WEARABLE GLOVE MOUSE

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ABSTRACT

This paper presents the design and development of a wireless glove mouse, utilizing the Arduino Leonardo, ADXL345 accelerometer module, flex sensors for left and right clicks, and buttons for scrolling functionality. The aim of this project is to provide an alternative input device for computer interaction that offers increased mobility and intuitive control. The implementation details, including the hardware setup, software programming, and testing procedures, are described. The results demonstrate the successful creation of a functional glove mouse prototype that can be utilized as an innovative input solution for various applications.

Keyword : *Glove Mouse, Arduino Leonardo, ADXL345, Flex Sensor, Wireless Control, Gesture Recognition*

1. INTRODUCTION

The traditional computer mouse, although widely used, has certain limitations in terms of mobility and ease of use. This paper proposes the development of a glove mouse as an alternative input device to overcome these limitations. The glove mouse allows users to control cursor movement, perform left and right clicks, and perform scrolling operations using finger gestures and hand movements. The Arduino Leonardo is employed as the main controller, while the ADXL345 module provides motion sensing capabilities. Flex sensors and buttons are integrated into the glove to facilitate click and scrolling actions. This paper presents the design, implementation, and evaluation of the glove mouse.

2. LITERATURE SURVEY

2.1 Air Mouse Using Bluetooth

D.Singh and A.Sharma," Design and Development of an Air Mouse Using Bluetooth," in Proceedings of the International Conference on Human- Computer Interaction(HCI), 2020. This paper presents the design and development of an air mouse that utilizes Bluetooth technology for wireless communication. The authors bat the attack setup, software programming, and testing procedures involved in creating a functional air mouse prototype.

2.2 Platform-Independent Hand Gesture-Controlled Wearable Mouse Is Being Created Through A Relative Disquisition Using An Accelerometer And Gyroscope

S.Patel et al.," Development of Platform Independent Hand Gesture Controlled Wearable Mouse A relative Study using Accelerometer and Gyroscope," in Proceedings of the IEEE International Conference on Computer Systems and Applications(ICCSA), 2019. This paper explores the development of a platform-independent wearable mouse controlled by hand gestures.The authors compare the performance of accelerometer and gyroscope- predicated sensors for gesture recognition. The study includes a detailed analysis of the attack, software, and experimental results.

2.3 A Wearable Computer Mouse For Amputees Using EMG And Gyro Sensors.

R.Gupta et al.," Wearable Multifunctional Computer Mouse predicated on EMG and Gyro for Amputees," in Proceedingsof the ACM International Conference on Assistive Technologies(ASSETS),2021. This paper presents a wearable multifunctional computer mouse designed specifically for amputees. The authors combine electromyography(EMG) and gyroscope sensors to enable amputees to control the mouse using residual muscle signals and hand movements. The paper discusses the design considerations, performance details, and user evaluation results.

2.4 A Paradigm of Sixth Sense Finger Cursor

Khan and R.Choudhary," A Paradigm of Sixth Sense Finger Cursor," in Proceedings of the International Conference on Human- Computer Interaction(HCI), 2020. This paper introduces the generality of a croquette cursor, a wearable device that allows stoners to control cursor movement through croquette gestures. The authors bat the attack design,software algorithms, and user experience evaluation of the croquette cursor paradigm.

2.5 A Wearable Glove Mouse Using Capacitive Sensing and an Inertial Measurement Unit is Being Developed

Li and colleagues published "Development of a WearableGlove Mouse Based on Capacitive Sensing and Inertial Measurement Unit" in the 2018 Proceedings of the IEEE International Symposium on Wearable Computers(ISWC). This study describes the creation of a wearable glove mouse that makes use of an IMU and capacitive sensing. The design philosophies, sensor integration, and gesture detection algorithms are discussed by the authors. Additionally offered are experimental findings and user opinions.

2.6 Wearable Mouse predicated on Pressure Sensor

Kumar et al.," Wearable Mouse predicated on Pressure Sensor," in Proceedings of the ACM Conference on Design, automation, and Test in Europe(DATE), 2016. This paper introduces a wearable mouse that utilizes pressure sensors to descry croquette movements and gestures.The authors bat the attack performance,software algorithms, and usabilityevaluation of the pressure sensor- predicated wearable mouse.

3. REQUIREMENTS

A. Software Requirements:

Arduino IDE: The Arduino Integrated Development Environment (IDE) is used to program the Arduino Leonardo board, facilitating sensor data acquisition, processing, and command transmission.Sensor Data Interpretation: The software interprets the data received from the ADXL345 accelerometer, mapping it to cursor movements on the screen. The sensitivity and calibration of the accelerometer are taken into account to ensure accurate cursor control.Click Action Recognition: The software analyzes the readings from the flex sensors to detect left and right click actions. By setting appropriate threshold values and implementing logic for click recognition, the software enables seamless mouse clicking.Scrolling Functionality: The buttons integrated into the glove are programmed to provide scrolling functionality. The software interprets button presses to trigger scrolling events, allowing users to scroll up and down the screen.HC-05 Communication: The software establishes a connection between the glove mouse and the computer through the HC-05 Bluetooth module. It enables wireless transmission of sensor data and receives commands from the computer to perform specific actions.

Fig 1: Arduino IDE

Fig 2: Arduino IDE Editor

B. Hardware Requirements:

1) Arduino Leonardo

The Arduino Leonardo is a microcontroller board grounded on the ATmega32U4 chip. It serves as the main regulator for the wireless glove mouse system. The Leonardo board is responsible for recycling the detector data entered from the accelerometer, flex sensor, and buttons. It executes the necessary algorithms and sense to interpret the detector inputs and induce corresponding commands for cursor control, click conduct, and scrolling. The Arduino Leonardo also handles the communication with the HC- 05 Bluetooth module totransmit the detector data wirelessly to the computer.

Fig 3: Arduino Leonardo

2) ADXL345 Accelerometer

The ADXL345 is a three- axis accelerometer detector used in the glove mouse system. It measures acceleration in three confines, allowing precise shadowing of glove movements. The accelerometer captures the exposure and movement of the glove, converting them into digital signals that the Arduino Leonardo can reuse. By assaying the data from the ADXL345, the system determines the cursor's direction and speed, enabling accurate control of the cursor on thecomputer screen

Fig 4: ADXL345 Accelerometer

3) Flex Sensor

Flex sensor are bendable resistive detectors integrated into the glove to descry cutlet flexion. They change their resistance grounded on the degree of bending, furnishing a dimension of cutlet movement. In the glove mouse system, flex sensor are used for left and right click conduct. When a cutlet is flexed to a specific threshold, the resistance of the corresponding flex detector changes, indicating a click action to the Arduino Leonardo. This allows druggies to perform mouse clicks by simply bending their fritters, furnishing a accessible and intuitive commerce system.

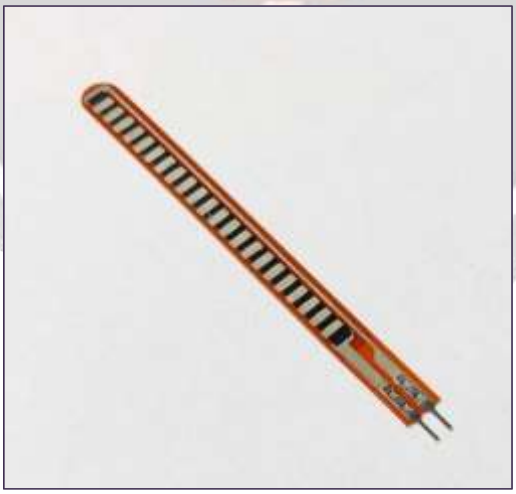

Fig 5: Flex Sensor

4) Push Button

Buttons are mechanical switches integrated into the glove to enable scrolling functionality. The buttons are strategically placed on the glove to allow druggies to press them comfortably. The Arduino Leonardo detects button presses and translates them into scrolling commands. By pressing the corresponding button, druggies can scroll the content on the computer screen either overhead or down. The buttons give an fresh means of commerce, enhancing the versatility of the glove mouse system.

Fig 6: Push Button

5) HC-05 Bluetooth Module

The HC- 05 Bluetooth module facilitates wireless communication between the glove mouse and the computer. It establishes a Bluetooth connection with the computer, enabling the transmission of detector data and entering commands. The Arduino Leonardo communicates with the HC- 05 module using the periodical communication protocol. The module wirelessly sends the reused detector data to the computer, allowing real- time cursor control and other conduct. also, commands entered from the computer, similar as configuration settings or mode selection, are transmitted from the HC- 05 module to the Arduino Leonardo for applicable action.

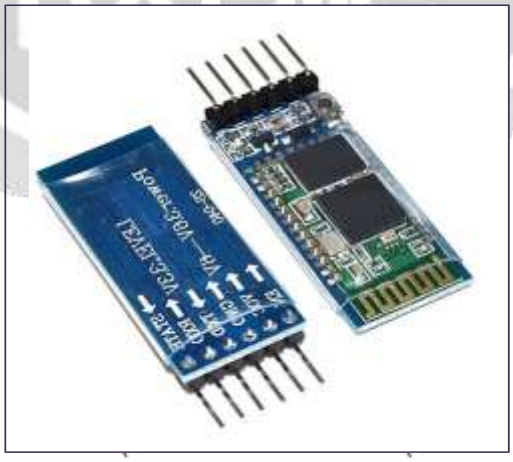

Fig 7: HC-05 Bluetooth Module

4. METHODOLOGY USED

HC-05 Is Used To Connect Two Arduino By Bluetooth

The HC-05 must be established as a master device and configured to pair with any address before the power to the module is turned on.Make sure we are in AT mode first. Hit Send after entering AT. You must hear "OK."

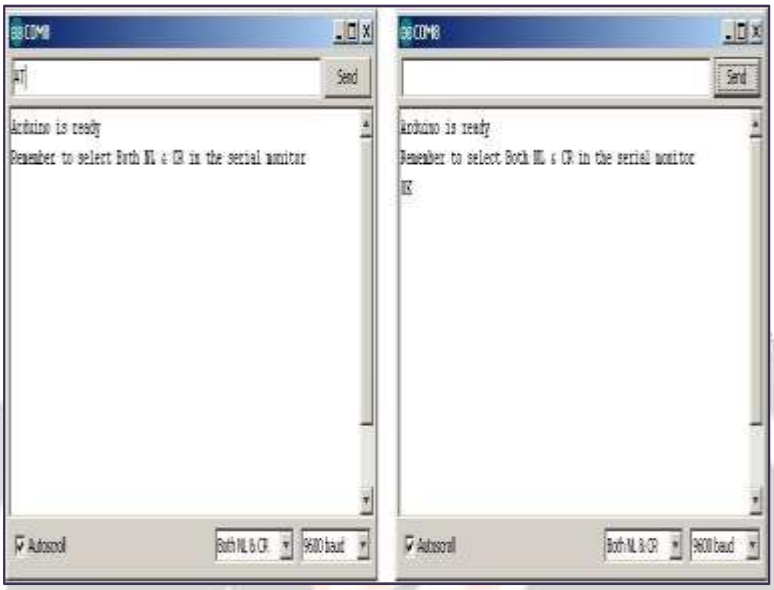

Fig 8: Entering AT Command

Use the AT+ROLE command to designate the HC-05 as themaster device: AT+ROLE=1 gives you another “OK” AT+CMODE=1 instructs the HC-05 to pair with any address.You should hear another "OK" soon"Switch off and on theHC-05's power. The HC-05's LED will rapidly blink twiceevery two seconds after it has made contact with the HC-05.The HC-05's LED will blink twice every second while itsearches. The HC-05's LED has to be turned on all the time. Now, everything you type into one of the serial monitors willbe sent via Bluetooth to the other Arduino and shown on theother serial monitor after that.

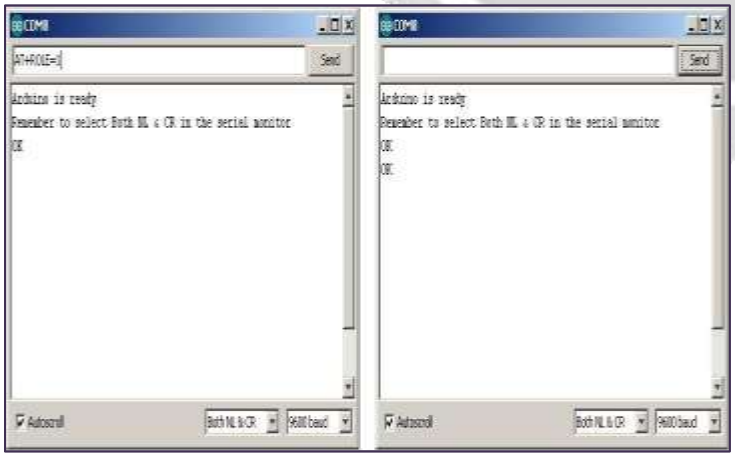

Fig 9: Entering AT +ROLE=1

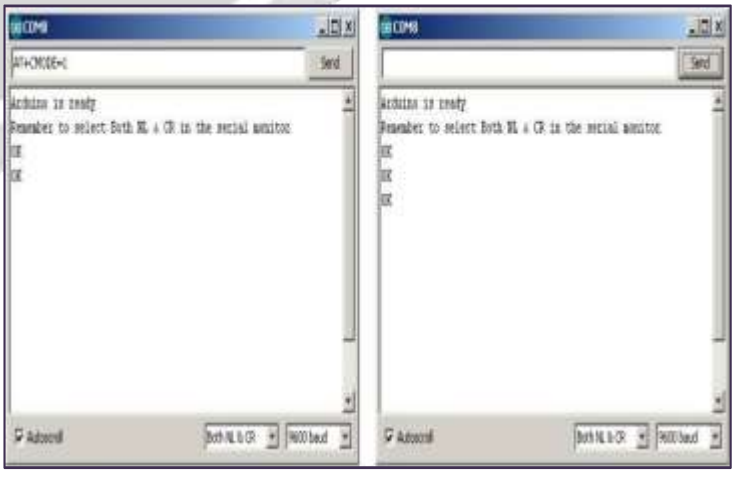

Fig 10: Entering AT +CMODE=1

Fig 11: Configuration Successful

5. BLOCK DIAGRAM

A. Transmitter

The parts of the wireless glove mouse system and how they are connected are shown in the transmitter block diagram.The primary controller for the transmitter part is the Arduino Leonardo. It processes the data in accordance with the input it gets from numerous sensors.The Arduino Leonardo is coupled with the ADXL345 accelerometer. It gives real-time information on the movement of the glove while measuring acceleration along three dimensions.The Arduino Leonardo is attached to the glove's built-in flex sensors. These sensors track the bending or flexing of fingers and output analogue signals in response.On the glove, buttons that are connected to the Arduino Leonardo are positioned in a thoughtful manner. The user can scroll up or down with these buttons, which provide scrolling capabilities.The receiver (computer) and glove mouse may communicate wirelessly thanks to the HC- 05 Bluetooth module. It is linked to the Arduino Leonardo, making it easier to send and receive commands and sensor data

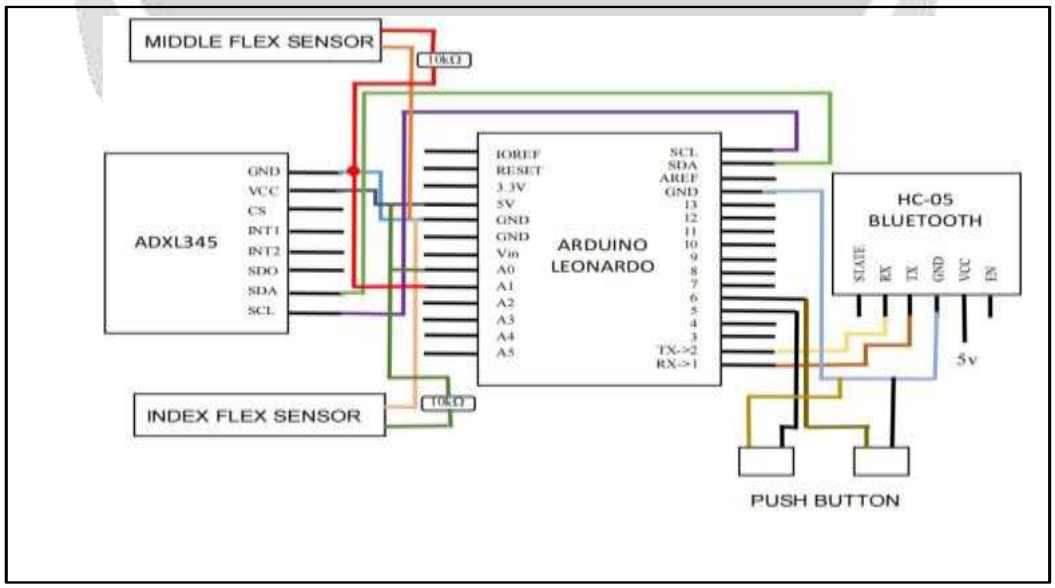

Fig 12: Transmitter

B. Receiver

The receiver block diagram represents the components and their interconnections in the receiver section, which is usually the computer receiving signals from the glove mouse.The HC-05 Bluetooth module is connected to the receiver(computer) and receives the wireless signals transmitted by the transmitter section.The Bluetooth receiver in the computerreceives the signals from the HC-05 Bluetooth module and converts them into digital data that can be processed by the computer.The computer interface connects the Bluetooth receiver to the computer's processing unit. It allows the received signals to be processed and interpreted by the computer softwareThe computer software processes thereceived signals and translates them into cursor movementson the computer screen. The data from the ADXL345 accelerometer helps determine the direction and speed of the cursor movementThe computer software recognizes the button presses received from the transmitter section and triggers scrolling events on the computer screen accordingly.It enables the user to scroll up or down based on the button press signals.The power supply in the computer ensures that all the components in the receiver section receive the requiredpower for their operation.

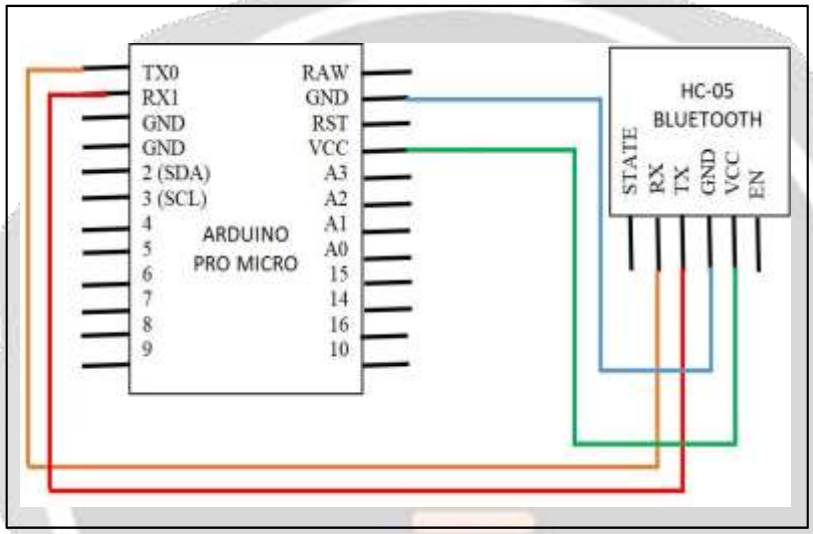

Fig 12: Receiver

6. IMPLEMENTATION

The glove mouse was successfully developed and tested on a computer running Windows 10. The device was tested for its ability to control cursor movement, left and right-click actions,and scrolling functions. The glove mouse was found to be accurate and responsive, providing users with a natural and intuitive way of interacting with the computer.

1) Cursor Movement

To implement the cursor movement, we used the ADXL345 accelerometer sensor. The sensor data was read by the Arduino Leonardo and processed to obtain the acceleration values in x, y, and z-axis. These acceleration values were thenintegrated twice to obtain the position of the cursor. The final position was then transmitted to the computer via the HC-05 Bluetooth module.

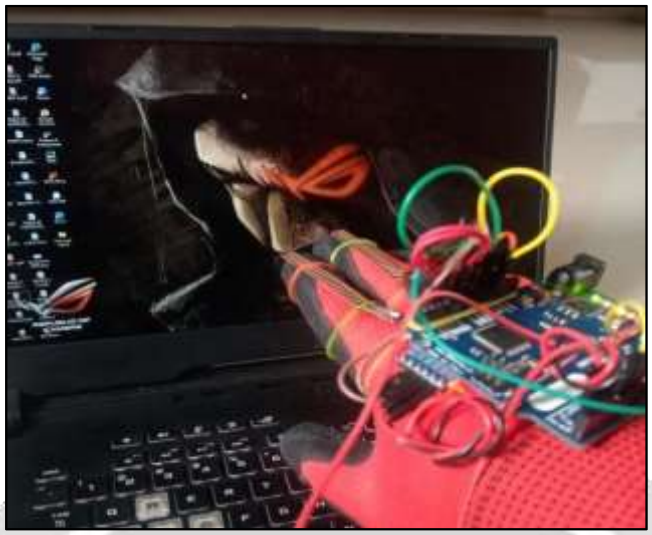

Fig 13: Cursor Movement

2) Left And Right Click

For left and right click operations, we used flex sensors. The flex sensors were placed on the index finger and the thumb of the glove. The flex sensors detect the bending of the finger and generate analog voltage proportional to the degree ofbending. This analog voltage was read by the Arduino Leonardo and processed to determine whether a left-click or a right-click was required. If the voltage value exceeded the threshold value, a left-click or right-click command was transmitted to the computer via the HC-05 Bluetooth module.

Fig 14: Right Click

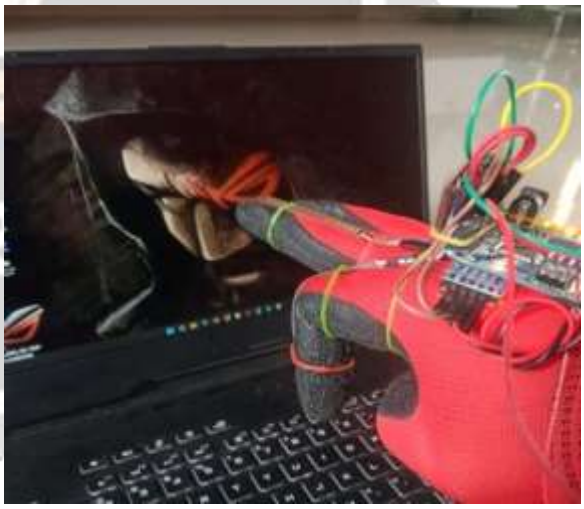

Fig 15: Left Click

3) Scrolling

To implement the scrolling operation, we used two push buttons. One button was used for scrolling up, and the other button was used for scrolling down. When a button was pressed, the corresponding command was transmitted to the computer via the HC-05 Bluetooth module.

Fig 16: Scrolling

7. CONCLUSION

Finally, the proposed glove mouse system exemplifies a fresh method of computer user interface. Accurate and dependable operation of the cursor on the screen is made possible by the integration of several sensors, including buttons, flex sensors, and accelerometers ADXL345 as well as the Arduino Leonardo and HC-05 Bluetooth module. Particularly for those with physical limitations, the technology offers a simple and natural approach to manipulate the mouse cursor.However, there are still a number of issues that need to be resolved. The precision of the cursor control, especially when dealing with little movements, was one of the implementation's problems. The existing technology needs to be calibrated to some extent in order to attain the highest degree of accuracy, which might be challenging for some users.

8. FUTURE ENHANCEMENT

Machine learning techniques may be included in future improvements to increase accuracy and decrease the requirement for calibration. A stronger sensation of control and feedback for users when engaging with the system may also be offered via the usage of haptic feedback.Overall, the suggested method is a promising first step towards creating user-friendly and organic human-computer interactions. It has the potential to significantly improve the quality of life for those with physical limitations and other people who could profit from an alternate mouse control mechanism with future development.

9. REFERENCE

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