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Dear Ms. Converse:

In this day and age, people rely on computers to simplify their daily tasks. However, the monotonous actions necessary to control computers often lead to repetitive stress injuries. These computer-related injuries are common in working environments and can cost companies millions of dollars in worker compensation.

AREA Tech.'s revolutionary SmoothTrack solves this repetitive stress injury problem for computer users. The SmoothTrack is an ergonomic touchpad designed for prolonged and comfortable computer usage. Because of the unique curvature and positioning of buttons, users easily control their computers in a comfortable fashion. Furthermore, the touchpad design gives an option for laptop users that experience pain or aches while using the standard flat touchpad.

If you have any questions or comments regarding the SmoothTrack, please feel free to contact us at the address above. It would be an honor for us to have you on board with our project, and thank you for your time.

Sincerely,

Alex Huitric

Rishabh Kumar

Eric Szczerbaty

Allen Jin

Encl: SmoothTrack Product Proposal

SmoothTrack

By:



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Executive Summary

As repetitive stress injuries become increasingly common from computer usage, more people are at risk to attain one of these incurable injuries—especially those whose jobs heavily rely on computer use. Therefore, professionals must take preventative measures through ergonomic computer devices. To address this health and safety problem, AREA Tech. has created the SmoothTrack.

Since the primary pointing device used in laptops is the touchpad, it is imperative to have a comfortable touchpad that people can use for long periods of time without side effects such as pain or stress. Survey results show that laptop owners are equally common as desktop owners. Because of the integration between touchpads and laptops, the potential market for an ergonomic touchpad is endless. Also, many individuals claim to have suffered from carpal tunnel or other debilitating injuries from prolonged computer usage. The SmoothTrack fixes this problem through its ergonomic design that alleviates unnecessary pressure on the wrist to ensure a relaxed operation.

Other devices claim to have the ability to prevent repetitive stress injuries, but no product is without its flaws. The Logitech Anywhere Mouse is a standard mouse that seems to be very popular among computer users. However, it lacks an ergonomic design and has a low build quality that leaves it prone to breaking down. The Wacom Bamboo Tablet has unique pressure sensing capabilities, but is not intended for general computer use—essential for larger numbers in sales. The Logitech MX Air is also special in that it has an accelerometer for motion tracking, but it lacks any stress relieving properties. Lastly, the Ergonomic Touchpad suffers from low build quality, and it is not ergonomic despite its name. Detailed comparisons between these products and the capabilities of the SmoothTrack clearly show that the SmoothTrack will take over the pointing device market.

The design features of the SmoothTrack are unique in that the laptop version can remain in the laptop while the lid is closed. Further customizations can be made so that specific tasks for individual users can be performed more efficiently. As with many standard computer devices today, the SmoothTrack is wireless, which relieves the hassle of dealing with tangled cords. Also, standard to touchpads is the multi-touch functionality that can be used to easily scroll or flip through documents. However, unlike other touchpads, the multi-touch commands can be customized by the user, which gives a large degree of flexibility. These features—among many other exclusive elements—make the SmoothTrack far superior to existing products currently available.

A working prototype will be available in approximately two months if proper funding is provided. This timeframe includes initial testing and design modifications. Once the design details are finalized, production and sales will

begin through a website. After the customer base is established, further marketing and television sales will begin to increase the number of units sold, which is estimated to be between 15,000 and 50,000 units semiannually. With a retail price of \$59.99, the SmoothTrack will earn a large profit while remaining under the standard price of other ergonomic devices on the market already.

As common occupational health problems in America, repetitive stress injuries need to be recognized. The SmoothTrack aims to prevent these injuries from prolonged computer usage while also remaining relatively cheap for an ergonomic device of this quality. The SmoothTrack will ultimately revolutionize the computer pointing device market and become a highly profitable investment for potential stockholders.

Introduction

The first electronic computers were developed in the mid-20th century. While technology has progressed, computers have become smaller, faster, and more present in our day-to-day lives. Therefore, it is common in this generation to see individuals spending hours at a time in front of a monitor, operating a computer.

Any individual who regularly uses a computer is at risk of getting a repetitive stress injury (RSI). The most commonly known form of an RSI is carpal tunnel syndrome, where pressure in the wrist area causes swelling in the nerves, which then leads to pain and tingling. A majority of these cases are related to an excessive amount of computer usage. While these injuries are not generally serious, there is no actual cure once the damage is done other than time away from the source. However, this is usually not an option for individuals who use computers for work or other non-leisure purposes. Because the possibilities of a cure are rare, the only other method to stop repetitive stress injuries is prevention; this is where ergonomic devices come into play for computer users.

An ergonomic device is one that modifies the position of the user so that each individual may comfortably operate the device for long periods of time and without any unnecessary stress. One of the most frequently used devices along with the use of computers is the pointing device, such as a mouse or touchpad. Therefore, pointing devices are often redesigned to improve efficiency and comfortableness for users. While there are many products already available for consumers, none prove themselves to prevent repetitive stress injuries; furthermore, there are limited options for laptop users who choose to use the more convenient touchpads rather than the standard mouse—AREATech's SmoothTrack design addresses these issues. The ergonomic design added to the convenience of a touchpad will significantly reduce the number of RSIs computer users attain.

The following report persuades prospective investors to become involved in our project by providing details about the current demand for an ergonomic touchpad. It also highlights the necessary medical details of preventing repetitive stress injuries and provides the standard treatment options. Additionally, the report will analyze some potential competitors to determine the economic viability of such a product like the SmoothTrack. Most importantly, this report documents the design features and manufacturing details of the SmoothTrack. Furthermore, this report details an economic assessment, which outlines the predicted expenditures to get this product into production and onto market shelves.

Background

In the last 30 years, the impact of personal computers on the world is undeniable. The invention of the personal computer has revolutionized many aspects of our lives in areas such as research, business, communication, and entertainment. "As of June 2008, the number of personal computers in use worldwide hit one billion, while another billion is expected to be reached by 2014" (Budig, 2010). Adults on average spend about two and a half hours daily on a

computer while children/teens spend an hour and half on average. Over 75% of Americans use the internet and are increasing in number. No doubt, personal computers are among the most popular electronic devices used today. With so many people in possession and in frequent use of a personal computer, the comfort and health of these individuals must be inquired as to their prolonged use.

Repetitive Strain Injuries

The use of a personal computer requires control of a certain pointing device to interface with the cursor and graphics. Many popular pointing devices include: the standard computer mouse, touchpad, trackball, tablet, touchscreen, joystick, and several others. These pointing devices are used extensively in our modern lives and require repetitive motions from the fingers and wrist. These repetitive motions can lead to a class of injuries under a category called Repetitive Strain Injury. An RSI is an injury of the musculoskeletal and nervous systems stemming from prolonged repetitive, forceful, or awkward body movements. The result is damage to muscles, tendons, and nerves of the neck, shoulder, forearm, and hand, which can cause pain, weakness, numbness, or impairment of motor control. Fine hand movements, such as the clicking and moving of a mouse, repeated hour after hour, day after day, thousands upon thousands of times, eventually strain the muscles and tendons of the forearms, wrists, and fingers, causing microscopic tears. Injured muscles tend to contract, decreasing the range of motion necessary for stress free work. The sheaths that cover delicate tendons run out of lubrication because they aren't given time to rest, so the tendon and sheath scrape, resulting in pain. Due to this abrasion, tendons become inflamed, and begin to pinch neighboring nerves. This can result in numbness, tingling, or hypersensitivity to touch. Unless this cycle is interrupted, it repeats itself over and over, and a long-term, chronic problem results.



Figure 1: A man in distress due to an RSI.

Source: <http://www.injurysolicitors.me.uk/Repetitive-Strain-Injury-Solicitors.html>

According to the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), repetitive strain injuries are the nation's most common and costly occupational health problem—affecting hundreds of thousands of American workers, and costing more than \$20 billion a year in workers compensation. Carpal Tunnel Syndrome, an RSI commonly caused by the use of current pointing devices, is the #1 reported medical problem, accounting for about 50% of all work-related injuries. Repeated bending and twisting of the

wrist causes the painful and potentially crippling Carpal Tunnel Syndrome, especially when force is applied. This constant bending inflames the tendons in the hand and wrist, causing the nerve that runs through a tunnel in the wrist (called the carpal tunnel) to be squeezed and pinched. When the nerve is pinched or squeezed, the hands go numb. The first symptom of carpal tunnel syndrome is nighttime numbness of the hand. Then, over time, as the nerve continues to get squeezed, the muscles in the hand start wasting away. If this condition is not treated promptly at the first signs of tingling or numbness, it can lead to permanent weakening of the hand.

Another common RSI called tendonitis is caused when the tendons in the hand and wrist become inflamed from repeated stressful movements of the wrist. Sometimes, the fibers that make up the tendon can actually tear. If this condition is left untreated, the tendon may be permanently weakened. The Repetitive Strain Injury is not a life threatening injury, for it can only cause pain and disability. At its worst, the RSI leads to permanent incapacity. Since a recovery from a Repetitive Strain Injury is a slow process, it is better to take treatment at early stage itself. However, with changes in technology, more and more jobs in the workforce can increase the chances of receiving an RSI. The most effective method for prevention from RSIs is to switch to more ergonomic technological tools. A standard computer mouse is very harmful because all the work is done by one finger, modern windows-based machines rely heavily on the use of a mouse, and users often stretch for the mouse causing increased strain. Laptop touchpads are even more harmful ergonomically since constant repetitive motions are required from the fingers if a cursor were to be moved a considerable distance that could be accomplished simply with a single movement of the arm from a computer mouse. The only solution to these popular yet inefficient and harmful pointing devices is a device that allows the user's hands to be loosely gripped, hands and wrist resting naturally, elbows straight, and helps the user avoid large movements.

The SmoothTrack

Our solution to the nation's most common health problem is a completely new ergonomic touchpad design called the SmoothTrack. Our product, the SmoothTrack, is a revolutionary product that will change the face of the personal computer industry. The SmoothTrack's amazing new ergonomic design is the quality that will dominate its existence in the pointing device market. Specifically designed to fulfill the ergonomic needs of the user it allows the user to have: loosely gripped hands on the device, hands and wrist resting naturally, straight elbows and forearm, and constraint of large movements. The SmoothTrack allows the user's hands to be loosely gripped because its shape is designed primarily for the hands to control a cursor without it having to be held. Additionally, the SmoothTrack allows the hands and wrist to rest naturally because the cursor is controlled with the movement of the palm as well as the

fingers—keeping the user's hand and wrist in a comfortable state at all times. Furthermore, SmoothTrack keeps the forearms and elbows straight since it is located on a flat surface of a laptop. Lastly, the SmoothTrack eliminates the need for large movements in order for the cursor to move a long distance by being placed on an axis such that the touchpad can rotate on the axis and move the cursor a certain distance without moving the position of the user's palm. The SmoothTrack is the perfect ergonomic alternative to common modern pointing devices and can significantly reduce the chances of acquiring an RSI.

What Potential Consumers Think

The SmoothTrack's main consumers will consist of the population with the most personal computer usage: college students and adults under 60 years of age. We administered a survey to a group of 43 people consisting primarily of college students with a small number of employed adults. We created this survey to discover the most popular computing-related trends among potential consumers and ultimately their attitudes about a new ergonomic touchpad design. We used the first four questions of the survey to give an idea of the most popular computing devices used among our potential consumers and how often they use these devices.

From the first two questions:

- All survey participants own a computer
- 83% admitted to using their computer for long periods of time each day.

Figure 2

Already, the survey shows a large percentage of our potential consumers at high risk of receiving an RSI. The next two questions revealed the most common type of computer among the survey participants to be the laptop

Figure 3

and the most popular pointing device to be a touchpad, with a staggering 39 people admitting to using a laptop and 34 people (3 more than the mouse) to using a touchpad.

Because most potential consumers use a touchpad pointing device and a laptop, this survey demonstrates that consumers use touchpads most frequently because this pointing device is a part of the laptop. If more laptops were sold with the SmoothTrack, this would greatly increase the number of people using the SmoothTrack; therefore, it would reduce health problems nationwide.

Question #5 exhibits the clear need of the SmoothTrack:

- A total number of 38 responses were “yes” to having “ever encountered any discomfort, pain, numbness, loss of control or other problems in the hand, wrist and arm used to control the above-mentioned pointer-device from question 4”
- More than 60% of the total responses to this question show that users have comfort issues with their pointing devices.

Question # 6, we wanted to know if the severity of this discomfort reaches Carpal Tunnel Syndrome:

- 3% of participants said they were suspected of having carpal tunnel
- 27% could not provide an answer.

These results are to be expected from this question because most of people that were surveyed were college students and they most likely have not spent enough time on a computer yet to receive a RSI as serious as Carpal Tunnel Syndrome. The goal of the SmoothTrack is to provide pointing device comfort at an early stage of extended computer usage, such as the beginning of a college education, so that the chance of an RSI developing over time is minimal.

Question #7 was designed to obtain an idea of what our potential consumers mainly use their personal computers for: general use, multimedia, gaming, and/or digital content creation. General use (browsing the internet, word processing,

casual gaming, etc) was ranked # 1 among the activities that our potential consumers use a personal computer for most. Multimedia (watching movies, listening to music, etc) was ranked #2, Gaming (non-casual) was ranked #3, and Digital content creation (CAD, 3D modeling, Photoshop, etc) was ranked #4 among the activities that our potential consumers use their personal computers for the most.

Personal Computer Activities Ranked by Most Frequent Usage among Survey Participants

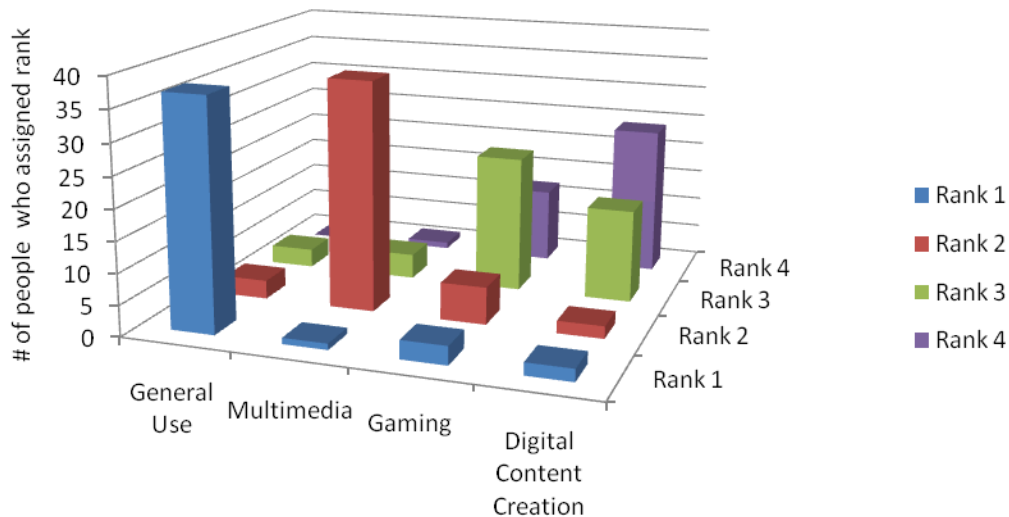


Figure 4

The responses to this question were just as expected and show a relative indicator of how important our potential consumers' pointing devices are to their activities on a personal computer. General use, although not requiring an efficient pointing device as much as non-casual gaming or digital content creation, still demands a capable pointing device that can provide ongoing comfort. Since most of our potential consumers say they use a personal computer for general use (browsing the internet, word processing, and casual gaming), this implies a frequent use of a pointing device and the need of this device's lasting functionality. From the responses to this question, we know the qualities that the SmoothTrack must have in order to respond well to the consumers' needs: comfort, durability, and convenience.

The final question on the survey, Question #8, is the most important question on the survey as it directly determines a desire for our product.

- Over 55% of the participants answered "yes" that "for an additional price from 10 to 20 United States Dollars, an ergonomic touchpad (one shaped so as to be comfortable even if used for prolonged

periods of time) would be something you might be interested in purchasing?”

The responses to this question show that there is indeed a desire for our product.

Current Market Offerings

One question always presents itself to any consumer who is deciding to purchase a new technological product: what makes this product better than its existing alternatives? With the new SmoothTrack, the answer is clear: everything. This is a new pointing device that is about to enter the market where

the existing computer mouse and laptop touchpad have control. This market also contains many “flashy” innovative pointing devices and products with its same title of “ergonomic touchpad.” The SmoothTrack would dominate its competition if it were to enter the pointing device market. To illustrate, the competition—the Logitech Wireless Anywhere the Mouse MX, the Wacom Bamboo Tablet, the Logitech MX Air Rechargeable Cordless Air Mouse, and the Ergonomic Touchpad—have flaws that cannot rival the SmoothTrack.

Logitech Wireless Anywhere Mouse MX

The Logitech Wireless Anywhere Mouse MX (Figure 5) is a wireless pointing device that functions by detecting 2-D motion relative to its supporting surface and translating this into motion of a cursor on a display. Created by Logitech, this wireless mouse is portable, applicable to more different types of surfaces, comes with a unifying receiver, has a compact design, contains hyper-fast scrolling, and includes back/forward thumb buttons.

Figure 5: The Logitech Wireless Anywhere Mouse MX.



Source:

<http://gizmodo.com/#!5340410/logitech-performance-anywhere-mouse-mx-review>

The major selling-point of this mouse is the freedom to work anywhere without a mousepad on more types of surfaces such as polished furniture, granite countertops, and even clear glass—a surface where no mouse has worked before. The Logitech Wireless Anywhere Mouse MX accomplishes this feat through the use of a five-year engineering effort called Darkfield Laser Tracking (Figure 6). Logitech's exclusive technology tracks mouse movements by producing a detailed micro-roadmap of the work surface. Darkfield Laser

Tracking illuminates the surface beneath the mouse at an angle, and it collects and focuses that light back into the lens. Any small particles, such as dust or micro-scratches, are cast against a black background. Similar to the way that our eye sees the clear night sky, the mouse's sensor sees the clean areas of glass as a dark background with bright dots: the dust. Then, the sensor interprets the movement of these dots to track exactly where the mouse was moved.

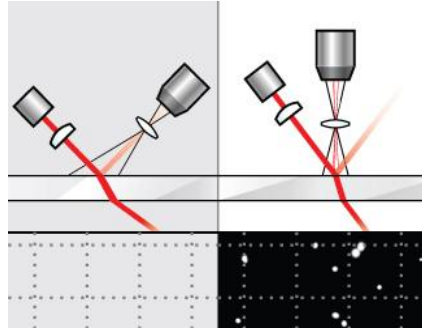


Figure 6: Darkfield Laser Tracking. The mouse reveals microscopic details for precise tracking.

Source: http://www.easycom.com.ua/periph/obzor_vezdesutzezi_besprovodnoyi_myeshi_logitech_anywhere_mouse_mx_s_tehnologiyi_logitech_darkfield_laser_tracking/?lang=rus

Although the Logitech Wireless Anywhere Mouse MX comes with several benefits—especially boasting its ability to work on virtually any surface without wires or pads—it lacks in the fundamental aspects of durability, wireless battery life, and comfort. A major complaint from consumers is the short-lasting functionality of the mouse. The mouse works only about a month without succumbing to a technical problem. Our ergonomic touchpad, the SmoothTrack, is designed to have long lasting functionality, and it is less prone to physical damage since it can be operated in a stationary position. Another complaint about the Logitech Wireless Anywhere Mouse MX is its dependence on AA batteries. This wireless mouse runs on AA batteries and uses them up very quickly—inconveniently stopping and requiring the user to buy more and more AA batteries. The SmoothTrack is powered by AA batteries as well, but it is designed to have lower power consumption than the Anywhere Mouse MX giving the SmoothTrack a significantly longer battery-life. Additionally, The Logitech Wireless Anywhere Mouse MX has received complaints from users who have large-sized hands because they feel discomfort from the small size of this mouse. The SmoothTrack eliminates the bias of hand sizes for pointing devices since the touchpad is designed to comfort hands of all sizes.

Wacom Bamboo Tablet

The Wacom Bamboo tablet (Figure 7) is a large-format, high-precision touchpad universal serial bus (USB) compatible tablet that accepts both stylus and hand

pressure as input, with a high sensitivity to the degree of pressure (over 1024 pressure levels per sensor) which is applied to it. It is used to control a computer cursor on the screen of a computer that it is attached to by tracking the movements of the stylus tip or the user's hand over its sensor grid. With the ability to detect the pressure with which the stylus is pushing down on the sensor surfaces, the Bamboo is designed to be able to send additional signals to the computer designating pressure values, which certain art programs can interpret as strokes of varying pressures. The Bamboo also has up to 4 buttons depending on the model, which can be configured via the device driver (a program which tells the computer how to interpret the device's signals) to perform a number of pre-programmed functions, such as left clicking, right clicking, and toggling touch input on or off. The stylus has two buttons across all design options which offer the stylus, and these can also be configured via the device driver to perform a number of additional pre-programmed functions. Two design options of the Bamboo support only either Touch or Pen input as opposed to both.



Figure 7: Wacom Bamboo Fun tablet

The Bamboo is marketed as being an ergonomic alternative to a mouse through the use of its combination of stylus and hand input and its freely positional touch surface—being an independent peripheral of the computer. The Wacom Bamboo is a consumer product that targets entry-level graphics design and editing, as well as standard use, with an option to be used in place of a keyboard by translating pen strokes to letters. However, this latter option is available only as third-party software, such as the handwriting-to-text interpreter program available with the Microsoft Windows versions Vista and 7.

The Bamboo has a total of 5 design options (Figure 8): the Bamboo Pen & Touch, Bamboo Pen, Bamboo Touch, Bamboo Fun, and Bamboo Craft. All Pen-capable tablets have 4 buttons, while the Bamboo Touch has only 2. There are two colors, black and silver, Pen & Touch, Pen, and Touch being black, and Fun and Craft being silver. All design options except for the Bamboo Fun have 5.5 by 3.5 inch active sensor areas, while the Bamboo Fun has an 8 by 5 inch

active sensor area.



Figure 8: Different Design options of Bamboo Tablets.

Source: <http://www.wacom.com/bamboo/>

While both the SmoothTrack and the Bamboo seek to provide ergonomic alternatives to mice, the SmoothTrack aims to be a general-purpose replacement with design options supporting multimedia (MediaTrack) and gaming (GameTrack) functions, while the Bamboo across its various configurations provides graphics design support. The Smoothtrack is also a wireless design; it uses a wireless USB adapter to communicate to the computer as opposed to a wired connection as the Bamboo does. While the Bamboo supports pressure sensitivity, the SmoothTrack does not. This functionality, however, is not used outside of a small set of art and photo editing programs (including Photoshop, Artweaver, Painter Essentials, and Open Canvas). The Bamboo also includes packaged image editing software (the exact software varies depending on the date of purchase and the model). As a result, the overall cost of the Bamboo is much greater. While the SmoothTrack's price ranges from \$30-60, the Bamboo's price ranges from \$100-200. The Bamboo also has the advantage of being thin, allowing it to be easily transported along with a laptop, but the laptop versions of the SmoothTrack are also designed to be thin and allow for the laptop to be closed with the trackpad still attached to the laptop—whereas the Bamboo can only be carried as a separate component.

While both the Bamboo and the SmoothTrack have their respective advantageous features, the two products are ultimately targeted at different market demographics. The Bamboo is designed to work with digital content, while the SmoothTrack through is designed for general use, multimedia playback, and non-casual gaming.

Logitech MX Air Rechargeable Cordless Air Mouse

The vast market for comfort inducing computer interface devices includes the Logitech MX Air Rechargeable Cordless Air Mouse. The MX Air (Figure 9) is a laser tracking mouse that is used to direct cursor movement, but it can also be used as a wand or remote in the air. This device, made by Logitech—an esteemed peripheral-device manufacturing corporation—boasts many features that claim to provide for the consumer comfort, relaxation, and ease in completing whatever tasks may be at hand.



Figure 9: The MX Air mouse
 Source: <http://www.logitech.com/en-us/mice-pointers/mice/devices/3443>

The most prominent design feature in the MX Air is the Freespace motion sensing function, which allows users to navigate media with simple hand motions through the air, without the need for a desk or other flat surface. Unlike other devices similar in function, the MX Air Mouse does not require the user to be in any particular position in reference to a computer or sensor navigating with the mouse. In other words, a user can direct the cursor in while facing any direction and in any comfortable position. The technology also includes tremor cancellation, which steadies the aim of the user, along with the ability to use gesture commands for actions such as volume control.

The MX Air is designed to handle all operations with the utmost efficiency and precision. In addition to the in-air functionality of the MX Air, it is also designed to handle the basic functions of an everyday computer mouse such as scrolling and surface tracking. The mouse is built with a laser tracking system which uses laser sensors to map the surface on which it is being used to provide the most accurate tracking to the user on a variety of surface types, as compared to the older method of optical tracking. The speed and precision of the laser tracking system is important to members of the PC gaming community or others who perform fine tasks with computers. Furthermore, with eight buttons on the mouse, multiple functions can be performed at ease—without the need for strenuous clicking. Alongside the laser tracking system in basic functionality is the scroll wheel. The mouse's main feature for the wheel is the lack of a physical wheel. Instead, a touch sensitive strip is positioned where a normal wheel would be, which is used to control scrolling. This has been both praised and criticized as some users complain that the sensitivity of the strip is impossible to control effectively.

As standard with most typical mice currently, the MX Air operates on a 2.4 GHz signal that allows users to operate the device up to 30 feet away from the Universal Serial Bus receiver. The mouse also comes with a recharging dock to power the non-removable lithium-ion battery inside the mouse.

While this device has plenty of features to keep users happy, these benefits come at a hefty price. At \$150, the MX Air is only available to those with a big budget. Furthermore, critical design flaws degrade the value of the mouse, such as the awkward placement of buttons and the inability to momentarily switch off the motion sensing feature. When giving presentations, normal hand gestures will be detected as inputs and can cause unwanted distractions. The button placement is also a problem as a majority of the buttons can only be used when held like a standard remote. When operating on a desk, the buttons are unreachable as they are directly under the palm.

As an ergonomic mouse, this device is even more of a disappointment. While being operated in the air does relieve pressure on the wrist, it only shifts the motion to other parts of the body. This means that repetitive stress injuries will simply occur in regions other than the wrist. Furthermore, as the buttons are ineffective in some positions, more movement is necessary to perform the same tasks, which increases the strain on the body.

While the MX Air does have nice features and is visually pleasing, as an ergonomic mouse it falls short. The Freespace technology is well developed and is an interesting concept for user interface devices, but more work must be done to enhance the comfort of the mouse.

Ergonomic Touchpad

The Ergonomic Touchpad is a computer touchpad that provides a smooth interface for browsing on a desktop or laptop. Connected to the computer through a universal serial bus cable, Scott Stenten created it to use an area next to the computer convenient to the user—positioned like a computer mouse. The regular version of the Ergonomic Touchpad (Figure 10) also gives the option of attaching to the keyboard of the laptop or desktop. With its elastic and flexible interface, it is smooth to control the pointer on the computer screen. Because it easily collapses to conform to different surroundings and to allow the Velcro to connect smoothly, it is highly sensitive to the touch. According to this company's advertisement, the comfortable position to use this device is to hold one's hand in a raised position while using one's pointer finger to scroll and click on the computer; however, the wrist is unsupported. The Ergonomic Touchpad also comes in various designs and add-ons: the normal-size touchpad, the extra-large touchpad, the remote control touchpad, the keyboard-clip, the tablet touchpad, the stylus, and the hands-free touchpad.

Figure 10: The Ergonomic Touchpad (Original)

Source: http://www.ergonomictouchpad.com/ergonomic_touchpad.php



Labeling one's product design as an "ergonomic" touchpad might be an effective marketing scheme to the unaware consumer; however, simply putting "ergonomic" in its name does not make it ergonomic. In fact, it gives the audience a higher expectation of the comfort of the device—these series of devices disappoint. To begin, having the Ergonomic Touchpad connected to an area next to the computer takes up a similar amount of space as a mouse, in addition to the room your hand takes up positioning for it, which costs them the space advantage this company claims to have. While the keyboard-clip touchpad connects with the keyboard to solve the space problem, the inconvenience and discomfort one would have positioning one's hand to use the touchpad either above or out of the way of the keyboard (a keyboard is not designed to friendly host connected devices—it is a connected device) defeats the purpose of the saved space. On the other hand, our product, the SmoothTrack, saves space by connecting on top of the already-positioned touchpad on a laptop or by being ergonomically positioned below the keyboard of a desktop.

Although the elastic design of the Ergonomic Touchpad's "foam pad" easily positions itself to match its surroundings, its sticky pad will wear in time as one uses it to match its foam pad in different positions (Figure 11). As a result, this seemingly advantageous elastic texture causes problems in the long run: as the adhesive coating fades, the sticky pad will be useless, and the Velcro (which will get dirty and also lose its adhesiveness) lining will be the only thing holding it together. Therefore, the design makes a short-lived product through materials that fall apart easily through casual use. Because the SmoothTrack is one solid unit, it is not malleable; it will not fall apart from poor design.



Figure 11: Ergonomic Touchpad (original) Design.

Source: http://www.ergonomictouchpad.com/ergonomic_touchpad.php

Additionally, the company's established "comfortable" position to use the Ergonomic Touchpad leaves the wrist unsupported while the user raises his hand

(Figure 12)—causing more discomfort than a normal touchpad or mouse according to consumers. As a result, this is its most prominent flaw because it adds to the problem it attempts to fix. Holding one's hand in such an arched position for casual browsing on the internet is uncomfortable, especially for an extended period of time, and while doing something less casual such as playing games, it is unmanageable. As a result, this flaw defeats the purpose of this product. On the other hand, the SmoothTrack's ergonomic curve and convenient placement parallel to the keyboard provides optimal comfort and ease of browsing.



Figure 12: Hand position over an Ergonomic Touchpad
 Source: http://www.ergonomictouchpad.com/xl_touchpad.php

Furthermore, the price ranges for the different Ergonomic Touchpads fall out of the range of reason (Figure 13): the generic Ergonomic Touchpad goes for \$30, the large goes for \$60, remote control for \$50, keyboard clips (extra attachment to connect a regular Ergonomic Touchpad to the keyboard) for \$10, tablet touchpads for \$30, a stylus (a pen to use on an Ergonomic Touchpad) for \$20, and the Hands-Free Touchpad for \$160. With regular and high-tech mice being well within the \$30-\$60 range in stores, these online-marketed touchpads do not compete with similar products on the market (especially when adding the minimum \$10 shipping fee). While the idea for a handicap-friendly touchpad has merit, the \$160 price for the hands-free touchpad displays this company's unreasonable pricing. Additionally, the need to provide a stylus amongst their devices proves these products' flawed and uncomfortable designs. However, with the SmoothTrack, one gets the reasonable \$35-\$60 price range without the need for separate attachments because of its universally-positioned comfort.

Figure 13: List of other Ergonomic Touchpads with prices
Source: <http://www.ergonomictouchpad.com/>

Table 1: Summarizes characteristics of the SmoothTrack and its competitors

	Logitech Wireless Anywhere Mouse MX	Wacom Bamboo	Logitech MX Air	Ergonomic Touchpad	SmoothTrack
Functionality	Designed for general use, gaming, and multimedia	- Used in digital art design - Ergonomic stylus use - Little support for gaming and multimedia	- Dedicated multimedia remote - Optical mode is not ergonomic	General use and multimedia	Designed for general use, gaming, and multimedia
Durability	Short-lasting functionality	Long functional lifetime	Easy to drop as there is no wrist strap	Materials can wear and fall apart easily	Use not prone to breakage
Wireless battery life	Short battery life uses AA batteries	Not wireless	Short but rechargeable	Not wireless	Long battery life uses AA batteries
Format	Wireless Mouse	Tablet	Motion sensing or optical	Touchpad	Touchpad
Cost	\$40	\$100-200	\$120	\$30	Up to \$60
Configurability	- Cannot be configured 6 buttons	- Highly configurable in-driver 2 or 4 buttons	- Low - Some functions cannot be disabled 7 buttons	- Cannot be configured 2 buttons	- Highly configurable in-driver - Configurable secondary buttons 2-4 buttons

Evidently, if the SmoothTrack were to enter the pointing device market, the statuses of its four main competitors would decrease considerably; competing pointing devices lack in fundamental areas where the SmoothTrack shines. The Logitech Wireless Anywhere Mouse leads the computer mouse market on Amazon.com, but it fails in comparison to the SmoothTrack's long-lasting functionality and long battery life. The Wacom Bamboo Tablet does not measure up to the SmoothTrack's diverse functionality and low cost. Additionally, The

Logitech MX Air Mouse cannot contend to the SmoothTrack's low chance of rupture, ergonomic proficiency, and low cost. Furthermore, the Ergonomic Touchpad does not match up to the SmoothTrack's genuine comfort and durability. The Smooth Track is truly a unique pointing device that—if created and implemented into the market—would dominate the current pointing device market with its fair price combined with its: versatility, durability, comfort, and configurability.

Product Design

Technical Definition

The SmoothTrack touchpad is a wireless, ergonomic, Universal Serial Bus compatible computer cursor-pointer device. It utilizes touchpad technology and ergonomic design to allow a user to interact with his or her computer in the same manner that he/she would with a mouse or other such device. The ergonomic design reduces the risk of suffering repeated stress disorders, such as carpal tunnel or tendonitis. The primary feature of the SmoothTrack touchpad is its curvature which allows for comfortable use and wrist support, preventing users from putting too much stress on their wrists. Other features of the SmoothTrack include its wireless configuration, and flexible configuration software, as well as a number of different design options that support additional buttons and touch sensors in order to provide an enhanced media playback or gaming experience on the computer.

The SmoothTrack comes in several main variants (Figure 14), with a laptop and desktop version of each.

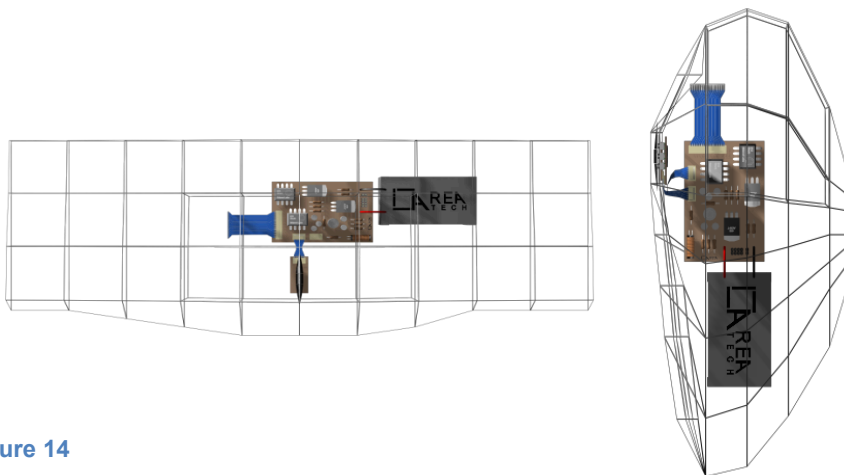


Figure 14

The laptop versions are designed to be low-profile and fit onto existing laptops

with the ability to be left inside of the laptop during transportation of the laptop. This is a novel feature, as no other interface peripheral that is independent of the laptop's body on the market is capable of doing this.

The primary variants include the MediaTrack and the GameTrack. These are versions of the SmoothTrack outfitted with additional buttons and touch sensors that can be mapped via the included configuration program integrated with the device driver (a piece of software that allows the computer and the device to understand the signals that they send and receive from each other). The purpose of this is to allow for quick access to commonly used functions of the user's own choice. The MediaTrack contains 4 mappable buttons, and the GameTrack includes an additional small touch sensor in addition to the 4 mappable buttons.

Components & Functions

Primary touch sensor

Outer Case

Figure 15Buttons

Button CircuitBoard

Primary Printed Circuit Board

Touch Sensor Cable

Battery case, wires and contacts

USB-Wireless adaptor

Secondary Touch Sensor Controller Board

Secondary Touch Sensor

Figure 16

Primary Touch Sensor - The primary touch sensor is a capacitance-based grid touch-sensor. It consists of a low-friction metal-oxide coating (which may or may not be coated depending on the design options selected) over a thin sheet of pliable protective plastic. Onto this layer of plastic is mounted a series of plate capacitors with a gel electrolyte. Based on the principals of capacitance, when pressure is applied to one of these capacitors, the two plates within the capacitor are pressed together, reducing the space that the electrolyte takes up between them. This increases the capacitance of the capacitor, allowing it to store a greater charge. This results in additional power being drawn from the power source. When the pressure is released, the electrolyte flows back into the space between the capacitor plates, reducing the charge that the capacitor can store, causing the excess charge to be discharged. Both the additional draw of power along with the discharge of excess power can be measured by sensors that are connected to the capacitors. Using the capacitor discharge also results in less continuous power draw on the batteries. As the capacitors on the touch sensor are located in a grid-like fashion, coordinate locations of each touch sensor can be easily assigned, and through extrapolation of which capacitors are being compressed and when, it becomes easy to tell which sensors are being compressed, and thus where the pressure is located relative to the edges of the grid. From this data gathered over time (at frequencies of hundredths of a second) the direction of the pressure movement (if any) can be determined, thus allowing the device driver software to interpret where the cursor should move. On the SmoothTrack, the Primary Touch Sensor has various sections that can be allocated for use in clicking or scrolling, as defined by the user in the configuration panel.

Secondary Touch Sensor (Design option: GameTrack) - The secondary touch sensor is identical to the primary touch sensor in all ways except it is much smaller, and positioned under the thumb. The purpose of the secondary touch sensor is to provide the thumb with a means of directional scroll (horizontal and vertical), freeing up space on the primary sensor which would otherwise be allocated to it. However, the direction scroll can be disabled and set to act as a

direction pad or stick, or even has an additional set of buttons.

Touch Sensor Cable - These cables allow for the touch sensors to interface with their individual controller boards. The GameTrack has a second controller board for the secondary touch sensor, while the primary touch sensor in all versions relies specifically on the main printed circuit board to house its controller.

Battery Contacts, Wires and Case - This houses the SmoothTrack's power source. When the battery is inserted, the case provides a space for the battery to reside in between the two contacts which tightly grasp either end of the battery enabling an electrical current to be established once the circuit is complete. All versions of the SmoothTrack require the use of two batteries in series.

Primary Printed Circuit Board (PCB) - The primary PCB houses the SmoothTrack's wireless adaptor, the controller chip for the primary touch sensor, ports enable cables to connect it to the various separate PCBs and components, such as the Primary touch sensor or the secondary touch sensor's PCB. The Primary PCB also connects to the battery case via wires enabling the batteries to supply the primary printed circuit board with power.

Secondary Touch Sensor Controller Board (Design option: GameTrack) - The secondary touch sensor's controller board contains only the controller chip and the interface cable ports to allow the secondary touch sensor to connect to it and for it to connect to the primary circuit board.

Buttons (Design option: GameTrack, Media Track) - The buttons present on the surface of the device are small pieces of plastic with small tabs on their base to keep them from sliding out of the SmoothTrack's outer shell. The buttons themselves have no electrical equipment and are useless on their own: small plastic protrusions from their bases push down against button-sensors on the button circuit board.

Button circuit board - this is a small, simple circuit board placed under the buttons mounted on the outer case, and has a number of small button sensors located directly beneath the plastic protrusions on the bottom of the buttons. It connects via a cable to the primary circuit board.

Outer Case - the outer case is a touch plastic shell molded into an ergonomic shape on the outside, while on the inside, it contains a number of snap-on mounting posts which enable the various internal components to be anchored to the case. This is done in place of using screws and screw posts, which is a more complex and costly method of affixing the internal components. The outer case has upper and lower halves which snap together once assembly is completed.

USB-Wireless adapter - the USB to wireless adapter (Figure 17) is a separate component from the rest of the SmoothTrack, as it connects directly to the computer. It contains a small printed circuit board containing a Read Only

Memory (ROM) chip and an electrical to electromagnetic signal converter. The ROM houses the device driver which is a necessary piece of software that the computer needs in order to interpret the signals sent from the device. The signal converter allows for the electrical signal from the computer to the adapter to be changed to an electromagnetic signal which the SmoothTrack can detect and use, and vice versa for the SmoothTrack's own adapter on its primary circuit board.



Figure 17

Theory of Operation

As the individual functions were explained in depth in the previous section, this section focuses on how all the components function together.

The batteries, once placed in the battery case, provide power to the primary PCB, which then powers all the peripheral components connected to it. The primary PCB then establishes a connection to the USB-Wireless adapter if said adapter is plugged into an available wireless port. The program on the ROM of the adapter then activates, and first checks the computer to see if the device driver is already installed. If not, then it will install the device driver automatically using USB Plug and Play. If the driver already is installed, then it will begin normal operation by converting all incoming electromagnetic signals from the SmoothTouch to electrical signals which that computer can then use.

Meanwhile, if any of the SmoothTouches' sensors are interfaced with (for example, a button is pushed or a touch sensor is touched), that sensor will generate an electrical signal which is then conducted through the connecting cables to the sensor's controller board where the controller chips on the board then interpret the signal and then pass it on to the wireless adapter located on the primary circuit board. This adapter then converts the signal to an electromagnetic signal which the USB-wireless adapter can then re-convert back into an electrical signal. The computer then receives this signal, and the driver program then interprets this signal into a command that the computer is capable of understanding based on the user-configurable settings that can be set in the configuration panel of the driver.

Design Options

The SmoothTrack comes in a number of different design option configurations, between the functionally different standard SmoothTrack, MediaTrack and GameTrack, the laptop and desktop versions of each, and the color options that they are available in. As explained previously, the laptop version of the SmoothTrack is designed to fit over a laptop's built in touchpad adjacent to the bottom of the keyboard, while the desktop version is a completely separate object from the main body of the computer, much like a standard mouse. The differences in the Standard SmoothTrack, MediaTrack, and GameTrack are that the Media and GameTrack both include user-configurable buttons, and the GameTrack includes a user-configurable secondary touchpad. The colors available include white, grey, black, silver-grey, silver-green, silver-red (Figure 18). In the future an option for custom colors may be made available.

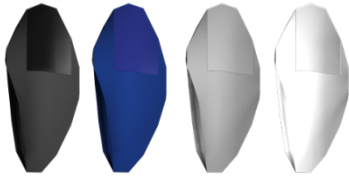


Figure 18

Implementation Plan

There is an inherent desire amongst consumers for an improved touchpad design for computers because of the lack of quality hand support in standard touchpads. Additionally, the multiple accounts of hand fatigue while extended browsing on the computer along with the hand problems associated with the older surveyed consumers—such as tendonitis—provide evidence for a need amongst the computer-owning community to have a reliable and ergonomic interface device over standard touchpads. When the SmoothTrack finally hits the shelves, if advertised correctly, consumers will embrace its comfort, and it will become the standard for computer-browsing-interface devices. Ultimately, it will be such a commonplace item among computer owners that computer manufacturing companies will integrate its style into their computers in their initial designs. However, before the SmoothTrack becomes a success, we need funding for: the prototype, product manufacturing, personnel, material, and equipment.

Prototype

For the prototype, we will be using the standard materials we have set for the final product in order to give the most accurate tests of its potential. A prototype

can be built as soon as all of the materials arrive in our main manufacturing site (within the same day). The team we have ready to test the durability, comfort, and functioning potential of the device will consist of the software product engineers from the MindTree Foundation—accredited worldwide and recognized as one of the top ten outsourcing providers in the “Consumers Goods Technology Reader’s Choice Survey”—as well as dozens (to hundreds depending on total funding and time) of randomly selected individuals to test different angles of comfort for necessary adjustments. The intricate adjustments and critiques from the randomly selected comfort testers may take one to two months of craftsmanship until we reach a “perfect” model. However, because we only need the plastic shells (upper and lower halves) to test the comfort as it relates to each individual, we only need funding for production of dozens of modifications of the plastic shells for this part of the testing. Since these plastic shells total about six dollars (as complete base, top, and battery cover lids), an approximate testing supply of one-hundred fifty would total about nine hundred dollars.

Durability Testing

Once the comfort specifications are finalized based on the results, the MindTree Foundation will begin its specialized durability tests to see what stress levels and how much pressure one can exert on the SmoothTrack before it loses functioning capabilities. Additionally, the MindTree Foundation will see the effects that the SmoothTrack has on screens while a screen is closed on the adjusted angle of comfort for consumers; they will test both lock and non-lock laptop screens as well as the impact potential over long-term use of closing the screen on the SmoothTrack while it is still attached to the computer. By doing this, we can make an accurate comparison to other devices that have the ability to stay on the laptop, but if they are not taken off, they harm or crack the screen. If no noticeably harmful effects occur in the long run, then closing the laptop lid over the SmoothTrack will be another beneficial characteristic over having to carry around a mouse or another connectable device aside from the computer. In order to best test this, we will let the MindTree Foundation work with the full component set of the SmoothTrack, and we will let them try various materials as to which would last the longest under standard conditions while be the cheapest to mass produce. Letting the MindTree Foundation Engineers complete their testing may take up to two weeks once enough models are complete for them to test on.

Expenses

The funding for discovering the correct specifications of durability will be more complex than the angle of comfort for consumers. Because the MindTree Foundation needs to specify the areas of weaknesses amongst multiple types of laptop screens, as well as the angles of indentation that will least harm computers, the simulated long-term effects of keeping the SmoothTrack attached

to a laptop may cost dozens of laptop screens—in addition to the component sets of the SmoothTrack that will be tested (minus the cables). As a result, the costs could vary between \$1,000 and \$2,000 dollars for this type of testing. However, if we wanted to test further conditions—such as extreme temperature or how long the SmoothTrack can still function as a browsing interface under certain constant temperatures—an expanded time frame and larger budget would be necessary.

Overall, the prototype design, testing, creation and personnel charges should total around \$25,000. After the final prototypes and specifications have been set, only about one and a half to two months will pass if all goes well.

Location

Because of its easily recognizable location and coastal shipping capabilities, our manufacturing site will be in Seattle, Washington. Because this is a well-known location, having our products and main site being here grants us networking capabilities into places like Microsoft's headquarters in Redlands, Washington. In addition, the lowered taxes and more affordable structure costs would make Washington more of an ideal state over one like California.

Product Manufacturing and Advertising

After prototypes that satisfy the utmost standards of longevity, comfort, and functionality have been made, we will begin large-scale production of the SmoothTrack. In order to make use of the first wave of SmoothTracks, we need to advertise efficiently. Because each of AREA Tech's executive personnel has a distinguished background in business administration as well as design, our plan is well thought out and considerate to all portions of the business. To begin, we will open a home website to incorporate all of our information and online shipping to consumers. Additionally, after we open our main headquarters in Seattle, we will begin contacting television networks in order to effectively communicate the SmoothTrack's message of comfort to consumers watching television. To coordinate this, we will hire a team of distinguished advertising professionals to work alongside our executive staff at AREA Tech to incorporate both an advertising and business standpoint to reflect the SmoothTrack's design in a succinct and efficient commercial. Furthermore, we will open mall booths to display hands-on demonstrations of the comfort versus competitor mouse designs and standard touchpads.

We expect to begin production of SmoothTrack devices for sale at \$59.99, with a projected sale rate of 15,000 to 50,000 units semi-annually. As customers

become more aware and there is more demand for the SmoothTrack, we will order more (than our initial 50,000 complete component sets) and decrease the price to as low as \$49.99 to stimulate sales and increase our customer base. The SmoothTrack will be available in: black, gray, white, and navy blue. In the future, however, we might offer a custom color order option for an additionally \$5 for any color a customer may want. Furthermore, we plan on making the other design options of the SmoothTrack—the “MediaTrack” and “GameTrack”—readily available once we have a strong customer base.

SmoothTrack Components: (approximate costs in low-unit quantities)

Touch sensor + cable:	\$12
Main Printed Circuit Board (PCB) w/ wireless adaptor:	\$10
USB-wireless adaptor PCB + plastic shell:	\$5
Main plastic shell [upper & lower halves + battery cover lid]:	\$6
Buttons (design option):	\$2-4
Button PCB + cable (design option):	\$3
Secondary touch sensor (design option):	\$5

Total: **\$45**

While these prices may lead to a somewhat steep product price in the touchpad and mouse market (needing a \$60 SmoothTrack base price to start the units off to have a clear profit margin), the price per unit of components will decrease when ordered in bulk. Despite the price, we know customers will buy because people are willing to pay for convenience and comfort; both are what a universally comfortable interface device for their computers will have for them. Accordingly, after the units begin to initially sell, we can order more in higher volumes to reduce the price while keeping the same marginal profit. As a result of the lower prices, the SmoothTrack will be at a higher level of threat to the mouse designs and other interface devices on the market; it would offer more capability for the same or lower price.

Conclusion

Over the last half a century, a technological revolution took place in our society. Now integrated into our lifestyles, personal computers have completely changed the way we search for information and access media. Because computers use up numerous waking hours, people should be comfortable when using them. Pointing devices such as a mouse, touchpad, tablet, touchscreen, and joystick operate personal computers. However, these devices require repetitive hand and wrist motions which may lead to an injury called Repetitive Strain Injury. These injuries can weaken—and possibly permanently impair—the use of a certain (overused) body part. To avoid this common health problem, we have invented the SmoothTrack pointing device. Although there are numerous pointing devices on the market, the SmoothTrack solves all of the ergonomic problems they present, and it significantly reduces the chance of receiving a Repetitive Strain Injury because the SmoothTrack allows: hands to remain loosely gripped and rest naturally, elbows to stay straight, and arms and hands to avoid large movements. The results of surveys distributed to potential consumers of the SmoothTrack strongly suggest the need and desire to purchase a new pointing device that offers greater comfort than current pointing devices. The SmoothTrack is not just an alternative to the computer mouse; it is the solution to America's prevalent occupational health problem.

References

- Brad, S. (2005, April 11). "Hi-Tech's New Day", Newsweek, p. 62. Retrieved February 11, 2011, from <http://www.cs.cmu.edu/~bam/numbers.html>
- Budig, G. A. (2010, March 31). Technology an integral part of today's education system. Retrieved February 11, 2011, from <http://www2.ljworld.com/news/2010/mar/31/technology-integral-part-today-s-education-system/>
- Logitech (2011). Mx air rechargeable cordless air mouse. Retrieved February 12, 2011, from <http://www.logitech.com/en-us/mice-pointers/mice/devices/3443>
- Logitech® Darkfield Laser Tracking: The World Is Your Mouse Pad An Innovation Brief. (n.d.). Retrieved February 12, 2011, from Logitech website: http://g-ecx.images-amazon.com/images/G/01/electronics/detail/page/B002QUZM0U_Darkfield_Innovation_Brief.pdf
- Logitech Wireless Anywhere Mouse MX for PC and Mac. (n.d.). Retrieved February 12, 2011, from Amazon website: http://www.amazon.com/Logitech-Wireless-Anywhere-Mouse-Mac/dp/B002QUZM0U/ref=dp_return_2?ie=UTF8&n=172282&s=electronics
- Media Use Statistics. (n.d.). Retrieved February 11, 2011, from medialiteracyclearinghouse website: <http://www.frankwbaker.com/mediause.htm>

Repetitive Stress Injuries: Musculoskeletal Disorders (MSDs). (n.d.). Retrieved February 11, 2011, from United Food and Commercial Workers International Union website:
http://www.ufcw.org/your_industry/retail/safety_health_news_and_facts/re_p_stress_overview.cfm

RSI Statistics. (n.d.). Retrieved February 11, 2011, from <http://www.rsi-therapy.com/statistics.htm>

Scott, C. (2010, February 5). Repetitive Strain Injury. Retrieved February 11, 2011, from <http://www.eecs.umich.edu/~cscott/rsi.html>

Soota, A. (2011) Hi-Tech/Product. Retrieved February 15, 2011, from <http://www.mindtree.com/services-portfolio/product-engineering/software-product-engineering/services/product-testing/hi-tech>

Stenton, S. (2007) The Ergonomic Touchpad. Retrieved February 13, 2011, from <http://www.ergonomictouchpad.com/>

Wacom Inc. (2011) Bamboo Fun. Retrieved February 13, 2011, from http://www.wacom.com/bamboo/bamboo_fun.php

SmoothTrack User Manual

Section 1) Contents of package

1x Touchpad
1x Wireless Universal Serial Bus (USB) adaptor for touchpad
1x User manual

Section 2) Minimum system requirements

- Pentium III 500Mhz or equivalent processor
- Open USB port (1.1 or greater. Note: [Gaming design option name] may require USB 2.0 or newer for optimal performance)
- 64MB of system RAM
- Any 32-bit compatible operating system

Section 3) Installing the touchpad

Step 1) Insert the USB adaptor into any open USB port on your computer

Step 2) Wait until message box pops up indicating device driver has been installed.

Step 3) Select configuration options you wish to apply (See Section 4 for explanations)

Step 4) Click "Apply".

Step 5) Invert SmoothTrack and open battery enclosure by pressing tab in

Step 6) Insert 1 AA Battery and close battery enclosure by firmly pressing lid closed

Step 7) Press the synchronize button on the bottom of the Smooth Track

Step 8) Within 30 seconds, press the synchronize button on the wireless USB adaptor

Section 4) Using and configuring the touchpad

Standard Settings

Pressure sensitivity: How much pressure must be applied before the sensor detects touch.

Left Click Options:

A

Tap Click: left-click can be triggered by tapping the active surface (the sensor region)

Click Region: left-click can be triggered by tapping in the marked region of the active surface

None: Disable left-click options on the active surface

Right Click Options:

Double Tap Click: right-click can be triggered by quickly tapping the active surface twice

2nd finger Tap Click: right-click can be triggered by quickly tapping the active surface with a second finger

Click Region: right-click can be triggered by tapping in the marked region of the active surface

None: Disable right-click options on the active surface

Scroll Options:

Side scroll: Sliding a finger along the marked edge of the touchpad will scroll

Two-finger scroll: Sliding two fingers will scroll

Thumb scroll (Media & GameTrack versions only): Movement of the thumb on the thumb sensor will scroll. Setting this option will automatically set the Thumb Sensor option to “Scroll”.

None: Disable Scroll options on the active surface

Secondary Button Options: These drop down lists include a number of Operating System pre-defined functions. (The options available will vary depending on your Operating System). Mouse-over an option to see a description of what it is.

Note: There is one drop-down list per button: the exact number of buttons varies by model of SmoothTrack.

B

Thumb Sensor Options (Media & GameTrack versions only): This drop down list includes a number of Operating System pre-defined functions. (the options available will vary depending on your operating system). Mouse-over an option to see a description of what it is.

Writing 50E Survey

1. Do you own a computer of your own? (as in, you are not using one in an internet cafe or library) (Computers you use at work are ok)
Yes
No (If so, end survey here)
2. How often do you use your device?
A. Less than once a month
B. At least once a month, but less than once a week
C. At least once a week, but less than once a day
D. At least once a day, but not for long periods of time each day
E. For long periods of time each day
3. What type of computers do you use? (Answer questions 3-7 for each response to this question)
Tablet
Laptop
Desktop
4. What sort of pointer devices (ie, a mouse, touchpad, etc. that is used to move the cursor/pointer icon around on the screen) do you use? Choose as many as necessary. (Answer Question 5 for each response to this question)
Mouse
Touchpad
Keyboard Nub
Tablet
Touchscreen
Direction-pad
Joystick
Rollball
Other (please specify)
5. Do you ever or have you ever encountered any discomfort, pain, numbness, loss of control or other problems in the hand, wrist and arm used to control the above-mentioned pointer-device from question 4 as a result of its use?
6. If your response to 5 was yes, do you have or are suspected of having carpal tunnel?
7. What do you use this computer for? Please rank (using each number ONLY ONE TIME)

from 1-4, 1 being the most, 4 being the least. If you feel there is a tie, put what you still feel is most representative of your use, WITHOUT repeating numbers.

General use (Browsing the internet, word processing, casual gaming, etc)

Multimedia (Watching movies, listening to music, etc)

Gaming (non-casual)

Digital content creation (CAD, 3D modeling, photoshop, etc)

C

Do you think that for an additional price from 10 to 20 United States Dollars, an ergonomic touchpad (one shaped so as to be comfortable even if used for prolonged periods of time) would be something you might be interested in purchasing?