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A Gyroscopic Mouse for the Specially-Abled

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Abstract:

There are few existing methods which were opted by specially-able people such as computer software and hardware, such as voice recognition programs, screen readers, and screen enlargement applications, help them with mobility and sensory impairments use computer technology.

The proposed device is gyro sensor based, that is, it operates by sensing the movement (rotation) of a body part. It is a module based device with many functions, which are adjustable according to people's comfort. It allows people to work efficiently with the computer.

The device has high sensitivity, that is, it provides controlled movement possibilities. It is easy to install and use on any computer. The device is small, light weight and comfortable for users (physically challenged users). The device connection is wired, using USB- standard interface and wireless, using Bluetooth module, that is, user can choose the mode of connection.

The aim of this project is to introduce a new horizon which could replace the traditional method of controlling the computer using mouse. The proposed device will not only offer a better control method, but it will also allow specially-able people to have an easy and full control of computer. This device is an advanced technical aid for a large group of specially-able people which can be placed on different suitable parts of body.

Keywords ─ **Gyroscope, Arduino, Mobility, Flexible, High Sensitivity**

I. INTRODUCTION

In the current world, it is almost impossible to imagine that someone can live without computers, which is still vastly changing. Due to the swift growth in the technologies, computers are used on an everyday basis by almost everyone, even specially-able people. So it is necessary to make the interaction and usage interface easier for them.

In human-computer interaction the mouse is still the most commonly used input device. Many technologies are implemented on computer mouse to make it more user friendly for everyone including specially-able people. But the technically advanced products are often not easy to use or fitted to use for them.

They need something which is suitable or flexible, that is, can be adjusted according to their comfort. To fulfil their requirements the idea of gyro sensor based mouse is implemented in this proposed project which allows them to adjust the device according to their needs and demands. This device is designed in such a way that it can be placed on different parts of body like hands, head etc.

This proposed device design is based on gyroscope technology, which tracks the motion of hands or head to control the computer. It is a wired and wireless device. Wired device is interfaced over USB and wireless device is interfaced over Bluetooth. [1]

II.   EXISTING SYSTEM

There are some existing devices in the market specifically designed for specially-able people such as cognitive assistance, computer software and hardware. Cognitive assistance, including computer or electrical assistive devices, can help people function following brain injury. Computer software and hardware, such as voice recognition programs, screen readers and screen enlargement applications, help people with mobility and sensory impairments use computer technology.
 Technology comes with advantages and disadvantage. These devices have several advantages such as fast response, accuracy and helpful. But as compared to the advantages, the disadvantages are even more such as expensive, complexity, not flexible and most important stressful for the user. [2]

III.   OBJECTIVE

The objective of this project is to develop a device which is suitable and helpful for the specially-able people to use computer efficiently.

IV.   PROPOSED MODEL

This proposed device overviewed with two modules- the hardware and the software interface.
 The sensor module consists of a gyroscope chip, a microcontroller and a USB or a Bluetooth. This module is wearable on the hand and head depending on the user. It senses the movement of hand and head with the gyroscope sensor, which is then processed by the microcontroller. The processed data is sent to the software interface via USB or Bluetooth.
 The software interface is developed using VB.NET. It receives the processed data, using the data it does the necessary calculation and make decision to move the cursor (pointer) in desire position according to the movement of hand and head. Right and left click is done by voice commands.

V.   METHODOLOGY

The different methods involved in the development of the system are described in this section with the appropriate diagrams.

A. Block Diagram

The system is divided into two modules-

1) *The sensor module*: The sensor module is the main module of this system which is responsible for sensing the movements of hand and head. Power supply of 9 volts is used for this module.
These components are responsible for sensing the change in values, that is, the change in values along the x-axis and y-axis. These values are transferred to the software interface via USB or Bluetooth.
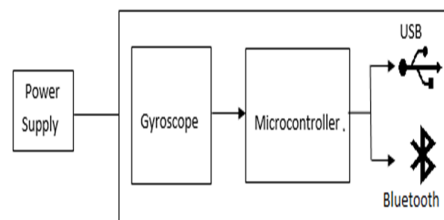

Figure 1. Block diagram of Sensor Module

2) *The software interface*: Software interface is developed on the .NET framework using VB.NET. It receives data from the serial port of the computer. Based on the code, it decides the direction (location/functions) of the cursor (pointer) on the computer screen.
The cursor movement changes speed after every 3 seconds. Voice
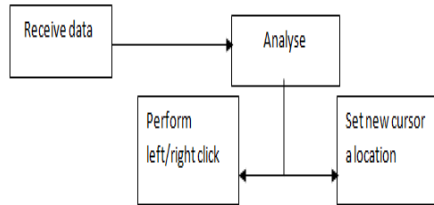
command is given for right click and left clicks.

Figure 2. Block diagram of software interface

B. *Hardware Unit*

The system consist of four hardware components-
- Gyroscope (MPU-605)
- Arduino UNO R3
- Bluetooth (HC-05)
- USB

1) *Gyroscope (MPU-605)*: This sensor combines a 3-axis Micro Electro Mechanical System (MEMS) gyroscope and a 3-axis MEMS accelerometer, which is capable of processing complex 9-axis algorithms, captures the x, y and z channel at the same time, and is very accurate due to the 16-bits analog to digital conversion for each channel. It also removes the cross-axis alignment problems that can occur on discrete parts. The sensor uses the I2C-bus interface with Arduino. [3]
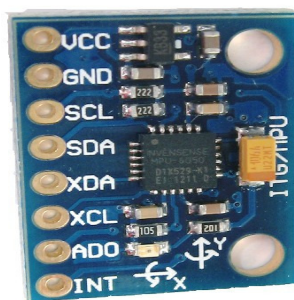

Figure 3. Gyroscope (MPU-605)

Working- In this proposed system only the gyroscope values of the chip are used. It senses the raw values along x,y and z axis and passes it to the microcontroller. It requires power supply of 3-5 volts.

2) *Arduino UNO R3*: This is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as Pulse Width Modulatio outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an In-Circuit Serial Programming header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Operating voltage of the microcontroller is 5V. Contains 32 KB of flash memory enough to store the data for this particular project. [4]
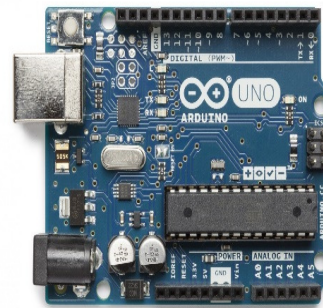

Figure 4. Arduino UNO R3

Working- In this proposed system arduino is used to read the values generated by the gyroscope and process those raw values to determine its two digit code. These two digit code are sent to the software interface via USB or Bluetooth.

3) *Bluetooth* (HC-05): HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless

serial connection setup. It is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with Complementary Metal-Oxide Semiconductor technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mm x 27mm. [5]

Figure 5. Bluetooth HC-05

Working- In this proposed system Bluetooth module is used to transmit the two digit code generated by the microcontroller. Power supply needed is 3 volts. It builts the wireless connection between the system and the computer.

4) *USB interface*: The Universal Serial Bus (USB) is a technology that allows a device to connect with the computer. It is a fast serial bus. It connects different devices using a standard interface. It can provide a small amount of power to the attached device through the USB cord. [6]

Figure 6. USB interface

Working- In this proposed system USB interface is used to sent the two digit code generated by the microcontroller to the serial port of the computer. It builts the wired connection between the system and the computer.
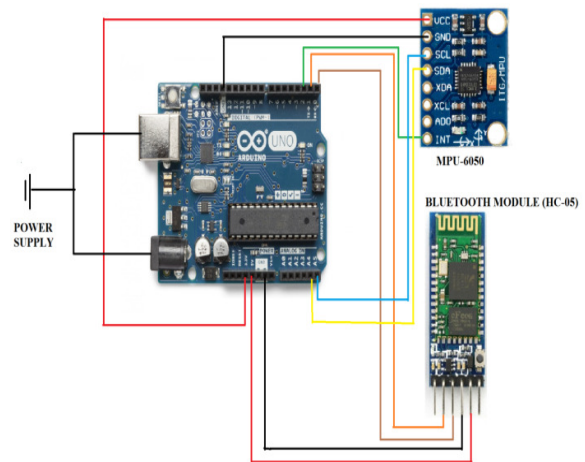
C. *Schematic Diagram*

Figure 7. Schematic Diagram of the device

VI.   OUTCOME

It has been observed that there is no lagging and delay in the movement of cursor on the computer screen up to 10 meters distance. The device is working precisely as thought.

The feedbacks of users about this device were to improve the device reliability. According to users, specially-able people who are not able to type, there is no point for them to use this device. For which there is an inbuilt keyboard which is based

on voice control. It is easy to use for the users.

According to users, depending on external power supply is not efficient, every time there is no charge they can't stop their work and wait till the battery is charged. For this problem, the device is made wired using USB interface. So, there is no need for the users to stop their work and wait. They can connect the device via USB port and continue using the device.

Figure 8. User wearing the device

A. Advantages

After the discussion with the users about this device, the advantages of this device are concluded as:
1) *Reliable*: Easy to adjust for individual user. Addition of the keyboard made it dependable for users who are not able to type.
2) *Efficient*: Wired feature of the device made it efficient when there is no charge in the external power supply.
3) *Mobility*: The device is small and wireless which make it easy to carry.
4) Very easy to install.
5) *High Sensitivity*: There is no lagging and delay of the device.
6) Less Costly.

B. Disadvantages

There are a few disadvantages as:
1) It becomes tiring after sometime but once the user get used to the device, it becomes better.
2) External help is required to put the device on.
3) Might not be very comfortable to wear.
4) Accuracy may vary.

VII.   CONCLUSION

This project is concluded as, a device which is useful for specially-able people in controlling the computer system. The device is easy to install and reliable as it allows users to adjust according to their comfort. It shows that it is possibly to design a small and comfortable computer mouse for them. The device is wireless and wired which make it more efficient to use. The module system is flexible, that is, it can be used by large number of specially-able people according to their need. It can be placed on hand and head. It is controlled by using voice commands.

The device is successfully created and tested. The feedback points given by the users are also implemented.

As the world is changing rapidly, the technology also changes every minute. There is always some scope of future enhancement. In this case, there are few changes which can be implemented in future such as power supply, design of the device and even technology can be changed if there is any other technology better than the one used in this device. Power supply can be made sufficient so that the device become wireless completely. Design of the device can be changed to make it even more comfortable for users.

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