IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 1, January 2021

DOI 10.17148/IJARCCE.2021.10133

Smart Mirror Using Hand Gesture

Sreejith PS[1], Arya PR[2], Athira PS[3], Hridya KS[4], Krishna CR[5]

Assistant Professor, Department of Computer Science And Engineering,Universal Engineering College,Vallivattom, Thrissur, India.[1]

B.Tech Student, Department of Computer Science And Engineering,Universal Engineering College ,Vallivattom, Thrissur, India.[2,3,4,5]

Abstract: Smart mirror is a device where would be able to see news, temperature, weather and can also schedule events for one month. We can interact with smart mirror using voice command, hand gesture and smart phone. Our system uses raspberry pi based processor board along with display and IoT based circuitry and temperature sensor. A camera used to capture the gestures and gives corresponding output according to the programming . The Internet of Things allows devices to communicate with each other in different and important places at the same time. One of the most important IoT applications is the smart mirror. It is a mirror that acts as a reflective surface and as an interactive screen at the same time. It provides valuable information on the display at a glance, while also acting as a conventional mirror. Smart Mirror is a mirror which allows touch-free user interaction with important information displays such as current news, time, date weather, schedule, Temperature and setting up of reminders in the form of widgets on the screen, while also providing notifications or alerts to the smart phone using an application. It uses innovative technology to achieve an interactive system, made for ease of access to basic important information and enhancing utility.

Keywords: Smart mirror, Hand gesture, Face detection, Voice command, Hand detection

I. INTRODUCTION

A smart mirror is a two-way mirror with an electronic display behind the glass. The display shows different kinds of information in the form of widgets, such as temperature ,weather, time, news updates. An app is developing to schedule, update and cancel events and also used to enrol face of users.A person who does not have enrol face with specific code using mobile application cannot use mirror.The unauthorised access results a notification on the phone which connected to the mirror.In existing system Smart Mirror is a mirror which allows touch-free user interaction with important information displays in the form of widgets on the screen, while also providing messaging features. By using hand gesture the smart mirror will be convenient to user. It reduce the difficulty to use touch screen by replacing the input method from touch screen to voice input and hand gesture. It uses innovative technology to achieve an interactive system, made for ease of access to basic important information and enhancing utility. The display has mirror-like reflective properties while still displaying information in typical lighting conditions consisting of fluorescent, incandescent and LED light as fluorescent and incandescent lighting are the most common type of lighting in home and offices, which are the most likely environments for the Smart Mirror to be installed. The device should be presentable as a display piece in a home.

II. THEORY

A. Face Recognition

A face recognition program is a software application for verifying a person and identifying him or her with a video or picture from a input source. Facial recognition can be done by the open source platform Intel called OpenCV quickly and reliably. One way from a face and an image database are the preferred facial features. The key element analysis using Fisher face algorithms, the Markov model, multilinear subspace learning using tensor representations.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 1, January 2021

DOI 10.17148/IJARCCE.2021.10133

The PCA(Principal Component Analysis) is designed for facial recognition by the wide 1-D pixel vector in compact main elements of the space function. This is called a projection of self-space. It build a camera-based real-time face recognition system and set an algorithm by developing programming on OpenCV, Haar Cascade, Eigenface, Fisher Face, LBPH, and Python.

B. Hand Gesture Recognition

Gesture Recognition is a process in which the user performs some gestures and these gestures are to be recognized by the machine or receiver. Gesture recognition is seen as how machines or computers can begin to recognize the body language of humans. Using a low resolution web camera frames are inputted. Then, these frames are passed through different modules like pre-processing, hand detection and gesture recognition module. To reduce the noise from the video frame median filter is used. Skin colour segmentation is used to segment the skin region from the frame and by using the morphology operation the imperfection can be reduced from the binary skin segmented frame. The hand is detected using the region of interest module and the fingers are counted using the finger counting algorithm.

C. Voice Command Recognition

Voice command recognition is the process that takes speech signals come from human speakers as input and process it accordingly to give output using methods like ASR(Automatic Speech Recognition). ASR has good accuracy rate in classifying manner, using relatively robust features of strong periodic energy, silence, and noise. Detection of periodicity is a major factor in estimating voicing. ASR decodes a speech signal indirectly using the sequence of spectral patterns of the speech signal. ASR systems built using Kaldi toolkit and Keras/Tensorflow tools. And also it uses MFCC (Mel Frequency Cepstral Coefficients) for identifying compact words in continuously spoken sentences and speaker identification.

D. Ultrasonic Proximity Sensor

An ultrasonic proximity sensor is connected to the Arduino microcontroller, which detects the presence of a user standing in front of the Smart Mirror and sends the signal to the microcontroller once a user is detected standing near the mirror. It uses ultrasonic sound waves to detect the presence of objects near it, and once an object enters the target radius of the sensor, it sends the distance of that particular object to the microcontroller.

E. Temperature sensor

Temperature sensor is an electronic device that measures the temperature of its environment. And it converts the input data into electronic data to record, monitor, or signal temperature changes.

III. RELATED WORK

Here we introduce each papers based on the technologies used in the smart mirror and it is arranged in technologies bases

The aim of this paper [1] is to develop of a smart mirror and represent an ambient home environment. This system can control the house hold appliances and provides news, multimedia data that are displayed on the screen . Face recognition is used to automatically identify the user and unlock their personal profiles . If an unauthorized user comes in front of the mirror it will deny access the personal services and only provide a standard mirror. Remote control can be used to access the home appliances.

The aim of the paper [2] is to develop smart home based ioT and also controls the lights in the house. It provides date, time, weather and location map. User can interact with the system using voice command and the system sensors will recognize the voice of the user to receive instructions. The approach used in this system is called

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 1, January 2021

DOI 10.17148/IJARCCE.2021.10133

evolutionary prototyping and it is a life cycle model that allows application to be developed in stages and modified easily.

This paper [3] is discuss about a system that act as a smart mirror which displays date, time, weather update can be collected from internet and displayed in that smart mirror. This system is built with raspberry pi, camera, and some sensors it is perfectly suitable for smart homes. Weather reports are extracted from the weather cloud they are Providing API for Extracting the information, that designed smart mirror has the advantage of small size and less weight and more compact to use.

This paper[4] present the development of an innovating appliance that incorporates interactive services of information. The framework will offer basic services, like the presentation of personalized weather, time, date and display some additional functionality. The framework is based on detecting presence of human using Passive Infrared sensors and Wi-Fi connectivity. Once a person comes in front of the mirror, it displays the information include calendar, time, weather, news feed, notifications and so on. And also discusses about the speech recognition and its application in control mechanism in home appliances and opening and closing of shelf.

The aim of the paper[5] is to allows users to access and interact with contextual information, such as weather data, seamlessly as part of their daily routine. This paper developed SmartReflect—a software platform for developing smart mirror applications. The main features are modular, lightweight, and extensible It allows developers to sidestep the sandboxed environment created by web browsers and it supports plugins written in any programming languages. It runs on a tiny computer, such as the Raspberry Pi. Second. It is quite common for smart mirror platforms to use web browsers as the primary display method.

The aim of this paper [6] is to detecting the dynamic hand gesture. There is two type of hand gesture that are static hand gesture and dynamic hand gesture. Here, the system is designed to work with images captured through using the web camera .there is mainly 5 steps. The first one is capture our image then the second step is pre-processing ths step also include median filter, skin color segmentation, morphological operation. In median filter it will be reducing the noise from the frame. In skin color segmentation it uses normalized RGB and HSV for identifying the skin pixel. In morphological operation it will reduce the imperfections. The third step is Hand detection it include region of interest and finger counting. In here shape analysis will happened. That is the image will converted to back &white. And calculating the defect. The Fourth step is Gesture recognition. In here it will check with data base and at last get the output.

The main intent of this paper [7] is Hand gesture recognition Features for hand gestures using palm and fingers relative distances. Features are extracted and the recognition system is trained with the available set of images which can convey the information of the gesture. The main steps of gesture recognition are Gesture Acquisition, Gesture pre-processing, Feature Extraction, Template matching, classification and Gesture recognition. The data acquisition means, image captured from the device like LMC, The image pre-processing means normalizing the pixel, edge enhancement, removal unwanted pixels.In Feature extraction phase, features of the image will be extracted from hand.In here a object pixel is given to the value of 1 then background pixel is valued as 0. Finally a binary image is obtained by coloring each pixel white or black, which is dependent on a pixel's label. Lastly the classification and recognizing the gesture using appropriate algorithms.

The aim of this paper [8] is an approach of vision-based gesture recognition.The first stage is hand gesture image capture. where the images are captured using digital camera under different conditions such as scaling, translation and rotation. The second stage is a pre-processor stage in here edge detection, smoothing, and other filtering processes will be occured. In the next stage, the features of the images are extracted using two method, hand contour and complex moments. The last stage is classification using Artificial Neural Network (ANN), Here the recognition rate is calculated for both hand contour-based ANN and complex moments-based ANN and comparison is carried out.

This paper [9] is convey some meaningful information by using the gestures given by user in an order.It is the natural ability to represents ideas and actions very easily, using these different hand shapes, being identified by gesture recognition system.Image Segmentation and Image Pre-processing is necessary steps for image enhancement and for getting good results. In this algorithm, the input RGB images gets converted in to YCbCr images.The RGB colour space is more sensitive to different light conditions so we need to encode the RGB information in to YCbCr. It give us with the higher recognition rate with minimum computation time.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 1, January 2021

DOI 10.17148/IJARCCE.2021.10133

The aim of this paper [10] is to recognize hand gesture in real-time by using different phases.The entire system of hand gesture recognition divided into four phases: Image Acquisition, Image Pre-processing, Feature Extraction and Hand Gesture Recognition. A camera is needed to capture the feature.The first step is pre-processing block is filtering. It is used to remove the unwanted noise from the image scenes. Frame extraction and Pre-processing comes under the video acquisition module.In Gesture recognition hand tracking system it consists of three stages: back-ground removal using GMM, skin feature extraction using HSV colour space, hand tracking using Eucli distance and finally gesture recognition.The main advantage of this paper is Easy to setup and it take less time for processing.

The main purpose of this work [11] is to develop a face recognition program which is a software application for verifying a person and identifying him or her with a video or picture from a source. With the open source platform Intel called OpenCV, facial recognition can be done quickly and reliably. One way from a face and an image database are the preferred facial features. It is generally compared to biometrics like fingerprints and eye reconnaissance systems, and is used in security systems, thumb recognition systems. The key element analysis using Fisher face algorithms, the Markov model, multilinear subspace learning using tensor representations and the nervously driven dynamic reference.

This work [12] is also a technology of IoT for face recognition which is combination of machine learning and the biometric techniques which holds the qualities of not only high precision but also the reliability. For automatically detecting the human's face from the databases this system can be used. This technology is used for authentication, validation, authorization and identification. Face identification is defined in three steps-face detection, feature extraction, face recognition. Camera configuration is very important to track moving persons and recognize them precisely. Facial feature points encode critical information about face shape. Precise location and facial feature points tracing are important. Each feature point is usually detected and traced by performing a local search for the better matching position. The edges are not only carrying valuable data about face but are also simple to process.

The aim of this paper [13] Face recognition system first requires a set of database images. The first task is to create dataset of images on which your algorithm can be tested. It uses a readymade dataset of images called "AT& T" dataset images which have been captured with different poses, variations, expressions. In this paper these dataset images will be used to test the proposed algorithm which consists of 400 images of 40 persons each having 10 different images which have pose and expressions variations.

The aim of this paper [14] is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies. Human face perception is currently an active research area in the computer vision community. Human face localization and detection is often the first step in applications such as video surveillance, human computer interface, face recognition and image database management. Locating and tracking human faces is a prerequisite for face recognition and/or facial expressions analysis, although it is often assumed that a normalized face image is available. In this paper we intend to implement the Haar-Classifier for Face detection and tracking based on the Haar Features.

In this paper [15] face detection is tha strategy that is adopted to search and determine whether it contains human face in any given image. And the location, size and attitude of the human face will be returned if it can be found. For any object in the image, to detect it, we must get something which is called feature in image processing to separated from other objects, such as color, grey value, texture, contour, etc. It can distinguish one object from others through features, it will involve how to organize various concerned features, and Adaboost is a well method of organized features in the target detection

The paper[16] proposed the voice command recognition technology based on artificial intelligence, deep learning neural networks and a reduced speech database. It is proposed to create and use a reduced database consisted and extracted as a chosen suitable part of a large databases dedicated mainly for the tasks of natural languages speech recognition. The system includes training, testing and real time recognition stages. The system works on NVIDIA platform or Google platforms and ASR algorithm with DSP is the best speech recognition algorithm used in NVIDIA platform. In training step the voice commands, as new samples, are collecting in reduced voice command database using a microphone. In the testing step check whether the chosen algorithm for voice commands recognition work with the preliminary defined accuracy. In last step real time recognition, using

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 1, January 2021

DOI 10.17148/IJARCCE.2021.10133

appropriates voice commands from a person and the proposed reduced voice commands database and algorithm command is recognized.

The paper[17] is concerned about automatic speech recognition (ASR) with grammar model (GM) instead of conventional language model (LM) used in spontaneous speech recognition. the most accurate methods require significant computational resources. In this paper the restriction of vocabulary and creating of a grammar of voice commands are considered. It can potentially increase the recognition quality in comparison with contemporary continuous speech processing systems. ASR with GM recognized and returned all existed variants from the grammar for the given speech data. The goal of this paper is to create a grammar based ASR with accurate transcription for an abstract robotic system with a limited set of commands that works in noisy environment.

The main intent of this paper [18] is to deliver speech recognition using Automatic Speech Recognition (ASR) systems mainly depending acoustic features. Electroencephalography (EEG) is a non invasive approach that help in speech recognition in this paper. EEG is a measure of electrical activity of the human brain. EEG signals used to perform envisioned speech recognition using random forest algorithm and they reported an average accuracy of 85.2 %. An ASR model created using gated recurrent unit (GRU) networks. The model was created using Google TensorFlow deep learning library. Trained and tested GRU based deep learning ASR model using three different feature sets. After extracting EEG and acoustic features do feature dimension reduction in order to obtain set of EEG features. This approach gave best performance for feature dimension reduction for EEG data recorded for words in presence, absence of background noise and for vowels in presence of background noise.

In this work [19] Automatic speech recognition (ASR) is work with the most common analysis method Mel Frequency Cepstral Coefficient (MFCC) approach. Here ASR is a task of artificial intelligence (AI) where an algorithm converts human speech to the text that was intended by the speaker. As in much of AI, it does pattern recognition (PR), to recognize a pattern (the text) that is present (although in a highly coded form) in the speech signal. As in any PR task, ASR seeks to understand an “informational” pattern in the input speech waveform. Speech signals come from human speakers, who wish to convey information to listeners. Human speech communication differs greatly from artificial communication systems. ASR designers have little control over speech production, other than asking speakers to talk slowly and clearly.

The aim of this paper [20] is to develop a system which has to convert spoken word into text using AANN modelling technique using acoustic feature namely MFCC. In this work the temporal envelop through RMS energy of the signal is derived for segregating individual words out of the continuous speeches using voice activity detection method. Features for each isolated word are extracted and those models were trained. AANN modelling technique is used to model each individual pronouncement. Thus each isolated word from the test sentence is matched against these models for finding the semantic representation of the test input dialogue. Mel Frequency Cepstral Coefficients (MFCCs) are short-term spectral based and dominant features and are widely used in the area of audio and speech processing.

IV. CONCLUSION

The smart mirror is a conventional a mirror with technology inside it. It displaying valuable day-to-day information to the user and provide interactive emergency triggering technology while keeping the device usable for any age groups. Voice inputs and hand gestures also make the device easily usable. The face recognition technology that used in smart mirror ensure the security of the smart mirror by identifying and verifying the face of the user. The product extends its applications to various environments such as in hospitals, offices, retail shops and so on. Smart Mirror architectural designed with voice assistant, the device enables users to perform tasks like web searches, without the need of touch input.

ACKNOWLEDGMENT

We utilize this opportunity to convey our gratitude towards all those who have helped us directly or indirectly for the completion of our work. We deeply and wholeheartedly thank **Dr. Sreeraj R** -HOD, Computer Science and Engineering for his extreme valuable advice and encouragement. We especially thankful to our guide and supervisor Mr. Sreejith P S -Assistant Professor, Computer Science and Engineering for giving me valuable suggestions and

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 1, January 2021

DOI 10.17148/IJARCCE.2021.10133

critical inputs in the preparation of this paper. We would like to extend our sincere gratitude to all faculty of Computer Science and Engineering department for the support and suggestions that helped us in the development of our work to what it is now. We thank our parents and friends for the mental support provided during the course of our work at the times when our energies were the lowest.

REFERENCES

[1]. M.A Hossain, Pradeep K Atrey "Smart Mirror for Ambient home Environment", IEEE 3rdIET International conference on computing communication (ICCC), 2010
[2]. Derick gold, David Solliner, Indramo "Smart Reflect: A modular smart mirror application platform", IEEE 7th International Conference and Workshop on Computing and Communication (IEMCON), 2016.
[3]. Frangly Francis, Radwin Raphel "Smart Mirror: A novel Framework for interactive display", IEEE 4th International Conference on Circuit, Power and Computing Technologies, 2016
[4]. Michael Taynnan Barros, Robert Mullins "Smart E mirror using OpenCV with Raspberry pi", IJERT (NCESC) Volume 6, issue 13, 2017
[5]. Muhammed Muizudeen Yusri, Sahreen Kasim, Rohayanti Hassan" Smart Mirror Smart Life" , IEEE 6th International Student project Conference (ICT-ISPC)
[6]. Mohd. Aquib Ansari, Dushyant Kumar Singh" An Approach for Human Machine Interaction using Dynamic Hand Gesture Recognition", 2019 IEEE Conference on Information and Communication Technology (CICT) 978-1-7281-5398-8/19/$31.00 ©2019 IEEE
[7]. Dr. Panduranga H. T., Mr. Mani. C "Dynamic Hand Gesture Recognition System: A Short Survey", 2018 International Conference on Inventive Research in Computing Applications(ICIRCA)
[8]. Haitham Badi "Recent methods in vision-based hand gesture recognition" 20 April 2016 International Journal of Data Science and Analytics volume 1 pages77–87(2016)
[9]. Meenakshi Panwar "Hand Gesture Recognition based on Shape Parameters", 2012 International Conference on Computing, Communication and Applications
[10]. Aisha Meethian, B.M.Imran "Real Time Gesture Recognition Using Gaussian Mixture Model ", International Journal of Scientific & Engineering Research, Volume 4, Issue 8, August-2013 1582 ISSN 2229-5518
[11]. Maliha Khan,Sudeshna Chakraborty,Rani Astya,Shaveta Khepra "Face Detection and Recognition Using OpenCv", 2019 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS)
[12]. Apoorva .P,Impana H.C, Siri S .L, Varshitha M. R" Automated Criminal Identification by Face Recognition Using Open Computer Vision Classifiers", Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC 2019) IEEE Xplore Part Number: CFP19K25-ART; ISBN: 978-1-5386-7808-4
[13]. Neel Ramakant Borkar , Sonia Kuwelkar "Real-Time Implementation Of Face Recognition System", Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication (ICCMC)
[14]. Prof. P Y Kumbhar,Mohammad Attaullah,Shubham Dhere,Shivkumar Hipparagi" Real Time Face Recognition and Tracing Using OpenCv ",Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication(ICCMC)
[15]. Min Zuo,Guangping Zeng,Xuyan Tu (2010)" Research and improvement of Face Detection Algorithm Based on the OpenCv", 978-1-4244-7618-3 /10/$26.00 ©2010 IEEE
[16]. Snezhana Pleshkova, Aleksander Bekyarski, Zahari Zahariev " Reduced Database for Voice Commands Recognition Using Cloud Technologies, Artificial Intelligence and Deep Learning" , XVI-th International Conference on Electrical Machines, Drives and Power Systems ELMA 2019, 6-8 June 2019
[17]. Artem Sokolov, Andrey V. Savchenko "Voice command recognition in intelligent systems using deep neural networks", SAMI 2019 IEEE 17th World Symposium on Applied Machine Intelligence and Informatics January 24–26
[18]. Gautam Krishna, Co Tran,Jianguo Yu, Ahmed H Tewfik "Speech Recognition With No Speech Or With Noisy Speech", 978-1-5386-4658-8/18/$31.00 ©2019 IEEE
[19]. Douglas O'Shaughnessy "Automatic speech recognition", 978-1-4673-8756-9/15/$31.00 © 2015 IEEE
[20]. R.Thiruvengatanadhan "Speech Recognition using AANN", International Journal of Innovations in Engineering and Technology (IJIET) Volume 12 Issue 2 January 2019 ISSN: 2319-1058