part varies with each model. The main unit marketed for the average consumer household and gyms will be a simple seat for the user with horizontal and vertical adjustments to suit a wide range of body types. The second rear unit is for the rehabilitation model. This unit is motorized by a battery to assist patrons in maneuvering onto the bike to exercise. The details of the unit are further explained in the methods section.

The goal of the Revo stationary bike is to use creative innovation to provide new services and features for stationary bikes that are currently not available. There are many types of

stationary bikes on the market each very similar to the next. There are very few stationary bikes that are used specifically for rehabilitation and even fewer that produce electricity to be used externally. By combining these two features into one product, the Revo stationary bike, will be very successful across a number of different markets.

For a much smaller market, specifically NASA, the Revo stationary bike has the possibility to become a vital innovation in human powered space systems. NASA has shown interest in the product, but further discussion as to their specifications and requirements have not been established.

2.2 Methods

The most complex unit is the head unit, which will house the "Generciser" unit which gathers the excess energy and feeds it back into an AC outlet. The "Generciser" is ideally a small, inexpensive, power inverter that can be easily integrated into the design of the stationary bike. The benefit of using an AC outlet is that the Revo bike does not need a dedicated circuit to transmit its electrical output. Dedicated circuits are currently in use by gyms utilizing patron generated power and the Revo would eliminate the need for such circuits. This would eliminate the need for such systems and make it easier for existing gyms to integrate patron power into their systems without the excess cost of reconfiguring the electrical system of the building.

The head unit will also house the pedal assembly and the display board. The lightweight pedals will have adjustable toe straps to help the user maintain firm contact with the pedals during the entire revolution. The toe straps would also help astronauts in the micro-gravity environment of space maintain contact with the pedals. The drive assembly will be chain driven utilizing a 36 tooth chainring on the right side of the pedal assembly. The chain will drive a 9-speed cassette. The placement of the chain on the cassette will be governed by a derailleur which is controlled by grip shifter on the hand rails. The main flywheel of the will be connected to a series of small dynamos which will gather power from the rotating wheel. The dynamos will provide a set level of resistance to the rotating wheel. The gearing allows the user to determine how much leverage they want to have in powering the rotating wheel. The higher the gear the user selects, the higher the resistance, the higher the speed of the wheel, and in turn the greater the amount of electricity generated.

The generated power is first used to power the display board of the Revo bike. Any excess power that is not required for the display is used to either charge the battery in the rear rehabilitation unit or is sent to the "Generciser" where it is converted to AC power and sent out into the grid via an AC outlet.

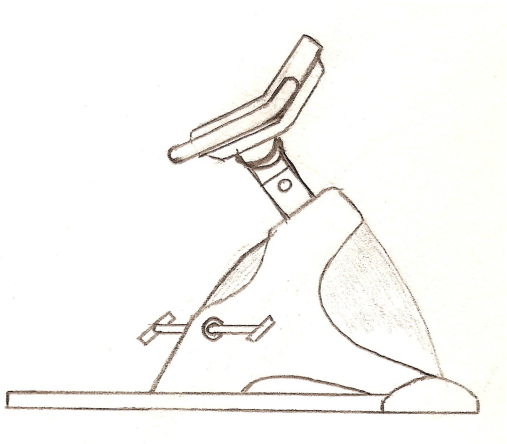


Figure 1: Preliminary Design Sketch of Head Unit with Display Board

Since the machine is intended for rehabilitation purposes it should be able to operate at low revolutions per minute (RPM). Most conventional stationary bikes will pause the display board or turn off the display when RPMs drop below 30 revolutions per minute. The display board will be powered by the rider. There will be a number of features on the display board including distance, speed, calories spent (total and per hour), output in watts (current and per hour), resistance level, heart rate, and workout time. The user will be able to input height and weight measurements to get more accurate caloric readings. Another display board object will be a small track made which will show user progress around a simulated 400 meter track. The display board will also have a port for charging iPods. While the iPod is attached, an LCD screen located in the center of the simulated track will act as a larger display for the iPod. This will allow the user to watch videos and cycle through music with ease during a workout. The display board will also have a standard headphone jack for audio when the user's Ipod is in the port. Small speakers on the sides of the display board will play the audio from the user's Ipod when the headphone jack is not in use. At the base of the display board will be two water bottle holders as well as small shelves for propping up magazines or books at different angles. Surrounding the

display board will be handrails which will also house the heart rate sensors and the grip shifter for the resistance setting.

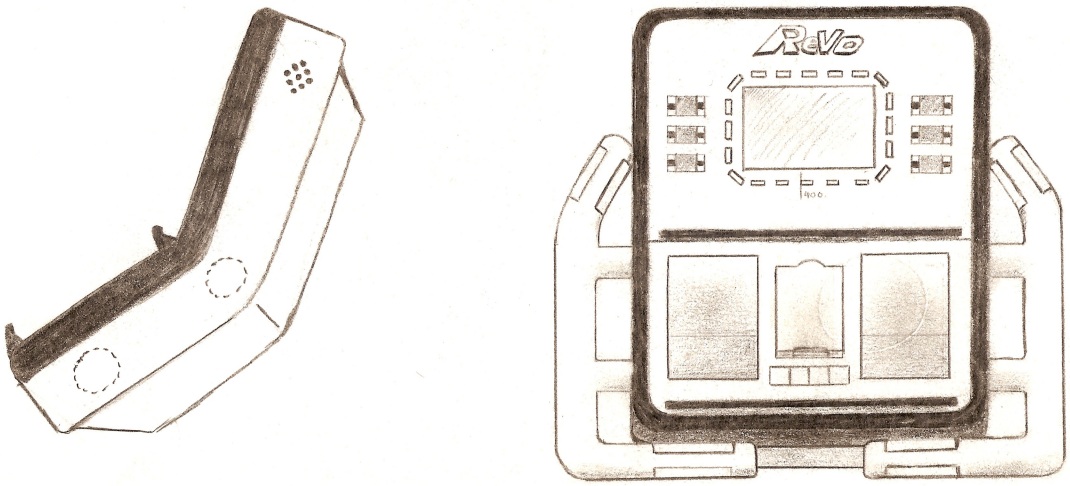
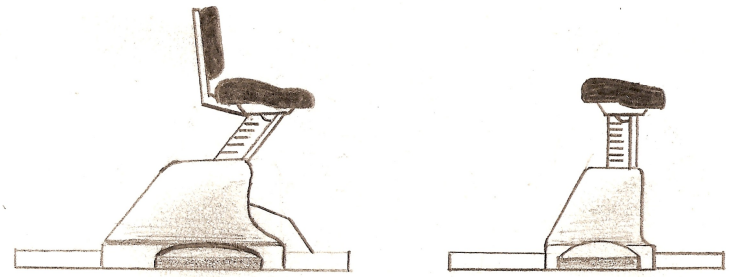


Figure 2: Preliminary Design Sketch of Display Board and Hand Rails

The second unit is the rehabilitation seat. One function will be to slide down and away from the machine to make it easier for users to reach the seat without stepping over the machine. In order to move away from the head unit the rear seat unit will slide away on a motorized track. The maximum distance will be between 2 and 3 feet, allowing the user to walk in front of the seat, sit down, and then slide themselves back up to the head unit. This would prove very beneficial for users who may usually need a walker to move around. The height of the seat unit will also be a motorized adjustment. It would be easier for a user to sit on and get off a lower seat than a higher one that may be required to perform the exercise. This will all be controlled by a panel on the seat post for horizontal and vertical adjustments. Another function is to potentially aide the user in standing after exercising on the Revo. The seat, powered by a hydraulics anchored in the sliding track, will be able to raise the up at a forward angle. This will put the user in an upright and standing position with the handrails within easy reach for stabilization. This unit will be powered by a 12 volt battery that is housed in the head unit and recharged once the user is pedaling. The seat will mimic a typical bicycle saddle however a retractable back will be

available to provide support for positions in which the rider is sitting at an angle greater than 90 degrees with respect to a horizontal plane.

The third unit is a conventional seat developed for gym and private use with no motorized support. The seat will have similar adjustability to the rehabilitation unit, allowing the user to move the seat forward, backward, and vertically. The adjustable back support could also be implemented in the conventional seat.



(a) (b)

Figure 3: Preliminary Design Sketch of Rehabilitation Rear Unit (a) and Conventional Rear Unit (b)

Budget:

3.1 Prototype Materials Budget

Part:	Quantity:	Price USD:
SRAM SX-5 Rear Derailleur - 8/9 spd	1	24.99
Sram Shifter - X5 Grip Shifter Set – 9 spd	1	27.95
2008 Sram 950 Cassette w/ 951 Chain Combo Kit	1	39.98
Shimano Deore M525 Disc Rear Hub	1	29.99
Sette Torx ST-27 Hollowtech II Bottom Bracket Tool	1	14.98
Sette Torx ST-215CB Cotterless Crank Puller	1	6.98
Truvativ Howitzer Team Bottom Bracket 2008	1	29.98
Truvativ Blaze 3.1 Crankset 2008	1	49.98
TKO BH-736HR 7 inch Headrest TFT LCD Monitor	1	82.99
Griffin AirDock Docking Station - 6139-AIRDOCK	1	24.99
Alloy 6061 Aluminum Material: Aluminum - Alloy 6061 Length: 48 Width: 2.000 In. Thickness: 0.250 In. **MSC #:** 06957948	1	27.34
Alloy 6063 Aluminum Wall Thickness: 1/8 Length: 72 Width: 4 Material: Aluminum - Alloy 6063 **MSC #:** 32001026	4	282.84

Alloy 6063 Aluminum Wall Thickness: 1/8 Length: 72 Width: 2 Material: Aluminum - Alloy 6063 **MSC #:** 32001000	2	83.22
Acrylic - Clear Material: Acrylic Thickness: 0.125 In. Length: 48 Width: 48 Color: Clear **MSC #:** 63388953	2	169.78
Alloy 6061 Aluminum Material: Aluminum - 6061-T6 Outside Diameter: 2 Wall Thickness: 0.250 In. Inside Diameter: 1.500 In. **MSC #:** 36968261	3	100.11
Display Board (Based on competitor models with electronics and casing)	1	500.00
Test Pilot 200mm Ladder Strap	2	15.98
Test Pilot Pump Buckle	2	13.98
Sarfas Reactive Gel EX-2600 Exerciser Bike Seat/Saddle	2	89.90
General Purpose Motors - Three Phase TEFC Thermal Protection Rating: None Applications: General Purpose Motor Type: Three Phase Energy Efficient Type of Enclosure: TEFC Horsepower: 1 Frequency Hz: 60 MSC #: 04089918	1	242.49
General Purpose Motors - Three Phase TEFC Thermal Protection Rating: None Applications: General Purpose Motor Type: Three Phase Energy Efficient Type of Enclosure: TEFC Horsepower: 5 Frequency Hz: 60 MSC #: 04088290	1	371.45
20° Spur Gears Type: Spur Gear Diametral Pitch: 16 Pitch Diameter: 3.000 In. Bore Diameter: 0.625 In., 5/8 Number of Teeth: 48 Outside Diameter: 3.125 In. MSC #: 02274306	2	92.58
M-Wave Alloy BMX 9/16-Inch Bike Pedals	2	15.28
Bolts + Fasteners	-	200.00
	Total:	2537.76

3.2 Budget Analysis

The prototype estimate comes out to be $2,537.76 in material costs. The final product should be priced for 35 percent of the initial prototype cost, which places the selling price at $888.22. This is a very reasonable amount for such an innovative machine. This places the pricing of the final product with mediocre level stationary bikes, below that of many high end

models with fewer capabilities. Models such as the Star Trac S-UBx Upright Bike have a MSRP of $2,595.00. The Life Fitness Club Series Upright LifeCycle Exercise Bike retails for $2,499.00. Neither of these models have features that can compete with the energy innovations of the Revo bike. One stationary bike that falls within the same price range as the Revo is the Kettler RT 307 Upright Stationary Exercise Bike which has a retail price of $649.00. The Kettler has displays total distance, time, speed, pulse. The Kettler also requires a 110 volt power source which makes it an inferior product to the conventional version of the Revo.

Conclusion:

4.1 Project Summary

The Revo stationary bike is intended to serve two main purposes. The first being a stationary bike that is specifically designed for rehabilitation purposes. This is achieved by designing the rear unit to move away from the machine, allowing easier access for users and a higher level of adjustability. Having access to the zero-impact workout of the stationary bike is crucial for people with recovering from hip or knee injury or replacements. Elderly individuals would also benefit from zero-impact exercises.

The second purpose of the Revo is to feed energy generated in excess by the user back into the electrical grid via an AC outlet. This has applications in large physical training facilities as well as in a private home environment. A gym could potentially power much of its facilities with the power generated by an array of Revo bikes. Another application of the energy capabilities of the Revo is in the space station. Astronauts could use a version of the Revo bike as part of a daily exercise regiment to maintain their muscular integrity. At the same time those astronauts would be generating electricity that can be used to power various devices on boards such as charging battery arrays or personal devices.

4.2 Market Summary

Due to the number of capabilities of the Revo stationary bike, it opens up a number of possible markets. First of all, rehabilitation facilities would be interested in the device for its ease of use. For this same reason, the Revo could become a popular device among elderly users, who have a difficult time using other conventional stationary bikes.

The energy potential would make the Revo a highly desired machine for physical training facilities looking increase their “Green” profile while minimizing cost. With arrays of Revo cycles, gym could potentially profit from their patrons’ workout routines. Private home users would also find interest in the Revo for its trendy “Green” energy system. It is also user friendly with the Ipod features which will cooperate with today’s technology age.

Another market potential is using versions of the Revo stationary bike as power generators in remote facilities such as in the space station. Having an easily renewable energy source is extremely important in the space station and even if the bike is used to charge small devices, it atleast takes some demand off the battery arrays of the station.

4.3 Budget Summary

The budget takes into account the material cost in building the prototype Revo stationary bike. The rough estimate of the prototype cost is $2537.76. The price of the final product then calculates out to be around $888.22 which places the Revo stationary bike in the center of the price range for similar devices. Stationary bikes can be purchased for amounts ranging from $100 to $5000 and higher. As the prices rise, so do the number of features and capabilities of each model. However, the Revo is able to incorporate a large number of functions and innovative features that as a device it is able to compete with very high end models while its pricing reflects that of a mediocre bike. The combination of these two entities gives the Revo a high potential for success.