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Tri-Axis Motion Detection using MEMS for Unwired Mouse Navigation System in the Future Generation Machines

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Abstract: The Human-Computer Interaction (HCI) is a field in which the developer makes a user friendly system. In this paper, a real-time Human-Computer Interaction based on the hand data glove gesture recognition is proposed. This paper presents a wearable prototype model for Hand gesture recognition system using MEMS which is capable of recognizing eight hand gesture, based on the signal from 3-axes MEMS accelerometer. The accelerations of a hand motion in three perpendicular directions are detected by accelerometers and acceleration values were transmitted to microcontroller. An automatic gesture recognition algorithm is developed to identify individual gestures in a sequence. Finally, the gesture is recognized by comparing the acceleration values with the stored templates. According to recognized gestures, respective commands are performed. HCI is becoming more and more natural and intuitive to be used. The important part of body that is hand is most frequently used as interaction in digital environment and thus complexity and flexibility of motion of hand is a research topic[5]. The gestures classified are clicking, dragging, rotating, pointing and ideal position. Recognizing these gestures relevant actions are taken, such as air writing and 3D sketching by tracking the path. The results show that glove used for interaction is better than normal static keyboard and mouse as the interaction process is more accurate and natural. Also it enhances the user's interaction and immersion feeling by eye blink sensor.

Keywords: HCL, MEMS accelerometer/sensor, Eye blink sensor, Zigbee communication

I. INTRODUCTION

Gesture recognition has been a research area which received much attention from many research communities such as human computer interaction and image processing. The increase in human-machine interactions in our daily lives has made user interface technology progressively more important. Physical gestures as intuitive expressions will greatly ease the interaction process and enable humans to more naturally command computers or machines [1].

A. EXISTING SYSTEM

Most of existing systems in the gesture recognition follows image-based approaches. It requires sophisticated image processing platforms .Mostly cameras were used as input devices. Object needs to be present in front of the cameras for capturing gestures, which limits the mobility. Power consumption is a challenging one. Several other existing devices can capture gestures, such as a "Wiimote," joystick, trackball and touch tablet. Some of them can also be employed to provide input to a gesture recognizer.

But sometimes, the technology employed for capturing gestures can be relatively expensive, such as a vision system or a data glove [2]. There are mainly two existing types of gesture recognition methods, i.e., vision based and accelerometer and/or gyroscope based.

B. PROPOSED SYSTEM

To overcome the limitations such as unexpected ambient optical noise, slower dynamic response, and relatively large data collections/processing of vision-based method [3], and to strike a balance between accuracy of collected data and cost of devices, a Micro Inertial Measurement Unit is utilized in this project to detect the accelerations of hand motions in three dimensions.

The proposed recognition system is implemented based on MEMS acceleration sensors. Since heavy computation burden will be brought if gyroscopes are used for inertial measurement [4], our current system is based on MEMS accelerometers only and gyroscopes are not implemented for motion sensing.

Fig. 1 shows the system architecture of the proposed gesture recognition system based on MEMS accelerometer. It was human section where the gestures are passed to PC section.

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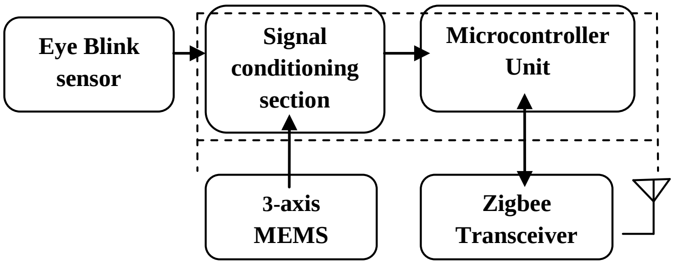

Fig.1. Proposed System Architecture or human section

Fig. 2 represents the personal computer section, in which the signals transverse by the human section like hand gestures, eye blinking are performed output at this section itself.

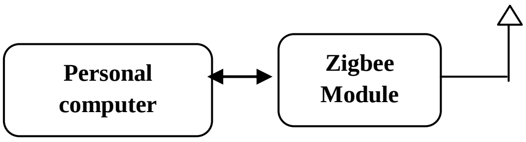

Fig. 2: PC Section

The details of the individual steps are described below. The sensing device senses acceleration in three axes .Those sensed signals are conditioned and given to the controller circuit. The system uses accelerometers to detect the user's hand tilt in order to direct mouse movement on the monitor. By clicking on the mouse it is activated by the user's eye blinking through a sensor.

II. HARDWARE IMPLEMENTATION

A. Working of System

Cursor can be moved with the help of head movements. 3-Axis Accelerometer will send the information about movement direction to Microcontroller. Microcontroller then passes the actual information to encoder. After Encoding it sends information using TX.

Zigbee receiver will decode the received information. Microcontroller sends to PC through RS232 cable. It will perform the operation like operation for selecting any documents with the help of eye blink.

B. ARM 7

In this project, an ARM7 processor was used for controlling the kit. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications. ARM7 processor has so many models to use in this project, LPC2148 Microcontroller was used.

Fig. 3. ARM7 LPC2148

a) LPC2148 Microcontroller

The Fig. 3 ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

III. NAVIGATION TECHNIQES

A. MEMS

The MEMS sensor is interconnecting with the microcontroller unit. The MEMS sensor function it is supported for the 3 axis direction. MEMS sensor is used to identify the hand gesture movements.

a) **MEMS features**

- Low Selectable Sensitivity (1.5g/2g/4g/6g)
- Current Consumption: 500 Ìa
- Sleep Mode: 3 ìA
- Low Voltage Operation: 2.2 V – 3.6 V
- 6mm x 6mm x 1.45mm QFN
- High Sensitivity (800 mV/g @ 1.5g)
- Fast Turn On Time
- Integral Signal Conditioning with LPF.
- Robust Design, High Shocks Survivability
- Pb-Free Terminations
- Environmentally Preferred Package
- Low Cost

B. Eye Blink Sensor

In this project eye blink sensor was used to open selected folder which was selected by MEMS sensor. This switch is activated when the user blinks their eye. It allows individuals to operate electronic equipment like communication aids and environmental controls hands-free. Each blink of the eye is detected by an infrared sensor, which is mounted on dummy spectacle frames. The eye blink switch can be set up to operate on either eye and maybe worn over normal glasses. The sensitivity of the switch can be adjusted to the user's needs and involuntary blinks are ignored. The sensor is connected to a hand-held control unit with a rechargeable battery.

IV. COMMUNICATION TECHNIQUES

Zigbee module

In this project, zigbee module was used to transmit signal from human section to pc section. Here in this project, zigbee works as transmitter at human section i.e. system module where the data/signals which are captured by MEMS, eye blink are transmitted. At PC section zigbee works as receiver, which is used to collect the data/signals from human section. Zigbee works as both receiver and

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transmitter operation according to the application. The flow of data in zigbee was illustrated in Fig. 5. The zigbee/XBee-PRO RF Modules are designed to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote devices.

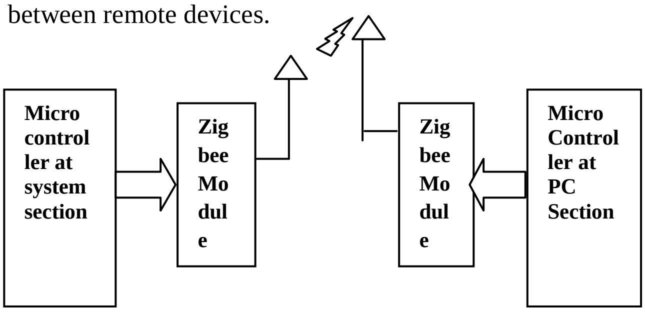

Fig. 5. Data flow diagram for Zigbee

V. FLOW CHART

The flow Chart of wireless mouse using MEMS is shown in Fig. 6. It makes use of MEMS sensor for selecting the directions of curser movement.

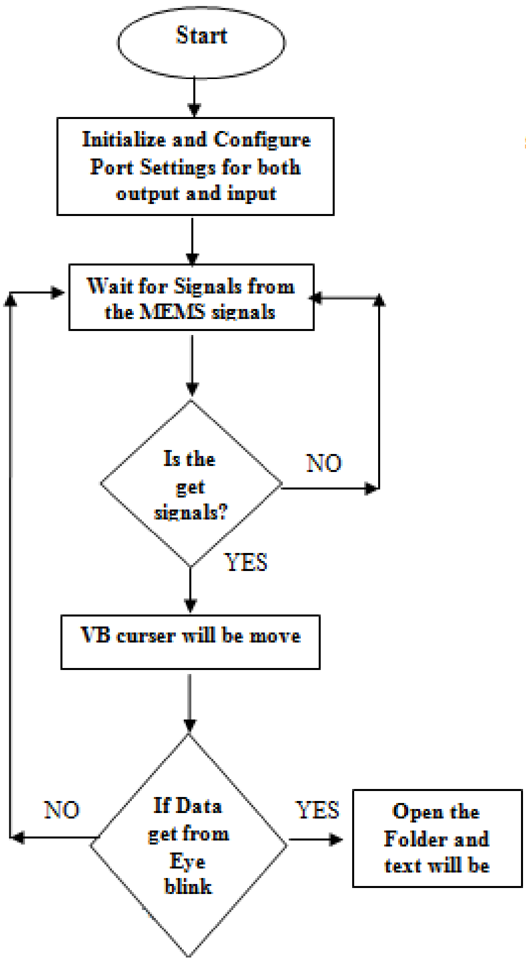

Fig. 6. Flowchart for wireless mouse using MEMS

VI. RESULTS

The working code was writen in visual basic software. MEMS sensor used in this progarm to get a 3 dimensional movement besides sensitivity, performance and accuracy. The code is then run to select the icon in the windows display. In Fig. 7, the first step of progarm is performed i.e. a window was opened in which some selected icons are displayed.

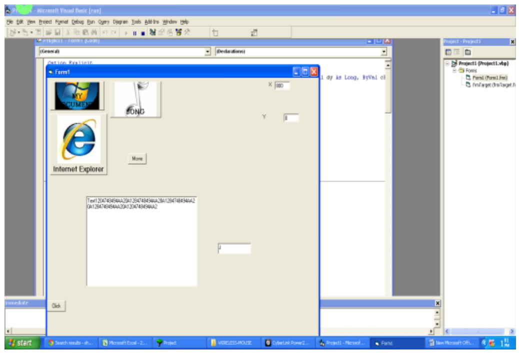

Fig. 7. Choosing Folder 1

In Fig. 8, the curser movement was observed and selection process is done.

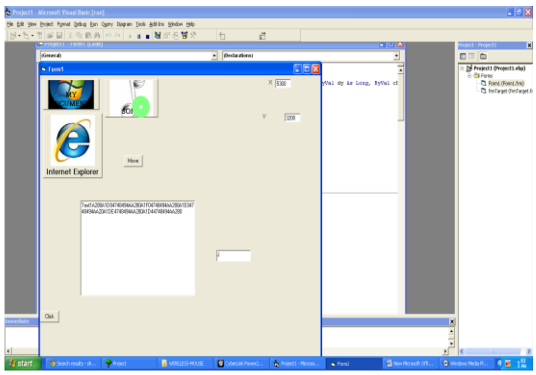

Fig. 8. Choosing Folder 2

In Fig. 9, the selected icon was opened.

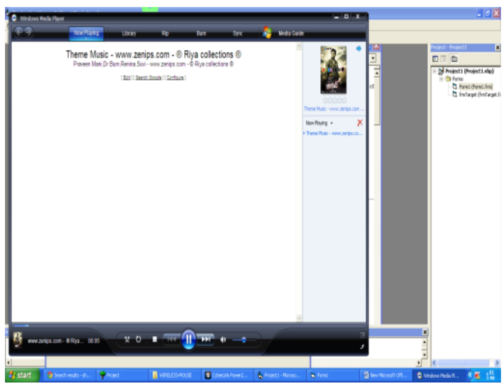

Fig. 9. Opening Folder

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VII. CONCLUSION

In this paper, MEMS sensor was used to operate effectiveness of pointing and scrolling on wireless device interfaces. The results indicate that pointing and scrolling can be effectively done using MEMS sensor. In this project eye blink sensor is also used to operate opening of a file or document. This paper will be very effective and accurate using of both MEMS and eye blink sensors as a wireless mouse for future generation machines.

REFERENCES

[1] A.Alice Linsie, J.Mangaiyarkarasi, "Hand Gesture Recognition Using Mems For Specially Challenged People", International Journal of VLSI and Embedded Systems-IJVES, Vol. 04, Issue 02; pages: 238 -241, March - April 2013.
[2] T. Yang, Y. Xu, and et al, "Hidden Markov Model for Gesture Recognition", CMU-RI-TR-94 10, Robotics Institute, Carnegie Mellon Univ.,Pittsburgh, PA,Vol. 03, issue 01, 1994.
[3] S. Zhou, Q. Shan, F. Fei, W. J. Li, C. P. Kwong, C. K. Wu et al, "Gesture recognition for interactive controllers using MEMS motion sensors," Procededing. IEEE International Conference Nano /Micro Engineered and Molecular Systems, pages: 935–940, 2009.
[4] S. Zhang, C. Yuan, and V. Zhang, "Handwritten character recognition using orientation quantization based on 3-D accelerometer," 5th Annual International Conference Ubiquitous Systems, vol. 01, pages 56-61, 2008
[5] Piyush Kumar, Siddharth S. Rautaray, Anupam Agrawa, "Hand Data Glove: A New Generation Real-Time Mouse for Human-Computer Interaction", 1st International Conference on Recent Advances in Information Technology RAIT, vol. 02, No. 01, 2012

BIOGRAPHIES

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