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Gesture Control System For Visual Disabilities

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ABSTRACT

Visual disabilities or visual impairment is a decreased ability which restricts a person to see anything. It also causes them problems while reading, driving,walking and socializing with rapid changes in the field of smartphones different creative ideas are used for solving the problem. This paper focuses on the usability issues of smartphones applications for people with visual impairment. Comparative analysis of android applications for visual impairment has been presented. Various touch interfaces are touch, gesture, physical control and wearable. These systems are very useful for people with upper physical extremity, robot control systems, sign language interactions,etc. Results attained after the survey depicts the various techniques that can be used to make a system useful for the visually impaired people.

Keywords: Gesture Control, Vision Impairment, Human Computer Interaction, DTW, SIFT, Piecewise Bezier Volume Deformation Model.

1. INTRODUCTION

Gesture recognition is used to classify meaningful expressions depicted by the human body which includes hands, arms, face, head, eyes and also the body as a whole.[1] Gesture can be classified in many ways,which can be arbitrary, mimetic and deictic. Arbitrary gestures are those whose interpretations must be learned due to their opacity,Deictic gestures only point at the most important objects and each gesture should be transparent in the given area, Mimetic gestures uses motion to form the objects shape or give the object its features.[2] Such control is very helpful in human computer interaction. This technology can replace the use of joystick, mouse and keyboards.Gesture recognition can be used with techniques from computer vision and image processing.

Vision impairment can be caused due to any injury to the eye, blindness from birth and vision impairment, infection in the eye and Amblyopia.

Human computer interaction is a method for designing, evaluating and implementing a computer system for making it useful for human use. The main research areas in human computer interaction are Facial Expression Analysis, Body Movement Tracking, Gesture Recognition and Gaze Detection.[3] Till date we have been using simple lock techniques such as password, swipe pattern, now-a-days we also have finger print techniques introduced in the latest IPhone and Samsung mobile phones, we also have Face detection systems, which has been already used in various laptops as password locks, but variations in illumination, posture and expression [4] can cause problems. We can also use TDS technology, which is a wireless and wearable technology which allows control or usage of computers using the gestures of tongue or the motion of the tongue, it identifies the commands using the magnetic tracer which is put on the users tongue.[5]

Speech and handwriting recognition systems can also be used, because all of these systems perform recognitions using various models such as spectral templates or hidden Markov model. Speech recognition

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system depends on various factors such as does the system need to be trained for a particular voice, vocabulary size and the recognition rate.

Unlike voice control, gesture control is more effective in noisy environments[6]. Gesture contol can be used as a method for the people who are visually impaired, similarly TDS technology can also be used. The output should be in the form of sound which would be understood by the visually impaired person. For such people smart phones must provide a face detection password lock or a finger print password lock.

For vision based gesture recognition techniques may make use of cameras and various sensors namely, depth sensors, commodity sensors, thermal cameras and IR cameras etc. which make the recognition more complex and costlier. [7] We can use Three Dimensional interactions for gaining quality images and handling large amount of data.

For the Gesture recognition we can also use K-NN Classifier which includes the DTW (Dynamic Time Warping) technique, this can adapt to changes in gesture types and users. This step also include feature extraction and normalizing the image, for this we used OpenNI to obtain the 3D coordinates of the hand from the frame which contains features, where xand y depict the pixel positions,whereas, z depicts the distance value between camera and the hand and then converting the image into projective coordinates. Then we obtain the normalization by subtracting the position of the hand from the complete trajectory and then we calculate the minimum enclosing sphere of the data and also find out the bounding cube. This technique also included Dynamic Time Warping, which is used for matching the patterns between the two given series, it also does not need any training data. By using DTW we align two samples of variable length and then we put K = 1, using the K-NN Classifier. [17]

The rest of the paper is organized as follows. Related research work are explained in section II. Survey III. Conclusion are given in section IV.

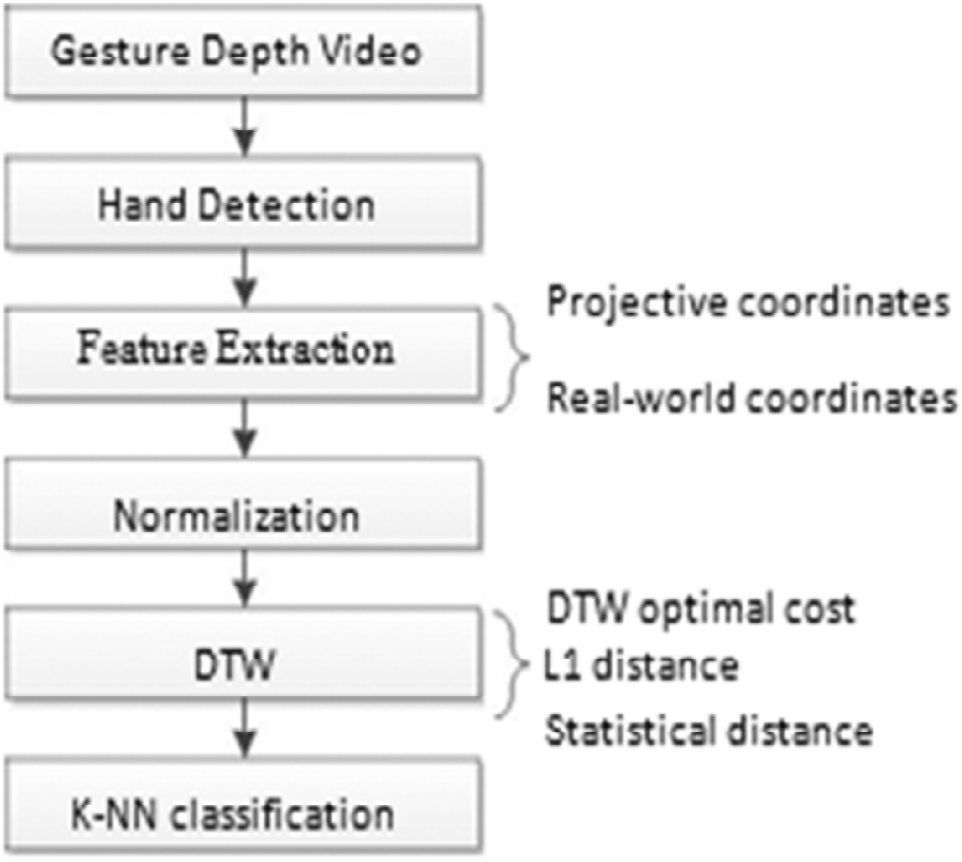

Figure 1: Framework For Gesture Identification

2. RELATED RESEARCH WORK

The major problem that occurs in hand gestures is of false labeling of hands, to solve this problem Sunitha Patidar et al used different colour combination models which is known as mix model approach.[8] For this purpose we also use Color – Based Probabilistic Tracking, in which objects and features are found using the frames of an image sequence, which can be further used in many departments such as video editing and compression,making visual effects, doing motion capturing, visual servoing, etc. [9]

We may use Muscle Gesture-Computer Interface system, it consists of three parts the MYO armband, the MGCI and mobile robot,it gets computer attached to it using bluetooth and wifi techniques.[10]

For the identification using face detection the identity may change due to change in the size of the face, the size of the features when a child gets older for this we use a continous identification authentication.It uses 3 D face modelling, in which the 3D Geometry of the face is represented using the vertices in the face space and hence we have developed a Piecewise Bezier Volume Deformation Model, using this model we can manually craft various predefined 3D face deformations, which are known as Action units.[11] Yue H. Yin et al has developed two systems known as, Neuro Fuzzy Controller and EPP system used for providing a bidirectional Human Computer Interaction.[12] Meng ang et al has developed Monogenic binary coding, which is used for extracting amplitude, phase and orientation from the given original signals.[13] Evan A.Suma et al had used full body control by using the Depth sensors alongwith virtual reality application and implemented it using FASST Algorithm. [14]

2.1. Monogenic Binary Coding – It is used for visualizing the general form of analytic signals from 1D to 2D. 1-D analytic signal can be represented as:

$g_a(x)=g(x)+j.g_H(x)$, where g_x is a real value of the 1D signal $g_H(x)= g(x)*h(x)$.

$$Local\ Amplitude = \sqrt{g^2 + gx^2 + gy^2} \tag{1}$$

$$Local\ Orientation = \alpha\ \tan\left(gy / gx\right) \tag{2}$$

$$Local\ Phase = -sign\left(g_x\right)\alpha \tan 2\left(\sqrt{gx^2 + gy^2} / g\right)[15] \tag{3}$$

2.2. SIFT (Scale Invarient Feature Transform) – This is a technique used to describe the features of the image. For this we use Pipelined stages of the SIFT Algorithm. Various features of an image are taken out such as, scale, rotation, illumination and translation. In tis transformation a N*N matrix is formed to generate the set of features.

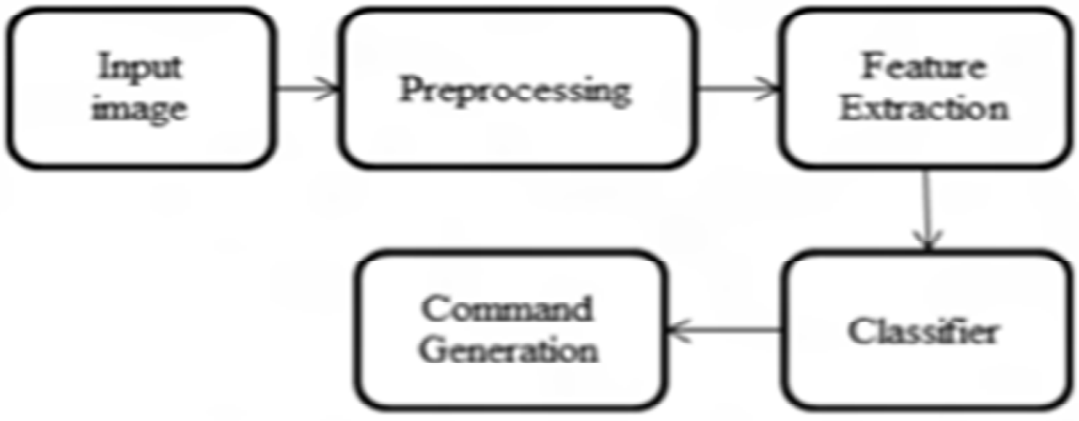

Figure 2: System model

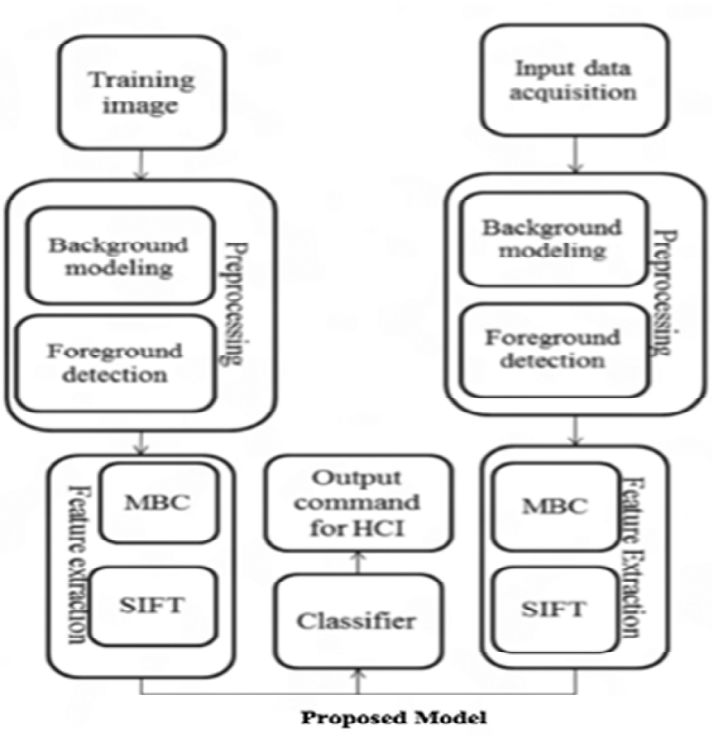

Figure 3: Functioning Model

3. SURVEY

Various input devices that are being used are wired gloves, depth aware cameras, stereo cameras, gesture based controllers, single cameras, radar, etc.

Various applications that use gesture control are,Side control, with this application we can set a dedicated gesture for a given task ; Xposed Gesture Navigation this application involves navigation with the multitouch gestures, using this we can get rid of soft keys and hardware keys; Air call accept this application helps you answer your call when you place your phone near your year, it works on a Bluetooth facility also ;All in one gestures in this application one needs to swipe fingers across the screen to form a gesture; Hovering control application provides gesture control using proximity sensors for simple applications ;Smart Controls provides features like air gestures control, speaking notification, speaking mode, pocket mode, flip mode, etc ; I Gest allows users to make there own gestures for all the applications used by the user frequently. We use various types of sensors in a smart phone which are namely,Accelometer is used for measuring the proper acceleration which it obtains with respect to free fall; Gyroscope is used to measure the spin movement of the device, it uses principle of angular momentumfor maintaining the orientation of the device ; Magnetometer are used to measure the direction as well as the strength of the original signal ;Proximity sensor uses LED and IR light detector it measures the distance between the smart phone to that of the human body ; Light sensor it measures how bright the ambient light is ; Barometer sensors are used to measure the atmospheric pressure it improves GPS accuracy; Thermometer sensor measures the temperature; Finger Print sensor used in Iphone 5s and Samsung Galaxy S5 used for sensing the movement of the fingers ;Heartbeat sensors are used to track the heartbeats of a person which can also be used for opening of the lock in smartphones. Full controllable detector systems[16] can be used this system reads the complete face that is, each and every feature is extracted.

4. CONCLUSION

In this Gesture control systems for visual disabilities,we need to build a smart phone using various feature extraction techniques for a password with face detection. After that various swipe functions can be used to

control various applications using fingerprint sensors and then we can use sound effects as the output for the convenience of the users. We can also use security after login[17] and identification of user at every application and setting up a system which asks for authentication after every 30 seconds by face detection techniques.These features combined together would make a good system for visually impaired person.

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