ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

Human Computer Interface Using Head Movements and Eye Blinks

Harika.K[1], HimaBindu[1], Irfana Fatima. S[1]
Department of ECE, Sri Venkateswara College of Engineering, Pennalur, Sriperumbudur-602117.
Ms. Jeyaprabha T.J.,[2] M.E., Assistant Professor,
Department of ECE, Sri Venkateswara College of Engineering, Pennalur, Sriperumbudur-602117.

***Abstract*—In today's digital age, computers are essential for our everyday activities. However, the demand for its ease of access for people with disabilities is still a challenge. To overcome these issues, it is necessary to come up with alternate methods to access the input controls of the computer. The proposed system is completely non-invasive and uses head movements and eye blinks as input methods to operate the computer. The tilting of the head which is detected by the accelerometer scrolls across the screen. The eye blinks, which are detected using the IR sensor, are used for clicking operations. This system has reduced hardware and cost. The setup is comparatively easy and convenient for the user. Since it uses simple gestures, this system can be used by people suffering from spinal cord injuries and physical disabilities.**

Keywords- Human Computer Interface, MEMS accelerometer, head movement, eye blink sensor

I. INTRODUCTION

People suffering from physical disabilities and severe motor impairment are not able to use a computer on their own using a normal keyboard and mouse. In order to enable them to access a computer on their own, an alternate technology, namely, a Human Computer Interface (HCI) can be used. The previously introduced systems have a lot of limitations. They are invasive and cause discomfort to the user. Some systems use a lot ofimaging algorithms which increase the complexity of the system. The proposed system overcomes these limitations by using simple gestures such as head movements and eye blinks as input access methods. It also reduces the use of hardware, thereby reducing the complexity of the system.

II. OBJECTIVE

The main objective of this project is to provide an easy and convenient method for the disabled to access a computer on their own without the use of mouse and keyboard. Gestures like head movements and eye blinks are used as alternate input methods. The head movements can be detected using accelerometer to move the mouse cursor across the screen and the eye blinks, using IR sensor is used for clicking operations. The signals are processed by a microprocessor and sent to the system. An application, developed on the computer receives these signals and performs the necessary operations. The overall hardware used is greatly reduced and is perfectly safe for the user.

III. EYE BLINK SENSOR

An Infrared (IR) sensor is used to detect eye blinks. An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photocoupler or Optocoupler. They are placed near the eye to detect blinks. Infrared radiation is invisible to the human eye and it is not harmful to the user.When the light emitted by the IR LED is incident on the photodiode after hitting an object, the resistance of the photodiode falls down from a huge value. One of the input of the op – amp is at threshold value and the other input is from the photodiode and both signals are compared. The final output is amplified.

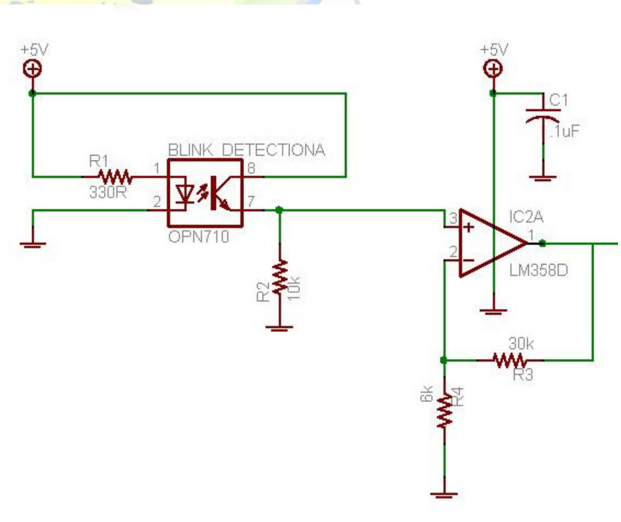


Fig 1: IR sensor circuit diagram

IV. TILT SENSOR

An accelerometer is an electro-mechanical device that measures acceleration forces. Accelerometers can measure acceleration on the three axes X, Y and Z as analog voltages.Modern accelerometers called micro electro-mechanical systems (MEMS) which are cost effective and reliable are used in this project. The device consists of a surface micro machined capacitive sensing cell (g-cell) and a signal conditioning ASIC contained in a single package. The g-cell beams form two back-to-back capacitors. As the center beam moves with acceleration, the distance between the beams changes and each capacitor's value will change. From these

ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

changes in capacitance, the acceleration can be determined and recorded by the sensors.

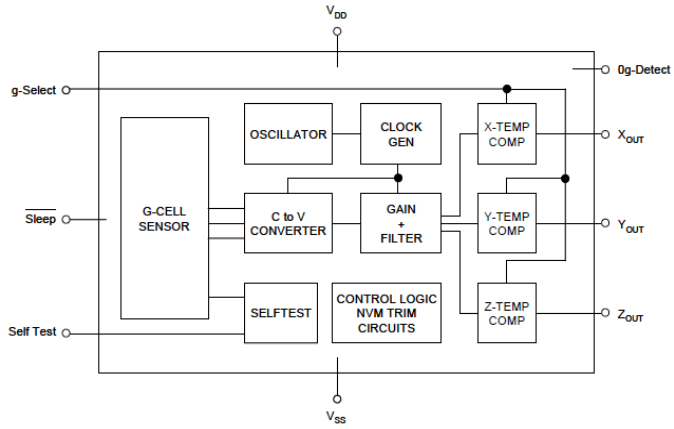


Fig 2 : Internal block diagram of accelerometer

V. MICROCONTROLLER MODULE

The PIC microcontroller is the main working processor of the system. PIC stands for peripheral interface controller. The PIC16F77A is CMOS FLASH-based 8-bit microcontroller with 40-pin or 44-pin package.The PIC16F877A features 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, and a Universal Asynchronous Receiver Transmitter (USART).

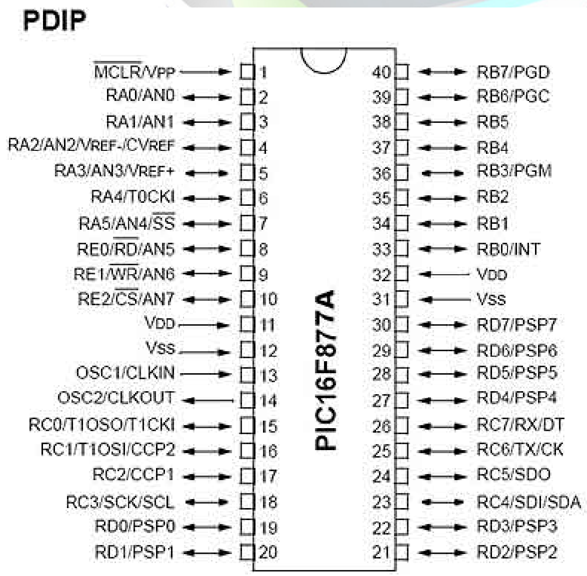
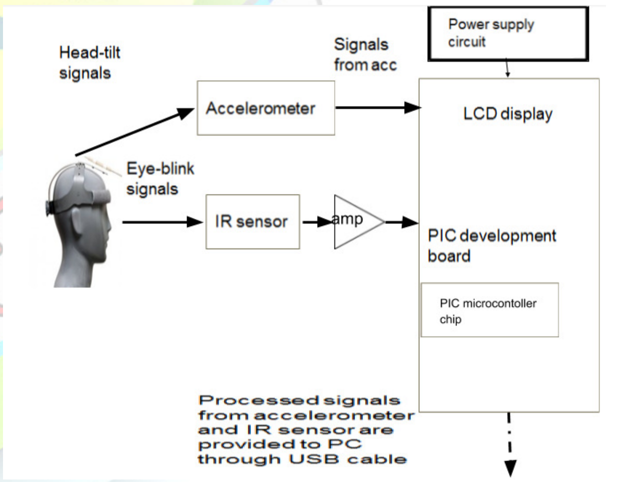


Fig 3: Pin configuration

It is based on RISC architecture and the memory structure follows the Harvard pattern i.e., separate program and data memory. There are five ports in the architecture PORT A, PORT B, PORT C, PORT D, PORT E. PORT A, which is directly connected to the A/D converter, receives the signals from MEMS sensor. PORT C gets the digitized voltage value from the IR sensor. The function of microcontroller is to receive the signals from A/D converter, process them and send the signals for serial communication.

VI. WORKING

The horizontal and vertical movements of the head are detected by the g-cell sensor of the accelerometer. The output of g-cell is a low-voltage signal, so it is amplified and demodulated. The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths 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.



To computer

Fig 4: Simple block diagram of transmitter

The head-tilt signals in form of displacement are fed to A/D of the microcontroller. Similarly the voltage signals from the eye-blink sensor are also given to A/D of the microcontroller. In A/D, the control registers are set to function using the external clock. The A/D starts the conversion once LSB of ADON register is set to 1. During processing, the MCUassigns each value to a variable as follows:

- XOUT → A
- YOUT → B

ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

nternational Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
/ol. 5, Special Issue 11, April 2018

- ZOUT → C
- Voltage from eye-blimk sensor → E

Then it sends these variables to the USART transmitter register for serial communication between the controller and the PC. A random variable D is sent to distinguish between accelerometer signals and eye-blink sensor signals. RS232 cable is used for connecting the system with the PIC development board. At the receiver end, an application is created to read these values from COM1 port and perform the mouse-click and move-move functions. To scroll the cursor across the screen, values of A and B parameters are checked as follows:

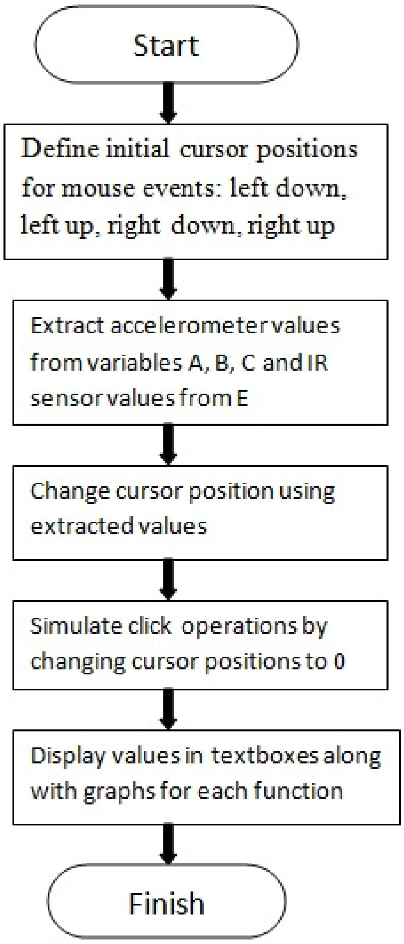
- If A> 115, move the cursor right by 8 pixels.
- If A< 60, move the cursor left by 8 pixels.
- If B> 115, move the cursor upward by 8 pixels.
- If B< 60, move the cursor downward by 8 pixels.

To click the cursor, value of E parameter is checked:

- If E< 20, call left click function.

VII. SOFTWARE

In this project MPLAB X IDE v 3.55 and PICKIT 3 programmer/debugger v2.61 are used for programming the PIC16F77A controller. Microchip's PICKIT 3 in-circuit debugger/programmer uses in-circuit debugging logic incorporated into each chip with Flash memory to provide a low-cost hardware debugger and programmer. The PICKIT can also reprogram any PIC microcontroller with a simple push of a button. Visual Studio v5.0 is used for performing the mouse-movement movement and mouse-click operations in the system. Visual Studio enables you to write code accurately and efficiently without losing the current file context. You can



easily zoom into details such as call structure, related functions, check-ins, and test status. You can also leverage the functionality to refactor, identify, and fix code issues. The program which needs to be burned into the controller is written and built in MPLAB software.

VIII. CONCLUSION

This project has successfully replaced the conventional mouse and keyboard input controls of a computer with simple gestures such as head movements and eye blinks. It does not require any complicated imaging algorithms to process images and data. The whole setup is fairly easy to use. The sensitivity of the accelerometer has also been calibrated to ease the pressure on the neck when tilting the head. Safety in the light emission on the photodiode is ensured through careful selection.Voice recognition can also be used with this system to further improvise its functionality.

ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

nternational Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
/ol. 5, Special Issue 11, April 2018

IX. FUTURE WORK

In the future, there is great scope for this system. It can be improvised to control other appliances like wheelchair, mobile phones, house appliances, etc. Better methods of transmission and reception can be developed on furtherexperimentation. It can also be adapted to work on all operating systems and platforms.This project can be extended by using gesture controlled accelerometer, which when fixed on the inner roof of the car, can monitor the head movement of the driver without use of headgear.

X. REFERENCES

[1] Seyede Mahaya Safavi, Subramanian Meenakshi Sundaram, Ali Heydari Gorji, Neha Satishkumar Udaiwal and Pai H. Chou, "Application of infrared scanning of neck muscles to control a cursor in Human-computer interface" 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2017, pp. 787-790.

[2] Tusher Chakraborty, Md. Nasim, Sakib Md Bin Malek, Md. Taksir Hasan Majumder, Mohammed Samiul Saeef, and A. B. M. Alim Al Islam, "Low-Cost Finger Gesture Recognition System for Disabled and Elderly People", International conference on Networking, Systems and Security (NSysS), 2017, pp. 180-184.

[3] Alexandru Pasarica and Radu Gabriel Bozomitu, Faculty of Electronics, Telecommunications and Information Technology "Gheorghe Asachi" Technical University, Carol I No.11 Av., 700506 Iaşi, Romania along with Hariton Costin, Casian Miron, Cristian Rotariu , Faculty of Bioengineering, "Grigore T. Popa" University of Medicine and Pharmacy Univ. 16 Av., 700115 Iaşi, Romania," Human-Computer Interface based on Eye Tracking with Dwell Time Selection" at 2017 IEEE 23rd International Symposium for Design and Technology in Electronic Packaging on 26th, 27th, 28th and 29th October 2017.

[4] M.Venkatasureshkumar, Assistant Professor, Department of ECE, A.I.T.S, Tirupati, B.Neelima, Assistant Professor, Department ofECE, A.I.T.S, Tirupati, "A Portable Wireless Head Movement Controlled Human-Computer Interface for People with Disabilities." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering ,Vol. 3, Issue 7, July 2014

[5] Tukur Gupta, Himanshu Verma, Gaurav Verma, Laxmikanta Sahoo, M.Tech. Scholar, Assistant Professor, Department of Electronics & Communication,Jaypee Institute of Information Technology, Noida (U.P.), India.Tech Lead, KPIT Technologies,Yokohama-shi, Kanagawa, Japan."A Portable & Cost Effective Human Computer Interface Device for Disabled." 2015 Fifth International Conference on Communication Systems and Network Technologies

[6] Xiaoxiang Zheng, Xin Li, Jun Liu, Weidong Chen, Yaoyao Hao "A portable wireless eye movement-controlled Human-Computer Interface for the Disabled" Complex Medical Engineering, 2009. CME. ICME International Conference on 9-11 April 2009.

[7] Madhumanti Maiti, Tanaya Banerjee, Kalyan Chatterjee Institute of Engineering and Management Salt Lake, India. "An InnovativePrototype to PreventAccidents Using Eye Blink Sensors and Accelerometer ADXL330" in Computing and Communication (IEMCON), 2015 International Conference and Workshop on 15-17 April, 2015.