An Overview of Wireless Mouse : History, Challenges and Applications

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ABSTRACT

As the method of existing wired mouse not adequately efficient in terms of mobility and independent of wire. So the users switch over to the concept of wireless mouse which has many unique features. In this paper, we are scrutinizes the methodology of wireless mouse
A wireless mouse is a computer mouse that needs no wires to send signals from the mouse to a computer. Over time, different technologies have led to the emergence of different types of wireless mice on the market. The cordless mouse offers obvious advantages over its tethered brethren, such as being able to point and click on a computer screen from across the room and run on multiple surfaces.

Key words: Mice, Tether less

INTRODUCTION:

A **mouse** is a pointing device that functions by detecting two-dimensional motion relative to its supporting surface. Physically, a mouse consists of an object held under one of the user's hands, with one or more buttons. The mouse sometimes features other elements, such as "wheels", which allow the user to perform various system-dependent operations, or extra buttons or features that can add more control or dimensional input. The mouse's motion typically translates into the motion of a pointer on a display, which allows for fine control of a graphical user interface.

Wireless mouse technology predominantly uses radio frequencies (RF) to send signals from the mouse to the computer. Like other radio technologies, this requires a transmitter and a receiver. The mouse transmits radio signals to a receiver, which is itself connected to the computer hardware, normally via a wire. This kind of wireless mouse is very reliable, and capable of transmitting the mouse's movements to the receiver from across a room. The various types of mouse Technologies are Mechanical mice , Optical and laser mice ,Inertial and gyroscopic mice ,3D mice ,Tactile mice , Ergonomic mice and Gaming mice .

Mechanical mice: The ball mouse replaced the external wheels with a single ball that could rotate in any direction. The ball mouse has two freely rotating rollers. They are located 90 degrees apart. One roller detects the forward–backward motion of the mouse and other the left–right motion. Opposite the two rollers is a third one (white, in the photo, at 45 degrees) that is spring-loaded to push the ball against the other two rollers. Each roller is on the same shaft as an encoder wheel that has slotted edges; the slots interrupt infrared light beams to generate electrical pulses that represent wheel movement. Each wheel's disc, however, has a pair of light beams, located so that a given beam becomes interrupted, or again starts to pass light freely, when the other beam of the pair is about halfway between changes

Optical and laser mice: Optical mice make use of one or more light-emitting diodes (LEDs) and an imaging array of photodiodes to detect movement relative to the underlying surface, rather than internal moving parts as does a mechanical mouse. A laser mouse is an optical mouse that uses coherent (laser) light.

Inertial and gyroscopic mice: It is not require a surface to operate, inertial mice use a tuning fork or other accelerometer to detect rotary movement for every axis supported. The most common models work using 2 degrees of rotational freedom and are insensitive to spatial translation. The user requires only small wrist rotations to move the cursor, reducing user fatigue or "gorilla arm".

3D mice: These devices generally function through ultrasound and provide at least three degrees of freedom. This wireless mouse was worn on a ring around a finger, which enabled the thumb to access three buttons. The mouse was tracked in three dimensions by a base station despite a certain appeal; it was finally discontinued because it did not provide sufficient resolution.

Tactile mice: It contained a small actuator to make the mouse vibrate. Such a mouse can augment user-interfaces such as giving feedback when crossing a window boundary.

Ergonomic mice: provide optimum comfort and avoid injuries such as carpal tunnel syndrome, arthritis and other repetitive strain injuries. It is designed to fit natural hand position and movements, to reduce discomfort.

Gaming mice: These mice are specifically designed for use in computer games. They typically employ a wide array of controls and buttons and have designs that differ radically from traditional mice. It has a relatively high sensitivity, measured in dots per inch (DPI). Gaming mice are held by gamers in three styles of grip: Palm Grip, Claw Grip, and Finger-Tip Grip [2]

The following diagrams show the Hardware and Software architecture of the wireless mouse [5].

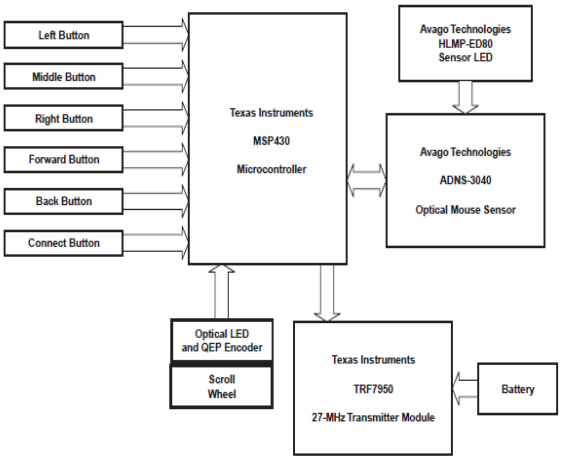

Fig 1. Mouse Transmitter Hardware Architecture

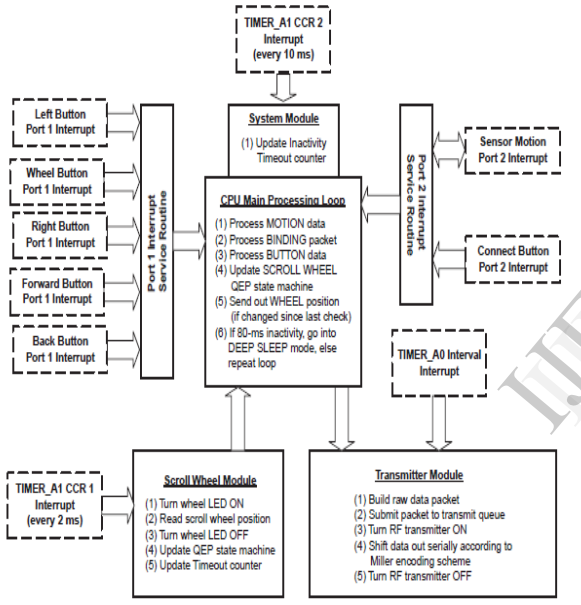

Fig 2. Mouse Transmitter Software Architecture

In section I, wireless mouse based on radio frequencies such as RF mouse, IR mouse and BLUETOOTH mouse are discussed. In section II, wireless mouse based on light source such as OPTICAL mouse, LASER mouse are discussed. In section III, wireless mouse based on mechanical movement like mechanical mouse is discussed. In section 1V, we discussed about comparisons on various mice. In section V, it contains conclusion and our future work on wireless mice. In section VI, it includes references.

SECTION I

RF MOUSE: Wireless mice usually work via radio frequencies (2.4GHz ISM Band) commonly referred to as RF. RF wireless mice require two components to work properly – a radio transmitter and a radio receiver.

OPERATIONS

RF Transmitter

A radio frequency (RF) transmitter is usually integrated inside the mouse. The mouse records its movements and buttons that are clicked and then sends this information via radio signal to the receiver.

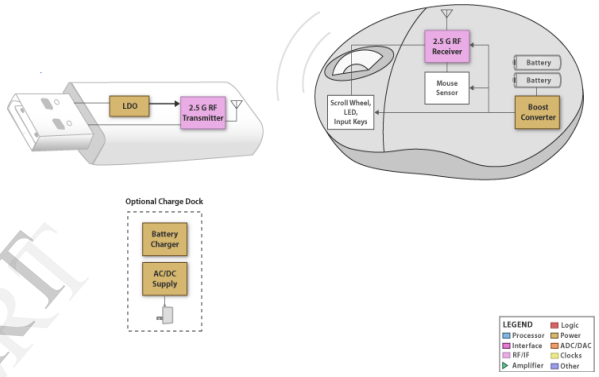

Fig 3. Block diagram of RF mouse

RF Receiver

The radio frequency (RF) receiver usually connects to the computer's peripheral mouse input. It receives these RF signals, decodes them, and then sends these signals directly to the computer as normal. RF receivers usually come in a few styles. The majority come as built in components that connect to the mouse input, others come as a separate card that is installed in one of the many expansion slots of computers, and the third type of receiver is a separate unit that is connected to a cable going directly to the computer's peripheral input. Since the technology has been mastered, most wireless mice have integrated receivers that plug into a computer's peripheral input and are very small in size.

IR MOUSE: In which the mouse is equipped with a Dot per Inch (DPI) shift button to adjust between 3 levels, meeting both common and gaming needs. By adopting infrared technology, the Anker 2.4G Wireless Mouse can be used on almost any surface and works with amazing stability.

Using TV remote as a cordless mouse for computer with IR

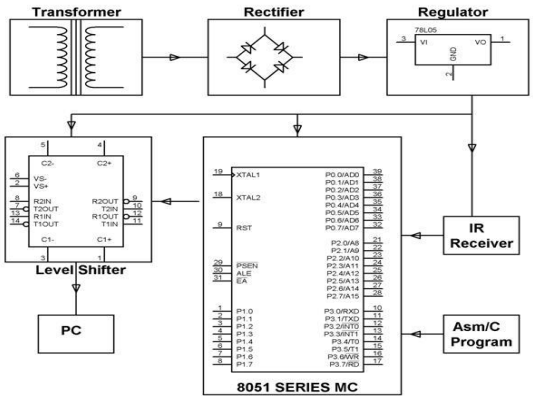

Fig4. Block diagram of IR mouse operations

OPERATIONS: The project is designed to use a TV remote as a cordless mouse for the computer. A conventional PC/laptop uses a mouse to operate and control all its applications. As a PC mouse is wired to the system, one has to sit near the PC to operate it. This becomes very tedious when the PC is used for presentation purposes (when using a projector). In this proposed system TV remote can be used as a cordless mouse, and the user need not operate the PC sitting near it. A typical TV remote sends coded infrared data that is read by an IR sensor interfaced to an 8051 family microcontroller. This data so received by the microcontroller sends it to the COM port of a PC through a level shifter IC. This IR code is traditionally coded by some manufacturers. Software named PC remote is used on the PC that recognizes data received from the microcontroller through the COM port and performs the required operation. Designated numbers on the TV remote are used to perform up - down, right - left cursor movement. Features like left click and right click of the mouse can also be performed with of the TV remote. Further this project can be enhanced using Bluetooth/ RF technology to overcome the traditional line of sight communication drawbacks of the infrared type.

BLUETOOTH MOUSE: A Bluetooth mouse is a computer mouse that uses radio waves to communicate wirelessly with a computer. Bluetooth mice are mobile, have a great range, and can be used with many different devices.

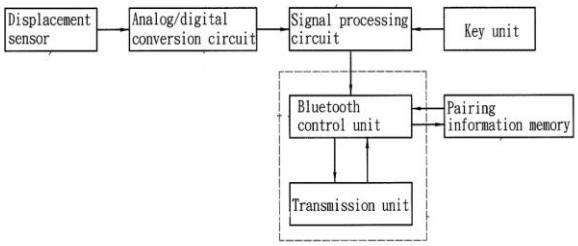

Fig 5 block diagram of Bluetooth mouse

OPERATION: The radio frequency (RF) devices often use USB ports for the wireless connection. There is a transmitter in the mouse devices that sends radio signals to the USB connector which then communicates with the computer and tells it what to do. The USB receivers have gotten smaller and smaller and now there is a way to use these wireless devices without taking up a USB port. Bluetooth devices communicate on radio frequencies, much like other RF devices. The Bluetooth devices transmit a 2.4 GHz signal through a technique known as frequency hopping. The frequency hopping allows the individual devices to avoid interference from other Wi-Fi devices. Rather than having a USB receiver, the latest generation of Bluetooth devices communicate directly with the computers. Many laptops and notebooks are Bluetooth enabled to allow the use of wireless devices. Using Bluetooth devices can save you time and headache of having to keep track of a USB receiver. Also, Bluetooth devices generally have a much larger range, up to 30 feet.

SECTION II

OPTICAL MOUSE: An optical mouse is an advanced computer pointing device that uses a light-emitting diode (LED), an optical sensor, and digital signal processing (DSP) place of the traditional mouse ball and electromechanical transducer. Movement is detected by sensing changes in reflected light, rather than by interpreting the motion of a rolling sphere [1]. The optical mouse takes microscopic snapshots of the working surface at a rate of more than 1,000 images per second. If the mouse is moved, the images change. The tiniest irregularities in the surface can produce images well enough for the sensor and DSP to generate usable movement data. The best surfaces reflect but scatter light; an example is a blank sheet of white drawing paper. Some surfaces do not allow the sensor and DSP to function properly because the irregularities are too small to be detected. An example of a poor optical- musing surface is unfrosted glass. In practice, an optical mouse does not need cleaning, because it has no moving parts. This all-electronic feature also eliminates mechanical fatigue and failure. If the device is used with the proper surface, sensing is more precise than is possible with any pointing device using the old electromechanical design. This is an asset in graphics applications.

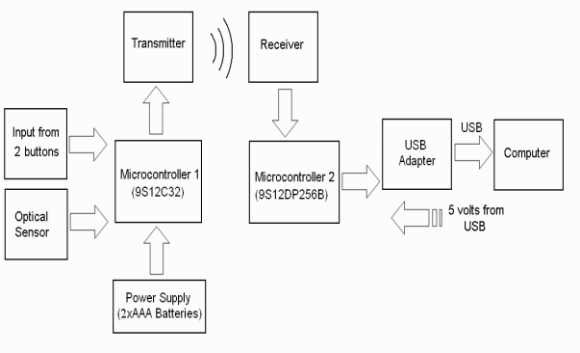

Fig 6. Block Diagram of Optical Mouse

OPERATION: The optical sensor detects the movement of the mouse by taking thousands of tiny images per second of the surface, which is illuminated by a red LED. The Digital Signal Processor (DSP) on board the IC compares image after image from the sensor and determines magnitude and direction of the mouse's movement. The data of the mouse's movement is output on the sensor's serial port. The microcontroller will process and encode the data produced by the optical sensor and the activity of the two push buttons, so that it can be transmitted. The microcontroller will also perform power management tasks for the sensor [2]. The XTAL circuitry, which runs off of a 16MHz crystal, will control the timing of the system. The RF circuitry will create a 916.48 MHz ISM (Industry, Scientific, Medical) RF signal from the encoded data using Frequency shift keying (FSK) modulation. The signal is amplified and transmitted over free air to the receiver. The receiver will consist of the 9S12DP256B (Star 12) microcontroller, RF reception circuitry, and a USB interface adapter.

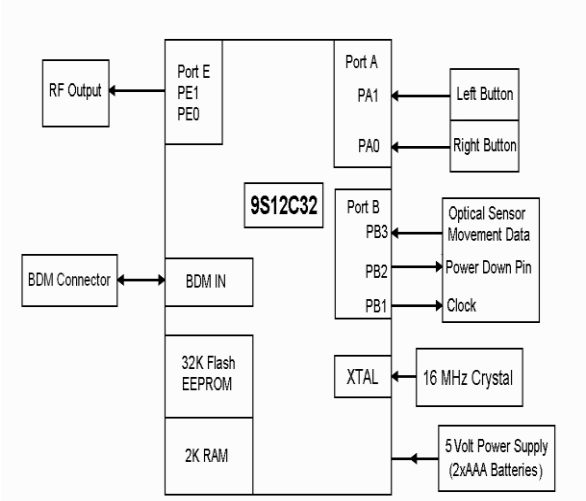

Fig 7. Optical mouse transmitter

The RF receiver will be implemented by an integrated circuit. The receiver will receive the signal sent from the mouse transmitter and demodulate it. The demodulated data is amplified and sent to the microcontroller. The 9S12DP256B microcontroller will decode the data. The decoded data is converted into mouse data format using the Microsoft Mouse Protocol, which is compatible with all major operating systems. The data packets, each three bytes long, are sent to the host computer via the Universal Serial Bus (USB) port. The USB adapter is used as the interface between the 9S12DP256B microcontroller and the computer's USB port. The microcontroller will be powered by the 5 volts provided by the USB port. The XTAL circuitry, which runs off of a 16MHz crystal, will control the timing of the system since optical computer mice do not use the ball or track that other types of mice use, they are more reliable.

It has more precision and accurately the cursor can be moved .It does not require mouse pad and it uses different surface issues. Though it has several advantages, it May have problems on glossy surfaces such as glass .Higher sensitivity and Many optical mouse have lights in them, which some people find annoying

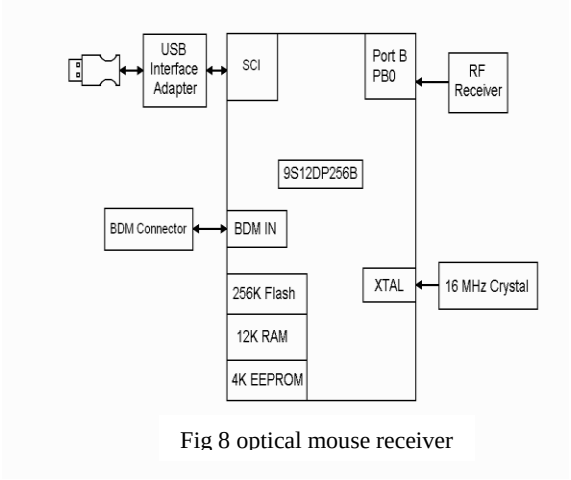

Fig 8 optical mouse receiver

LASER MOUSE: A laser mouse is a type of computer pointing device that uses a laser beam rather than a ball to track the movement of the user's hand. This type of mice is becoming increasingly common because they are perceived to have better tracking ability. In addition, they are not as subject to gumming up and subsequent distortion of the signal as conventional ball mice [1]. The lack of moving parts also makes them far less subject to damage.

Fig 9 Laser mouse

OPERATION: It works on the same principle as an optical mouse. An optical mouse uses an LED to track it's movements but laser mouse uses laser The mouse emits a laser beam and then the reflected image is received by the CMOS sensor and sent to the DSP (Digital Signal Processor). This cycle happens multiple times in a second .The DSP detects patterns and changes in the images and tracks the movement of the mouse and then sends the coordinates to the computer. A typical laser mouse is 2X or 3X more sensitive than optical mice laser mice can be used on any surface as laser reflects off anything however, optical mice can't be used on shiny surfaces like glass

SECTION III

MECHANICAL MOUSE: A **mechanical mouse** is a computer mouse that contains a metal or rubber ball on it's under side. When the ball is rolled in any direction, sensors inside the mouse detect this motion and move the on-screen mouse pointer in the same direction

OPERATION: A mechanical mouse has inside of it a ball which comes in contact with the desktop or mousing surface. As the user moves the mouse around on the desktop, the ball rolls with these movements. This rolling is detected by two wheels at 90 degree angles from each other which are positioned in this way so that one wheel can detect up & down movement, while the other detects left and right movement, together they can reliably detect mouse movement in any direction. A third wheel, the guide wheel is spring loaded and presses the ball against the two sensor wheels

Fig 10. Mechanical mouse

Mouse allows quick and easy access too many icons and operations on the computer, such as selecting from a list of possible actions (menu), work with Windows and moving files. When you move the mouse, the rubber ball turns and runs two rollers, both associated with wheel with slots. Light-emitting diode (LED) sends light through the slits and transducers convert light into an electrical signal. Pressing the button will send additional information to the computer. The main goal of any mouse is to translate the motion of your hand into signals that the computer can use.

SECTION IV

COMPARISION TABLE

Mouse Categories	Frequency	Distance covered	Characteristics
RF Mouse	**2.4 GHz**	**100 to 150 feet**	**No interference with other RF devices (FHSS)**
IR Mouse	**430THz - 300GHz**	**700nm-1mm**	**Line of sight communication**
Bluetooth Mouse	**2.4GHz**	**33 feet**	**No interference with other RF devices (FHSS)**
Optical Mouse	**100THz-10^{14} Hz**	**10 feet**	**High accuracy**
Laser Mouse	**916.5MHz**	**50 feet**	**Laser sensor for precise cursor movement**
Mechanical Mouse	**2.87-8.23Hz**	**20 feet**	**Low Accuracy**

SECTION V

CONCLUSION

Its intrinsic flexibility, lack of infrastructure, ease of deployment, auto-configuration, low cost and potential applications makes it an essential part of future pervasive computing environments. From a technological point of view, the realization of this vision still requires a large number of challenges to be solved related to devices, protocols, applications and services. From an economical point of view, wireless mouse open up new business opportunities for various kind of people.

FUTURE WORKS: To provide a better option for users with spinal cord injuries or severe disabilities, wireless head tilt mouse using an accelerometer has been designed and built and its targeting performance has been compared to traditional mouse devices to show feasibility.

SECTION VI

REFERENCES

1. **Laser Pointer Mouse ,** Xinpeng Huang and William Putnam TA: Javier Castro 6.111: Introductory Digital Systems Laboratory 18 may 2006
2. "5 Tips when Choosing a Gaming Mouse". Best-Gaming.org. Retrieved 3 January 2013.
3. Stanford University Mouse Site with stories and annotated archives from Doug Engelbart's work
4. http://www.microsoft.com/hardware/en-us/30-years-of-hardware.
5. Ultra-Low-Power 27-MHz Wireless Mouse Reference Design Application Report SLAA302–May 2006