ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 2, Issue 1, January 2013

A REVIEW ON HAND GETSURE RECOGNITION SYSTEMS

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Abstract-- **Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait and human behaviors is also the subject of gesture recognition techniques. This paper handles the case study on the different hand gesture recognition systems and also the devices with data glove and vocalizer system. These systems are beneficial for disable people and their hands will speak having worn the gesture vocalizer data glove.**

Key-Words-- ASL, **Bend Sensor, Data Glove, Gesture Recognition, Tilt Sensor**

I. INTRODUCTION

Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. Gesture recognition enables humans to interface with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

In human communication, the use of speech and gestures is completely coordinated. Machine gesture and sign language recognition is about recognition of gestures and sign language using computers. A number of hardware techniques are used for gathering information about body positioning; typically either image-based (using cameras, moving lights etc) or device-based (using instrumented gloves, position trackers etc.), although hybrids are beginning to come about [1], [2].

Although this technology is still in its infancy, applications are beginning to appear. Flutter, a start-up out of Palo Alto, CA, is allowing anyone with Mac/Windows computer and webcam to download an app that allows them to control Music & Video apps such as Spotify, iTunes, Windows Media Player, QuickTime, and VLC using gestures.

Gesture recognition can be conducted with techniques from computer vision and image processing.

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II. LITERATURE SURVEY

1. American Sign Language

American Sign Language is the language of choice for most deaf people in the United States. It is part of the "deaf culture" and includes its own system of puns, inside jokes, etc. However, ASL is one of the many sign languages of the world. As an English speaker would have trouble understanding someone speaking Japanese, a speaker of ASL would have trouble understanding the Sign Language of Sweden. ASL also has its own grammar that is different from English. ASL consists of approximately 6000 gestures of common words with finger spelling used to communicate obscure words or proper nouns. Finger spelling uses one hand and 26 gestures to communicate the 26 letters of the alphabet. Some of the signs can be seen in figure1 below.

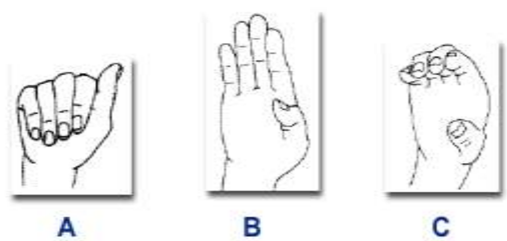

Figure 1: ASL examples

Another interesting characteristic is that ASL offers to describe a person, place or thing and then point to a place in space to temporarily store for later reference. ASL uses facial expressions to distinguish between statements, questions and directives. The eyebrows are raised for a question, held normal for a statement, and furrowed for a directive. There has been considerable work and research in facial feature recognition, they will not be used to aid recognition in the task addressed. This would be feasible in a full real-time ASL dictionary.

2. Hand gesture recognition systems

Research on hand gestures can be classified into three categories. The first category, glove based analysis, employs sensors (mechanical or optical) attached to a glove that transduces finger flexions into electrical signals for determining the hand posture. The relative position of the hand is determined by an additional sensor. This sensor is normally a magnetic or an acoustic sensor attached to the glove. For some data glove applications, look-up table software toolkits are provided with the glove to be used for hand posture recognition.

The second category, vision based analysis, is based on the way human beings perceive information about their surroundings, yet it is probably the most difficult to implement in a satisfactory way. Several different approaches have been tested so far. One is to build a three-dimensional model of the human hand. The model is matched to images of the hand by one or more cameras, and parameters corresponding to palm orientation and joint angles are estimated. These parameters are then used to perform gesture classification. A hand gesture analysis system based on a three-dimensional hand skeleton model with 27 degrees of freedom was developed by *Lee and Kunii*. They incorporated five major constraints based on the human hand kinematics to reduce the model parameter space search. To simplify the model matching, specially marked gloves were used [3], [4].

The third category, *analysis of drawing gestures*, usually involves the use of a stylus as an input device. Analysis of drawing gestures can also lead to recognition of written text.

III. IMPLEMENTATION

Here the design of the system of hand gesture recognition of first category which is based on data glove is discussed. It includes the modules,

- Data Glove
- Tilt detection
- Gesture detection

Block diagram of the system is shown Fig.2.

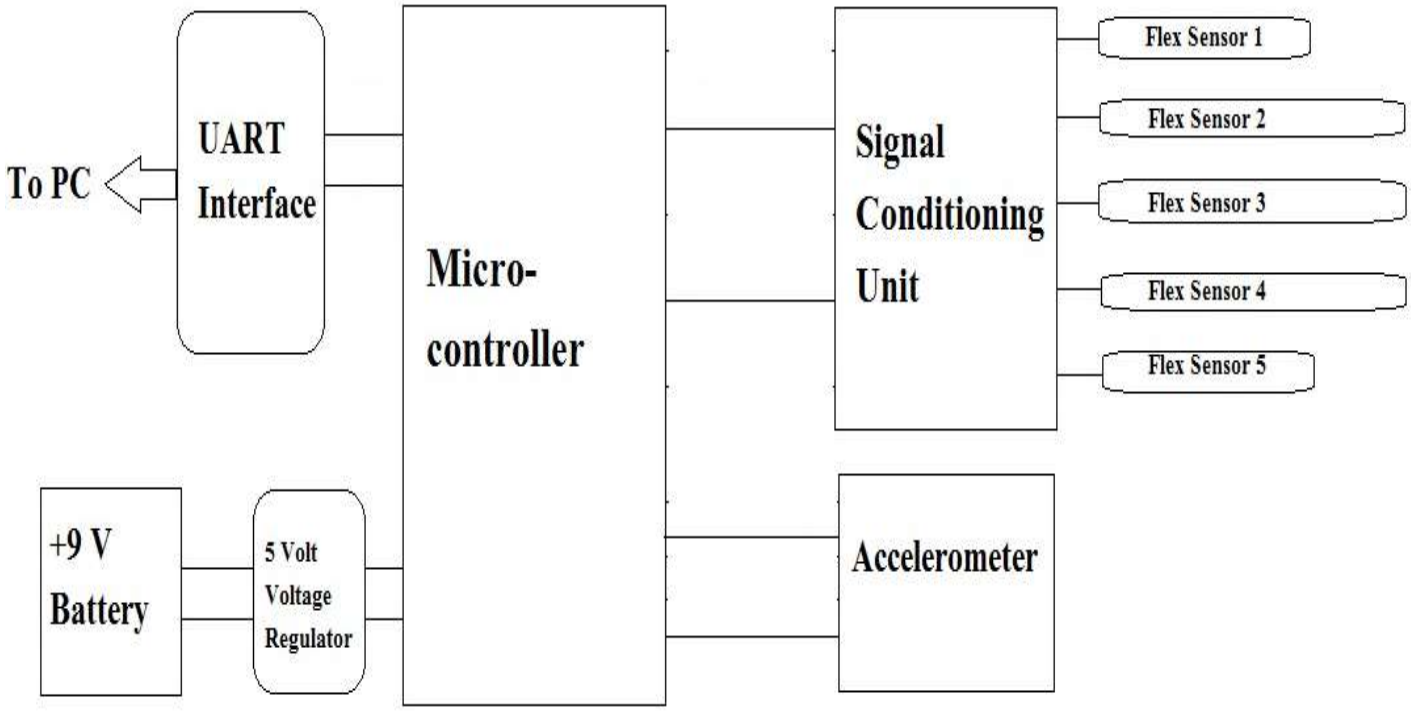

Figure2: Block diagram of the system

a) *Data glove*

It is used in this system was consisting of 5 flex sensors and the accelerometer. All the five flex sensors used are mounted on each of the finger of hand glove. The accelerometer is on wrist of a hand. The actual preview of hand glove is shown in the following figure [5].

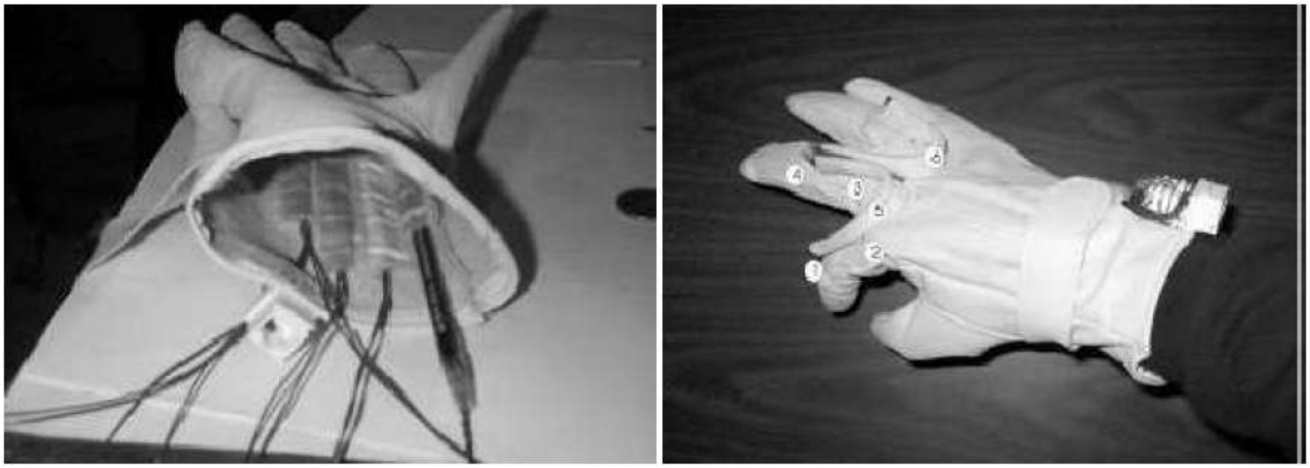

Figure3: (a) Inside and (b) outside the data glove.

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b) Flex sensor

The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius the smaller the radius, the higher the resistance value [7], [8].

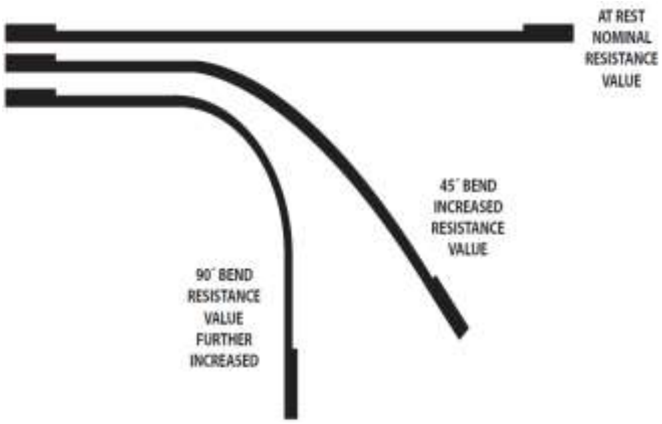

Figure 4: Flex sensors offer variable readings

c) Accelerometer/Tilt Sensor

Accelerometer in the Gesture Vocalizer system is used as a tilt sensor, which checks the tilting of the hand. ADXL103 accelerometer is used in the system, the accelerometer has an analog output, and this analog output varies from 1.5 volts to 3.5 volts. If we convert the analog output of the accelerometer, which ranges from 1.5 volts to 3.5 volts to a digital 8-bit output the systems becomes very sensitive. Reason is division of 2 volts range into 256 ($2^8 = 256$) steps is much more sensitive than converting 5 volts range into 256 steps. Now the question arises, why do we need a less sensitive system, the answer if a more sensitive system is used then there is a huge change in the digital output with the very little tilt of the hand, which is difficult to be handled.

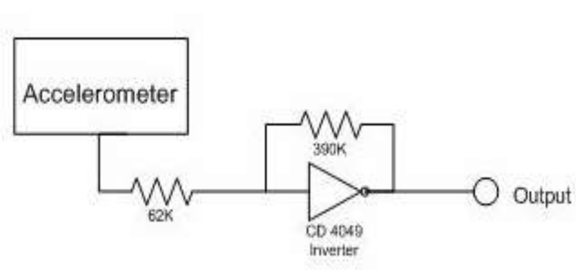

Figure 5: Amplification and attenuation circuit

d) Actual Functioning of the system

The basic function of tilt detection module is to detect the tilting of the hand and sending some binary data against meaningful gestures, to the bend detection module.

The output, which is obtained from the accelerometers after amplification, is an analog output. To deal with this analog output, and to make it useful for the further use, it is required to change it into some form, which is detectable for the microcontroller. The analog output of the accelerometer is converted into digital form.

The bend detection module is the most important and the core part of the system. This module is based on a microcontroller-controlled circuitry. In this module one microcontroller is used and three ports of this microcontroller are in use. Port zero takes the input from the five bend sensors, which is to be processed. The port one takes data from the tilt detection module and the port three gives final data, which represents some meaningful gesture to the speech synthesis module.

At first the microcontroller takes input of the five-bend sensor at its port zero. Output of the five bend sensors is given at the separate pin. Microcontroller deals with the bend sensors one by one. First of the microcontroller checks the output of the first bend sensor, and calculates its pulse width, after the calculation of the pulse width of the first bend sensor the microcontroller saves its output, and then moves towards the second bend sensor and calculates its pulse width in the similar manner, and keeps on calculating the pulse width of the bend sensors one by one, having calculated the pulse width of the outputs of the five bend sensors, the microcontroller moves towards the next step of the module, i.e. gesture detection [9], [10].

Gesture detection is the most important part of this module. The pulse width calculation part of the module calculates the pulse width of the signal obtained from the bend sensors at a regular interval. Even a little bend of the finger is detected at this stage of the system, so the bending of the figure has infinite levels of bends, and the system is very sensitive to the bending of the finger. Now the bending of each finger is quantized into ten levels.

At any stage, the finger must be at one of these levels, and it can easily be determined how much the finger is bent. So far the individual bending of each finger is captured. System knows how much each finger is bent. Now the next step is to combine the movement of each finger and name it a particular gesture of the hand. Now the system reads the movements of five fingers as a whole, rather than reading the individual finger. Having read bending of the fingers, the system checks whether the bend is some meaningful bend, or a useless or undefined bend. If the bending of the fingers gives some meaningful gesture, then system moves towards the next step.

In the next step the system checks the data, which was sent by tilt detection module at port one of the microcontroller. The data sent by this module shows whether the tilt of the hand is giving some meaningful gesture or it is undefined. If the tilt of the hand is also meaningful then it means the gesture as a whole is a meaningful gesture.

So far it is detected by the system whether the gesture given by hand is some meaningful gesture, or a useless one. If the gesture is meaningful the system sends an eight bit data to the speech synthesis module. This eight bit data can represent 256 (2^8=256) different gestures. The gesture detection module assigns a different 8bit code to each gesture.

IV. CONCLUSIONS

This paper describes survey on the different systems available for gesture recognition and the categories involved in hand gestures. One of the systems is explained in brief here. The design and working of a system which is useful for disable people to communicate with one another and with the normal people. The dumb people use their standard sign language which is not easily understandable by common people and blind people cannot see their gestures. This system converts the sign language into voice which is easily understandable by blind and normal people. The sign language is translated into some text form, to facilitate the deaf people as well.

Data glove can put promising results in the field of medicine. It can be used for monitoring hand function for rehabilitation purposes; it can be used in telerobotic surgery and not to mention high quality virtual interactive gaming.

References

[1] Arefin Shamsil and Thilakshan McMaster University "*Motion Tracking Glove for Human-Machine Interaction: Grasp & Release*", 4-23-2010.

[2] Klimis Symeonidis "*Hand Gesture Recognition Using Neural Networks*" School of Electronic and Electrical Engineering, August 23, 2000.

[3] "*Data Glove With a Force Sensor*" Kostas N. Tarchanidis, Member, IEEE, and John N. Lygouras, Member, IEEE.

[4] *Development of a data glove with reducing sensors based on magnetic induction* Chin-Shyurng Fahn; Herman Sun; Industrial Electronics, IEEE Transactions on Volume 52, Issue 2, April 2005 Page(s):585 – 594 Digital Object Identifier 10.1109/TIE.2005.844259.

[5] Seong-Whan Lee, "Automatic Gesture Recognition for Intelligent Human-Robot Interaction" *Proceedings of the 7th International Conference on Automatic Face and Gesture Recognition (FGR'06)* ISBN # 0-7695-2503-2/06

[6] Srinivas Gutta, Ibraham F. Imam, Harry Wechsler, " Hand gesture Recognition Using Ensembles of Radial Basis Functions (RBF) Networks and Decision Trees" *International Journal of Pattern Recognition and Artificial Intelligence, Vol 11 No.6 1997.*

[7] Vladimir I. Pavlovic, Rajeev Sharma, Thomas S Huang, "Visual Interpretation of Hand Gestures for Human-Computer Interaction: A review" *IEEE Transactions of pattern analysis and machine intelligence, Vol 19, NO 7, July 1997.*

[8] Ata-Ur-Rehman, Salman Afghani, Muhammad Akmal, Raheel Yousaf "Microcontroller and Sensors Based Gesture Vocalizer", Proceedings of the 7th WSEAS International Conference on Signal Processing, Robotics and Automation (Ispra '08) Issn: 1790-5117 8 2 Isbn: 978-960-6766-44-2 University of Cambridge, UK, February 20-22, 2008.

[9] Kazunori Umeda Isao Furusawa and Shinya Tanaka, "Recognition of Hand Gestures Using Range Images", *Proceedings of the 1998 IEEW/RSJ International Conference on intelligent Robots and Systems Victoria, B.C.*, Canada October 1998, pp. 1727-1732.

[10] Hong Li and Michael Greenspan, "Multi-scale Gesture Recognition from Time-Varying Contours", *Proceedings of the Tenth IEEE International Conference on Computer Vision (ICCV'05).*