

Design and Materials of E-Mouse

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**Asia Pacific Journal of
Multidisciplinary Research**

Vol. 3 No. 4, 68-73
November 2015 Part I
P-ISSN 2350-7756
E-ISSN 2350-8442
www.apjmr.com

Date Received: August 6, 2015; Date Revised: October 3 2015

Abstract— *The paper presents the design and the materials used in the development of an E-Mouse or the Ergo-Mouse. The proposed engineering design is based on the studies conducted about the risk factors such as having a carpal tunnel syndrome in using the traditional mouse. The concepts of the existing traditional mouse incorporated the features of a touch pad, which is ergonomically designed was considered in the development of the project. The proponent made use of different technologies such as the Bluetooth to connect the E-Mouse to the computer system, the capacitive glass touch screen sensor type which is made of a glass panel, a controller which acts as the interface between the display and the sensor and the software driver to recognize the input. Emphasis is mainly on the kind of materials to be used and to come up with the design that is tailor fit to the needs of the users with the current technology.*

Keywords—*touch pad, ergonomics, mouse.*

INTRODUCTION

In the development of a fast growing technology, many researchers perform different kinds of studies. These studies led to advancement of our technology. These advancement are being promoted because these make our lives better by providing easier ways of doing things or just by allowing us to enjoy even more what we already have. Computers are being used in almost anything that is possible with regards to the capabilities of computer. Computer is one of the most advanced technologies in this generation. One of the most important components of a Computer is a computer mouse as an input device. The mouse has played a critical role as a primary input device [1] and is the most commonly used non keyboard input device with desktop computers [2]. Nowadays, computer mouse have undergone a variety of changes and enhancements. The demand of the user on a better way of using mouse as input device continues to arise. Many researchers and developers keep their studies to make it more suitable on the needs of the user. Also, concerns have arisen that the keyboard or the mouse are causal factors of musculoskeletal disorders among employees. A study in 1997 indicated that Cumulative Trauma Disorders (CTDs)'s risk factors of the forearm and wrist can be attributed to mouse operation per se. Therefore improved mouse design can contribute to the reduction of such risk [3]. Keir, et.al. pointed out that

intensive mouse use has been associated with increased risk of upper extremity MSDs, including carpal tunnel syndrome [4].

The increased risk of carpal tunnel syndrome because of long hours of use of computer mouse have been demonstrated in several studies [5]. A pronated forearm posture, contact pressure on the palm, sustained or repeated pinching, wrist deviation or wrist extension are the risk factors associated with the conventional mouse. The risk of carpal tunnel syndrome may be developed by the risk factors caused by the increased compression of the median nerve [6]. To eliminate having the carpal tunnel syndrome, the proponent was triggered to undergo research and studies regarding on the development of the proposed project. The proponent considered on how to make the mouse easy to use. The proponent also considers the fact that the mouse is more useful if the navigation of the cursor is smooth and if it can be used with a new and better way.

We all know that mouse is a critical part of the computer system. As time goes by, the design of computer mouse evolves and its approaches to its position or pointing on a display. The proponent led to the study of enhancing this device to introduce a new and better way of interacting with the computer. The project will change the way of interacting with the computer by the use of this project. This project not only improves the way of its design, it also allows

the user to experience the newest way of communicating with the computer that can get rid of muscle pain and discomforts in forearm and wrist. Hence, the proponents proposed this study entitled “Design and Materials of Ergo-Mouse or E-Mouse”

OBJECTIVES OF THE STUDY

To come up with the design and new technology for the development of an ergonomically designed mouse/touch pad for desktop/laptop computer systems.

Specifically, this design aims to come up with Schematic representation of “E-Mouse”; identify the materials to be used; and determine the engineering processes/ functions involved.

REVIEW OF LITERATURE

Technical Data and Information

A survey conducted by Yim, H.J. among 289 consumers who used computer and worked with a computer mouse regularly gathered the following findings:

Current type of mouse	Future purchase decision on mouse technology			
	Ball mouse with cable	Ball mouse wireless	Optical mouse with cable	Optical mouse wireless
Ball mouse with cable	13.68%	13.68%	14.74%	57.89%
Ball mouse wireless	0.00%	20.00%	15.00%	65.00%
Optical mouse with cable	0.95%	0.95%	48.57%	49.52%
Optical mouse wireless	0.00%	3.39%	10.17%	86.44%

Table 1. Data on technology preferences grouped by current technology [7].

It can be noticed that the optical wireless technology is the one where highest growth can be expected. This is based on high rates of consumers that currently own mice of different technologies and at the same time on an extremely high percentage of respondents that would buy again an optical wireless mouse. The first fact might be the result of high expectations in potential benefits that this technology might offer, the second fact is indicating a high satisfaction with this technology by consumers used to it. Both aspects are supporting the decision to concentrate ones effort on the development of an optical wireless mouse.

All types of technologies and devices that use space signal-propagating medium, and are not connected by a wire or cable is termed as ‘wireless’. Wireless communication may be defined as the transmission of user information without the use of wires. There are different forms that the user information be represented. It can be digital data, email, human voice, video and, etc. In every aspect of our daily lives, wireless communication is revolutionizing. From the ubiquitous mobile phone to automated inventory counting in large retail stores to remote wireless sensors installed in inaccessible locations, wireless-communication technology is poised to continue expanding at a very fast pace. Using wireless communications to send and receive messages, browse the Internet, and access corporate databases anywhere, any time across the world has already become common. A wide array of devices ranging from computers to digital cameras, laser printers, and even household appliance can already communicate without wires. We are moving towards a wireless world to live in a global village [8].

Bluetooth is a short-range wireless network technology. Its purpose is to connect electronic devices through a wireless connection or without any cables or wires or any direct action from the user. If the two or more Bluetooth devices come within range of each other, a Bluetooth networks can be formed automatically. Piconet is another term for Bluetooth network [9].

Searching for other Bluetooth devices within range can form a network. When another Bluetooth device is detected, it typically broadcasts what it is; for example, a printer, a PC or a cell phone. Before data is exchanged, the owners of the two Bluetooth devices have to exchange passkeys, of PINs. Once passkeys have been exchanged, the two Bluetooth devices form a trusted pair. Future communication between these two devices does not require the passkey to be re-entered.

To wireless link phones, computer and other network devices over short distances, Bluetooth is a specification for the use of low-power radio communications. More than 1,000 years ago, a king in Denmark, named Harald Bluetooth, is where the Bluetooth is borrowed. The main object why Bluetooth technology was designed is just to support simple networking (wireless) of personal consumer devices and peripherals, including headsets, PDAs and cellular phones. There is only a limited distances that the signal can be transmitted by Bluetooth

devices, typically up to 10 meters (30 feet). For the speed, they generally communicate less than 1 Mbps. A PAN or piconet is the dynamic topology that Bluetooth networks feature. A maximum of eight and a minimum of two Bluetooth peer devices can make up a Piconet. Part of the Bluetooth Specification is using protocols so that devices can communicate. There are different versions of the Bluetooth specification. These versions are: 1.1, 1.2 and 2.0. Wi-Fi, same with Bluetooth standard also utilizes the same 2.4 GHz range. The 802.11b and 802.11g, but a Bluetooth technology cannot be a suitable replacement for Wi-Fi. The reasons are, Bluetooth networking is a bit more limited in range, it is slower and supports many fewer devices. Bluetooth technology has concerns with security and interoperability with other networking standards. It was ratified as IEEE 802.15.1 [10].

Mouse is one of the important components of a computer system. This device controls the movement of the pointer or what is called the cursor on the screen or display. You can roll it along at hard or flat surface. Because it looks a bit like a mouse, its name is derived from a mouse's shape and its connecting wire can be imagined as its tail. The pointer on the screen moves in the same direction as you move the mouse. A mouse can have at least one button, others have many as three, of course, depending on what program is running, they have different functions. Others have scroll wheel, helpful for scrolling through long documents. For GUI (Graphical User Interface) Programs, mouse is very important because you can simply point to objects or options and just click the mouse button in order to execute or open them. These are often called point-and-click programs. Mouse can also be used to draw pictures to use it as pencil, paintbrush or like a pen [11].

A Touch pad is described as a rectangular pad across which a thumb or fingertip slides to move the pointer on the display or screen. To perform other functions or mouse clicks actions, there are buttons that appear next to the touch pad surface; often the pad can be tapped to make selections, as well. Almost all laptop or notebook computers use touch pads. But touch pads are also available as stand-alone devices to be used with desktop computers and are built into some keyboards. Touch pad is an alternative to mouse devices. It is a device for controlling input positioning on a computer display screen. Ideally used in laptop computers, which is built-in but touch pads are also being made for use with desktop computers. It works

by sensing the downward pressure and user's finger movements. The Apple Computer was the first to have it licensed and use touch pads in their Powerbook laptops in 1994. George E. Gerpheide invented the first touch pad in 1988. It became the leading cursor controlling device in laptops and notebook computers. Although other laptops such as the IBM ThinkPad laptops use a trackball or sometimes called trackpoint that is set into the keyboard [12].

Previous Projects/Works

The Explorer Touch Mouse is the newest addition to Microsoft's growing wireless touch-enabled mice line. It has the following features: it has five customizable buttons, a blue laser sensor for tracking on virtually any surface, an impressive 18-month battery life, and a touch strip with both vertical and horizontal navigation as well as touch scrolling [13]. The limitation of this mouse is that it is RF dongle enabled only not Bluetooth enabled.

Another touchpad has been developed by Logitech. It is a wireless trackpad imitated the one developed for Mac users for Apple which they called Magic Trackpad. The Logitech named their latest peripheral as Wireless Touchpad, this is much bulkier and less streamline wireless trackpad for desktop. It is the Magic Trackpad rival. Same with Magic Trackpad, the Wireless Touchpad features a 4 month battery life and a wide 5" multi-touch finger tracking surface for various different types of multi-touch gestures. Also, a Bluetooth connection is not possible. A tiny 2.4 Ghz USB wireless receiver forces you to make a room for it [13].

It can be noted that the use of bluetooth technology is not present on the mentioned products whereas it is the technology to be used in the proposed product.

MATERIALS AND METHODS

In order to improve the traditional way of using the mouse, the proponent performed research and study on the ideas, concepts and methods to be used to be able to create the new product. Different presentations and cycles were analyzed by the proponent to develop step by step procedures that will help her in creating and designing the E-Mouse. These gave the proponent important ideas and information on the subject matter and had been the basis for the development of the new product. To be able to make use of the gathered information, the

proponent underwent different procedures that guided her through the design and conceptualization of the product.. It served as a guide and it ensured that the proponent is taking the correct actions or steps in creating the desired project and to meet its desired output.

The proponent came up with use of Engineering Cycle which was presented by Jesse Strickeras as a guide in the developing the design for the project and its phase is presented at Figure 1.

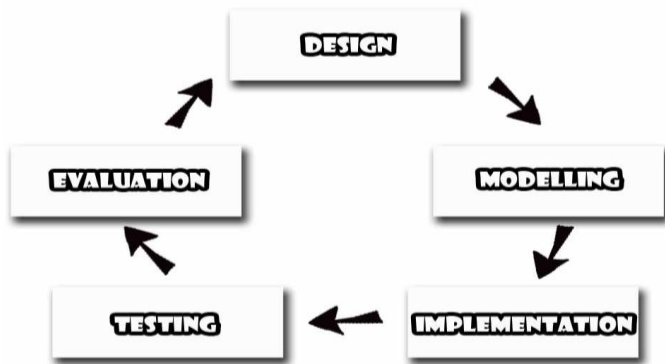


Figure 1. Engineering Design Cycle

Figure 1 shows the Engineering Design Cycle. The Engineering Design Cycle is the basis of the proponents in creating and developing the design project. This diagram shows different phases in which the proponents underwent through the whole process of developing the proposed design project. This served as a step by step procedure for the proponents to finish the project. It also indicates different steps and procedures to the development of the design project. The cycle will be recurring until the prototype successfully meets the requirements.

Prior to the development of the design project, the proponents accomplished different procedures in developing the physical design of the proposed project. It is comprised of all the basic components used to operate the design project. The proponents developed the system for the E-Mouse according to the following:

Design and Modeling

Design is a primary step in the development of the design project. During the first phase of the design process, the external factors influencing the proposed e-mouse were analyzed such as the financial resources, availability of data and sub assemblies, components and material. Checklists and guidelines

regarding ergonomics in the use of mouse were also put into considerations during the conceptual design. The result of the conceptual design stage is a concept with best meets all requirements.

The requirements such as the hardware and software components including how it works were analyzed in order to utilize its function. Furthermore, the scope of the design project is defined to visualize the set objectives. The output set in this process in terms of drawings and plans are important in the construction of the project. It also evaluates the operation and technical aspects of the design project.

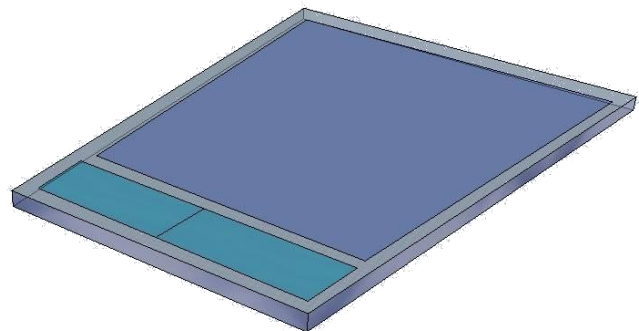
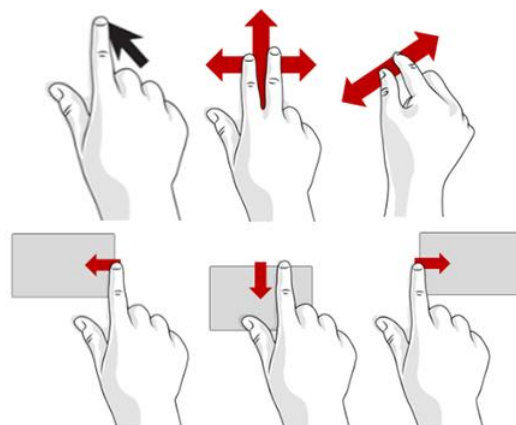


Figure 2 Physical Design of E-Mouse

Figure 2 shows the physical design of the design project. It includes the necessary parts and components of the design project.

The proponent also considered the common gestures for touch screen shown in Figure 3.



To come up with the complete setup of the proposed project, the proponent gathered the different components for the device to work. Figure 4 shows the different components for the project.



Figure 4. System Components of E-Mouse

Supplies and Materials

To achieve the objectives of developing the project, the proponent determined the supplies and materials needed. These refer to the things that support the hardware components of the proposed product especially during the development and modification stage.

Components of a Touch Screen

The proponent came up with the following basic components of a touch screen:

The Touch Screen Sensor

A touch screen “sensor” is a clear glass panel with a touch responsive surface. This sensor is placed over an LCD so that the touch area of the panel covers the viewable area of the video screen. The capacitive glass touch screen sensor type is one of the several basic types of touch screen sensors. A capacitive glass touch screen sensor is placed on a touch screen panel that is coated with indium tin oxide. The panel conducts a continuous electrical current across the sensor in order to detect changes in capacitance. Glass thickness is 1.88mm and 2.8mm $\pm 10\%$.

The Controller

The finger slides and downward movement will be captured by the PCB or the printed circuit board which acts as the interface between the display and the sensor. This is the ones taking the information from the touch screen. The controller also translates the information that the computer can understand, such as the right and left clicks, the cursor controls, and other signals. The circuit board dimension is 62mm x 33mm (2.48inches x 1.29inches). Its power requirement is D.C.+5V, external unregulated 5-12V power.

The Software Driver

In order to recognize the input, such as the cursor controls, a computer program is needed to allow the computer operating system and the controller to communicate. This software allows the touch screen and system controller to work together and tells the product’s operating system how to interpret the touch event information that is sent from the controller. The driver supports operating systems such as Windows Vista, 2000/XP, Linux Red Hat/Fedora/Mandrake. Alignment of fast full oriental 4 points position is incorporated in the software driver together with calibration 9,25 points linearity calibration.

Surface Capacitive Screens

Surface Capacitive Touch Screens are an all-glass construction with greater than 9H Surface hardness able to withstand over 300 million touches.

The figure below exhibits the layers and the kinds of materials to be used.

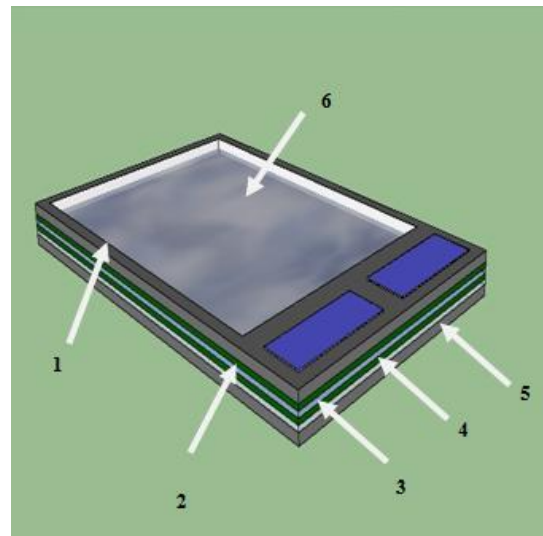


Figure 5. Layers of Materials of the E-Mouse

Materials for the E-Mouse

1. Polyester Top Sheet
2. Etched (Indium Tin Oxide) ITO Coating
3. Spacer Dots
4. Etched (Indium Tin Oxide) ITO Coating
5. Glass Substrate
6. Glass (Discrete Touch Points Defined by Etching)

Measurements and Dimensions

Table 1 shows the height, width and diagonal measurement of the touch active area and the outside dimensions.

Table 1. Dimension of the E-Mouse

Display Diagonal Size (Aspect Ratio)	Surface Treatment	Touch Active Area			Outside Dimensions	
		Height	Width	Diag	Height	Width
7.4"	High resolution antiglare	4.94"	6.36"	7.65"	6.45"	7.85"

CONCLUSION AND RECOMMENDATION

The project has several potential advantages to frequent computer users. The E-mouse provides more comfort and less hand movement because of its low profile ergonomic design. It will help the users to prevent computer-mouse related injuries such as Carpal Tunnel Syndrome. It results with a more natural and easier tap and scroll. This eases the tendon and muscle fatigue in the hand, elbow and arm. It assumes the natural position of the wrists even when working, using computer mouse does not require the user to twist the forearm. Less effort and energy used when scrolling. It is not too slippery on the screen or on the mouse pad and it also reduces tension.

It is suggested to conduct further studies on the compatibility of the E-mouse to different operating systems. The E-Mouse is only compatible to computer systems running Microsoft Windows and to different distributions of Linux. Use of lighter materials can also be improved to minimize the weight of the mouse. Likewise, hand motion sensor can also be studied and integrate in the device to allow hand gestures as input.

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