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HUMAN SYSTEM INTERFACE CONTROLLED BY LIP MOVEMENT

P. Dhanalakshmi, K. Adalarasu
Department of Electronics & Communication Engineering, PSNA College of Engineering & Technology, Dindigul, Tamilnadu, India

ABSTRACT---Human Computer Interface (HCI) is the most useful technique that makes people to communicate easily with the computers. Human Computer Interface is used in areas such as industrial design, personal information management and human interaction management. This paper is to extract the features from the lip of a human that is being pronounced. The input is taken as a video and it is processed using image processing technique in order to obtain the lip features such as width, height, area, lower lip thickness and upper lip thickness. These features may vary from person to person for each word. The extracted features are stored in the database. In the experiment, the spoken words are from the common people. From the result, it was concluded that height feature is better for differentiating opening and closing of the mouth.

Keywords: Lip movement, Image Processing, Device control.

I. INTRODUCTION:

HCI (Human-Computer Interaction) focuses mainly on the interaction between humans and the machine. An interface depends on number and diversity of its inputs and outputs. The independent single channel in an interface is called as modality and a system with one modality is called uni-modal. A system that is based on more than one modality is called multi-modal systems. Lip is the unique organ in the human body. The uniqueness is proven from the color and the shape analysis for every person. Lip reading is used to understand the movement of the lips when sound of that person is not available. Lip reading may help hard hearing people as well as the deaf to easily process the information from the moving lip. While speaking, the size of the lip may differ from person to person for each word.

Speech recognition may be still difficult though the voice is available while the view of the person is not clear and there are many people in a single frame. It may also become difficult in dark background or if the head of the speaker turned away from the camera and in noisy environment. So lip reading may enable the person to identify the words which would be more accurate even in noisy environments.

II. RELATED WORKS:

Computer based lip reading track the lip movement that is being spoken. The features such as the horizontal and vertical distances are used to find the surface area of the lip. This work **[Talha]** showed that the elliptical area is more accurate than the surface area. **Dalka** in his work designed a multimodal device called Lip mouse. It makes use of the movement and gestures of the mouth to allow the user to control the cursor on the computer. This work used various gestures such as opening the mouth, keeping the tongue of the mouth and making the mouth puckered.

Lip control system (LCS) designed for paralyzed persons**(Jos and Lopes)** has

components such as headset and a lower joystick that is to be placed on the lower lip. Fitt's law is used to evaluate the lower lip potential and an input device is controlled with that potential. **Tin** used optical method to extract the facial and the lip features from the facial points. Lip shape is being considered as triangle and the vertices of the triangle are used to extract the lip features. **Panikos** used lip shape along with the hand position in order to find the pronounced letters in French. This method used the hand and lip recognition components to make the phonemes clear for deaf and hard hearing persons.

III. METHODOLOGY

3.1. IMAGE PROCESSING

Lip reading deals with the interpretation of the movement of the lip while speaking. It involves four stages (Figure 1). First is the image acquisition from which the videos are taken as input. Secondly, the images are processed in order to remove the unwanted information. The next step is to detect the lip from the face image using Viola Jones algorithm. Final step is to extract the lip features such as the width, height, lower lip thickness and upper lip thickness.

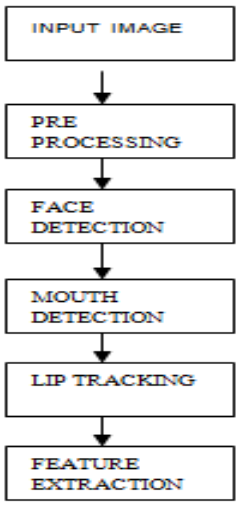


Fig.1. Flow chart of lip recognition

Image processing steps

The acquired video is converted into number of frames and the frames are then taken for further analysis. The converted frames are preprocessed in order to make them suitable for further analysis. The first step is to convert the color image into the gray scale image and then the image is filtered in order to remove the uncertainties in an image. In this paper, median filter which replaces the median of all the pixels in an image is used for noise removal.

Morphological image processing orders the pixels in the image based on the shape of the image. Technique such as dilation, erosion, opening and closing are used to modify an image. Dilation adds pixels to the boundaries of an image whereas erosion removes or reduces the size of an image. . Dilation is given by the equation

$$(f \oplus s) = \{(p+q) | \, p \in f, p \in s\}$$

And equation of erosion is given by

$$f \ominus s = \{p | s_p \in f\}$$

Dilation and erosion are followed by the opening and closing of an image. Opening will make smaller elements to disappear while retaining the larger structures. Closing will fill all the holes that are smaller in the background.

Opening: $f \circ s = (f \ominus s) \oplus s$

Closing: $f \bullet s = (f \oplus s) \ominus s$

By these equations, opening of f is erosion of f by s and then dilation by s whereas closing refers to the dilation of f by s and then erosion by s. Hence dilation and erosion are duals of each other.

Viola Jones algorithm is used which is more efficient in mouth detection than other algorithms. Viola Jones provides high detection rate and can process nearly 2 frames per second. It includes three stages namely the haar feature selection, the integral image formation and the cascading classifiers.

Using the region of interest, curve is drawn on the lip region in which the exact shape of the lip can found. The region of interest will crop the area that does not provide much information to the lip features. The region of interest provides more accuracy than any other method as the region is selected correctly.

Principal component analysis (PCA) is the method that is used for feature extraction. This algorithm predicts the variances of the data that are orthogonal to their preceding component which results in an uncorrelated orthogonal set. The Eigen values are found from the internal structure of the data from which the variance can be evaluated.

The Euclidean distance classifier finds the distance between any two points in a given area. It also refers to the minimum distance in a Euclidean space. If X and Y are the two points in an image then the distance from X to Y is given by the Pythagorean Theorem as

d (x,y=) $\sqrt{X^{2-}\ Y^2}$

where X and Y are the two points in an image

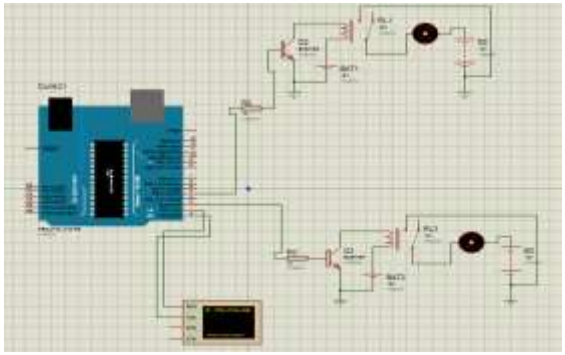
IV. HARDWARE IMPLEMANTATION

ARDUINO

Arduino is an AVR (Advanced Virtual RISC) microcontroller that facilitates easy programming and it is a open source hardware. Arduino consists of analog and digital input output pins that can be interfaced to other circuits. It consists of serial interfaces such as Universal Serial Bus (USB) in order to load the program from the computers. Integrated Development Environment (IDE) is used for programming the microcontrollers. It supports programming languages such as C and C++.

Arduino consists of Atmel 8, 16 and 2 bit AVR microcontroller. The component that connects CPU with other modules is termed as the Shield. The shields communicate directly with other pins and sometimes through the Inter- Integrated Circuit (I²C) serial bus. The Arduino consists of series of Atmel megaAVR such as ATmega8, ATmega168, ATmega328, ATmega1280 and ATmega2560. Arduino requires 5V regulator and a 16 MHz crystal oscillator. An Arduino microcontroller is pre-programmed with a boot loader as it simplifies the burden of uploading the programs to the on-hip memory when compared with other devices that requires an external programmer. In Arduino UNO, optiboot bootloader is defaultly installed bootloader as it allows the use of computer to act as the bootloader.

The distances that are found using the MATLAB are sent to the ARDUINO processor in order to control motors. The feature distances that are obtained from the lip include the width, the height, the surface area, upper lip thickness as well as the lower lip thickness. The processor will classify the features of the lip motion features and control the device. The motor 1 will be tuned ON if the word forward is pronounced. It will be in ON state until the user again pronounces the same word. Likewise the motor 2 will be in ON condition if the user pronounces the word backward.



. Fig.2. Device control by lip movement.

V. CONCLUSION

Lip reading has attracted the deaf and hard hearing persons and it is more convenient for them to understand what others convey. The important step is to classify various possible features of the lip and finally fed this feature into the classifier for efficient classification. The

main objective is to design and implement the lip based detection system using Viola Jones algorithm. The detected features are then fed into the processor in order to control a device which is more useful for paralysed and tetraplegia persons.

VI. FUTURE WORK

The lip reading can be extended by including more number of subjects in the future. The control can also be extended by implementing it in the wheel chair as it may help the paralyzed persons which may reduces the work of the care takers.

REFERENCES

1. Hlaing Htake Khaung Tin., "Facial Extraction And Lip Tracking Using Facial Points", International Journal of Computer Science, Engineering and Information Technology, Vol. 1, No.1, pp. 1-7, April 2011.
2. Kamil S. TALHA, Khairunizam WAN, Viratt Chittawad, S.K.Za'ba, M.Nasir Ayob, Zurodzman M. Razlan and Shahriman AB., "Extracting Feature Points Of Lip Movement for Computer Based Lip Reading"., International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol:14, No:02, pp 48-53, April 2014.
3. Marcelo Archajo Jos, and Roseli de Deus Lopes., "Human–Computer Interface Controlled by the Lip"., IEEE Journal Of Biomedical And Health Informatics, Vol. 19, No. 1, pp 302-308, January 2015.
4. Panikos Heracleous, Noureddine Aboutabit, and Denis Beautemps., "Lip Shape and Hand Position Fusion for Automatic Vowel Recognition in Cued Speech for French"., IEEE Signal Processing Letters, Vol. 16, NO. 5, MAY 2009 339
5. Piotr Dalka, Andrzej Czyzewski., **"**Human-Computer Interface Based On Visual Lip Movement And Gesture Recognition'., International Journal of Computer Science and Applications, Vol. 7 No. 3, pp. 124 - 139, 2010.
6. SHEN Xian-geng, WU Wei., "An algorithm of lips secondary positioning and feature extraction based on YCbCr color space"., International Conference on Advances in Mechanical Engineering and Industrial Informatics (AMEII 2015)
7. David Sodoyer, Bertrand Rivet, Laurent Girin, Christophe Savariaux, Jean-Luc Schwartz, Christian Jutten., "A study of lip movements during spontaneous dialog and its application to voice activity detection"., HAL Archives- ouvertes., February 2014.
8. Maycel-Isaac Faraj and Josef Bigun., "Synergy of Lip-Motion and Acoustic Features in Biometric Speech and Speaker Recognition"., IEEE Transactions on Computers, Vol. 56, No. 9, September 2007
9. Namrata Dave., "A Lip Localization Based Visual Feature Extraction Method"., Electrical & Computer Engineering: An International Journal (ECIJ) Volume 4, Number 4, December 2015
10. H. Ertan Cetingül, Yucel Yemez, Engin Erzin, and A. Murat Tekalp., "Discriminative Analysis of Lip Motion Features for Speaker Identification and Speech-Reading"., IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 15, NO. 10, OCTOBER 2006
11. Samir Kumar Bandyopadhyay, S .Arunkumar, Saptarshi Bhattacharjee., " Feature Extraction of Human Lip Prints"., Journal of Current Computer Science and Technology Vol. 2 Issue 1 [2012] 01-08
12. Yun-Long Lay, Hui-Jen Yang, Chern-Sheng Lin, Bin-Fen Lee., "Lip Language Recognition for Specific Words" ., Indian Journal of Science and Technology, Vol:5 Issue:11 November 2012 ISSN:0974-6846