WIRELESS KINETIC GAUNTLET CONTROLLER

KANISH.R,
DEPARTMENT OF COMPUTER SCIENCE,
RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI

Mrs.M.Shanthalakshmi,
Assistant professor , DEPARTMENT OF COMPUTER SCIENCE, RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI.

Abstract: This paper describes a "kinetic gauntlet controller" that does not require any contact to the surface for its operation. This device shall be operable in two modes - 2D and 3D. In the 2D mode, the movements of the gauntlet shall be recorded in 2 dimensions, which will enable the full functionality of a mouse pointer on the screen. The 3D mode will assist 2D mode by further enhancing the mouse pointer functionality for functions such as 'scrolling'. 3D mode can be utilized for various applications such as 3D images or games and for 3D interfaces with the PC. The project setup consists of the ESP32 module interfaced with the MPU6050 sensor which is used for motion tracking which acts as a controller for the mouse pointer. By tracking the motion of the sensor in three dimensions, the navigation can be controlled. The sensor reads the data in spherical polar coordinates, the data is split into 2 independent data for different purposes when used, from the split data 2 of the coordinates transformed to x and y coordinates for pointer moment i.e converts the spherical polar coordinates into planar coordinates for x and y moment and the 3rd axis data is used for scrolling. ESP32 microcontroller uses low energy Bluetooth technology(BLE) to send the controller data to the computer. And this does not require any wire connection or a USB dongle to transfer data unless the computer does not have Bluetooth inbuilt. Any computer with a Bluetooth functionality can use this controller.

Keywords- **3d, motion tracking, spherical polar coordinates, mouse pointer, microcontroller, BLE.**

1. INTRODUCTION

More than 45 years the standard PC mouse sustains a great demand in usage and recent innovations in 3D technologies are testing the limits of the mouse's design and robustness. A scroll wheel has been added to the mouse to compensate for the two-dimensional nature of the mouse, which can traverse the third dimension when needed. But The mouse demands mandatory contact with the surface to be operational. To calculate mouse coordinates on the screen. The surface is taken as a reference. This design doesn't allow free movement of hands for the mobility of the cursor. Moreover, this design does not allow for simultaneous movement in three dimensions, nor does it have a high resolution along the depth axis. "Kinetic gauntlet controller" is a human interface device that allows the user to interact with the PC in 2 and 3 Dimensions, without the need for any contact surface for cursor mobility. Here, the spherical polar coordinates may be used as per the application. Sensor MPU6050 is paired with esp32 such that the sensor tilt among the particular 3 axes is monitored and given as input to ESP32 which converts it to planar coordinates and sends the input to the computer for the navigation purposes. The esp32 is interfaced as an HID mouse, it uses BLE technology to send data to the computer which is then used to move the cursor. The Touch capacitance is used for left-click and right-click functions. This device provides freedom of movement as it can be used in 3d space and doesn't require a surface for operation.

2. OBJECTIVE and MOTIVATION

2.1 OBJECTIVE

Its aim is to provide the user the freedom of moment to use the controller in free space instead of placing the hand on the same surface for a long time and "more natural and simple ways to interact with digital 3D content". Kinetic Gauntlet features are not only applicable to the graphic simulation and 3D objects but they will briefly change the whole world of manufacturing and constructing technology. It is also applicable to other areas of science like biology, chemistry, learning and also entertainment.

2.2 MOTIVATION

The conventional mouse(2-D) has evolved drastically throughout the year from the classic trackball mouse to the popular and precise laser mouse. However they still require a surface to navigate the pointer through both the axes . Hence it cannot be exactly used from anywhere the user wishes to use. There are a number of ailments that can come from using your mouse incorrectly or for a longer period of time , from sore wrists to aching shoulders. To develop they may take years, however once present, it could be difficult to reverse. By allowing pointer navigation through all three axes , the "3D space controller" bridles this problem and thereby becomes more convenient for daily usage gaming platforms and CAD applications.

3. LITERATURE SURVEY

3.1 The Design of Wireless Air Mouse Based on LPC54100

For navigation and control, a device mounted with MPU-6050 sensor and few buttons are used here. The buttons are used for left click , right click etc. Motion tracking is done using MPU-6050 sensor and navigation and other purposes are done via bluetooth by feeding the coordinate values as input to the system. Data is received, processed and sent to the machine with the help of a usb component that is connected to the computer. For authentication, it uses data and coding algorithms. Since this mouse can be used even in air rather than just on a surface like a table, this device has better advantages than wireless mouse which already exist. Hence it gives the advantage of carrying it anywhere in order to use. Rather than the conventional 2D navigation, this mouse can be used for 3D navigation and control. Since this device cannot be held for too long , it should be placed somewhere before changing the hand to a keyboard as it cannot be used while using a keyboard.

3.2 2D and 3D Air Mouse

This paper presents an air mouse, which wouldn't need any contact surface for its operation. The two modes by which single devices are operated are 2D and 3D modes. Full functionality of a mouse pointer can be enabled by using the 2D mode by recording the mouse movements in 2 dimensions. The mouse pointer functions such as zoom in and zoom out are enhanced when the 3D mode assists the 2D mode . Various applications such as 3D images and games which require 3 dimensional interface with the PC can utilise this 3D mode. However for receiving input, it needs to be in front of the sensor.

3.3 MAGIC GLOVE- WIRELESS HAND GESTURE HARDWARE CONTROLLER

The interface between humans and computers isn't very smooth. An abundance of input methods have been formulated, keeping in mind the need to remove the barrier between humans and the systems they interact with. These include, but are not limited to: mouse, keyboard, game controllers, touch screens and joysticks. Sadly, these devices haven't been effective in bridging the gap between man and machine. We intend to tackle this hindrance, through the Magic Glove control system, where the user gains the ability to employ human motions to control a hardware device. This device will capture the hand gestures of the user, taking advantage of a myriad of sensors and uses that information to control a device - in this case, a modified RC car. This paper aims to capture simple hand movements through the Magic Glove and implement that input to control a modified RC car using wireless means. Controlled variables include steering, lights, speed and sounds using a combination of force, flex and gyroscopic sensors. Since the Magic Glove outputs a continual control signal, multiple variables are controlled simultaneously. The results of testing have shown that novice users were able to wear the glove and control the car with limited instructions. With further upgrades and improvements, there is a strong possibility of completely curbing the learning curve. The level of functionality of this device is minimal and it is still in a development state.

3.4 V-Glove A 3D virtual touch interface

Traditional interaction devices, like mouse and keyboard do not attune very well to immersive environments, as they're not ergonomically designed for it. These devices are conformed to work on desks and hence are not exactly helpful when the user wants to operate while moving. In addition, in the present interaction model for immersive environments, which is based on wands and 3D mice, a change of context is required every time, to shift to the execution of a non-immersive task. These constant context changes between immersive and 2D desktops result in a break in the user interaction with the application. The primary focus of this work is to create a device that maps a touch interface in a virtual reality enveloping habitat. A wireless glove (vGlove) was developed so as to achieve interaction in a 3D virtual reality immersive environment and it has two main functionalities: To track the position of the user's index finger and vibrating the fingertip when it reaches an area mapped in the interaction space to simulate a touch feeling. Qualitative and quantitative analysis were performed with users to evaluate the v-Glove, comparing it with a gyroscopic 3D mouse. This uses a very complex mechanism and should be used only in a confined space and in front of the camera sensor.

3.5 Evaluation of Three Wearable Computer Pointing Devices for Selection Tasks

This paper shows us the outcome of an inquiry comparing three easily available pointing devices (a trackball, gyroscopic mouse and Twiddler2 mouse) performing selection tasks for use with wearable computers. The experiment involved 30 members carrying out the selection tasks with the three pointing devices while wearing a wearable computer on their back and using a head-mounted display. The error rate and time to accomplish the selection of the circular targets was measured. When inspecting the results, the gyroscopic mouse showed the fastest mean time for selecting the targets, while the trackball performed with the lowest error rate. By considering this as a base idea, this project is carried on.

3.6 GEST

Gest is a device worn in hand that allows you to control your mobile device or computer with your hand gestures. Gest controller lets you work with your hands in a more intuitive way. You can switch between apps just by twitching your finger and also point at your screen to move the mouse around. Twist your palm to adjust sliders in Photoshop. You can rotate a 3D object by literally grabbing it and rotating your hand.

4. EXISTING SYSTEM AND ITS LIMITATIONS

Mouse :-

A mouse is a data input device that's used with a computer. Moving a mouse along a flat surface can move the mouse pointer to different items on the screen. Items are often moved or selected by pressing the mouse buttons (called clicking). But it can control only the 2d view(x and y axis) and may only be used on a surface.

SpaceMouse:-

This device provides a natural and comfortable way to interact with digital content in the most popular CAD and creative applications making it easier to focus on your design and detail rather than your software. But this device needs a surface for its operation.

XBOX Kinect :-

It is a motion sensing input device and originated as a means to eliminate the game controller from Microsoft's Xbox video game hardware, competing with the Nintendo Wii's own motion-sensing capabilities, hoping to draw a larger audience beyond traditional video game players to the Xbox. But can be used only in front of a camera sensor and very few functionality.

5. Proposed System

By tilting the controller in any one of the axes moves the mouse pointer on the screen with its respective axis. This device provides freedom of movement as it can be used in 3d space and doesn't require a surface for operation. Wireless BLE technology is used so no need to use it in a confined space. Can be useful for 3d applications as this gives 3 axis coordinates as input. Can be used with any device with bluetooth.

The proposed system consists of a ESP32 microcontroller with wifi and bluetooth inbuilt. And a 6 axis accelerometer and gyroscope sensor MPU6050 is interfaced with the microcontroller. The ESP32 acts as a HID controller device and connects with the system. The user must be equipped with the controller in their hand and if the controller is paired and connected to the system , ESP32 will emit a blue light until the connection is live with the system. The ESP32 with the help of MPU6050 tracks the motion of the hand which is equipped with the controller and converts the spherical polar coordinates to the respective planar coordinates and sends it to the system as an input through BLE technology. The BLE technology is used so that the ESP32 consumes less power while transmitting the data. It also has 3 touch capacitance sensors for other mouse/controller functions like left click, right click, etc.

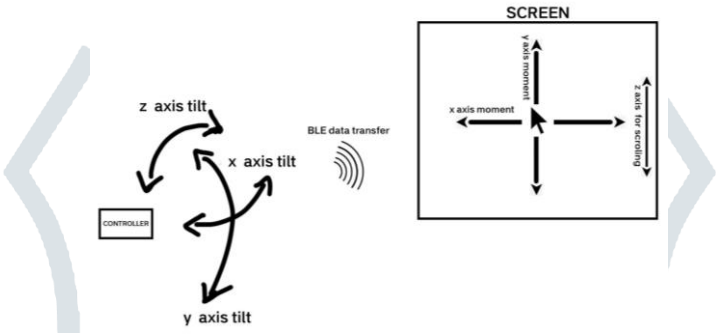

Figure 1. Proposed system

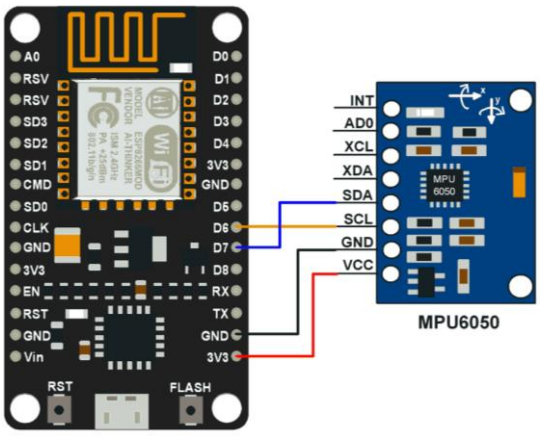

Figure 2. Interfacing mpu6050 with esp32

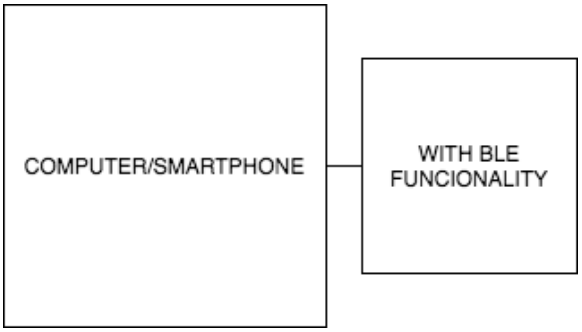

Figure 3. Architecture diagram 1(system)

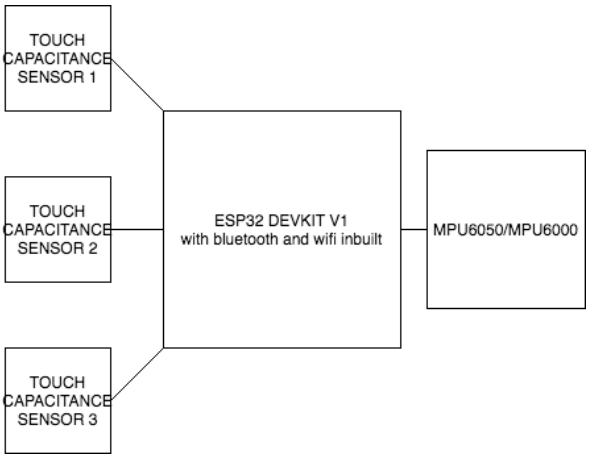

Figure 4. Architecture diagram 2(controller)

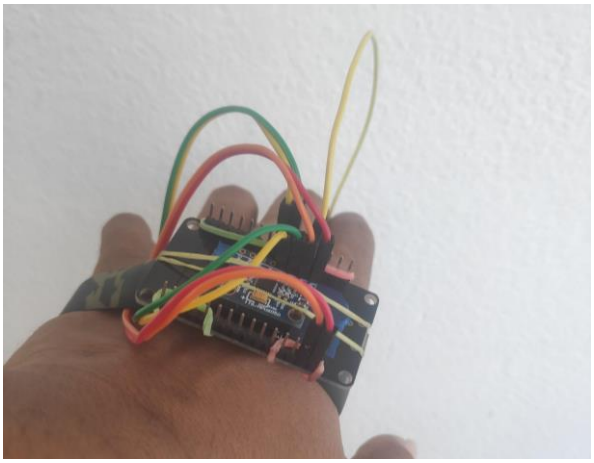

Figure 5. Working Prototype

6. Modules used in the controller

6.1 ESP32

ESP32 microcontroller that has Wifi, Bluetooth, Ethernet and Low Power support in one chip. It also consists of integrated antenna and RF balun, power amplifier, low-noise amplifiers, filters, and power management module. the whole solution takes up the smallest amount of printed circuit board area. This board is employed with 2.4 GHz dual-mode Wi-Fi and Bluetooth chips by TSMC 40nm low power technology, power and RF properties best, which is safe, reliable, and scalable to a spread of applications.

6.2 MPU6050

The MPU-6050 devices incorporate a 3-axis accelerometer and a 3-axis gyroscope on an equivalent silicon die, alongside an imminent Digital Motion Processor™ (DMP™), which processes complex 6-axis MotionFusion procedures. The device can access surface magnetometers or other sensors through a supplementary master I²C bus, allowing the devices to congregate a full set of sensor data without interference from the system processor.

6. FUTURE ENHANCEMENT

This can be further enhanced by adding another hand extension for more functionality like a keyboard without the presence of a materialistic keyboard by just virtualizing a keyboard on a free space and virtually mapping the keys as in the QWERTY keyboard and the keys can be virtually pressed by moving fingers with virtually keeping the palm as the centre. This can also be enhanced with more gestures for more functionality and also extend its compatibility for interfacing with more devices apart from computers like remote control devices, etc.

6.1 CONCLUSION

To conclude this device can be used by anyone as a replacement for a mouse as it provides freedom of movement in the free space. This can be used anywhere regardless of the angle. In addition to freedom of movement in free space this also unlocks the functionality of the third dimension as it takes all three dimensions's data from the sensor to process and to give the input. So this can Extravagantly change the way we control the computer and it can be very useful in 3d applications, and can be also used well in gaming as this provides free movement in any space to any extent.

7. REFERENCES

[1] The Design of Wireless Air Mouse Based on LPC54100 by Kaiyu Wang* , Wenjun Zeng1 , Chi Ma1, Chunyu Cheng1 , Peng Sun1 , Lin Wang1 , Wendong Cai1

[2] 2D and 3D Air Mouse by Anand Bora, Abrar Chapalgaonkar, Nikhil Dalshania and Aditya Bhongle

[3] MAGIC GLOVE- WIRELESS HAND GESTURE HARDWARE CONTROLLER by Akshay Dekate, Anam Kamal, Surekha K.S.

[4] V-Glove A 3D virtual touch interface by Paulo Gallotti, Alberto Raposo, Luciano Soares

[5] Evaluation of Three Wearable Computer Pointing Devices for Selection Tasks by Joanne E. Zucco , Bruce H. Thomas , and Karen Grimmer

[6]Gest controller., website:- www.gest.co