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An Ideology of Novel Interactive Mouse

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Abstract: A general mouse occupies too much unnecessary space to operate, considering its limited number of functions. It would be so much more efficient to reduce the size and invent something that is at a higher level. The objective of this paper is to design a small, wireless novel computer mouse with two optical sensors and two pressure sensors. Each sensor will contribute to create a multi-touch function that we can see from an Apple Mac Book and its mouse pad such as scrolling and zooming in and out along with general functions of a mouse such as moving and clicking. The user will be allowed to use the mouse on a wider range of surfaces than a normal optical mouse, and due to its compact size, it will be easier to carry around and thus, use it can be used in any place. One of the newest in mouse technology to be developed is the Novel Interactive mouse. The Novel Interactive mouse will be a new versatile and comfortable kind of mouse. The Novel Interactive mouse is definitely a prochoice for a number of reasons. Another important factor to consider while choosing a mouse is durability. Because of the fact that optical computer mice don't use the ball and roller mechanism, there are no movable parts that can get dirty or work out. This makes them more reliable and longer-lasting than other mice. The normal optical mouse needs a mouse pad to work. When it comes to a Novel Interactive Mouse, a mouse pad is no longer necessary. It can be operated in any surface a surface. This makes the Novel Interactive Mouse much more versatile. Finger-worn devices are a vastly unexplored space for interaction design. It opens a world of possibilities for solving day-to-day problems, for visually impaired people and sighted people. The concept of a finger-worn device is presented in this paper.

Keywords: Optical Mouse, Sensor, Data, Communication, Novel.

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1. Introduction

Every day of our computing life, we reach out for our mouse whenever we want to move our cursor or activate something. Our mouse senses our motion and our clicks and sends them to the computer so that it can respond appropriately. It is amazing how simple and effective a mouse is, and it is also amazing how long it took Mice to become a part of everyday life. Given that people naturally point at things -- usually before they speak -- it is surprising that it took so long for a good pointing device to develop. The proposed system may serve for numerous applications. We will discuss how finger to other domains. Although originally invented in the 1960s, it took quite longer time for mice to become main stream. In the beginning there was no need for any pointing devices because computers used crude interfaces like teletype machines or punch cards for data entry. The early text terminals did nothing more than emulate a teletype (using the screen to replace paper), so it was many years (well into the 1960s and early 1970s) before arrow keys were found on most terminals.

Touch sensing as a human interface device (HID) technology, for example to replace the computer mouse, is becoming increasingly popular. Various sensing systems can be developed based on the different principles including resistive, capacitive, infrared, surface acoustic wave, electromagnetic, near field imaging, etc. Resistive and capacitive methods have been widely used in conventional touch screens of commercial products such as mobile phones, PDAs, and consumer electronics devices. Resistive touch screen consists of two sheets which are coated with a resistive material, commonly indium tin oxide (ITO), and those sheets are separated by an air gap or microdots. When a finger presses the screen, the two sheets will be connected at the touch position that will cause a change in the current flows on the screen. A sensing circuit can detects the changes and located the touch. Similarly, a capacitive touch sensor is based on capacitive coupling effects. A typical design is the screen will be coated with a thin, transparent metallic layer, thus form a collection of capacitors. When a user touches the surface, the disturbance caused by the finger will lead to change the capacitance and current that flows on the screen.

Infrared (IR) touch systems use an array of infrared (IR) light-emitting diodes (LEDs) on two adjacent bezel edges of a display with photo sensors placed on the two opposite bezel. An object, such as a finger, that touches the screen interrupts the light beams, can be detected by photo sensors and thus the touch will be sensed and located. The purpose of this paper is to design and build a compact, wireless computer mouse with two optical sensors and two pressure sensors. The mouse will be consisted of four main parts: a USB wireless signal receiver, decoder, wireless signal transmitter, and two pairs of optical and pressure sensor.

Each sensor will contribute to create a multi-touch function and its mouse pad such as scrolling and zooming in and out along with general functions of a mouse such as moving and clicking. The main goal is to make the mouse more compact and easy to use with more features than a existing optical mouse. The user can use the mouse on a wider range of surfaces which is not possible in a normal mouse, and due to its compact size, it will be easier to handle and thus, use it in a greater number of places. The major goal of this new finger mouse was to replace a standard mouse by adding additional features and increasing the mobility by decreasing the overall volume. In fact, the benefits of using the new finger mouse are high mobility and versatility due to its compact size and capability of using the mouse on a wider range of surfaces. The main product features include wireless system with a multi-touch features that allows scrolling and zooming along with general functions of a mouse such as moving and clicking.

A. Disadvantages of the Existing System

Surface issues is one of the few real issues with current optical mice is how they behave on certain surfaces. Optical mice won't work on glossy or highly reflected surfaces, this mean you must probably need a mouse pad.

Fig.1: The existing optical mouse

The Fig.1 shows the existing optical mouse that uses CMOS sensor which basically requires a mouse pad for operation. However, for many people this is a disadvantage because the increasing speed makes it harder to control, Optical mice solved many of the problems of roller-ball mice had, but still require a relatively large area to work. If you're using a laptop on a airplane or while sitting on a deck chair, an optical mouse is not practical.

B. Advantages of the proposed system

Reliability - Another important point to consider when choosing a mouse is durability. In the Novel Interactive Mouse, a mouse pad is no longer necessary. All you really need is a surface. This makes the Novel Interactive Mouse much more versatile. One of the few real issues with current optical mice is how they behave on certain surfaces. Fig.2. reveals the proposed Ideology which is comparatively more reliable than existing models.

Fig. 2: Shows the proposed ideology

B. Multi-Touch Features

Most mice that are on the market today do not have functions that are dynamic in real-time depending on the motion of the mouse; they are all single commands that are operated by a click of a button. In the proposed model, multi-touch features such as zooming in and out, and scrolling up and down during appropriate movements are written in C, and downloaded in MCU. This would be more user-friendly and beneficial.

C. Wireless Communication

When we are going for a wireless mouse, it increases the mobility, and eliminates unnecessary wires that could get tangled with other objects. Thus, transferring the data to and from the mouse to the computer was designed to be wireless and the skeleton of the proposed NI mouse model is shown in below Fig.3.

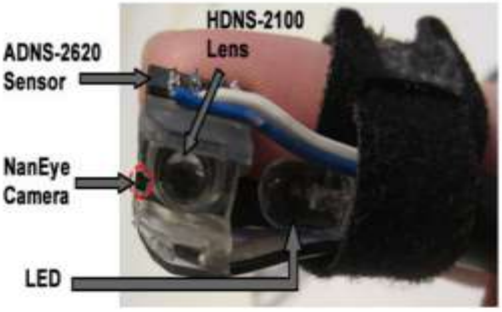

Fig. 3: Skeleton of the proposed model

D. Data Transfer

There are many ports through which the mouse can communicate with the host computer, and usually, it is through the USB port. However, the host computer does not take any form of data; it must be decoded into Human Interface Device language via another MCU.

2. SYSTEM DESIGN OF THE PROPOSED MODEL

The following will give a detailed description about designed circuits described in the previous section.

A. Power Supply: DC/DC Converter

L6920DTR requires only four external to realize the conversion from the batter voltage to the selected output voltage of 3.3 V – three capacitors and one inductor. These components determine efficiency, response time and output ripple. According to the datasheet, for capacitors, it recommends that the capacitance value to be in the range of 10 µF to 100 µF. Thus, 47 µF 5 Surface-mountable capacitor was chosen as it was available in the shop. For inductors, anything from 5 µH to 40 µH is suitable. The inductance determines its physical size and smaller the value, faster the response would be. Thus, µH was chosen for the power supply.

Fig.4. Inner design of the proposed model

The Fig.4 shows the inner design of the proposed model which consists of PCB and LED that are embedded in it. As an ultimate source of power, a single AAA battery was enough as it is most commonly used in most mice on the market. Also, the L6920 can very well take an input of 1.5 V and convert it to 3.3 V with 500 mA; the startup is guaranteed at 1V and the device can operate down to 0.6 V.

B. Clicks of A Mouse: Trossen Robotics Force Sensor Details

The force sensor is a varying resistor. Depending on the amount of force applied to the sensor, the sensor changes its resistance as shown in the Figure 4. Using this characteristic, it is possible to use the voltage drop across the force sensor depending on the amount of force applied to detect whether the user wanted clicking or not.

Fig.5: shows the concept of glove structure

The Fig.5 describes the concept of finger worn mouse that resembles a glove like structure which has large area for the components that can be embedded on it. It only comes down to choosing what resistor to use that would be has exponential decay as force applied to the sensor increases and thus more and more voltage drop would occur from the resistor as the resistance of that resistor increases.

Fig.6. illustrates the embedded components

Fig.6 shows the components embedded on the skeleton model. Empirical data was achieved and tested this data and came to a realization that in some kilo-Ohms range was a good range to see a significant drop in voltage across the force sensor to distinguish the clicks and other little force on the sensor. Specifically, 20 K-Ohms was chosen. Using the 20 K-Ohms, these conclusions were made. Since the input voltage is 3.3 V in the new mouse design, voltage across the force sensor would be 3.3 V if no force is applied. Empirical data was needed and came to a conclusion that when flicking motion is applied on the force sensor, the voltage drops to about 1.2 V to 1.7 V while just a little tab on the force which may be applied when moving the mouse would drop voltage to about 2.1 to 2.5 V.

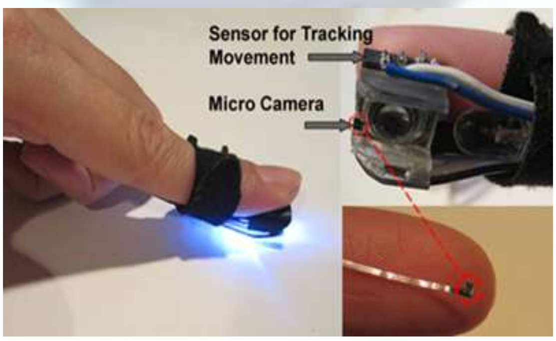

Fig.7.The integrated Micro camera

Fig.7 shows the micro camera that is fixed on the model for the tracking of the pointer movement which marks the co-ordinates of X, Y axis and process them using DSP sensor. Given the information, some sort of comparator circuit was required to give out high signal whenever voltage across the force sensor is greater than 1.8 V and give out low signal when the voltage was smaller than 1.8V since clicking is active low. The reference voltage of 1.8 V was needed to achieve from our voltage input of 3.3 V by setting the value of resistors.

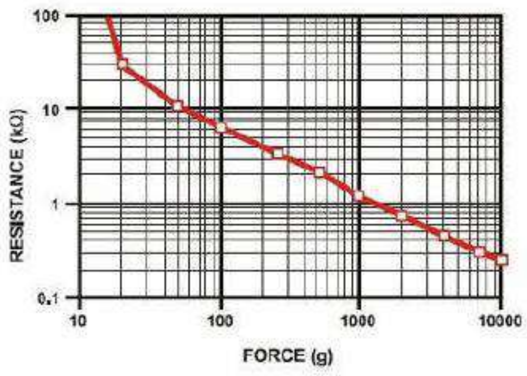

Fig.8: The graph between Force and Resistance

Fig.8 represents the stress sensed by the sensor and the graph is drawn between the force and resistance. The sinusoidal voltage source connected to pin 2 signifies the change in voltage caused by the change in resistance in a FSR. The reference voltage is randomly selected to be 10 V, but should be adjusted to an appropriate value according to the specifications of the MCU.

C. Motion of a mouse: Avago Technology Optical Sensor ADNS-3530

MSP430F1222 communicates with the sensors and the transmitter. Its main function is to control the optical sensors and transmitter and accepting different data from the sensors to give out exact information for the transmitter to send. MSP430F1222 contains built-in communication capability using asynchronous UART and synchronous SPI protocols. The below diagram Fig.9 describes the flowchart of the mouse operation such as left click, right click, movement, zoom-in, zoom-out and scrolling.

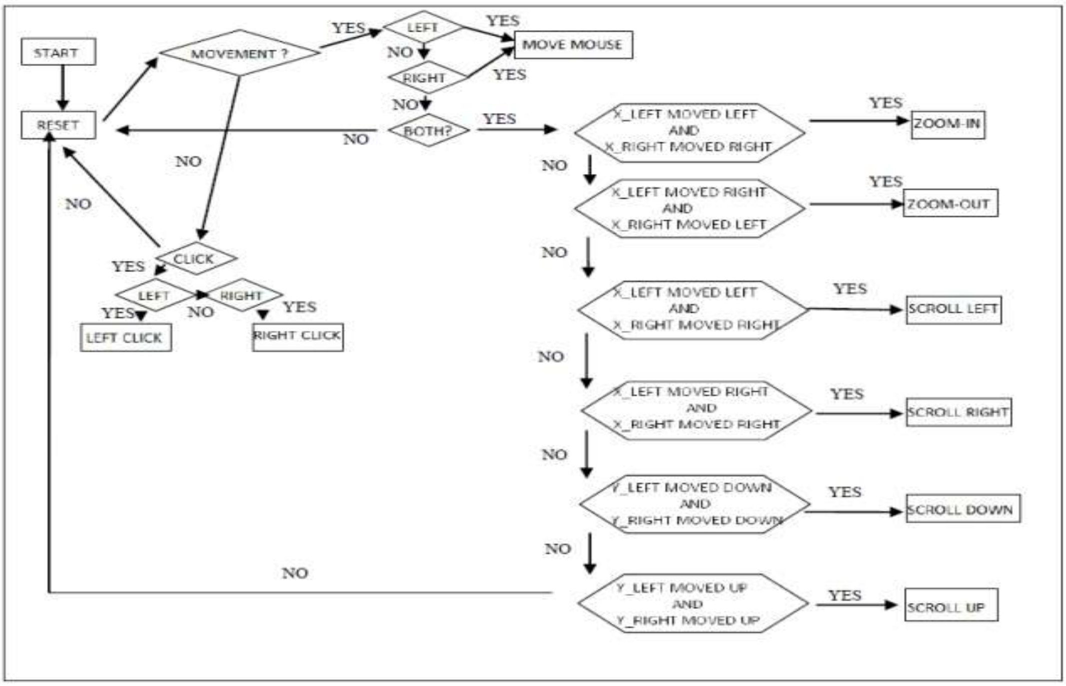

Fig. 9: The mouse operation flowchart

D. Software: Texas Instrument MCU430F1222

After deciding what kind of optical sensors to use, it was important to decide the ways to handle multi-touch function of the new mouse design. It was important to get the displacement data from both of the optical sensors. Using the displacement data, software implementation was necessary to operate multi-touch features of the new mouse design. This was done in the MCU.

3. METHODOLOGY

Wireless mouse usually work via radio frequency referred as RF. RF wireless mouse require two components to work properly – a radio transmitter and receiver. Let us discuss all the components used in wireless finger mouse.

Fig.10: The Glove concept

The above mentioned diagram Fig.10 represents concept in which the components are placed in a glove like structure which also includes accessories like ON/OFF switch, USB charger and other operations that are to be transformed to into the NI mouse.

A. RF Transmitter

A RF transmitter is usually integrated inside the mouse. The mouse record its movements and the touch which are sensed and sends to the RF receiver.

B. RF Receiver

The radio frequency receiver usually connects to the computers peripheral mouse input. It receives the RF signals, decode them then sends the signal directly to the computer as normal.

C. Bluetooth RF

Bluetooth is commonly known to connect computers to peripheral devices. It is similar to 802.11b and 802.11g in that it uses 2.4GHz frequencies. However, it also uses software called ADAPTIVE FREQUENCY hoping to choose frequencies that have no or little interference. Bluetooth also has decent range usually about 33 feet.

D. Working of the proposed system

The technology underlying the modern NI mouse is known as Digital image correlation. NI mouse uses image sensors to image naturally occurring texture in all common materials. The technology underlying the modern optical computer mouse is known as Digital image correlation. NI mouse uses image sensors to image naturally occurring texture in all common materials. Images of the surfaces are captured in continuous successions and compared with each other to determine how far the mouse has moved. The mouse captures nearly one thousand successive images per second. Depending on how fast the mouse moving each image will be offset from the previous one by a fraction of pixel or as many as several pixels. The mouse mathematically process these images using cross correlation to calculate how much each successive image is offset from the previous one. The coordinates of each images are processed and compared by the DSP processor which sends the information to the screen and that's how the mouse pointer moves on the screen.

E .Block Diagram

The Block Diagram of Novel Interactive mouse is shown below:

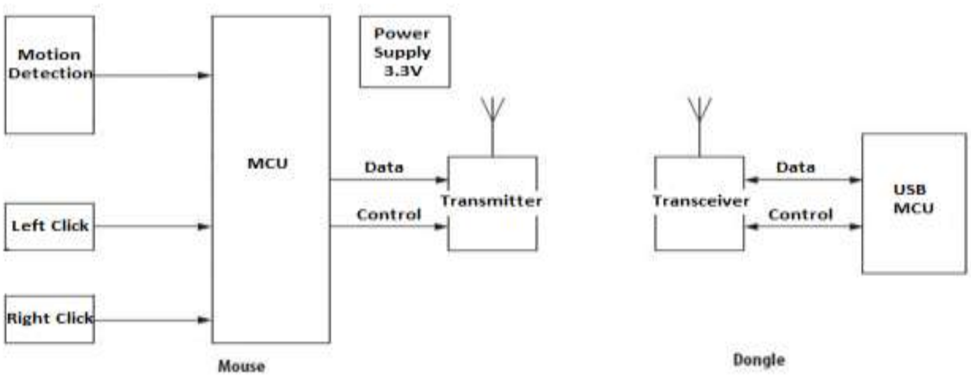

Fig.11: The block diagram of the proposed system

Fig.11 represents the complete layout of the proposed system which also includes the external USB dongle that acts as the wireless interface between the device and computer.

4. SYSTEM OUTCOME

This Novel Interactive Mouse will be a solution to all the above mentioned issues. The other advantage of a Novel Interactive Mouse is its comfort to handle since it is wireless and compact.

Fig.12: Illustrates the outcome of the NI mouse

The optical mouse reduces the strain on your wrist and the need to constantly move your hand around. The optical mouse does not have any movable parts as of the ball mouse.

Fig.13a. The concept model of the NI mouse

Fig.13b: The concept model of the NI mouse

Fig. 13 a&b shows the outcome of the proposed model which is very compact and possess more features than the existing mouse models. So, the life of the optical mouse is long compared to the ordinary mouse. Since the mouse works with the sensor recognition, the movements are clearly captured and so the moves gives out a same function in all moves. Since the ball is absent in the optical mouse, the weight of the mouse is less than that of the ball mouse. The dust clustering problem is abolished in the optical mouse as its parts are all static. The optical mouse can also function good without a mouse pad, which is impossible with ordinary mouse. NI mouse can be used above reflecting glasses or any glass materials.

5. CONCLUSION

Thus this NI mouse offers high definition technology for ultra precise, responsive and smooth tracking. This NI mouse is designed for comfort in either hand. Moreover, it features sleeping mode and low battery indicator to maximize power consumption. You could experience ultimate performance since it will never hunt for any space on your desk. It is ideal for using at home, at office, especially for mobile traveler. It works while strapped to the fore finger and it can work on any surface, such as clothes, glass etc. Clicks of a mouse was successfully implemented, and motion of a mouse was seemingly finished drawn from the facts that the LED lit up, blinked, went through various modes designed in the MCU, and the sensors outputted translatable signal to the MCU.

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