

Human Computer Interaction Using Hand Gesture

T.Geetha M.E., Mba.,¹ Assistant Professor, Mohammad Sharief,²
Chowdam Ramachandrudu,³ C.Ajith,⁴ T.Murali⁵
Dhanalakshmi Srinivasan Engineering College (Autonomous), Perambalur.

Submitted: 05-05-2021

Revised: 17-05-2021

Accepted: 20-05-2021

ABSTRACT: Hand gesture recognition provides an intelligent and natural way of human computer interaction (HCI). Its applications range from medical rehabilitation to consumer electronics control (e.g. mobile phone). There has been great emphasis on Human-Computer-Interaction research to create easy-to-use interfaces by directly employing natural communication and manipulation skills of humans. As an important part of the body, recognizing hand gesture is very important for Human-Computer-Interaction. In recent years, there has been a tremendous amount of research on hand gesture recognition. While there are numerous researches focused on this topic, there are still several problems to be solved. The speed and accuracy are two main characteristics of the algorithm, thus a robust and fast method is needed to improve user experiences. In order to distinguish hand gestures, various kinds of sensing techniques are utilized to obtain signals for pattern recognition. Gestures a non-verbal form of communication provides the HCI interface. The goal of gesture recognition is to create a system which can identify specific human gestures and use them to convey information or for device control. Real-time vision-based hand gesture recognition is considered to be more and more feasible for HCI with the help of latest advances in the field of computer vision and pattern recognition. This project deals with discussion of various techniques, methods and algorithms related to the gesture recognition. The hand gesture is the most easy and natural way of communication. Hand gesture recognition has the various advantages of able to communicate with the Technology through basic sign language. The essential aim of building hand gesture recognition system is to create a natural interaction between human and computer where the recognized gestures can be used for controlling a robot or conveying meaningful information.

digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and is able to transfer data over a network. Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), microservices and the internet. The convergence has helped tear down the silos between operational technology (OT) and information technology (IT), enabling unstructured machine-generated data to be analyzed for insights to drive improvements. Although Ashton's was the first mention of the internet of things, the idea of connected devices has been around since the 1970s, under the monikers embedded internet and pervasive computing. The first internet appliance, for example, was a Coke machine at Carnegie Mellon University in the early 1980s. Using the web, programmers could check the status of the machine and determine whether there would be a cold drink awaiting them, should they decide to make the trip to the machine. IoT evolved from machine-to-machine (M2M) communication, i.e., machines connecting to each other via a network without human interaction. M2M refers to connecting a device to the cloud, managing it and collecting data. Taking M2M to the next level, IoT is a sensor network of billions of smart devices that connect people, systems and other applications to collect and share data. As its foundation, M2M offers the connectivity that enables IoT.

I. INTRODUCTION

1.1 INTERNET OF THINGS

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and

1.2 BENEFITS OF IOT

The internet of things offers a number of benefits to organizations, enabling them to:

- monitor their overall business processes;
- improve the customer experience;
- save time and money;
- enhance employee productivity;
- integrate and adapt business models;
- make better business decisions; and
- generate more revenue

IoT encourages companies to rethink the ways they approach their businesses, industries and markets and gives them the tools to improve their business strategies.

Consumer and enterprise IoT applications

There are numerous real-world applications of the internet of things, ranging from consumer IoT and enterprise IoT to manufacturing and industrial IoT (IIoT). IoT applications span numerous verticals, including automotive, telco, energy and more. In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and connected heating, lighting and electronic devices can be controlled remotely via computers, smartphones or other mobile devices. Wearable devices with sensors and software can collect and analyze user data, sending messages to other technologies about the users with the aim of making users' lives easier and more comfortable. Wearable devices are also used for public safety -- for example, improving first responders' response times during emergencies by providing optimized routes to a location or by tracking construction workers' or firefighters' vital signs at life-threatening sites. In healthcare, IoT offers many benefits, including the ability to monitor patients more closely to use the data that's generated and analyze it. Hospitals often use IoT systems to complete tasks such as inventory management, for both pharmaceuticals and medical instruments. Smart buildings can, for instance, reduce energy costs using sensors that detect how many occupants are in a room. The temperature can adjust automatically -- for example, turning the air conditioner on if sensors detect a conference room is full or turning the heat down if everyone in the office has gone home. In agriculture, IoT-based smart farming systems can help monitor, for instance, light, temperature, humidity and soil moisture of crop fields using connected sensors. IoT is also instrumental in automating irrigation systems. In a smart city, IoT sensors and

deployments, such as smart streetlights and smart meters, can help alleviate traffic, conserve energy, monitor and address environmental concerns, and improve sanitation.

II. LITERATURE SURVEY

2.1 Title: A Hand Gesture Recognition Technique For Human-Computer Interaction

Author: Nurettin Cagri Kiliboz, 2015

The language (language of individuals with hearing disabilities), as a special communication system utilized by specific teams of individuals in definite things and draw back areas, is associate attention-grabbing and promising object for linguistics. In several things and cases the language is that the solely doable chance of communication realization. Till recently the language was used solely within context of human communication. However currently with the event and wide implementation of laptop information technology, the problem of translation from signs (Gestures) to regular text language, following its transformation into sound kind while not a personality's translator became a degree of active analysis interest. The analysis is dedicated to creation of program and technological computerized applications that will enable considerably improve things regarding language, particularly with in the cases once no different communication is out there

DISADVANTAGES

- Difficult to capture hand motions

2.2 Title: Static Vision Based Hand Gesture Recognition Using Principal Component Analysis

Author: Mandeep Kaur Ahuja, 2015

In the present days, the use of intelligent computing and efficient human computer interaction (HCI) is becoming a necessity of our daily life, The basic units of an interacting human with a computer are mouse and keyboard. Generally, these units are utilized by trained user. Therefore, without prior knowledge, these systems are difficult to use. Hence nowadays, there search interest has increased in the development of natural intuitive user interface. Such interface is invisible to the user and helps the user to interact with computer and electronic devices effectively. Therefore, hand gesture is a more natural and convenient way to communicate between the user and devices as compared to mouse and keyboard. The application of gesture recognition system in real time should provide high accuracy and robustness to the various clutter backgrounds.

These several necessities and their inherent complexity still provide a challenging task for the researchers. This paper demonstrates the development of vision based static hand gesture recognition system using web camera in real time applications. The vision based static hand gesture recognition system is developed using the following steps: preprocessing, feature extraction and classification. The preprocessing stage consists of illumination compensation, segmentation, filtering, hand region detection and image resize. This work proposes a discrete wavelet transform (DWT) and Fisher ratio (F-ratio) based feature extraction technique to classify the hand gestures in an uncontrolled environment. This method is not only robust towards distortion and gesture vocabulary, but also invariant to translation and rotation of hand gestures. A linear support vector machine (SVM) is used as a classifier to recognize the hand gestures. The performance of the proposed method is evaluated on two standard public datasets and one indigenously developed complex background dataset for recognition of hand gestures. All above three datasets are developed based on American Sign Language (ASL) hand alphabets.

DISADVANTAGES

- Only support image datasets of hands

III. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Many systems exist that are used for controlling the robot through gestures. Some gesture recognition systems involve adaptive color segmentation, hand finding and labeling with blocking, morphological filtering, and then gesture actions are found by template matching and skeletonizing. This does not provide dynamicity for the gesture inputs due to template matching. Some systems uses machine interface device to provide real-time gestures to the robot. Many of input providing technologies require physical touch and also there are other variations that provide input to the application without using physical touch as they may be based on other human characteristics like speech, hand gesture etc. Gesture Recognition consists of two approaches a) vision based b) glove based. Glove based approach uses sensors or gloves to identify the hand gesture. Some type of flex sensors, accelerometers etc are used in glove based approach. The Gestures can be either static or dynamic. Static gestures use hand poses and the image is captured by using cameras. The images captured are given for analysis which is done using segmentation. Skin detection algorithm detects the

skin region from the input image as the background may consist of many other things along with the hand region. In image acquisition the image obtained through a webcam is in the RGB color model. This image is converted to HSI color model because the regions which belong to the skin can be easily identified in HSI model. After recognizing hand it is converted into a binary image. The skin regions are represented using white color and all other non-skin regions are black.

3.1.1 DISADVANTAGES

- Need hardware control to detect the hands
- Hand segmentation become complex of various backgrounds
- Segmentation accuracy is less in hand tracking

3.2 PROPOSED SYSTEM

In this system, user operates the robot from a control station that can be a laptop or a PC with a good quality inbuilt webcam or external webcam. This webcam is used to capture real time video stream of hand gestures to generate commands for the robot. Gesture commands are given using hand palm. Mainly five kinds of gestures are used which are explained further. Robot is moved in all possible directions in the environment using five possible types of commands which are used to open the five applications. Image frame is taken as an input and processed using Image Processing. Processed image is then used to extract the gesture command. This gesture command can have one of the five possible commands as specified. From this generated gesture command, signal is generated and it is passed to the robot using web camera. The input image is taken from web camera. The given RGB image is converted to grayscale image by eliminating the hue and saturation information. The contrast of obtained image is adjusted by illumination control. The background estimation is done using region of interest algorithm at gray scale image. It creates structural element using disk shape which is known as Frame separation method. The background is eliminated from gray scale image. The output image of background separation displayed is in the form of image without background. It identifies the hand from the background separated image by converting it into binary image. The binary image separates hand gesture as black and white. Thresholding technique is performed for segmentation using Otsu's method, which minimizes the intra class variance of the black and white pixels. The output produces open binary image which is in the form of small objects with low pixels removed from binary image. The

controller has peripheral features like inbuilt camera, required to get the signals from the various binary image output. The hand gesture is identified and voice output is obtained from the speaker.

3.2.1 ADVANTAGES

- Segmentation accuracy is high
- Easy to detect the finger counts
- Track fingers and open applications with less computational steps
- No need for additional hardware system

IV. SYSTEM IMPLEMENTATION MODULES DESCRIPTION

1. HAND IMAGE ACQUISITION:

The hand gesture, during daily life, is a natural communication method mostly used only among people who have some difficulty in speaking or hearing. However, a human computer interaction system based on gestures has various application scenarios. In this module, we can input the hand images from real time camera. The inbuilt camera can be connected to the system. Gesture recognition has become a hot topic for decades. Nowadays two methods are used primarily to perform gesture recognition. One is based on professional, wearable electromagnetic devices, like special gloves. The other one utilizes computer vision. The former one is mainly used in the film industry. It performs well but is costly and unusable in some environment. The latter one involves image processing.

2. BACKGROUND SUBTRACTION

Background subtraction is one of the major tasks in the field of computer vision and image processing whose aim is to detect changes in image sequences. Background subtraction is any technique which allows an image's foreground to be extracted for further processing (object recognition etc.). Many applications do not need to know everything about the evolution of movement in a video sequence, but only require the information of changes in the scene, because an image's regions of interest are objects (humans, cars, text etc.) in its foreground. After the stage of image preprocessing (which may include image denoising, post processing like morphology etc.) object localization is required which may make use of this technique. Detecting foreground to separate these changes taking place in the foreground of the background. It is a set of techniques that typically analyze the video sequences in real time and are recorded with a stationary camera. All detection techniques are based on modeling the background of the image i.e.

set the background and detect which changes occur. Defining the background can be very difficult when it contains shapes, shadows, and moving objects. In defining the background it is assumed that the stationary objects could vary in color and intensity over time. Scenarios where these techniques apply tend to be very diverse. There can be highly variable sequences, such as images with very different lighting, interiors, exteriors, quality, and noise. In addition to processing in real time, systems need to be able to adapt to these changes. The implement the techniques to extract the foreground from background image. Using Binarization approach to assign the values to background and foreground. Foreground pixels are identified in real time environments

3. REGION OF INTEREST

Segmentation refers to the process of partitioning a digital image into multiple segments. In other words, grouping of pixels into different groups is known as Segmentation. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The division of an image into meaningful structures, image segmentation, is often an essential step in image analysis, object representation, visualization, and many other image processing tasks. But segmentation of a satellite image into differently textured regions (groups) is a difficult problem. One does not know a priori what types of textures exist in a satellite image, how many textures there are, and what regions have certain textures. The monitoring task can be performed by unsupervised segmentation and supervised segmentation techniques. A region of interest (ROI) is a subset of an image or a dataset identified for a particular purpose. In other words, region of interest (ROI) can be defined as a portion of an image which is needed to be filtered or to be performed some other operation on.

4. FINGER COUNT DETECTION

First, the centroid of the binary image is determined. This will be the center of the hand which will be used to remove the wrist of the hand and palm. After finding the centroid of the image, the right side of the image which is the wrist will be removed as it does not involve the finger detection. Then, the largest distance between one pixels to another on the contour of the object is determined using the ROI formula. For every usage, either the thresholding value is static that is each time same value is used or the user is required to set the threshold value to ensure good level of

hand segmentation. Thus this method is not used since it puts the systems success or failure dependent on the user setting a proper threshold value or on the quality of the static threshold value. This method is useful where the intensity of the hand is almost similar whenever the system is used.

5. APPLICATION PROCESS

The detected fingers are classified into their respective finger count. The gestures are classified using the maximum distance between the centroid of the two fingers determined in the finger detection process. In this module, we can classify the finger count to open applications for blind peoples. If finger count is 1 means, open music player, 2 means open date and time and 3 means open youtube with news link.

V. SYSTEM DESIGN

SYSTEM ARCHITECTURE



VI. SOFTWARE DESCRIPTION

FRONT END: PYTHON

Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. In July 2018, Van Rossum stepped down as the leader in the language community. Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library. Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of Python's other implementations. Python and CPython are managed by the non-profit Python Software Foundation. Rather than having

all of its functionality built into its core, Python was designed to be highly extensible. This compact modularity has made it particularly popular as a means of adding programmable interfaces to existing applications. Van Rossum's vision of a small core language with a large standard library and easily extensible interpreter stemmed from his frustrations with ABC, which espoused the opposite approach. While offering choice in coding methodology, the Python philosophy rejects exuberant syntax (such as that of Perl) in favor of a simpler, less-cluttered grammar. As Alex Martelli put it: "To describe something as 'clever' is not considered a compliment in the Python culture." Python's philosophy rejects the Perl "there is more than one way to do it" approach to language design in favour of "there should be one—and preferably only one—obvious way to do it".

BACK END:MY SQL

MySQL is the world's most used open source relational database management system (RDBMS) as of 2008 that run as a server providing multi-user access to a number of databases. The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation.

Inter images

MySQL is primarily an RDBMS and ships with no GUI tools to administer MySQL databases or manage data contained within the databases. Users may use the included command line tools, or use MySQL "front-ends", desktop software and web applications that create and manage MySQL databases, build database structures, back up data, inspect status, and work with data records. The official set of MySQL front-end tools, MySQL Workbench is actively developed by Oracle, and is freely available for use.

Graphical

The official MySQL Workbench is a free integrated environment developed by MySQL AB, that enables users to graphically administer MySQL databases and visually design database structures. MySQL Workbench replaces the previous package of software, MySQL GUI Tools. Similar to other third-party packages, but still considered the authoritative MySQL frontend, MySQL Workbench lets users manage database design & modeling, SQL development (replacing MySQL Query Browser) and Database

administration (replacing MySQL Administrator). MySQL Workbench is available in two editions, the regular free and open source Community Edition which may be downloaded from the MySQL website, and the proprietary Standard Edition which extends and improves the feature set of the Community Edition.

VII. SYSTEM TESTING

Software testing is a method of assessing the functionality of a software program. There are many different types of software testing but the two main categories are dynamic testing and static testing. Dynamic testing is an assessment that is conducted while the program is executed; static testing, on the other hand, is an examination of the program's code and associated documentation. Dynamic and static methods are often used together.

Testing is a set activity that can be planned and conducted systematically. Testing begins at the module level and work towards the integration of entire computers based system. Nothing is complete without testing, as it is vital success of the system.

Testing Objectives:

There are several rules that can serve as testing objectives, they are

1. Testing is a process of executing a program with the intent of finding an error
2. A good test case is one that has high probability of finding an undiscovered error.
3. A successful test is one that uncovers an undiscovered error.

The data is entered in all forms separately and whenever an error occurred, it is corrected immediately. A quality team deputed by the management verified all the necessary documents and tested the Software while entering the data at all levels. The development process involves various types of testing. Each test type addresses a specific testing requirement. The most common types of testing involved in the development process are:

- Unit Test.
- Functional Test
- Integration Test

VIII. CONCLUSION AND FUTURE ENHANCEMENT

9.1 CONCLUSION

One of the most precious gifts to a human being is an ability to see, listen, speak and respond according to the situations. But there are some unfortunate ones who are deprived of this. Humans know each other by conveying their ideas,

thoughts, and experiences to the people around them. There are numerous ways to achieve this and the best one among the rest is the gift of "Speech". Through speech everyone can very convincingly transfer their thoughts and understand each other. Our project aims to bridge the gap by introducing an inexpensive computer in the communication path so that the sign language can be automatically captured, recognized and translated to speech for the benefit of blind people. In this project considering an image processing technique is used for recognizing the handmade gestures. A newly integrated proposed system for voice impaired using this application is proposed. This image processing techniques which helps the blind people to interact blind people normally like normal person. The camera based region of interest can be helps in gathering the data of the user. Each action will have its distinct significance. The accessibility of the gestures is enhanced than the previously proposed system. This makes the user feel like a normal person just with the help of finger classification

9.2 FUTURE ENHANCEMENTS

In future, we can extend the approach to implement the framework with deep learning algorithm and embed the system with real time embedded systems. Future enhancement is to do additionally investigate with a specific end goal to create improved form of the proposed framework. Framework would have the capacity to convey in both headings by precisely knowing the yield from a specific part. It will have the ability to make an interpretation of ordinary dialects to hand signals effectively. The picture handling some portion of the framework will likewise be altered to work with each conceivable condition. A test will be to perceive signs that include movement

REFERENCES

- [1]. Kılıboz, NurettinÇağrı, and UğurGüdükbay. "A hand gesture recognition technique for human-computer interaction." *Journal of Visual Communication and Image Representation* 28 (2015): 97-104.
- [2]. Kılıboz, NurettinÇağrı, and UğurGüdükbay. "A hand gesture recognition technique for human-computer interaction." *Journal of Visual Communication and Image Representation* 28 (2015): 97-104.
- [3]. Shrivastava, Rajat. "A hidden Markov model based dynamic hand gesture recognition system using OpenCV." 2013 3rd IEEE International Advance Computing Conference (IACC). IEEE, 2013.