

## GESTURE RECOGNITION

1. Introduction: Gesture is defined as a motion of limbs or any other body part which are made to emphasize speech. It can also be defined as an act or a remark made as a sign of attitude.

2. A gesture is scientifically categorized into two distinctive categories: dynamic and static. A waving hand means goodbye is an example of dynamic gesture and the stop sign is an example of static gesture. It is necessary to explain all the static and dynamic gestures over a period of time in order to understand full message. Gesture recognition is interpretation of human motion by computing device. Hand gesture can be detected by controller that contains accelerometers to sense tilting and acceleration of movement. The basic purpose of this system is to provide a means to control electronic devices (capable of infrared communication) using hand gestures. Thus, this system will act like a remote control for operating all the consumer electronic devices present in a house, but this will be achieved through hand gestures instead of pushing buttons. Few widely used palm/hand controlled alphabets/gestures are shown below:-

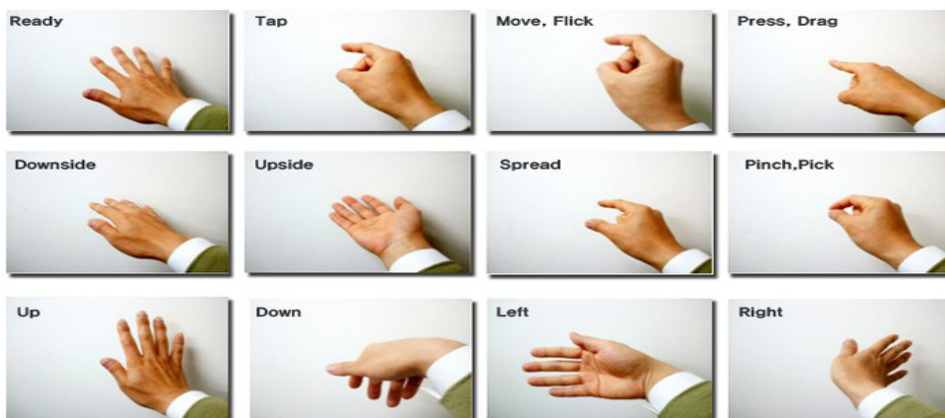
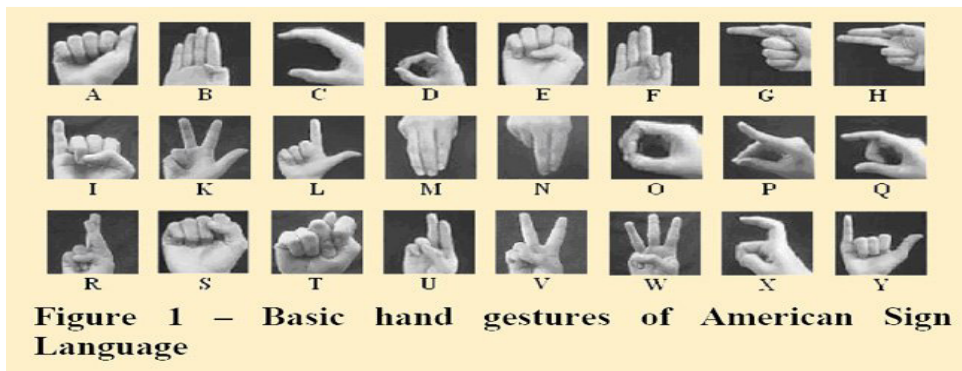


Fig.2 : Examples of Palm Gestures

3. Gestures can be recognized by using sensors, accelerometer etc. Accelerometer-based gesture recognition performs matching or modelling in time domain, there is no feature extraction stage. The detected and recognized hand gestures are used as the command signals for controlling devices, Some user interfaces, e.g., icon-based interface or motion-based interface are adjusted accordingly in order to support natural hand control.

4. Types of Gesture: In computer interfaces, two types of gestures are distinguished. Online gestures, which can also be regarded as direct manipulations like scaling and rotating. In contrast, offline gestures are usually processed after the interaction is finished; e.g. a circle is drawn to activate a context menu.

(a) Offline gestures: Those gestures that are processed after the user interaction with the object. An example is the gesture to activate a menu.

(b) Online gestures: Direct manipulation gestures. They are used to scale or rotate a tangible object.

5. Advantages: Few advantages of using the gesture language are given below:

(a) Low power requirement.

(b) Simple circuitry as it does not require special hardware.

(c) Higher security as directionality of the beam helps ensure that data isn't leaked or spilled to nearby devices as it is transmitted.

(d) Devices can be controlled more comfortably.

6. Disadvantages: Some basic limitations of using such communication are given below:

(a) It has distance limit in controlling devices.

(b) Line of sight communication as transmitters and receivers must be almost directly aligned (i.e. able to see each other) to communicate.

(c) The data rate or speed of transmission is lower than a typical wired transmission.

7. Applications: Gesture communication is still widely used and has specific applications:

(a) It can be used in any IR device.

(b) To overcome situations where normal cabling is difficult or financially impractical.

(c) It can be used in home theatre system where short distance communication is required.

(d) Suitable for physically impaired people to operate the devices within the room.

(e) Suitable for controlling home appliances. The basic working of such appliances is shown below:-

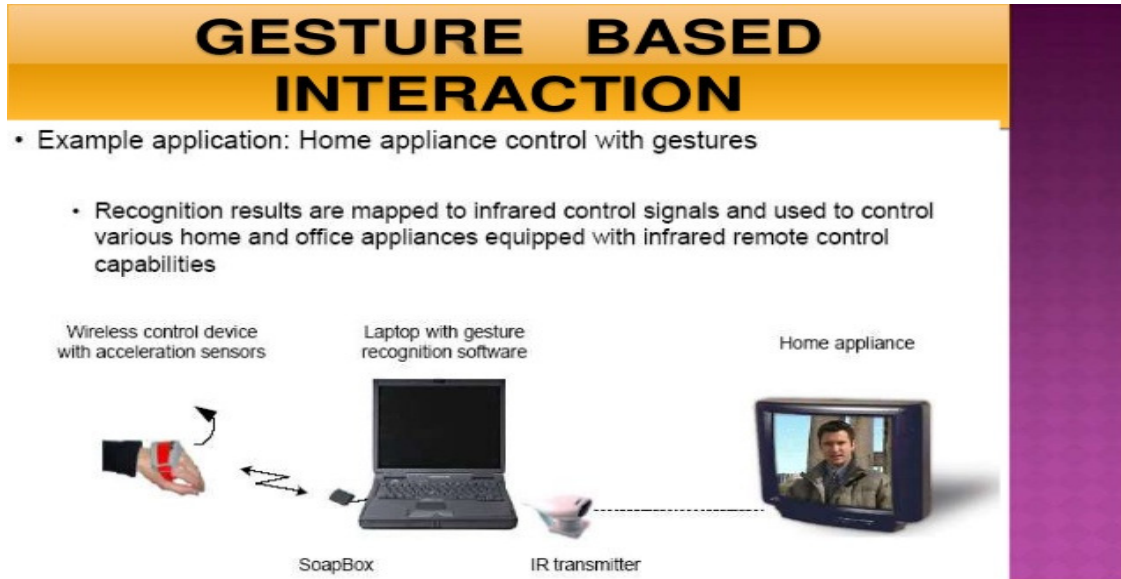


Fig. 3 : Working of Wireless Based Home Appliances

### Challenges

8. There are many challenges associated with the accuracy and usefulness of gesture recognition software. For image-based gesture recognition there are limitations on the equipment used and image noise. Images or video may not be under consistent lighting, or in the same location. Items in the background or distinct features of the users may make recognition more difficult.

9. The variety of implementations for image-based gesture recognition may also cause issue for viability of the technology to general usage. For example, an algorithm calibrated for one camera may not work for a different camera. The amount of background noise also causes tracking and recognition difficulties, especially when occlusions (partial and full) occur. Furthermore, the distance from the camera, and the camera's resolution and quality, also cause variations in recognition accuracy. In order to capture human gestures by visual sensors, robust computer vision methods are also required, for example for hand tracking and hand posture recognition or for capturing movements of the head, facial expressions or gaze direction.

### 11. References:

- (i) Shiguo Lian, Wei Hu, Kai Wang, "Automatic User State Recognition for Hand Gesture Based Low-Cost Television Control System", IEEE, 2014
- (ii) Ahmad Akl, Chen Feng and Shahrokh Valaee, "A Novel Accelerometer-Based Gesture Recognition System", IEEE Transactions On Signal Processing, Vol. 59, No. 12, December 2011.