Control Theory and Informatics
ISSN 2224-5774 (Paper) ISSN 2225-0492 (Online)
Vol.4, No.1, 2014

Accelerometer based gesture recognition robot

Prashant Sahu, Shubhank Mishra, Vaibhav Mishra,

Electronics & communication engg..

RGTU Bhopal

Prashantmahadev956@gmail.com, Shubhank_mishra@ymail.com, Vaibhav1986mishra@gmail.com

INTRODUCTION

Gesture recognition can be termed as an approach in this direction. It is the process by which the gestures made by the user are recognized by the receiver. Gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms, head, face, or body
with the intent of:

- conveying meaningful information or
- interacting with the environment.

They constitute one interesting small subspace of possible human motion. A gesture may also be perceived by the environment as a compression technique for the information to be transmitted elsewhere and subsequently reconstructed by the receiver.

Classification

hand and arm gestures:

Recognition of hand poses, sign languages, and entertainment applications.

head and face gestures:

Nodding or shaking of head; direction of eye gaze; etc.;

body gestures:

involvement of full body motion, as in; tracking movements of two people interacting outdoors; analyzing movements of a dancer for generating matching music and graphics;

Benefits:

A human computer interface can be provided using gestures:
Replace mouse and keyboard
Pointing gestures
Navigate in a virtual environment
Pick up and manipulate virtual objects
Interact with the 3D world

DESCRIPTION

A. Architecture of recognition system

A basic gesture input device is the word processing tablet. In the system, two dimensional hand gestures are sent via an input device to the computer's memory and appear on the computer monitor. These symbolic gestures are identified as editing commands through geometric modelling techniques. The commands are then executed, modifying the document stored in computer memory. Gestures are represented by a view-based approach, and stored patterns are matched to perceived gestures using dynamic time warping. View-based vision approaches also permit a wide range of gestural inputs when compared to the mouse and stylus input devices.

Hand and arm gesture

Hand gestures are the most expressive and the most frequently used gestures. This involves:

1) a posture

static finger configuration without hand movement, and

a gesture

dynamic hand movement, with or without finger motion.

Gestures may be categorized as

Gesticulation **:** spontaneous movement of hands and arms, accompanying speech. These spontaneous movements constitute around 90% of human gestures. People gesticulate when they are on telephone, and even blind people regularly gesture when speaking to one another;

*Language like gestures***:** gesticulation integrated into a spoken utterance, replacing a particular spoken word or phrase;

*Pantomimes***:** gestures depicting objects or actions, with or without accompanying speech;

*Emblems***:** familiar signs such as "V for victory," or other culture-specific "rude" gestures;

*Sign languages***:** well-defined linguistic systems. These carry the most semantic meaning and are more systematic, thereby being easier to model in a virtual environment.

Representation of hand gesture

Representation of hand motion includes:

Global configuration: six DOF of a frame attached to the wrist, representing the pose of the hand.

Local configuration: the angular DOF of fingers.

COMPONENTS USED

The following components are used for making a working model of accelerometer based gesture recognition

Atmel Atmega 8 microcontroller

L293D Motor Controller IC

3-axis Accelerometer

RF module for wireless transmission and reception. It includes an RF transmitter and an RF receiver

HT12E 12 pin encoder

HT12D 12 pin decoder

7805 Voltage Regulator

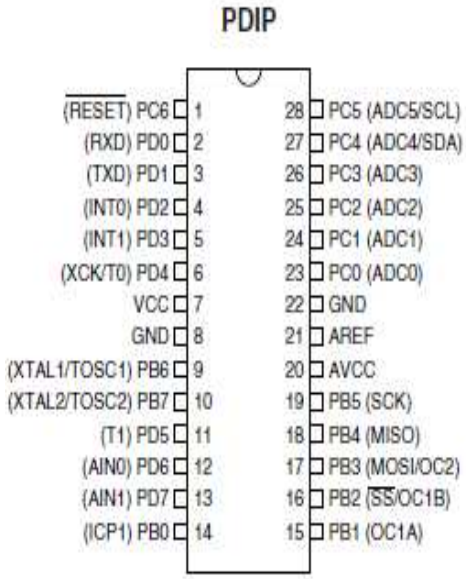
7812 Voltage Regulator

LCD

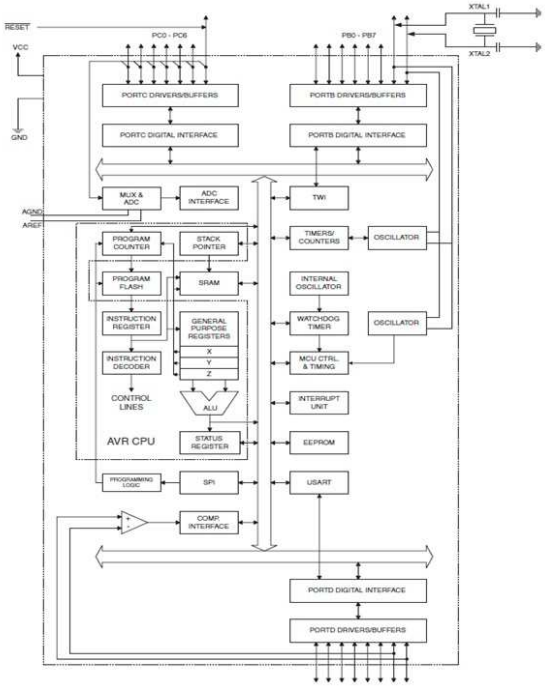
Power Supply circuitry

The detailed description of each is given below.

PIN CONFIGURATIN OF ATMEL ATMEGA 8 MICROCONTROLLER



BLOCK DIAGRAM



ACCELEROMETER

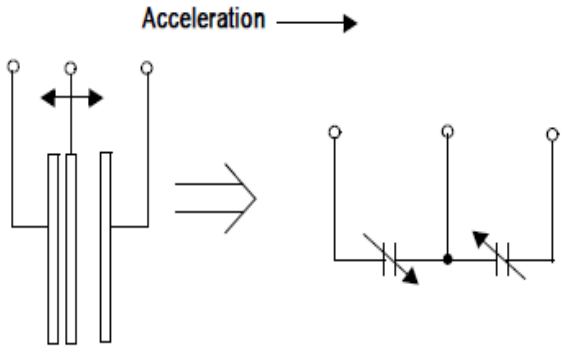
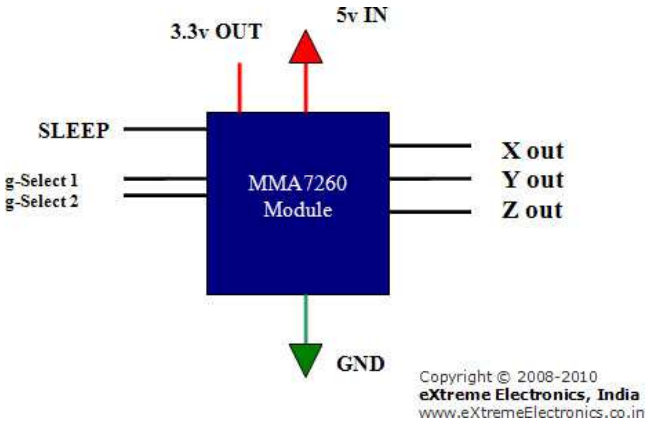


Figure 3. Simplified Transducer Physical Model

The g-cell is a mechanical structure formed from semiconductor materials (polysilicon) using semiconductor processes (masking and etching). It can be modeled as a set of beams attached to a movable central mass that move between fixed beams. The movable beams can be deflected from their rest position by subjecting the system to an acceleration (Figure 3). As the beams attached to the central mass move, the distance from them to the fixed beams on one side will increase by the same amount that the distance to the fixed beams on the other side decreases. The change in distance is a measure of acceleration. 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, ($C = A\varepsilon/D$). Where A is the area of the beam, ε is the dielectric constant, and D is the distance between the beams. IC uses switched capacitor techniques to measure the g-cell capacitors and extract the acceleration data from the difference between the two capacitors. IC also signal conditions and filters (switched capacitor) the signal, providing a high level output voltage that is ratio metric and proportional to acceleration.



HAND HELD UNIT

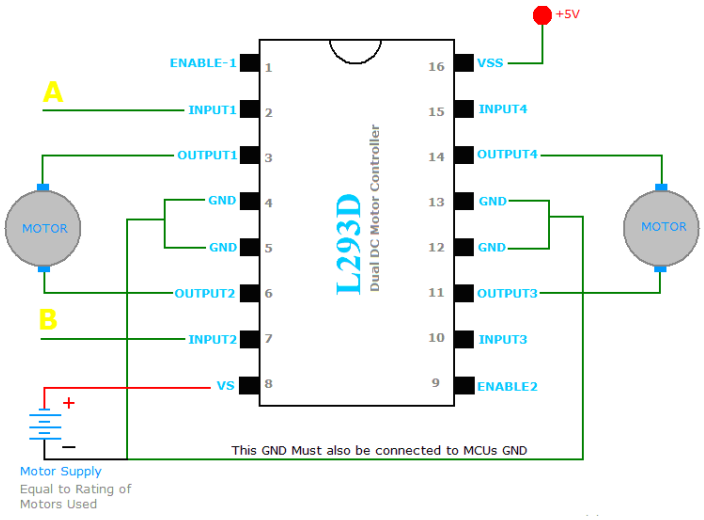
In this unit we are using a Avr series of microcontroller which is having inbuilt ADC. Accelerometer XY signals are applied to the ADC input of microcontroller for conversion of analog signal into digital form .Then these signal are compared with a threshold value using programming and transmitted in a form of 4 bit data signals to a RF encoder IC HT 12E.This IC converts this 4 bit information into serial form by which it can be transmitted by a RF transmitter.

BASE UNIT

In base unit RF signal being received by the receiver is applied to decoder IC from where it is applied to a H bridge circuit for controlling two dc motors. H bridge is one of the popular circuit used for controlling directions of a dc motor for a single dc motor it requires two input , hence four input are required for two dc motor.

H BRIDGE MOTOR CONTROLLER

This chip is designed to control 2 DC motors. There are 2 INPUT and 2 OUTPUT PINs for each motors. The connections is as follows.



Motor Controller Using L293D

The behavior of motor for various input conditions are as follows

	A	B
STOP	LOW	LOW
CLOCKWISE	LOW	HIGH
ANTICLOCKWISE	HIGH	LOW
STOP	HIGH	HIGH

just need to set appropriate levels at two PINs of the microcontroller to control the motor.

Since this chip controls two DC motors there are two more output pins (output3 and output4) and two more input pins(input3 and input4). The INPUT3 and INPUT4 controls second motor in the same way as listed above for input A and B. There are also two ENABLE pins they must be high(+5v) for operation, if they are pulled low(GND) motors will stop. The following program starts the motor runs it one direction for some time and then reverses the direction.

ACKNOELEDGEMENT

It is our immense pleasure to express deepest sense of gratitude and indebtedness to our highly respected **Prof. AMIT AGRAWAL** H.O.D, Electronics & comm. Engineering , Takshshila Institute of Engg. and Tech , Jabalpur (M.P.).His invaluable guidance , inspiration , continuous encouragement , sincere criticism and sympathetic attitude could made this Project possible.
We would take this opportunity to express deep sense of gratitude and acknowledgement to **prof. S.R SONI**, Principal, Takshshila Institute of Engg. and Tech , Jabalpur (M.P.).for his encouragement , inspiration and kind approval of this dissertation. We thank him for providing required resources from the college. We are indebted to our highly respected and esteemed guide **Prof. SHOBHIT VARM**, for his / her valuable and precious suggestions during making of this project.
We are equally indebted to supporting staff members of Department of Mechanical Engineering, TIETECH, Jabalpur who have helped us directly or indirectly.
Last but certainly not the least, we express our gratitude to Almighty for his blessings and courage.

REFERENSES

[1] A. Mulder, “Hand gestures for HCI”, *Technical Report 96-1*, vol. Simon Fraster University, 1996

[2] F. Quek, “Towards a Vision Based Hand Gesture Interface”, pp. 17-31, in *Proceedings of Virtual Reality Software and Technology*, Singapore, 1994.

[3] Ying Wu, Thomas S Huang, “ Vision based Gesture Recognition : A Review”, Lecture Notes In Computer Science; Vol. 1739 , *Proceedings of the International Gesture Workshop on Gesture-Based Communication in Human-Computer Interaction*, 1999

[4] K G Derpains, “A review of Vision-based Hand Gestures”, Internal Report, Department of Computer Science. York University, February 2004

[5] Richard Watson, “A Survey of Gesture Recognition Techniques”, Technical Report TCD-CS-93-11, Department of Computer Science, Trinity College Dublin, 1993.

[6] Y. Wu and T.S. Huang, “Hand modelling analysis and recognition for vision-based human computer interaction”, *IEEE Signal Processing Mag. – Special issue on Immersive Interactive Technology*, vol.18, no.3, pp. 51-60, May 2001

[7] A. J. Heap and D. C. Hogg, “Towards 3-D hand tracking using a deformable model”, In *2nd International Face and Gesture Recognition Conference*, pages 140–145, Killington, USA, Oct. 1996.