GESTURE BASED HOMEAUTOMATION

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***Abstract*-As there is rapid rise in technology more efforts are made in making the life of people easier and comfortable. In present times home automation as become the most evolving technology. In this paper a home automation system is designed to help elder people and people who can't walk to do their daily activities efficiently. Many home automation systems such as home automation using android apps and voice commands already existed in the usage but illiterates, dumb people and bedridden patients cannot use them effectively. In such scenarios this gesture based home automation system overcome those limitations.**

This proposed gesture-based home automation system Leveraging both a Personal computer and Arduino integrates hardware and software components to provide an intuitive and interactive control interface for smart homes. Webcam captures handgestures video and it is going to be fed to the personal computer. Sophisticated gesture recognition software (python), employing computer vision using a machine learning technique (CNN-Convolutional Neural Network) detects and classifies these gestures respectively. By analyzing movement patterns and features, the system translates gestures into predefined commands. The Personal computer then communicates with Arduino to operate the corresponding device which is bulb.

Keywords—ConvolutionalNeuralNetwork, home appliances such as bulb and fan, gesture recognition, grayscaling.

I.INTRODUCTION

In recent times home automation has gained a lot of scope and has been implemented using different approaches and techniques. There are many conventional home automation available in the market which include Bluetooth based home automation, android apps based home automation whereas these are not much useful for aged and physically challenged people and so now gesture based home automation can into picture. The main propaganda of this proposed objective is to create a system through which we can control home appliances through hand gestures. Aged and physically challenged need an effortless way to control their surroundings so this system can serve their need effectively and efficiently.

II.LITERATURE SURVEY

A system is introduced [1] where a extensive study on moving gesture recognition is made and predicted by using Convolutional Neural Networks (CNN). Initially, Leap Motion (LM) is used as an acquisition equipment. Leap motion is used to recognize hand gestures more robustly. Then research the performance of networks of gestures in depth and different architectures. To identify the static signs [2] of ISL(Indian Sign Language) a hand gesture recognition system is proposed to aid deaf and mute which is developed using Convolutional Neural Network(CNN).A dataset is created with 3500 static signs images of 10 static signs gathered from impaired humans. CNN consists of many layers, in this paper we use 4 layers and 16 filters of CNN Architecture based on deep learning technique.
This paper[3] is based on recognition of gestures based on CNN visual mode in human-computer recognition. In this paper sensor is not used to collect data and it can identify similar gestures in the recognition process. The CNN model is constructed based on VGG16 model is used to extract frames for each gesture action and it also constructs vector using CNN model. CNN algorithm[5] is used to classify and separates all different types of images. The input is taken as image and converted to text and further converted to audio. The input is extracted and then the images are

trained and tested. The results are obtained and tested and check the effectiveness of CNN. In this paper[6] Double channel Convolutional Neural Network is used to detect the presence of hand gestures The hand gesture models works on webcams andCCTV and mobile camera. These implementations will target both static and dynamic gestures. A series of images, or a video clip is used to determine the gesture. Hand gestures[7] has been the oldest form of communication. Hand gesture recognition can be used to control various smart home devices such as lights, thermostats, TVs, and speakers. Users can simply wave their hands to turn devices on or off, adjust settings, or even dim lights. The model[8] has been divided into mainly three modules. In first module a CNN module is developed to predict the gestures and train those predicted gestures. Second module is about predicting the gesture through live video feed. The third module is designed in such a way that different gesture is assigned for different actions. For the predicted gesture, we use PyAutoGUI module to control devices like mouse and keyboard. In this work,[9] we propose a deep convolutional neural network (DCNN) based model for static hand gestures recognition. Static hand gesture images corresponding to five different classes are presented to DCNN model without any preprocessing. Convolutional Neural Networks (CNN)[10] are offered as a technology that can solve this problem in this research. CNN can learn the image data and it's database this technology will greatly improve human-machine interaction effectively. Data was extracted using Vivaldi antennas with a frequency bandwidth of 7.4-9.0 GHz and gain characteristics of 8 dB in five sign language operations, and data that went through the preprocessing process was learned through CNN. Proposed model[11] is used for preprocessing of input image and then make use of threshold values to eliminate noise from image and smoothen the image gesture. The image recognized is trained using CNN keras using tensorflow as backend tool.

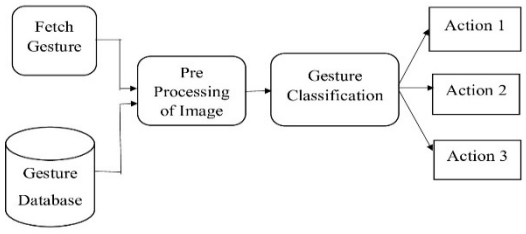

Fig 1: System Architecture

After training data is classified. Keras model is used for training of data. After completion of testing gesture recognition takes place, user pass the gesture and window display will display the hand gestures and then convert it into speech form.This research paper[12] focuses on human-computer interaction and recognition of hand gestures. Here three methods of contactless gesture recognition – vision based, sound wave based and radio frequency signal based and highlights the vision based method. Sign language is the principal and the only mode of communication for deaf and dumb people. Communicating with those people is challenging for normal people. As a result, there is a need for solutions that can considerably reduce the requirement for human translators and can lead to more easy communication between physically challenged and normal people. The goal of this study[13] is to create an efficient model that can precisely and accurately identify hand gestures and transform them into a apprehensible format. In this study we effectively predict classes by reducing the number of high complex parameters of high dimensional sign image. For this purpose we use Deep learning algorithms such as CNN(Convolutional Neural Network) and YOLOv5 (You Only Look Once).This system is [14] effective in efficiently predicting the sign gestures and assign appropriate light conditions very well with plain background. We converted the model into an efficient Artificial Intelligance which helps to understand sign language easily. Initially video of deaf person is captured after that video is converted into frames and then it is converted to gray scale image using gaussian blur filter.

In this paper,[15] they proposed the use of Electromyography (EMG) signals for classifying hand gestures through Employing both a Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) in combination is being used. The main problem lies in the noise signals produced by the EMG sensor. In this work, we employ a Low Pass Filter for preprocessing the signal images, followed by feature extraction using the CNN model. To reduce the high dimensional signal and normalize the features for the classification process, we utilize LSTM.

III.PROPOSED SYSTEM

This proposed gesture-based home automation system Leveraging both a Personal computer and Arduino integrates hardware and software components to provide an intuitive

and interactive control interface for smart homes. Webcam captures hand gestures video and it is going to be fed to the personal computer. Sophisticated gesture recognition software(python) employing computer vision using a machine learning technique(CNN-Convolutional Neural

Network) detects and classifies these gestures respectively. By analyzing movement patterns and features, the system translates gestures into predefined commands. The Personal computer then communicates with Arduino to operate the corresponding devices such as bulb.

IV.STEPS INVOLVED IN SYSTEM WORKING

A. Capturing gestures from the user

1.Initially the hand gestures videos are collected from user by using opencv module.
2.A video is a sequence of frame, where each frame is a picture. A video is being captured by a number of frames per second (FPS).
3.In the process of capturing continuous video, hand gesture are recognized with the computer.
4.There are predefined directories for each gesture video and the corresponding video will be stored into that particular folder.
5.Before that pre-processing of video has been done such that the colour image is converted to Gray so that all the unwanted error values will be eliminated.
6.The files of different gestures are stored for training the data.
7. They are three different video gestures for each unique task.
The gestures are thumbsup, swiping right, swiping left.
8.Each gesture is associated with each unique task.

B. Image classification of input gesture

Classification of images is done using Convolutional Neural Network(CNN). The model is trained by the predefined images in the data.The backend database is developed based on preprocessing, CNN Model training. Based on the predicted or recognized image the respective action is assigned for each different gesture.
The recognized image is given as input to the Arduino Uno unit.
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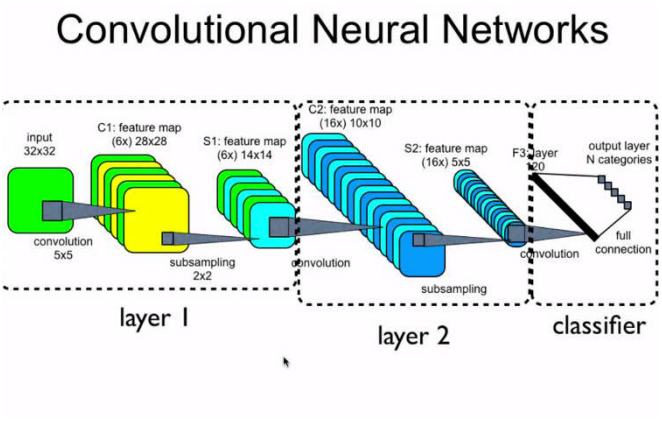
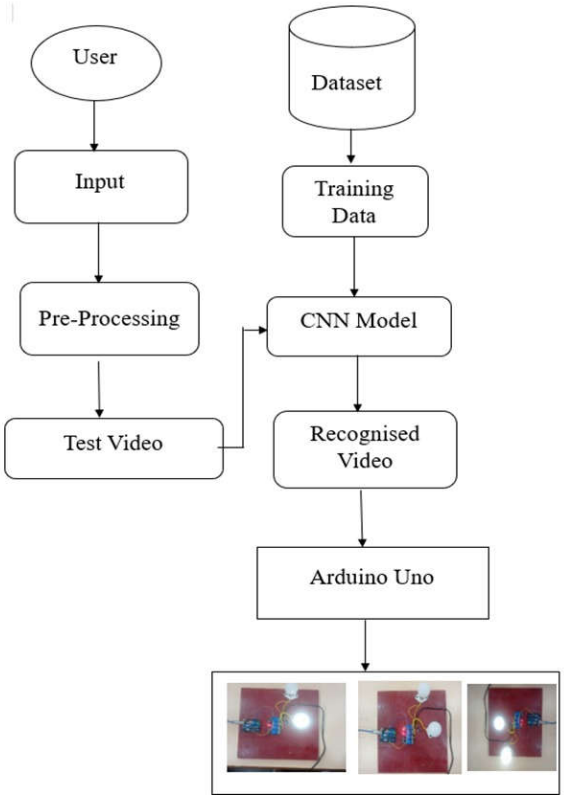


Fig 2: CNN Architecture

C. Appliance of Gesture Based Home Automation

The software is implemented and the software code is dumped into Arduino Uno for integration of hardware and software.
The hardware components used are Arduino uno, Relay module, Home appliances.The input gestures are predefined such that thumbup and hand swipping left and right hand control the bulb.

If the shown gesture is thumbsup then the two bulbs will turn off.
If it is recognized imageis swipping right then two bulbs will turn on.
If the recognized image is swiping left then single light bulb will turn on.



V.TOOLS AND TECHNOLOGIES USED

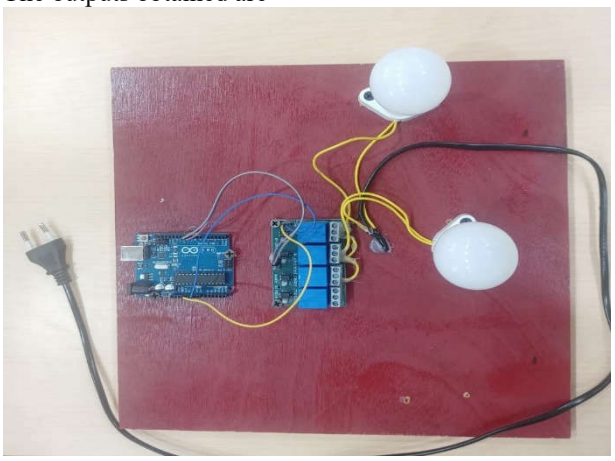
- Arduino- The Arduino is an open source micro controller used to interact with other sources like leds, motors etc.
- Our system requires several libraries like OpenCV, Keras, Numpy, Pandas etc.
- Home appliances controlled are bulb.

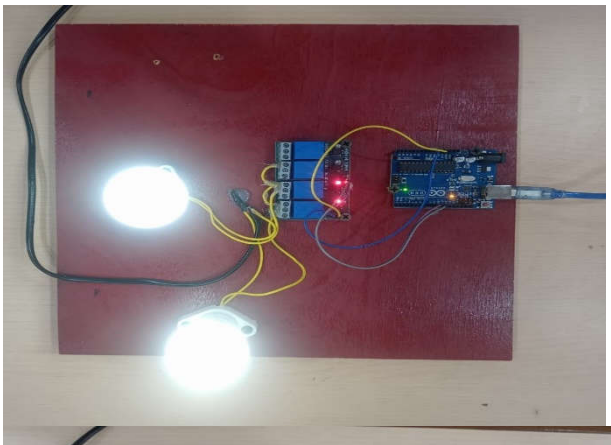
VI.RESULTS AND DISCUSSION

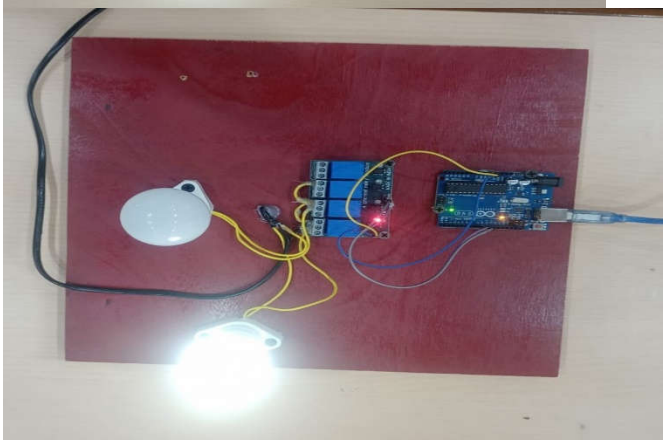
The project consists of both software and hardware units.
The software unit is implemented using python opencv module and tensor flow module.Based on the predicted or recognized image the respective action is assigned for each

different gesture. The project consists of two parts software and hardware. The software involves recognition and prediction of hand image gestures. Software involves developing a Python language using Deep Learning algorithms. Three dimensional pictures are detected in this project interpreting the shape of image . The multiple layers in CNN architecture are LSTM, Flatten, Dense layer and Softmax.By integrating LSTM units into CNN architectures, models can effectively capture both spatial and temporal information from sequential data, which leads to higher rate of performance such as video analysis, action recognition, and temporal sequence modelling. The purpose of the flatten layer is to recognized image the respective action is assigned for each different gesture. Transforms the multi-dimensional output from the preceding convolutional and pooling layers into a one-dimensional array. The convolutional and pooling layers are used to convert multidimensional vector images to single dimensional vector images.In CNN architectures, dense layers are essential for converting the retrieved characteristics into judgments or predictions that are pertinent to the current task. They introduce non-linearity, perform classification or regression, aggregate features, adapt to task complexity, and learn parameters through training, making them integral components of CNNs for various machine learning tasks.
The softmax function in the output layer of a CNN serves to convert raw scores into a probability distribution, making the output interpretable, facilitating decision-making, ensuring normalization, and enabling efficient training through backpropagation. It is used in classification tasks, where the aim is to assign inputs to one of multiple predefined classes based on learned features. The images are recognized and detected using software.

The software code is dumped into Arduino uno for integration.Finally the home appliances operate according to the input gesture.
The outputs obtained are







VII. APPLICATIONS

1. The aim of this proposed system is to create an environment that ensures automation of home appliances using hand gestures.

2.Gesture based home automation enhances home security by enabling gesture based authentication and controlling devices.

3.This system can be used in homes, control surveillance cameras.

VIII. CONCLUSIONS

Evolution of home automation has many advantages and it has grown rapidly in today's world. Many people who are physically challenged and bedridden people rely on home automation for daily activities. Thus home automation is a better choice for these people so that they can lead their life easily and comfortably without relying on others.

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