Device & Voice Control System Based On Gesture Recognition Using 3d Mems Accelerometers

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***Abstract*-The advent of MEMS technology and the subsequent surge of various transducers using the MEMS technology have opened up many avenues for new applications, MEMS based transducers today find applications in applications ranging from automotive electronics to aviation. But one possible application domain where MEMS technology can make significant advances is in the various types of modalities that can be designed to assist people with different types of physical disabilities. Using the MEMS technology assistance can be provided to physically handicapped people who are deprived of the usage of their limbs to move or to control things around them. Dumb people can be provided with modalities to communicate with people without having to depend on sign language. Even partially paralyzed people who are either limited to their rooms or beds can be equipped to control things around them in their day to day life. This project is an attempt in this direction to design modalities that can assist people who are limited by either handicaps or diseases to have a better quality of life. In this project a low cost device will be designed that used MEMS accelerometers to recognize different gestures made by people. Once recognized these gestures can be used to do various functions.**

KEYWORDS: Gesture recognition; handwritten recognition; MEMS accelerometers.

I. INTRODUCTION

Human gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms, head or body with the intent to convey meaningful information or to communicate with the environment. With the rapid development of computer technology, human computer interaction has become a ubiquitous activity in our daily life. More attention has been focused on translating these human gestures into computer-understandable language in the past few years. Many gesture tracking and recognition technologies have been proposed. In general, these current gesture tracking technologies derive pose estimates from electrical measurements received from mechanical, magnetic, acoustic, inertial, optical, radio or microwave sensors Each sensor has its advantages and limitations. During this work a miniature accelerometer based recognition systems which acknowledge hand gestures in 3-D is constructed by using gestures, numeric and alphabets will be recognized the digital format MEMS is termed as a micro electro mechanical system where mechanical parts like membranes have been manufactured at microelectronics circuits. It uses micro-fabrication technology. It has channels, cantilevers, membranes, holes, cavity, and additionally mechanical parts. Miniaturization of the device reduces cost by decreasing material consumption. MEMS also increases the applicability by reducing size and mass. Integrated MEMS already includes data acquisition, filtering, data storage, communication interfacing and networking. MEMS technology makes the things smaller and better. A typical example is brought by the MEMS accelerometer development. An accelerometer is a device that measures the physical acceleration. The physical parameters are temperature, pressure, force, light, etc.. It measures the weight per unit mass. MEMS accelerometers can measure is g-force. MEMS accelerometer can detect the acceleration change of three directions in space. MEMS based inertial sensors are lightweight, good for fast motion tracking, and can offer a large sensing range, but they lack long term stability due to the problem of severe zero drift.

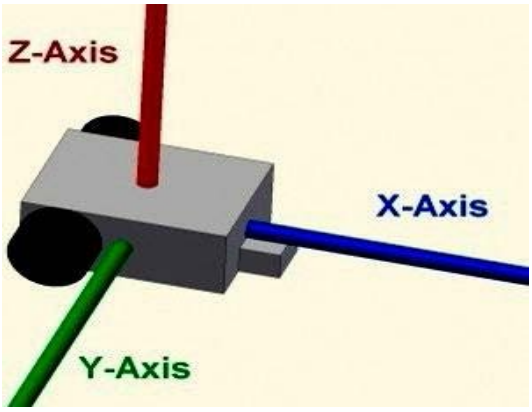

Fig. 1 . Sensing direction of the triaxial MEMS accelerometer

In this paper, we proposed the portable embedded device consists of triaxial accelerometer, microcontroller (PIC18LF45K22) and Zigbee wireless communication modules.Users can utilize this portable device to write digits and make hand gestures.In this research MEMS accelerometers measure the acceleration of the signal in three co-ordinates such as x-axis, y axis and z-axis. These co-ordinates are displayed on the LCD using the PIC microcontroller.

II RELATED WORK

MEMS accelerometer measures the acceleration of the signal in three co-ordinates such as x-axis, y-axis, and z-axis. To capture the hand motions online, the general MEMS sensor which can be operated without any external reference and limitation in working conditions is used. However, motion recognition is comparatively tough for different users since they have different styles and speeds to generate various motion trajectories. Thus, several researchers have tried to avoid this type of problem for increasing the accuracy of handwriting recognition systems .By manipulating the acceleration signals and angular velocities of sensors, several researchers have reduced the error of handwriting trajectory reconstruction. However, these trajectory reconstructions suffer from different errors due to the usage of inertial sensors. Hence, Jang et al. Proposed optical tracking calibration method to obtain accelerations of the MEMS inertial sensors based proposed device by calibrating two dimension trajectories and to obtain accurate attitude angle by using multiple camera calibration. Yang et al. Proposed a digital pen to track motion in three dimension space by MEMS accelerometer and gyroscopes to improve the recognition accuracy by introducing the efficient acceleration error compensation algorithm which is based on zero velocity compensation. Luo et al proposed an extended kalman filter with magnetometers to compensate the orientation of the MEMS motion sensor based digital writing device.

Fig 2. Accelerometer sensor

III HARDWARE DESIGN AND DESCRIPTION

There are two parts to the device one is the portable device that is provided to the user (user module), the second is the device that does the control function (control module). The user module has a 3D accelerometer, interface to a microcontroller with an inbuilt multi-channel ADC. The microcontroller is in turn connected to a low cost short range RF transmitter.

The accelerometer is attached to any body part of the person that he can move under their voluntary control. When the person moves his hand the accelerometers produce analog voltages corresponding to the acceleration experienced by its various axes. The microcontroller is preprogrammed with the signals corresponding to certain gestures. When the gesture made by the user matches any of the gestures made by the user, the microcontroller generates a certain code uniquely identifying the gesture.

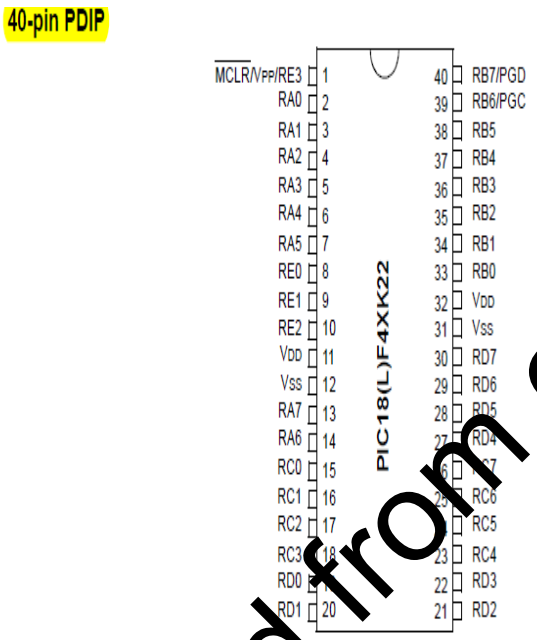

Fig 3. Pin diagram of Pic Microcontroller

The control module has an RF receiver, which can receive the code from the user module. The RF receiver is in turn connected to a microcontroller, which is programmed with specific functions that can be done in the corresponding unique gesture code. The function that is done could be decided depending on the nature of the user

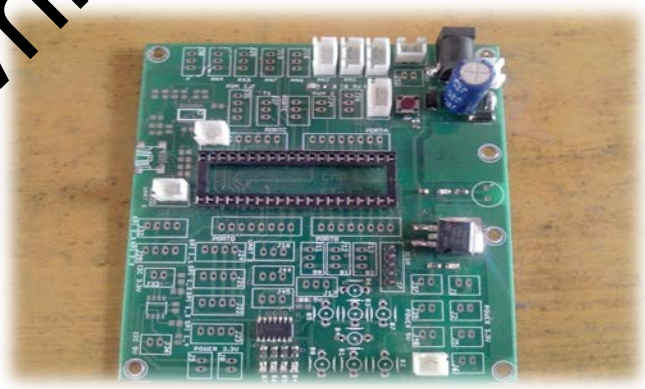

Fig4.Microcontroller

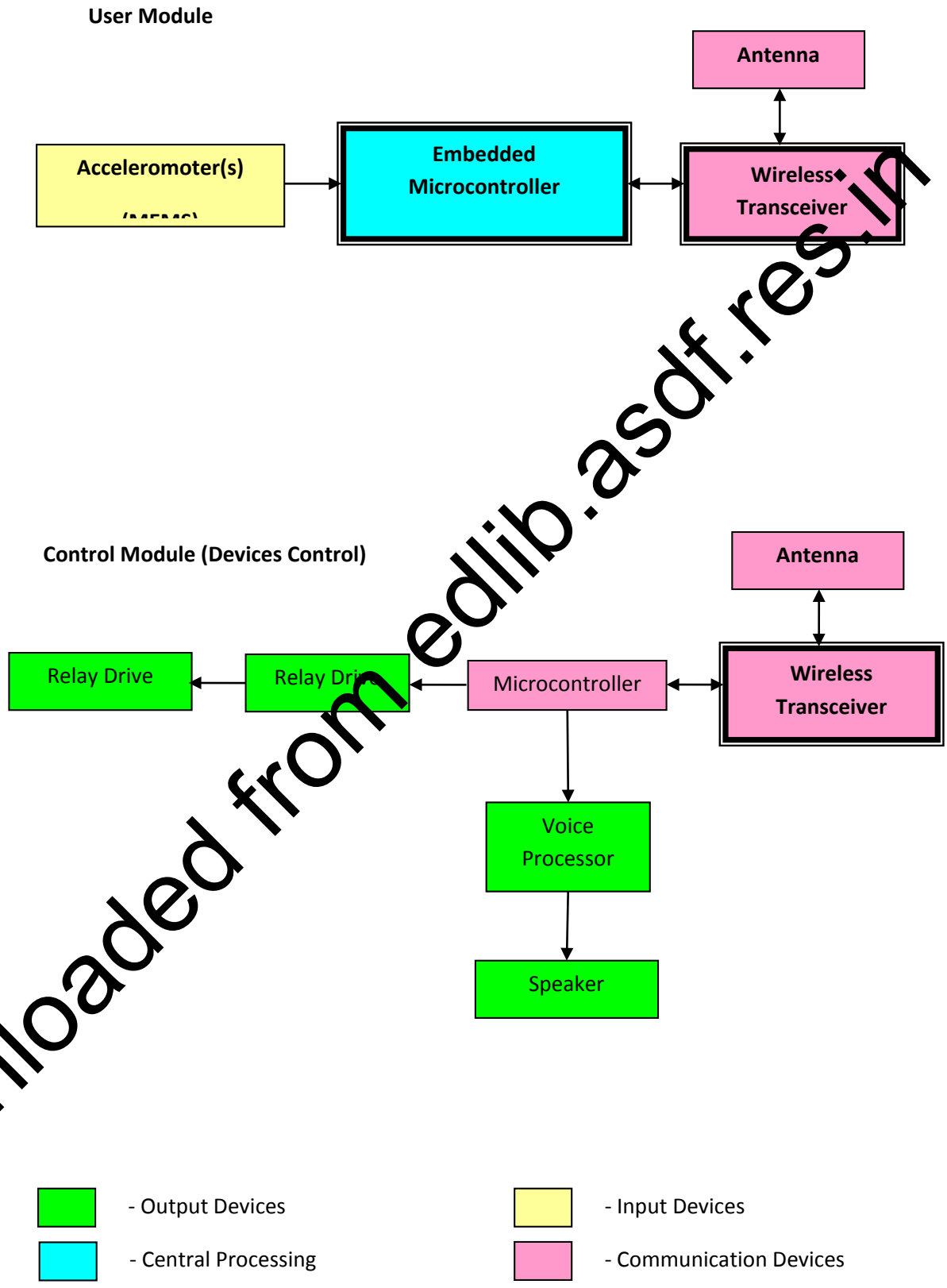

Fig. 5. block diagram

IV EXPERIMENTAL RESULTS

MEMS accelerometers measure the acceleration of the signal in three co-ordinates such as x-axis, y-axis, and z-axis. An accelerometer based portable device can also be used as mouse by selecting the mouse mode in the system. The each and specific gesture of the accelerometer based mouse is used to recognize the specific mouse functions

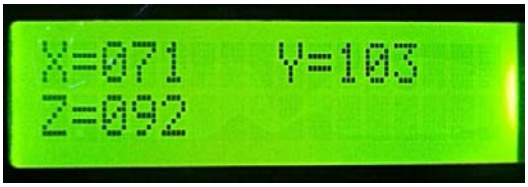

Fig.6. Display Co-ordinates (X, Y, Z) on LCD

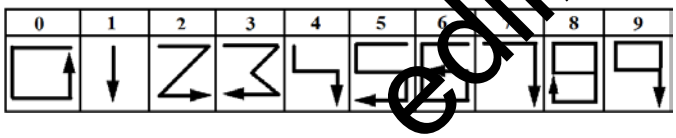

Fig.7. Gestures for generating the handwritten digits

Fig.8. Handwritten recognition

CONCLUSION

The development of the MEMS accelerometer based portable device used to generate desired commands by hand motions to control electronic devices without any space limitations. The acceleration made by the hand motion is measured by the MEMS accelerometer are wirelessly transmitted to the computer by using the Zigbee wireless module. MEMS accelerometer based portable device is used to control the mouse cursor on a computer. Also the usage of simple sensor in the process of authentication using the same MEMS accelerometer based device helps for simple, accurate and efficient way of verification. MEMS accelerometer based recognition system provides an efficient and strong password protection

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