

A Survey: Gesture Recognition Methods and Applications

Mehta Parth V.¹ Asst. Prof. Ravi A. Parikh²
^{1,2}Parul Institute of Engineering & Technology

Abstract--- This paper presents a review of the gesture detection methods and about the application and advanced technologies which based on gesture recognition. We consider all the possible method for all singular gesture and mentions application which are already presence in the market and also mentioned the future technologies. The main part of body which is hand, head, leg, face and eyes used to generate the gesture. We consider the next way of gesture controlled user interfaces using gestures seems appropriate for recent and upcoming devices. This paper also provides a research background for gesture controlled research area as well as application development based on gesture recognition.

I. INTRODUCTION

A. Human computer interface system

Computers are used by all over the world. Special input and output devices have been designed over the years with the purpose of easing the communication between computers and humans, the two most known are the keyboard and mouse. By developing advanced system or methods for communication which are easy in used as well as comfortable to use the systems. Every new device can be seen as an attempt & try to make the computer more intelligent and making humans able to perform more complicated communication with the computer. This has been possible due to the result oriented efforts made by computer professionals for creating successful human computer interfaces; this area is more developing and research area since last from few years. The idea is to make computers understand human language and develop a user friendly human computer interfaces (HCI). Making a computer understand speech, facial expressions and human gestures like Hand, Face, Leg, and Body are some steps towards it. Gestures are the non-verbally exchanged information. A person can perform innumerable gestures at a time. Since human gestures are perceived through vision, it is a subject of great interest for computer vision researchers.

B. Gestures

It is rigid to inhabit a specific useful definition of gestures due to wide variety of applications and a statement can only specify a particular domain of gestures. Many researchers had tried to define gestures but their actual meaning is still subjective. For a successful communication, a sender and a receiver must have the same set of information for a particular gesture.

Gesture recognition is a topic in computer science, embedded system and language technology with the goal of

interpreting human gestures by algorithms, logical methods. Gestures can initiate from any bodily motion or by change of body state but commonly originate from the face or hand moments. Current focuses in the field include emotion recognition from the face and hand gesture recognition. A energetic (dynamic) gesture is intended to change over a epoch of time whereas a static gesture is observed at the spurt of time. A waving hand means goodbye is an example of dynamic gesture and the stop sign is an example of static gesture. To understand a full message, it is necessary to interpret all the static and dynamic gestures over a epoch of time. This complex process is called gesture recognition. Gesture recognition is the process of recognizing and interpreting a rivulet continuous sequential gesture from the given set of input data.



Fig. 1: American Sign Language

Gesture recognition pertains to recognizing meaningful expressions of motion by a human, involving the hands, arms, face, head, and/or body.

It is of utmost importance in designing an intelligent and efficient human-computer interface. In below Fig 1. the American sign language gestures are shown. That are very basic signs which are frequently used in day to day verve. Now a days new interaction forms are not limited by Graphical User Interfaces (GUIs) making Human Computer Interaction (HCI) more natural. The development of humanoid robots or gesture cars for natural interaction is a challenging research topic. By using gesture based

humanoid we can operate any system simply by gestures. The inter-human communication is very complex and offers a variety of interaction potential.

II. HAND GESTURE RECOGNIZING METHODS

A. Flex sensors:

The Flex Sensor technology is based on resistive elements. When the sensor is bent, it produces a resistance output interrelated to the bend Radius .the smaller the radius, the higher the resistance. Flex sensors are look like a strip of metal. Metal is made up of resistive element. When the strip of flex sensor is bend, same time resistance of strip is change. Flex sensor is shown in fig 2.

Use of that kind of resistive sensors is,

1. Automotive controls
2. Check-up devices
3. Computer & Consumer products
4. Melodic instruments

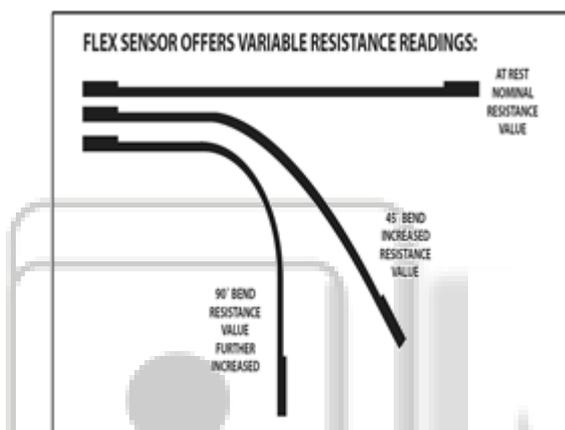


Fig. 2: Flex Sensor

B. MEMS based Accelerometers, Gyroscope & Geomagnetic Sensors:

An accelerometer is a device that measures proper acceleration. The proper acceleration measured by an accelerometer is not necessarily the coordinate acceleration (rate of change of velocity). Instead, the accelerometer sees the acceleration associated with the phenomenon of weight experienced by any test mass at rest in the frame of reference of the accelerometer device. For example, an accelerometer at rest on the surface of the earth will measure an acceleration $g = 9.81 \text{ m/s}^2$ straight upwards, due to its weight. By contrast, accelerometers in free fall or at rest in outer space will measure zero.

The most significant advantage of MEMS is their ability to communicate easily with electrical elements in semiconductor chips. Other advantages include small size, lower power consumption, lower cost, increased reliability and higher precision. Micro-electromechanical systems (MEMS) are micrometer-scale devices that integrate electrical and mechanical elements.

Other advantages include the on-chip integration of electromechanical systems and the circuitry used to control them, allowing further miniaturization. Furthermore, many MEMS fabrication technologies allow parallel manufacturing of thousands of systems by leveraging the parallel fabrication techniques of the integrated circuit

industry. This may lead to a decline in the manufacturing cost and improvement in trustworthiness. MEMS is a process technology used to create miniature integrated devices or systems that coalesce mechanical and electrical components. They are fabricated using integrated circuit (IC) consignment processing techniques.

The main MEMS sensors are Accelerometers, Gyroscopes, & Geomagnetic Sensors.

1) Accelerometer:

Accelerometers sense acceleration by using a suspended proof mass on which external acceleration. Upon acceleration (or deceleration), a force ($F=ma$) is generated on the proof mass resulting in displacement. The force or displacement is usually measured by piezo-resistive and capacitive methods.

2) Gyroscope :

A gyroscope is a device that measures the revolution rate and detects inertial motion. As a result it can be found, for example, in transportation, navigation missile guidance applications. It relies on measuring the influence of the force on a body in a rotating frame. MEMS gyroscopes typically use vibrating structures because of the difficulty of micromachining rotating parts with sufficient useful mass.

C. Image Processing

1) Image acquisition & extraction

Hand gesture image is processed by image acquisition and extraction by following process as per show in figure below. It shows a complete process for gesture recognizing system.

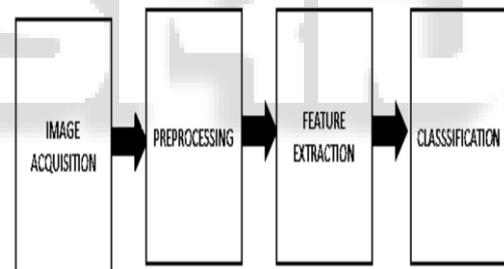


Fig. 3: Block Diagram of gesture recognition system

2) Tracking Technologies:

Gesture only interfaces with syntax of many gestures typically require particular hand pose tracking. A common technique is to instrument the hand with a glove which is equipped with a number of sensors which provide information about hand position, orientation, and flex of the fingers. The first commercially available hand tracker, the Data glove, is described in Zimmerman, Lanier, Blanchard, Bryson and Harvill (1987).

III. CURRENT OPPORTUNITIES FOR GESTURE TECHNOLOGY

There is a special attention for the line of gesture commands as we HCI is progressing rapidly in modern years. From the study we can see the opportunities of implementing the technology in different areas-

A. Supplementary activity

Gesture expertise can provide more entertainment

opportunity for any type of users. Sony Eyetoy, Microsoft's X-box has demonstrated different entertainment opportunities such as playing music, personalized gaming etc.

B. Artificial Intelligence

Community, devices and computation are going to integrate day by day with each other and will soon become part of our regular life. Using gesture based technology will contribute significant part in this intellectual life. Gesture from any part of the body can provide the instructions of communication or even to control the curtain of the window. Robotic industry is also using gesture technology to administer and manage the activities of the robot as part of the Human Robot interaction. Like Select-and-Point, many researches are easily accepted by consumer and it can significantly improve users' interaction with various devices in a ubiquitous computing environment. Based on networking technologies and hand gestures, users can connect multiple devices.

C. Simulation

Body gesture creates the simulation of human body activities in the screen. Physical simulation can improve the realism of the resulting gestural animation in several ways. GestureTek develops a stimulating computer generated virtual reality therapy world that guides patients through clinician-prescribed interactive rehabilitation exercises, games and activities that can target specific body parts. Patient performance is measured and recorded.

D. Training & Education

The technology solution can be developed for training and education purpose. In the rehabilitation or fitness centers, it can train people automatically based on the user's profile, body structure. Taking natural input from the body movements is the most important advantage here over mouse or keyboard. Wii demonstrated many videos of training people on their own speed, based on gesture; the outcome of the training is also immediate.

IV. CONCLUSION

The innovation in the Gesture Interface technology is almost begins around ending of 19th century. Technologies developed based on gesture are now really affordable and converged with familiar and popular technologies like TV, large screen. From this paper we can see the trends of gesture controlled communication systems. Easing of the technology use, affordability and familiarity indicate that gesture based user interface can open new opportunity for elderly and disable people. The aim for this review is to make aware researcher about gesture recognizing methods and technologies which are coming soon.

REFERENCE

- [1] Ruize xu, shengli zhou, and wen j. Li, "mems accelerometer based nonspecific-user hand gesture recognition", *iee sensors journal*, vol. 12, no. 5, may 2012.
- [2] Pedro neto, j. Norberto pires, a. Paulo moreira, "accelerometer-based control of an industrial robotic

arm", european commission's sixth framework program, march 15, 2009

- [3] A.Alice linsie, j.mangaiyarkarasi, anna university regional center madurai, madurai, tamilnadu, india, "hand gesture recognition using mems for specially challenged people", *international journal of vlsi and embedded systems-ijves*, vol 04, issue 02; march - april 2013.
- [4] Utpal v. Solanki, Nilesh h. Desai, "Hand gesture based remote control for home appliances : handmote", 978-1-4673-0125-1_c 2011 *iee*
- [5] Jim Rhyne., *Dialogue Management for Gestural Interfaces*, IBM Corporation
- [6] Bojan mrazovac*, milan z. Bjelica*, djordje simic**, srdjan tikvic** and istvan papp*, "gesture based hardware interface for rf lighting control", *faculty of technical sciences, university of novi sad, novi sad, serbia*, 2011 *iee 9th international symposium on intelligent systems and informatics* • september 8-10, 2011, subotica, serbia.
- [7] Kim, D, Kim, D, An Intelligent Smart Home Control Using Body Gestures. In the Proceedings of International Conference on Hybrid Information Technology (ICHIT'06), IEEE, Korea
- [8] Brad A. Myers. "A Brief History of Human Computer Interaction Technology." *ACM interactions*. Vol. 5, no. 2, March, 1998. pp. 44-54.