

Interaction between Human and Computer by Using Hand Gesture

Sreenivasa Reddy P, Sk. Aayesha, B. Ramesh

¹Electronics and Communication Engineering, S.S.N College of Engineering and Technology, Ongole, India

²Electronics and Communication Engineering, Pace College of Engineering and Technology, Ongole, India

³Electronics and Communication Engineering, S.S.N College of Engineering and Technology, Ongole, India

Abstract: *This system makes use of movements of any body part to which MEMS accelerometer sensor is fixed and helps in the movement of the cursor. The cursor movements help in operating all the PC applications. The control system consists of MEMS accelerometer sensor and microcontroller. Microcontroller collects data from the sensor and announces appropriate cursor movement for that data (gestures). This operation is done by the Microcontroller which is loaded with an intelligent program written using embedded 'C' language. This system uses MEMS (Micro Electro Mechanical Systems) accelerometer devices and measures only mechanical X and Y-axis acceleration of the movements of a mouse which will be converted into (X, Y) coordinates on the screen. When user moves the mouse, the acceleration is measured by a MEMS accelerometer. The degree of acceleration is represented by the difference between two different capacitance values in the MEMS device. By holding it one way, it can sense forward/backward and left/right. If you hold it a different way, it can sense up/down and forward/backward. Two axes of acceleration are enough for many of the applications. The system contains the ability to measure the acceleration of movements that are modulated and converted into two dimensional location coordinates. Gesture-based human-computer interaction (HCI) provides more intuitive and subjectively enjoyable communication between human and devices. These systems use expensive multi-view stereo camera or specially designed imaging device to generate depth images. Moreover, these systems need to run on high performance CPUs or GPUs due to complex computation. Integrating these hand gesture HCI systems into general consumer electronics, such as TV and STB, adds considerably to the cost.*

1. INTRODUCTION

Gesture-based human-computer interaction (HCI) provides more intuitive and subjectively enjoyable communication between human and devices. Many hand gesture HCI systems based on depth images [1]-[3] have been developed. These systems use expensive multi-view stereo camera or specially designed imaging device to generate depth images. Moreover, these systems need to run on high-performance CPUs or GPUs due to complex computation. Integrating these hand gesture HCI systems into general consumer electronics, such as TV and STB, adds considerably to the cost. In existing system are having mouse and key board with wire connection and the distance of wireless. The power consumption of mouse and key board is high i.e. 12v the cost of mouse and key board is more. The disadvantage is distance is less that means we are place in pc only and also cost and high power consumption.

This system makes use of movements of any body part to which MEMS accelerometer sensor is fixed and helps in the movement of the cursor. The cursor movements help in operating all the PC applications. The control system consists of MEMS accelerometer sensor and microcontroller.

Microcontroller collects data from the sensor and announces appropriate cursor movement for that data (gestures). This operation is done by the Microcontroller which is loaded with an intelligent program written using embedded 'C' language. This system uses MEMS (Micro Electro Mechanical Systems) accelerometer devices and measures only mechanical X and Y-axis acceleration of the movements of a mouse which will be converted into (X, Y) coordinates on the screen. When user moves the mouse, the acceleration is measured by a MEMS accelerometer. The degree of acceleration is represented by the difference between two different capacitance values in the MEMS device. By holding it one way, it can sense forward/backward and left/right. If you hold it a different way, it can sense up/down and forward/backward. Two axes of acceleration are enough for many of the applications.

2. THE HARDWARE SYSTEMS

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Microcontroller Section: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ZIGBEE: ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.

MAX232: To allow compatibility among data communication equipment made by various manufactures, an interfacing standard called RS232 was set by the Electronic Industries Association (EIA). This RS-232 standard is used in PCs and numerous types of equipment. However, since the standard was set long before the advent of the TTL logic family, its input and output voltage levels are not TTL compatible. In RS-232, a 1 is represented by -3 to -25V, while a 0 bit is +3 to +25V, making -3 to +3 undefined. For this reason, to connect any RS-232 to a microcontroller system we must use voltage converters such as MAX232 to convert the TTL logic levels to the RS-232 voltage levels and vice versa.

Micro electromechanical systems (MEMS) (also written as micro-electro-mechanical) is the technology of the very small, and merges at the nano-scale into nano electromechanical systems (NEMS) and nanotechnology. MEMS are also referred to as micro machines (in Japan).. MEMS are separate and distinct from the hypothetical vision of molecular nanotechnology or molecular electronics. MEMS are made up of components between 1 to 100 micrometers in size (i.e. 0.001 to 0.1 mm) and MEMS devices generally range in size from 20 micrometers (20 millionths of a meter) to a millimeter. They usually consist of a central unit that processes data, the microprocessor and several components that interact with the outside such as micro sensors ^[1]. At these size scales, the standard constructs of classical physics are not always useful. Due to MEMS' large surface area to volume ratio, surface effects such as electrostatics and wetting dominate volume effects such as inertia or thermal mass.

RF Transmitter: In this project ST-TX01-ASK is used as the RF transmitter module. The encoded signal is given to the RF transmitters data pin. Then the signal is modulated (ASK) by the RF transmitter module and transmitted through the antenna. This section is fully described in the RF communication section.

Encoder: We are using IC HT12E Encoder which is an 18 pin IC. This encoder circuit will encode the data send by the microcontroller and then transmits the data serially to the RF transmitter module. Here we are using ST-TX01 transmitter module for transmitting the data.

RF module (RECIEVER): In this section we are using ST-RX04 RF Receiver module. The transmitted signal is received by this receiver module. The received data is transmitted to the decoder to decode the data as we encoded the data while.

DECODER: We are using IC HT12D Decoder which is an 18 pin IC. This Decoder circuit will decode the data from the receiver and then send the decoded data to the microcontroller.

3. DESIGN OF PROPOSED HARDWARE SYSTEM

This system makes use of movements of any body part to which MEMS accelerometer sensor is fixed and helps in the movement of the cursor. The cursor movements help in operating all the PC applications. The control system consists of MEMS accelerometer sensor and microcontroller. Microcontroller collects data from the sensor and announces appropriate cursor movement for that data (gestures).

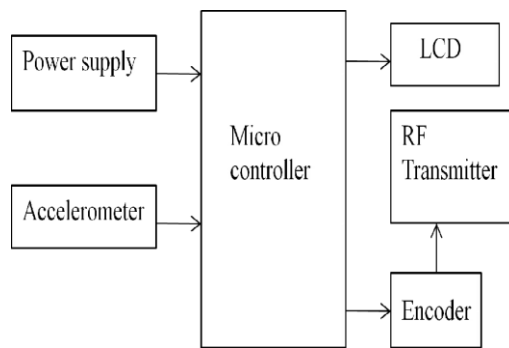


Fig.1. Transmitter Section

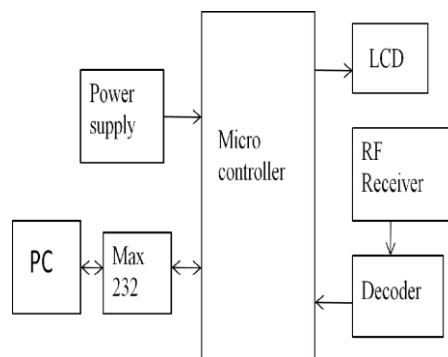


Fig.2. Receiver section

This operation is done by the Microcontroller which is loaded with an intelligent program written using embedded ‘C’ language. This system uses MEMS (Micro Electro Mechanical Systems) accelerometer devices and measures only mechanical X and Y-axis acceleration of the movements of a mouse which will be converted into (X, Y) coordinates on the screen. When user moves the mouse, the acceleration is measured by a MEMS accelerometer. The degree of acceleration is represented by the difference between two different capacitance values in the MEMS device. By holding it

one way, it can sense forward/backward and left/right. If you hold it a different way, it can sense up/down and forward/backward. Two axes of acceleration is enough for many of the applications. The system contains the ability to measure the acceleration of movements that are modulated and converted into two dimensional location coordinates.

4. BOARD HARDWARE RESOURCES FEATURES

MEMS: Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete **systems-on-a-chip**. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors and micro actuators and expanding the space of possible designs and applications.

The critical physical dimensions of MEMS devices can vary from well below one micron on the lower end of the dimensional spectrum, all the way to several millimeters. Likewise, the types of MEMS devices can vary from relatively simple structures having no moving elements, to extremely complex electromechanical systems with multiple moving elements under the control of integrated microelectronics. The one main criterion of MEMS is that there are at least some elements having some sort of mechanical functionality whether or not these elements can move. The term used to define MEMS varies in different parts of the world. In the United States they are predominantly called MEMS, while in some other parts of the world they are called "Microsystems Technology" or "micro machined devices".

While the functional elements of MEMS are miniaturized structures, sensors, actuators, and microelectronics, the most notable (and perhaps most interesting) elements are the micro sensors and micro actuators. Micro sensors and micro actuators are appropriately categorized as "transducers", which are defined as devices that convert energy from one form to another. In the case of micro sensors, the device typically converts a measured mechanical signal into an electrical signal.

Over the past several decades MEMS researchers and developers have demonstrated an extremely large number of micro sensors for almost every possible sensing modality including temperature, pressure, inertial forces, chemical species, magnetic fields, radiation, etc. Remarkably, many of these micro machined sensors have demonstrated performances exceeding those of their macro scale counterparts.

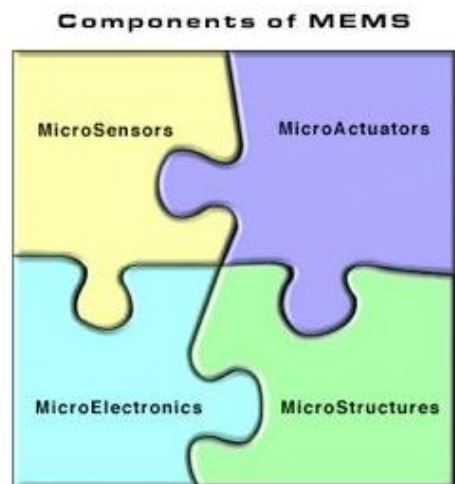
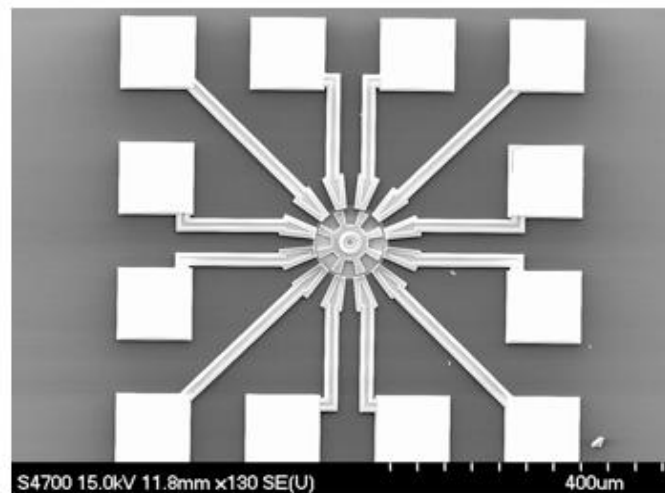


Fig.3. Components of MEMS

That is, the micro machined version of, for example, a pressure transducer, usually outperforms a pressure sensor made using the most precise macro scale level machining techniques. Not only is the performance of MEMS devices exceptional, but their method of production leverages the same batch fabrication techniques used in the integrated circuit industry – which can translate into low per-device production costs, as well as many other benefits. Consequently, it is possible to not only achieve stellar device performance, but to do so at a relatively low cost level. Not surprisingly, silicon based discrete micro sensors were quickly commercially exploited and the markets for these devices continue to grow at a rapid rate.

More recently, the MEMS research and development community has demonstrated a number of micro actuators including: micro valves for control of gas and liquid flows; optical switches and mirrors to redirect or modulate light beams; independently controlled micro mirror arrays for displays, micro resonators for a number of different applications, micro pumps to envelop positive fluid pressures, micro flaps to modulate airstreams on airfoils, as well as many others. Surprisingly, even though these micro actuators are extremely small, they frequently can cause effects at the macro scale level; that is, these tiny actuators can perform mechanical feats far larger than their size would imply. For example, researchers have placed small micro actuators on the leading edge of airfoils of an aircraft and have been able to steer the aircraft using only these microminiaturized devices.



A surface micro machined electro-statically-actuated micro motor fabricated by the MNX. This device is an example of a MEMS-based micro actuator.

5. RF TRANSMITTER SECTION

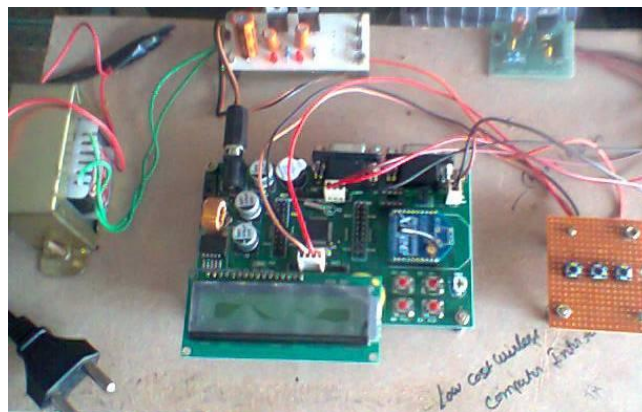
RF transmitters are electronic devices that create continuously varying electric current, encode sine waves, and broadcast radio waves. RF transmitters use oscillators to create sine waves, the simplest and smoothest form of continuously varying waves, which contain information such as audio and video. Modulators encode these sign wives and antennas broadcast them as radio signals. There are several ways to encode or modulate this information, including amplitude modulation (AM) and frequency modulation (FM). Radio techniques limit localized interference and noise. With direct sequence spread spectrum, signals are spread over a large band by multiplexing the signal with a code or signature that modulates each bit. With frequency hopping spread spectrum, signals move through a narrow set of channels in a sequential, cyclical, and predetermined pattern.

Selecting RF transmitters requires an understanding of modulation methods such as AM and FM. On-off key (OOK), the simplest form of modulation, consists of turning the signal on or off.

Amplitude modulation (AM) causes the base band signal to vary the amplitude or height of the carrier wave to create the desired information content. Frequency modulation (FM) causes the instantaneous frequency of a sine wave carrier to depart from the center frequency by an amount proportional to the instantaneous value of the modulating signal. Amplitude shift key (ASK) transmits data by varying the amplitude of the transmitted signal. Frequency shift key (FSK) is a digital modulation scheme using two or more output frequencies. Phase shift key (PSK) is a digital modulation scheme in which the phase of the transmitted signal is varied in accordance with the base band data signal.

Additional considerations when selecting RF transmitters include supply voltage, supply current, RF connectors, special features, and packaging. Some RF transmitters include visual or audible alarms or LED indicators that signal operating modes such as power on or reception. Other devices attach to coaxial cables or include a connector or port to which an antenna can be attached. Typically, RF transmitters that are rated for outdoor use feature a heavy-duty waterproof design. Devices with internal calibration and a frequency range switch are also available.

RF transmitters are used in a variety of applications and industries. Often, devices that are used with integrated circuits (ICs) incorporate surface mount technology (SMT), through hole technology (THT), and flat pack. In the telecommunications industry, RF transmitters are designed to fit in a metal rack that can be installed in a cabinet. RF transmitters are also used in radios and in electronic article surveillance systems (EAS) found in retail stores. Inventory management systems use RF transmitters as an alternative to barcodes.



Transmitter section



Fig.4. *Transmitter pin description*

6. RF RECEIVER SECTION

RF receivers are electronic devices that separate radio signals from one another and convert specific signals into audio, video, or data formats. RF receivers use an antenna to receive transmitted radio signals and a tuner to separate a specific signal from all of the other signals that the antenna receives.

Detectors or demodulators then extract information that was encoded before transmission. There are several ways to decode or modulate this information, including amplitude modulation (AM) and frequency modulation (FM). Radio techniques limit localized interference and noise. With direct sequence spread spectrum, signals are spread over a large band by multiplexing the signal with a code or signature that modulates each bit. With frequency hopping spread spectrum, signals move through a narrow set of channels in a sequential, cyclical, and predetermined pattern.

Selecting RF receivers requires an understanding of modulation methods such as AM and FM. On-off key (OOK), the simplest form of modulation, consists of turning the signal on or off. Amplitude modulation (AM) causes the base band signal to vary the amplitude or height of the carrier wave to create the desired information content. Frequency modulation (FM) causes the instantaneous frequency of a sine wave carrier to depart from the center frequency by an amount proportional to the instantaneous value of the modulating signal. Amplitude shift key (ASK) transmits data by varying the amplitude of the transmitted signal. Frequency shift key (FSK) is a digital modulation scheme using two or more output frequencies. Phase shift key (PSK) is a digital modulation scheme in which the phase of the transmitted signal is varied in accordance with the base band data signal. RF receivers vary in terms of performance specifications such as sensitivity, digital sampling rate, measurement resolution, operating frequency, and communication interface. Sensitivity is the minimum input signal required to produce a specified output signal having a specified signal-to-noise (S/N) ratio. Digital sampling rate is the rate at which samples can be drawn from a digital signal in kilo samples per second. Measurement resolution is the minimum digital resolution, while operating frequency is the range of received signals. Communication interface is the method used to output data to computers. Parallel interfaces include general-purpose interface bus (GPIB), which is also known as IEEE 488 and HP-IB Protocol. Serial interfaces include universal serial bus (USB), RS232, and RS485.

Additional considerations when selecting RF receivers include supply voltage, supply current, receiver inputs, RF connectors, special features, and packaging. Some RF receivers include visual or audible alarms or LED indicators that signal operating modes such as power on or reception. Other devices attach to coaxial cables or include a connector or port to which an antenna can be attached. Typically, RF receivers that are rated for outdoor use feature a heavy-duty waterproof design. Devices with internal calibration and a frequency range switch are also available.

Pin Description:

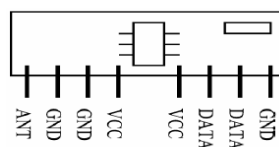


Fig.5. pin description



Fig: 7.Receiver section

7. CONCLUSION

A low-cost hand gesture HCI system for remote controlling of TV and STB has been proposed in this paper. The proposed system adds only a little to the hardware cost as just a webcam is used, and can run on mainstream and even low-end TV and STB without any software and hardware upgrading. In near future, the proposed system will be upgraded to support multi-point interaction.

ACKNOWLEDGEMENT

I Sreenivasa Reddy P would like to thank everyone, including: parents, teachers, family, friends, and in essence, all sentient being for their help and support this paper would not have been possible. Especially, I dedicate my acknowledgment of gratitude toward my mentor and Co-authors SK AAYESHA, B. RAMESH for their guidance and support.

REFERENCES

- [1] S. Kang, A. Roh, and H. Hong, "Using depth and skin color for hand gesture classification," In Proc. IEEE International Conference on Consumer Electronics, pp. 155-156, Mar. 2011.
- [2] J. Shotton, A. Fitzgibbon, M. Cook, and et al, "Real-Time Human Pose Recognition in Parts from Single Depth Images", In Proc. IEEE International Conference on Computer Vision, 2011.
- [3] C. Manders, F. Farbiz, J.H. Chong, and et al, "Robust hand tracking using a skin tone and depth joint probability model", In Proc. IEEE International Conference on Automatic Face & Gesture Recognition, pp 1-6, 2008.
- [4] L.Y. Liu, N. Sang, R. Huang "Background subtraction using shape and color information," Electronics Letters, vol. 46, no.1, pp.41-43, Jan.2010.
- [5] P. Viola, M. Jones, "Robust Real-Time Face Detection," International Journal of Computer Vision, vol. 57, no.2, pp.137-154, 2004
- [6] L.Y. Liu, N. Sang, S.Y. Yang, and R. Huang, "Real-time skin color detection under rapidly changing illumination conditions", IEEE Transactions on Consumer Electronics, vol.57 no.3, pp.1295-1302, 2011
- [7] G. R. Bradski, S. Clara, "Computer vision face tracking for use in a perceptual user interface", In Proc. IEEE Workshop on Applications of Computer Vision, pp.214 - 219 1998.

AUTHORS' BIOGRAPHY



Sreenivasa Reddy p

SSN COLLEGE OF ENGINEERING AND COLLEGE
ONGOLE



Sk. Aayesha

PACE COLLEGE OF ENGINEERING AND TECHNOLOGY
ONGOLE



B. Ramesh

SSN COLLEGE OF ENGINEERING AND COLLEGE
ONGOLE