DESIGN AND IMPLEMENTATION OF TECH GLOVES FOR DUMB PEOPLE

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Abstract-- This paper introduces about the "Smart Gloves for Dumb People," a novel wearable technology designed to enhance interaction and accessibility for individuals facing challenges in expressing their feelings through communication. The smart gloves are equipped with advanced sensors, embedded computing capabilities, and haptic feedback mechanisms to facilitate seamless communication and navigation for users with limited verbal or cognitive abilities.

The primary objective of these smart gloves is to empower specially challenged peoples who are not able to speak, such as those with speech impediments, cognitive impairments, or language barriers. The gloves leverage state-of- the-art technology, including natural language processing algorithms and gesture recognition, to interpret user inputs and convert them into meaningful outputs.

Keyword— Smart Gloves, Arduino, Sign Language, Flex Sensors .

1. INTRODUCTION

In a world where technology is omnipresent and constantly evolving, accessibility and inclusion are critical factors to take into account. However, people with speech or hearing impairments frequently encounter major obstacles to fully engaging in the digital world amidst the quick spread of smartphones, smart gadgets, and digital platforms. These people—who are sometimes referred to as "dumb"—are usually excluded because of their limited capacity for digital gadget use and communication. Therefore, there is an urgent need for creative solutions that enable this group of people to participate more actively in the digital world.

The "Design and Implementation of Tech Gloves for Dumb People" project is creates a cutting-edge assistive technology product that is especially suited for those with low speech or hearing. With their flexible and user-friendly interface for interfacing with digital devices, these tech gloves offer a ground-breaking solution to the communication gap that this group faces.

Acknowledging the varied needs and experiences of people with impaired speech or hearing is essential to the project's goals. The project aims to obtain a comprehensive understanding of the target demographic's distinct issues, preferences, and objectives about technology use by means of comprehensive study and engagement with members of the target demographic. Every step of the design and implementation process is influenced by this user- centric approach, which guarantees that the tech gloves successfully meet the demands and concerns of their intended users in the actual world.The research highlights how crucial interdisciplinary innovation and teamwork are to the creation of assistive technology solutions. By utilizing knowledge from human-computer interaction, engineering, and disability studies, among other areas, the initiative promotes inclusive and holistic design and execution. The project intends to produce tech gloves that not only suit users' practical requirements but also resonate with their lived experiences and identities by bringing together varied viewpoints and skill sets.

This introduction sets the stage for exploring the implementation of a tech gloves using Arduino, highlighting its potential impact on enhancing the lives of users within the domain of assistive technology and rehabilitation engineering.

2. LITERATURE SURVEY

[1] Title: BRIEF REVIEW PAPER ON SMART GLOVES FOR SPEECH IMPAIRED PEOPLE USING IOT AND EMBEDDED SYSTEM

Er. Sonam Singh*1, Aditya Sahai*2, Aditya Kumar Lodhi*3, Aman Chaudhary*4 Year:2023

Methods: The thumb has one button connected to ground, the remaining fingers/buttons are connected to the Arduino digital pins, using the code we will pull-up the input from the remaining fingers i.e. the Arduino register sends 5 volts by default to the buttons. If we touch the thumb and rest buttons, we will get the sentences as output. Here output shows through LCD device that is connected through a I2C module and through this Bluetooth module it is connected to a mobile device and it also gives audio and image output The Arduino Uno receives input from metal buttons, processes that input into text output and audio output by reading the input from the metal buttons. Then we define the pins that we are using, this pins are made as high as using the input pull up in the code. When the pin value becomes zero, the pin sentence is displayed through the LCD using a I2C module and through Bluetooth module we get the audio output. Also using MIT app inventor we build an app, which is used to connect Mobile device and also to get audio output.

Drawbacks: The drawback to using the Arduino IDE is its space and speed limitations. Their system is restricted to a limited number of gestures. Another limitation is using flex sensors, as the value of resistance changes with the rigorous use of the system. Due to which, the probability of getting the correct output reduces by some percentage(American University of Ras Al Khaimah & Institute of Electrical and Electronics Engineers, n.d.)

ii) Implementation of IoT Based Smart Assistance Gloves for Disabled People

Authors: R. Senthil Kumar, P. Leninpugalhanthi, S. Rathika, S. Sandhya Year:2021

Methods :We created the smart assistance gloves for people with disabilities because there hasn't been any significant advancement in their lives. Flex sensors are used in the design of the suggested model, and the Arduino Uno board receives the instructions. The Android app shows the corresponding output in the form of a text, together with an audio output, for the finger gesture that the flex sensor detects. The Arduino Uno, Raspberry Pi, and GSM module are the main components of the entire procedure. A wireless serial port module is used to transfer data between the Raspberry Pi and Arduino Uno. In the event of an emergency, the emergency contact will receive a notification via the GSM module.

Drawback: The primary disadvantage is that the instructions are shown in the app and on the webpage, and the output is received via the app. Furthermore, the output is provided as audio. The audio output is connected to the speaker. An alert message is delivered to the emergency contact in the event of an emergency.

(accelerometer sensor) are interfaced using the Arduino Uno. The smartphone is already attached in the upper arm to give the instruction to the phone.

Advantages: It can be used to assists disabled people. Wireless Connection additionally, it is cost efficient.

Drawbacks: It needs to improve the execution of 3- D printed hand gestures. major limitation can be seen on the fingers of the 3-D printed arm which is the object that easily falls when gripping and holding the material. Because of the slick surface on the fingers of the 3-D printed arm.

iii) Design and Implementation Of Smart Gloves For The Specially Privileged

Author: Anisha M R, Ashwin S Nair, Anu Shreya, Chinnannagari Tharun, Neethu K N Year:2020

methods: The smart glove's foundation is made of synthetic gloves. It will have every component hooked to it. The four flex sensors that make up the glove will be affixed to the middle, small, ring, and index fingers, in that order.The frontal side of the glove will have the ultrasonic sensor fastened to it. The buzzer is going to be fastened to the palm's side. The Arduino 2560 controller will be attached to each of these parts.

3. PROPOSED SYSTEM

3.1 Materials Used:

i . Flex Sensors

Flex sensors are specialized components integrated into the smart gloves, engineered to detect and measure the degree of bending or flexing within specific regions of the hand. These sensors operate based on the principle of changes in resistance concerning the angle of flexion.

As the sensor bends, its resistance changes, producing a varying electrical output proportional to the extent of bending, thereby enabling precise gesture recognition. Calibration is crucial to ensure the accuracy and reliability of flex sensors. Before integration into the smart glove system, sensorsrequire precise calibration procedures to establish baseline measurements and understand the sensor's behavior at various bending angles. This calibration process helps in accurately interpreting hand movement Flex sensors are strategically placed across different parts of the glove to capture diverse hand movements effectively.

Their integration involves careful placement on specific areas of the glove corresponding to various hand joints or segments, ensuring comprehensive coverage for detecting a wide range of gestures. Proper positioning and attachment of sensors are critical to accurately capture and interpret hand movements.

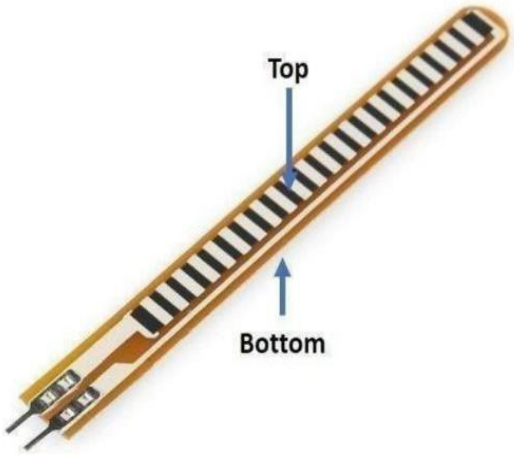
In conclusion, flex sensors are integral components in smart gloves, enabling precise detection and interpretation of hand gestures. Their proper integration, calibration, compatibility, and accurate data processing are pivotal in facilitating effective gesture recognition and user interaction for individuals with speech impairments

ii)Bluetooth Module

The tech gloves and cellphones can communicate wirelessly thanks to Bluetooth technology, doing away with the need for awkward physical connections. With more mobility and flexibility when engaging with mobile devices, this wireless feature improves the user experience. The Bluetooth module guarantees constant connectivity between the gloves and the mobile device, improving the system's overall usefulness and convenience whether texting, making calls, or accessing digital apps.

By utilizing the vast capabilities of contemporary smartphones, the tech gloves with Bluetooth module increase the functionalities accessible to users. The gloves may access a multitude of digital resources, such as third-party apps, online chat platforms, and multimedia information, by establishing a dependable Bluetooth connection. Through this connectivity, users may fully utilize the capabilities of their smartphones, converting the gloves into adaptable digital interfaces for a variety of tasks and activities. The tech gloves with Bluetooth functionality provide access to a wide range of mobile technology functions, such as media playback control, information access, and integration with smart home devices.

Furthermore, the project's use of a Bluetooth module demonstrates a dedication to interoperability and compatibility with already-existing digital infrastructure. Because Bluetooth is extensively supported by a wide range of platforms and devices, it integrates seamlessly with a number of smartphones and mobile operating systems.



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iiiTech Gloves

Modern technologies are combined into these gloves to give consumers a flexible and easy-to-use interface for using digital gadgets. Fundamentally, the gloves include sophisticated gesture detection capabilities that let users interact with menus and input commands with hand gestures. With this novel technique to engagement, people may communicate and manage digital devices more easily and naturally by doing away with the need for conventional input devices like keyboards and touchscreens.

Because the tech gloves have a Bluetooth module, they can link wirelessly to mobile devices like tablets and smartphones. Users may easily pair the gloves with their mobile devices thanks to its Bluetooth integration, creating a dependable communication channel for sending commands and getting feedback. The gloves' use of Bluetooth technology allows users to interact with their digital devices more freely and flexibly, enabling them to stay connected and involved in a variety of settings.All things considered, the tech gloves created for this project mark a paradigm change in assistive technology by providing people with weak speech or hearing with an effective tool for engagement and communication in the digital age. These gloves open the door for increased accessibility and inclusivity in the field of technology with their creative design and feature set, enabling users to confidently and independently engage fully in the digital world.

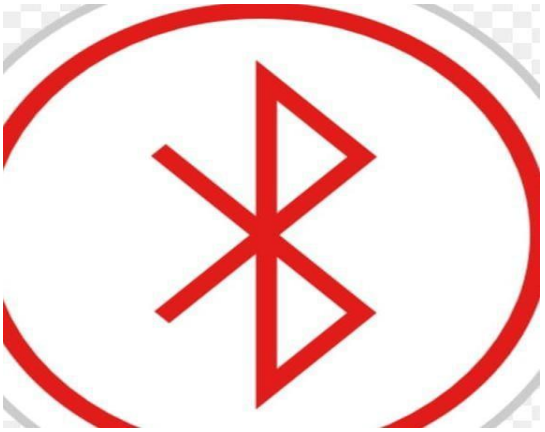
iv Mobile App

The tech gloves created for the "Design and Implementation of Tech Gloves for Dumb People" project benefit greatly from the addition of the "Arduino Bluetooth Text to Speech" program, which improves the system's overall performance and usefulness. Through Bluetooth connectivity, this program acts as a go-between for the user's mobile device and the tech gloves, facilitating smooth communication and engagement.

The app's main function is to let users use the tech gloves' gesture detection capabilities to enter text- based instructions or communications. After being entered, these text commands are sent wirelessly to the user's mobile device using Bluetooth. There, the Arduino Bluetooth Text to Speech application interprets the text and produces audible speech output. With just their hand gestures and movements, users can now efficiently converse with others, obtain information, and operate digital devices thanks to this real-time text-to-speech conversion.

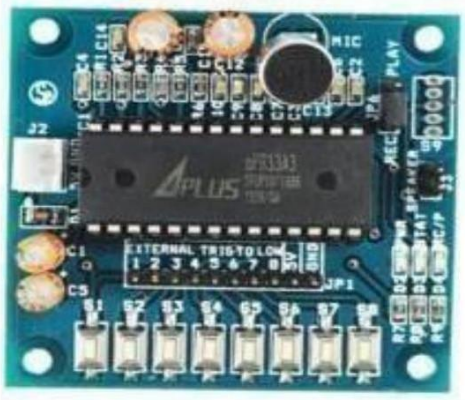
The application functions as a foundation for future growth and innovation, giving developers the freedom to gradually incorporate new features and functionalities. The Arduino Bluetooth Text to Speech app can adapt to users' changing needs and preferences through continuous updates and enhancements, making the tech gloves a useful and practical option in the field of assistive technology.

Figure: App logo



Overall, using the Arduino Bluetooth Text to Speech app improves the tech gloves' functionality and gives users more freedom and ease while interacting with digital devices and communicating. This software improves the system's inclusivity and accessibility by utilizing Bluetooth connectivity and text-to-speech conversion technology. This enables those with limited speech or hearing abilities to engage more fully in the digital world.

V. ARDUINO UNO



First off, the Arduino Uno serves as a bridge between the Bluetooth module that facilitates wireless communication with the user's mobile device and the input sensors on the tech gloves, like buttons or gesture recognition sensors. It gathers input signals from the gloves' embedded sensors, decodes them, and then processes them to produce commands or data packets that may be sent over Bluetooth.

Additionally, the Arduino Uno controls the communication between the user's mobile device's Arduino Bluetooth Text to Speech app and the tech gloves. It creates and maintains the Bluetooth connection, which makes it easier for the gloves and the app to communicate and send commands. By guaranteeing dependable and effective text input transfer from the user to the mobile device, this communication protocol allows audio playing via the APR33A Voice playing Module and real- time text-to-speech conversion.

It acts as the system's brains and facilitates easy communication and interaction between the user, the tech gloves, and digital gadgets.

Vi. PYCHARM

An easy-to-use environment for productive Python, web, and data science development is created by PyCharm, an IDE specifically designed for Python developers. It offers a wide variety of necessary tools for Python developers.

3.2 Methodology:

In order to create an efficient and user-centered assistive technology solution, the "Design and Implementation of Tech Gloves for Dumb People" project utilized a methodology that entails a methodical approach to research, design, development, and testing. The steps that make up the methodology are as follows:

User Needs Assessment: The project starts with a thorough analysis of the requirements, preferences, and difficulties faced by people who have trouble speaking or hearing. This entails conducting in- person interactions with the target population through surveys, interviews, and observational studies in order to learn about their needs and experiences with technology use.

Requirement Analysis: A thorough set of functional and design requirements is developed for the tech gloves based on the results of the user needs assessment. The fundamental features, functionality, and performance standards that the gloves must fulfill in order to successfully meet the needs of the intended users are outlined in these specifications.

Design Exploration and Prototyping: After gathering the necessary information, the project team starts the design exploration stage by generating ideas and concepts for the tech gloves. Using an iterative approach, preliminary prototypes and mockups are made to visualize and assess several design alternatives while taking accessibility, ergonomics, and usability into account.

Technology Selection and Integration: Following the completion of a design idea, the relevant components and technologies are chosen and included into the tech gloves. These could include speech synthesis modules (like the APR33A Voice Playback Module), gesture recognition sensors, haptic feedback actuators, Bluetooth modules, and microcontrollers (like the Arduino Uno). After that, the chosen technologies are included into the glove's design to guarantee functioning and compatibility.

Software Development: Software development starts at the same time as hardware integration and involves programming a microcontroller (such as an Arduino Uno) to interpret gesture recognition sensor input signals, connect wirelessly through Bluetooth, and manage user interaction with a mobile device. Software development may also entail the creation of a mobile application for real- time text-to-speech conversion and audio playback, such as the Arduino Bluetooth Text to Speech app.

Testing and Iteration of the Prototype: After obtaining a working prototype of the tech gloves and related software, thorough testing and iteration take place. In order to assess the efficacy, usability, and acceptability of the system, this entails doing user trials and usability testing on members of the target population.

Validation and Evaluation: To determine the overall effectiveness and usability of the system, a final validation and evaluation step is carried out after the tech gloves have undergone several iterations and revisions based on user feedback. This could entail qualitative evaluations of user happiness and perceived utility in addition to quantitative studies of performance indicators like gesture recognition accuracy and system responsiveness.

documenting and Dissemination: The project comes to a close with the documenting of the results, development process, and design approach. The present documentation functions as an all-inclusive source for prospective utilization and distribution, facilitating the exchange of knowledge and duplication of the project's outcomes and techniques across the assistive technology community. Additionally, in order to encourage the adoption of the tech gloves among stakeholders and end users, the project outcomes may be shared through academic papers, conferences, and public presentations.

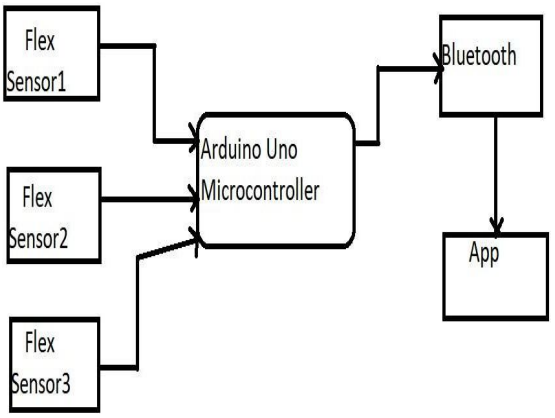


Figure: System Architecture

The figure shows the system architecture. Where, we are using flex sensors they are connected to the Arduino Uno . It will act as a central unit, and the bluetooth is also connected to uno. Then from the the input taken, it will process it and gives the output in the app.

4 APPLICATION

With the help of these tech gloves, users may easily interact with a variety of digital platforms and devices thanks to its multipurpose interface. Users of the gloves may perform a wide range of basic and sophisticated tasks with unprecedented ease and independence, from sending text messages and making phone calls to controlling smart home devices and accessing digital information. The gloves also have a great deal of promise for use in classrooms, where they can help students who struggle with communication engage in interactive learning.

5 OUTCOMES

Users experience a surge in empowerment and independence as a result of the creation and use of these tech gloves, which enable them to engage with digital platforms and gadgets in ways that were previously unattainable. In addition to bridging barriers in communication, the project promotes inclusivity, allowing people to engage more fully in social, academic, and professional domains. In the end, the result is a big step in the direction of building a more inclusive and equitable digital ecosystem for everybody.

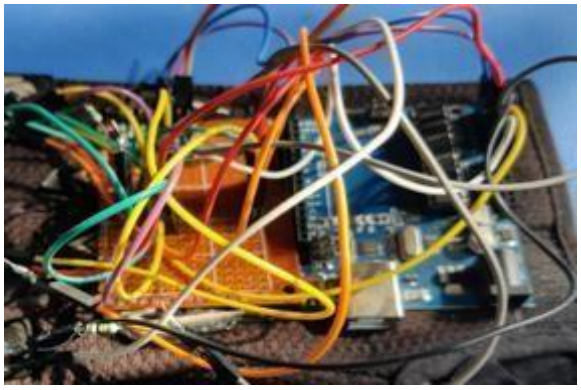


Fig. Connections of the gloves

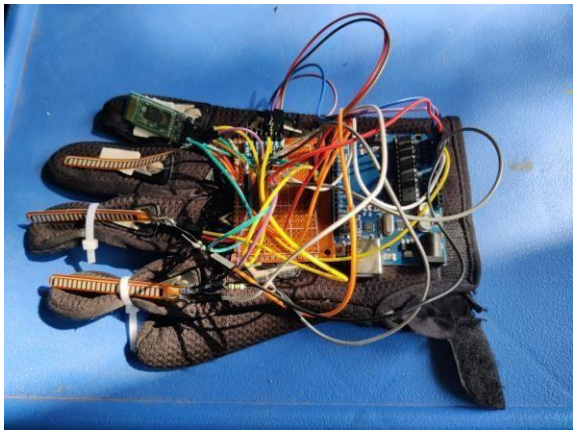


Fig.Output of the smart gloves

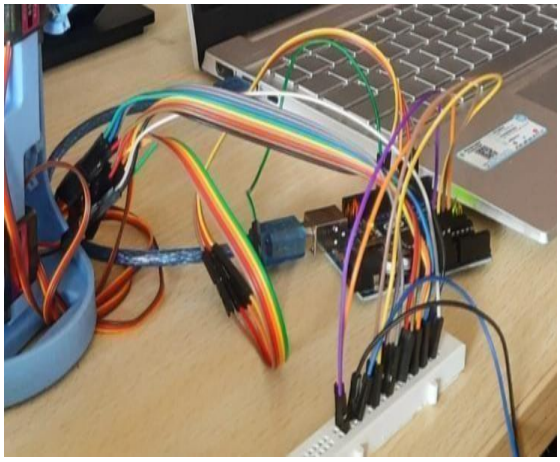


Fig.Connection of Arduino

6.CONCLUSION

In conclusion, the development and implementation of smart gloves for individuals with limited technical expertise hold great potential in bridging the gap between technology and user accessibility. By creating intuitive interfaces, simplified controls, and seamless integration with everyday tasks, these smart gloves aim to empower users who may feel overwhelmed by traditional technologies. The key lies in designing user friendly features, clear instructions, and ensuring that the benefits of technology are accessible to a broader audience. As technology continues to advance, the evolution of smart gloves for simplicity and ease of use could contribute significantly to fostering inclusivity and enhancing the overall user experience

References:

1. Subhas Chandra Mukhopadhyay, Vincenzo Piuri,Nagender Kumar Suryadevara, Sumarga Kumar Sah Tyagi, “Artificial Intelligencebased Sensors for Next Generation IoT Applications: A Review,” 2021 DOI 10.1109/JSEN.2021.3055618, IEEE Sensors Journal
2. Ajay Suri, Dr. Sanjay Kumar Singh, Rashi Sharma, Pragati Sharma, Naman Garg, Riya Upadhyaya, “Development of Sign Language using Flex Sensors,” 2020 IEEE Xplore Part Number: CFP20V90-ART.
3. Godwin Ponraj, Hongliang Ren, “Sensor Fusion of Leap Motion Controller and Flex Sensors Using Kalman Filter for Human Finger Tracking,” IEEE Sensors Journal, VOL. 18, NO. 5, MARCH 1, 2018
4. Anchal Sood , Anju Mishra, “AAWAAZ: A Communication System for Deaf and Dumb,” 2016 5th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO) (Trends and Future Directions), Sep. 7-9, 2016, AIIT, Amity University Uttar Pradesh, Noida, India
5. Sruthi Upendran, Thamizharasi. A, “American Sign Language Inter- preter System for Deaf and Dumb Individuals,” 2014 International Con- ference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT)
6. Yan-Rui Guo, Xiao-Can Zhang, Ning An, “Monitoring Neck Posture with Flex Sensors,” 9th International Conference on Information Science and Technology (ICIST), Hulunbuir, Inner Mongolia, China; August 2-5, 2019

7. Areesha Gul, Batool Zehra, Sadia Shah, Nazish Javed, Muhammad Imran Saleem, "Two-way Smart Communication System for Deaf & Dumb and Normal People," 2020 International Conference on Informa- tion Science and Communication Technology
8. .Akash Kumar Panda, Rommel Chakravarty, Soumen Moulik, "Hand Gesture Recognition using Flex Sensor and Machine Learning Algo- rithms," 2020 IEEE EMBS Conference on Biomedical Engineering and Sciences (IECBES)
9. J. Thilagavathy, A. Jeyapaul Murugan, S. Darwin, "Embedded Based Hand Talk Assisting System for Deaf and Dumb, " International Journal of Engineering Research Technology (IJERT) ISSN: 2278-0181 Vol. 3 Issue 3, March - 2014
10. .Vishal Pathak , Sushant Mongia, Gaurav Chitranshe, "A Framework for Hand Gesture Recognition based on fusion of Flex, Contact and Accelerometer Sensor," 2015 Third International Conference on Image Infonnation Processing
11. H. Kala, S. R. S., S. Pal, U. S. K., and S. Chakma, "Development of Device for Gesture to Speech Conversion for the Mute Community," 2018 Interational Conference on Design Innovations for 3Cs Compute ommunicate Control (ICI3C), pp. 97–99, 2018.
12. R. Balakrishnan, Santosh BK, Rahul H, Shivkumar, Sunil Anthony, "Embedded Based Hand Talk Assisting System for Dumb Peoples on Android Platform," 4th National Conference on Design Innovations for 3Cs "Compute-Communicate-Control," Bangalore, India, pp. 24-28.
13. A. J. Jadhav and M. P. Joshi, "AVR based embedded system for speech impaired people," 2016 International Conference on Automatic Control and Dynamic Optimization Techniques (ICACDT), pp. 844–848, 2016.
14. Mandeep Kaur Ahuja, Dr. Amardeep Singh, "Hand gesture recognition using PCA," IJCSET (www.ijcse.net) , july 2015, vol 2, Issue 7, pp. 267-271.