Wireless Hand Glove Mouse

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***Abstract*: Human Computer Interaction is a branch in which developer makes user friendly system. Now days, many persons suffer from Carpal Tunnel Syndrome and repetitive strain injuries due to continuous use of mouse. To avoid such serious problem of injuries and pains, a wearable wireless device is proposed in this project. The proposed device uses Accelerometer to sense the gestures with the help of ATMEGA 16 microcontroller. The accelerometer is mounted on a wearable hand glove. This device uses RF modules at both user side and computer side and provides wireless communication. Due to simple gestures such as left click, right click, and drag operation rotation operation and pointing operation, the proposed device achieves user friendly and effectively enhances user's interaction with computer.**

***Keywords:* Accelerometer, mouse, OCR.**

I. INTRODUCTION

Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from face and hand gesture recognition. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user Interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. Gesture recognition enables humans to communicate with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional inputdevices such as mouse, keyboards and even touch-screens redundant.

Often gestures are in two forms: 1) Static (i.e., posture or certain pose) which may require less computational complexity or 2) Dynamic (i.e., sequence of postures) which may be more complex but are suitable for real time Environment. There are different methods having been proposed for acquiring this information necessary for Gestures recognition system. Some of the methods use additional hardware devices such as data glove devices and color markers to easily explore a thorough description of features of different gesture. Recent reviews explain gesture recognition system applications and its growing importance in our life particularly in Human computer Interaction (HCI), Robot control, games, and surveillance, using different tools and algorithms [1].There already exist many methods of hand gesture identification and tracking, as summarized below. They tend to all involve constraints that make their use in a commonplace wearable system impractical. As per the work in [3], authors present a new approach for controlling mouse movement using a real-time camera. Most existing approaches involve changing mouse parts such as adding more buttons orchanging the position of the tracking ball. This method is to use a Camera and computer vision technology, such as image segmentation and gesture recognition, to control mouse tasks(left and right clicking, double-clicking, and scrolling) and show how it can perform everything current mouse devices can. This paper shows how to build this mouse control system. As mentioned in [6] we can see a hand-gesture based interface for facilitating communication among people with speech and hearing impaired disabilities. The input device in the system is a wireless sensor glove equipped with five flex sensors and a 3D accelerometer. The user's hand gestures can be translated into sounds, by integrating the speech synthesizer on to an automatic gesture recognition system. [7] A hand gesture recognition system built around an accelerometer sensor can be studied. This system consists of a sensing and transmitting part and a computer. The computer receives the data describing the motion trajectory and interprets it, through OCR, as a letter. The commands which are given by gesture can be used in a more complex human-computer friendly interface. The system can be also used in gaming systems, embedded systems, and intelligent peripherals and so on.

Recently, due to digitization in every field, data processing speeds have increased dramatically, with computers being advanced to the levels where they can assist humans in complex tasks. Compared to the optical mouse which offers a limited range of length of connecting cable and also they require a surface to work on, the wireless in not of much use other than allowing for a desktop with fewer wires attached. Human Machine Interaction (HMI) is one of the important areas of research where people try to improve the computer technology. The role of human operator is very significant in operating the machine.

II. Background and Related Work

In today's computer-centric world, you spend copious amounts of time with a mouse in your hand. A high quality **m**ouse will be comfortable, help ease strain from constant clicking, come with software for macros and other Automation, and provide pinpoint accuracy and speedy response. The peripheral competition between Logitech, Microsoft and other big brands is as fierce as ever, and more and more companies are releasing mice for gaming and other specific uses every dayNintendo Wii Remote uses simple 3-D mouse principle. A main feature of the Wii Remote is its motion Sensing capability, which allows the user to interact with and manipulate items on screen via movement and pointing Through the use of accelerometer

and optical sensor technology. Apple I-PHONE gained lot of attention with its Interactive keyless accelerometer based navigation. Market has lot of play station remotes including inertial sensors for playing 3-D games. Gyration has just released their Gyro mouse with simple 3-axis gyroscope as inertial sensor based onMagnetic properties to sense amount of degree of rotation along any of 3-axes.Simple orientation application also gives help in GPS based navigation system .The central goal of the paper [5] is to implement a system through which the user can give commands to wireless Robot using gesture. Here, the user control or navigate the robot by using gesture of palm. The command signals are generated from this gesture using image processing and signals are passed to the robot to navigate it in the specified direction. The paper[4] explain about the implementation and design of gesture controlled robot by using Flex Sensor, Ultra sonic Sensor, Electronic compass and accelerometer connected to Atmega16 Microcontroller.

III Proposed work

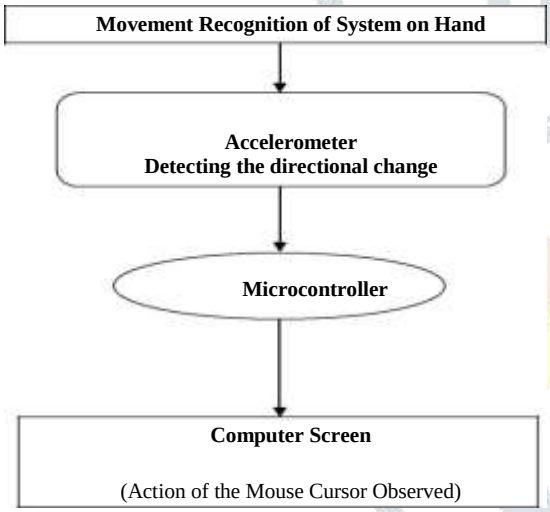
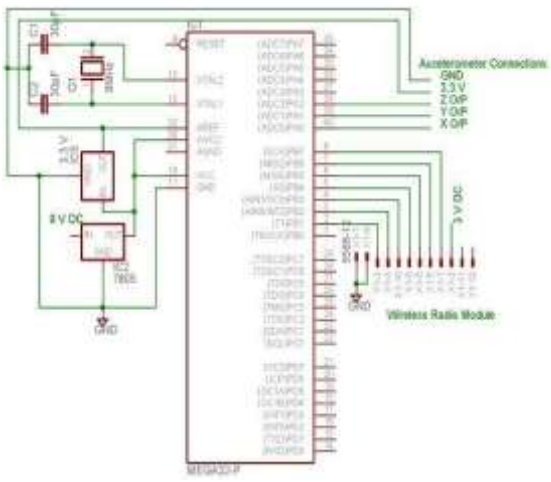


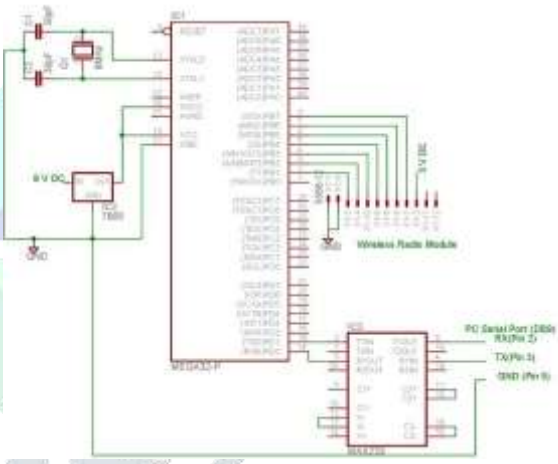
Figure1

The figure 1 illustrates the functional block diagram of the system that we wish to design and implement. In the initial stage, the handgesture of the user is recognized by the accelerometer which reads the movement axis of the hand and gives output as voltages. The analog hand gesture is then read by a microcontroller which has two built in codes that helps to carry out two tasks. The built-in analog to digital converter helps to convert the analog hand gesture, so that it is understandable by the computer when the signal is fed into the system. The whole project is divided into two sections one is transmitter section and other is receiver section. The circuit diagram and the transmitter module is shown in figure 2, and the transmitter section consists of one ATMEGA 16 Microcontroller, one 3-axis accelerometer and one RF transmitter module.



RF Transmitter

The circuit diagram of receiver module is shown in figure 3. The receiver section consists of one RF receiver module, and a USB to serial port converter. Here, two separate 5 volt power supply is applied to both the sections.



RF Receiver

Finally, the microcontroller reads the analog output values i.e., x-axis and y-axis values from the 3 axis accelerometer and converts the analog value to respective digital value. The digital values are processed by the microcontroller and send to the RF transmitter which is received by the Receiver and is processed at the receiver end which shifts the cursor in the particular direction. The cursor moves upwards, downwards right and left when there is tilt in the palm of user in upwards, downwards, right and left respectively.

III. Hardware used

A. *Accelerometer(ADXL335)*

It is a device (basically a sensor) used to measure the acceleration. The accelerometer used here is ADXL335, which is a small, thin, low power, 3- axis accelerometer with signal conditioned voltage outputs. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. Bandwidth can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. Now the change in the orientation of hand gesture to which the accelerometer sense is being transferred to ATMEGA16 Microcontroller.[11]

B. ATMEGA16(Microcontroller)

A microcontroller is a single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit.

The ATMEGA16 is a low-power, high-performance advance RISC 8-bit microcontroller with 32K bytes of in-system programmable flash memory. Versatile 8-bit CPU with in-system programmable flash on a monolithic chip, the Atmel ATMEGA16 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many, embedded control applications. [12]

C. RF link:

It is a type of wireless communication used in this device to establish a link between the wireless mouse and the system in which the wireless mouse used. Radio systems needa transmitter to modulate (change) some property of the energy produced to impress a signal on it. Radio frequencies occupy the range from 3 kHz to 300 GHz, although commercially important uses of radio use only a small part of this spectrum.[13].The signal or the sensing function that are governed with the user gesture are being transferred to the computer via USB enabled Interface (a Serial to USB Converter).

D. *USB Enabled Interface:*

Work with 5V and 3.3V Power.
The 3 pin jumper selects power from the PC or an external power source.
Dimensions:
32 mm x 50 mm
JUMPER information:
POSITION 2-3: board will use power from PC serial port +5V.
POSITION 1-2: board will use External Power +3.3V or +5V.

IV. Hardware Implementation:

The hardware of this system comprises many components together to achieve its functionality without any error. The handgesture of the user is recognized by the accelerometer which reads the movement axis of the hand and gives output as voltages. The analog hand gesture is then read by a microcontroller. The built-in analog to digital converter helps to convert the analog hand gesture. The signal from the microcontroller is interpreted as corresponding cursor movement on the computer screen and moves according to the hand gestures of the user.

V. Software Implementation

The software side of the project includes programming in CODE VISION AVR VERSION 3.19. Code vision AVR is a C cross compiler. The program is a native 32 bit application that runs under the Windows 95, 98 and

2000 and Xp operating systems. The C cross compiler implements nearly all the elements of the ANSI C language, as allowed by the embedded system's needs. Integrated development environment and automatic program generator design for the ATMEL AVR family of microcontroller.

VI. Conclusion and Future work

The wireless accelerometer based mouse is designed to make our day to day operations on the PC more convenient and time saving. This introduces entirely different technology in navigation compared to earlier Ball mouse with opt coupler or latest optical image processing based mouse. Simple low cost, low power inertial sensor based mouse with wireless capability will provide ease of use. It can be converted to be useful in 3-d gaming application. It also provides health benefits by preventing a problem of carpeltunnel syndrome caused due to the use of keyboard and mouse. A custom PCB could be used to simplify the physical construction. Higher resolution cursor movement could be attractive for commercialization. The above project can be developed in future to move the cursor using the movement of eyes. The EEG waves (brain waves) can also be used for cursor movement. The accelerometer read the movement axis of the hand and was able to convert the hand gestures of the user to its corresponding voltages. Hence, the proposed device did perform the operations such as hovering of cursor in X-Y domain (horizontal and vertical movement of hand), left click and right click successfully .Final prototype is able to effectively control mouse movement and clicking with user hand gestures. There are many primary input devices, but those are application specific. The proposed system is easy to use for computer applications that are mouse specific. A smaller wearable unit (for example, a single glove without an armband) would be more practical for everyday use. This wearable hand glove system avoids aches, pains and injuries.

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