DEPTH BASED GESTURE CONTROLLING OF HOME AUTOMATION FOR PHYSICALLY CHALLENGED PEOPLE

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Abstract—Hand gestures are playing the major role in today's industry. The development of gesture recognition or detection will help the people in different ways. Development of many automated technologies like machine learning, neural networks and computer vision will help in using futuristic methods like gesture controlling and recognition. A smart home automation system which uses Hand gestures for disabled people to switch ON fans & lights of the house power saving capabilities to switch ON exterior lights based on light intensity is designed and developed. The system consists of house network (Sensors and Appliance actuators and camera to respect controller; an Arduino microcontroller that communicates with a Relay which is the user interface is used. Events can be programmed to be triggered under specific conditions, and this can have a great role in reducing the total energy consumed by some appliances.

Keywords—Computer vision, Hand gesture, Image processing, Open CV

1. INTRODUCTION

The Communication or transfer of data between human and human is really easy and understandable. But when it comes to machine and human is really difficult because the machine knows all the languages human can speak and understand, they cannot communicate with that knowledge or data. So, for improving that communication feature with machines we can develop some interactive techniques like gesture recognition.

Computer-Human communication refers to the way how the human communicates to the computer/machine, and since the machine is not useful until a human train the machine for the particular task. There are mainly 2 characteristics that will be checked when developing a man-machine communication model as mentioned in: machines performance and usage. The model performance refers to how well the machines are performing to communicate with the human and usage refers to weather all the provided functionalities are performing according to the development.

Gestures can be in any form like hand image or pixel image or any human given pose that require less computational difficulty or power for making the devices required for the recognitions to made work. Different techniques are being proposed by companies for gaining necessary information/data for recognition handmade gestures recognition models. Some models work with special devices such as data glove devices and color caps to develop a complex information about gesture provided by the user/human.

Home automation technique is used is used to design and implement a remotely controlled, energy efficient and highly scalable Smart Home with basic features that safeguard the resident's comfort and security. A smart Home automation system which uses Hand gestures for disabled people to switch ON lights & fans of the house, power saving capabilities to switch ON lights only in presence of people, switch ON exterior lights based on light intensity is designed and developed. The system consists of house network (Sensors and appliance actuators and camera to respect controller; an Arduino microcontroller that communicates with a Relay which is the user interface is used. Smart house uses video processing systems and sensors, thus making it a cost-efficient hybrid system.

2. LITRATURE REVIEW

S. Chew etal (2012), The smart white cane called Blindspot that combines GPS Technology, social networking and ultrasonic sensors to help visually impaired people to navigate public spaces. The GPS detects the location of the obstacle and alerts the blind to avoid them hitting the obstacle in tracing the location of the obstacles since tells the distance of the obstacle.

C.J Cohen etal (2015), "A basic hand gesture control system for PC applications". Analysis and understanding of imagery. The first color and depth sensor called Kinect was developed by Microsoft for the Xbox console and released in November 2010. This sensor projects an infrared pattern of 307,200 dots in a 640 x 480 mesh and receives the reflected pattern through a CMOS monochrome sensor. This structured light application allows the device to measure the depth of every point using triangulation. Moreover, an RGB camera provides synchronized color, information for each point. Microsoft Kinect was formerly developed for full-body tracking to interact with video games using body movements and gestures.

Mr. Bejoy Antony Asst. prof, Anju Anna Wilson, etal (2018), "Hand Gesture Recognition and Patient monitoring system with automated bed and Voice

control" using GSM Module and flex sensors which causes electronic interference, and GSM provides limited data rate capability & Cost for flex sensors are more which produces error when used for long time due to change in the flexibility of the sensors.

3. HARDWARE COMPONENTS SETUP

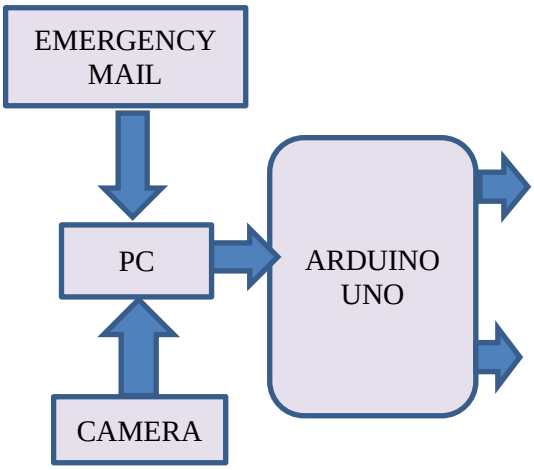

Fig 1: Block diagram

This project mainly concerned with the implementation of the hand gestures recognition technology (using image processing) using Arduino Uno board and a Webcam interfaced to it. Appropriate code is written in Python language using open CV libraries and is dumped into the board. The webcam will capture the images and send to the board, where the image processing is done and a Relay circuit which will enable and disabled by the driver circuits. The main Keywords are used here are Arduino Uno, Hand gesture, Image processing, Open CV and Python. The block diagram is shown figure 1.

This project is mainly intended in implementing a technology of hand gesture recognition and made it available to the common man for the most affordable price. We can implement this project in Social applications include the movement of wheel chair of handicapped person.

As of now, a wheel chair can be controlled using voice control and remote-control technologies which is not only expensive but also involves expertise of the user in terms of using the device.

4. OVERVIEW OF AN ARDUINO UNO BOARD

The Arduino-Uno is an open source and programmable microcontroller board developed as a simplified version of Arduino mega 328. The board has mainly 14 digital input/output pins analog pins which can be programmable by using Arduino IDE (Integrated Development Environment). It can be programmed by simple C/C++ programming by connecting with type B USB cable. It accepts voltage between 7-20 volts by connecting it with a power source. The clear details of configurations and technical specifications can be obtained from official Arduino website as mentioned below.
https://store.arduino.cc/usa/arduino-uno-rev3

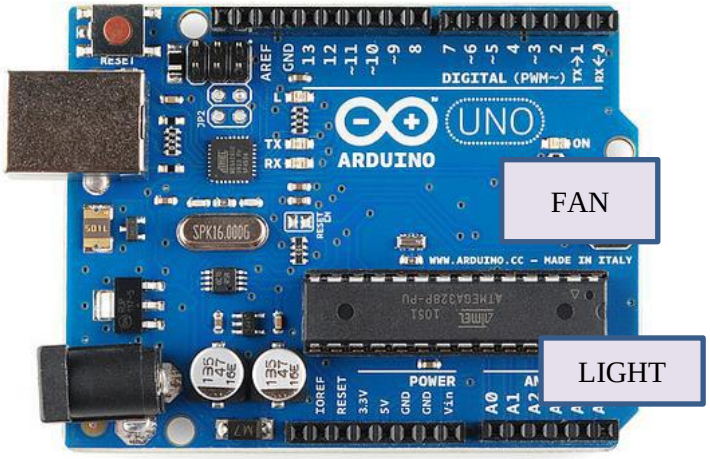

Fig 2: Arduino Uno Board

5. INSTALLATION OF SOFTWARES & PACKAGES

5.1. INSTALLATION OF ARDUINO IDE

Arduino IDE is open-source software developed in order to program circuit boards easily and efficiently. We can perform simple operations like turning on LED to complex operations like controlling robots. We can tell our board to do whatever operation we want by our Arduino board using set of programming instructions. So, to perform these operations we use a software called Arduino IDE. Using this software, we can perform coding for various projects like IoT, wearable devices, 3D printing, Circuit boards etc.

5.2. INSTALLATION OF PYTHON IDE

We have to install latest version of python i.e. 3.83(at the time paper was written).

The main purpose of installing this software is to use python packages that will simplify the code and also helps in performing various operations effectively.

5.3. INSTALLATION OF PIP PACKAGE INSTALLER

Pip is one of the best and widely used package manager used in Python for installing, deleting and managing packages. For some of packages, pip comes preinstalled. So, in order to check whether Pip is installed in your system or not we type "pip-version" in python console.

5.4. INSTALLATION OF PyAutoGUI Library

PyAutoGUI is a library in python which allows us to control keyboard as well as mouse to perform operations over a computer without the help of them. So, to install it we use following command “pip install pyautogui”.

5.5. INSTALLATION OF PySerial Library

PySerial library is used to provide backend support for python running on our computer. The major role of this library is it enables our program to communicate with the serial port. So, to install it we use following command “Pip install pyserial”.

6. SYSTEM IMPLEMENTATION

The system working conditions and environment is based on Anaconda Environment interface design, with Open CV, Tensor Flow, Kera’s, Mat plot Lib, NumPy libraries and some of the sub packages of these libraries. Camera resolution is 1920*1080 and with fps of 40 (Default System Camera).

While the device is ON and when the model is run. The model will open a tab of the camera which takes input from the user. The model is designed for the recognition and further working is done by the commands given to the system and how the user wants the gestures to make recognize. At the same time, the mouse pointer movement will be captured and made operate without any human interaction. The model working and implementation is shown in figures.

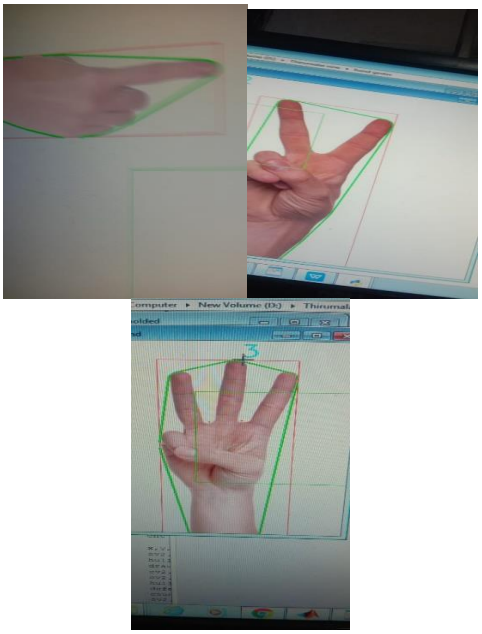

Fig 3: These are some sample images of trained data that will represent the way we have converted the image into system understanding way.

7. RESULTS

This is a sample image of how the system will convert the input into computer understandable images.

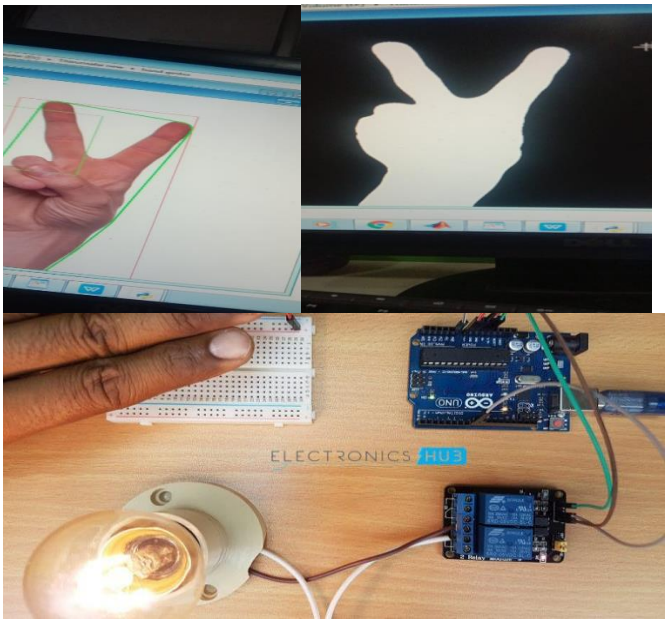

Fig 4: The sample image converted into Gray scale image to produce the output (Light Turned ON)

The Above figure shows the one of the Hardware outputs. Here the two fingers show an angle ∠90 degree, as per the software programmed the light is turned ON by the Arduino Uno which uses Relay as switching device for this project.

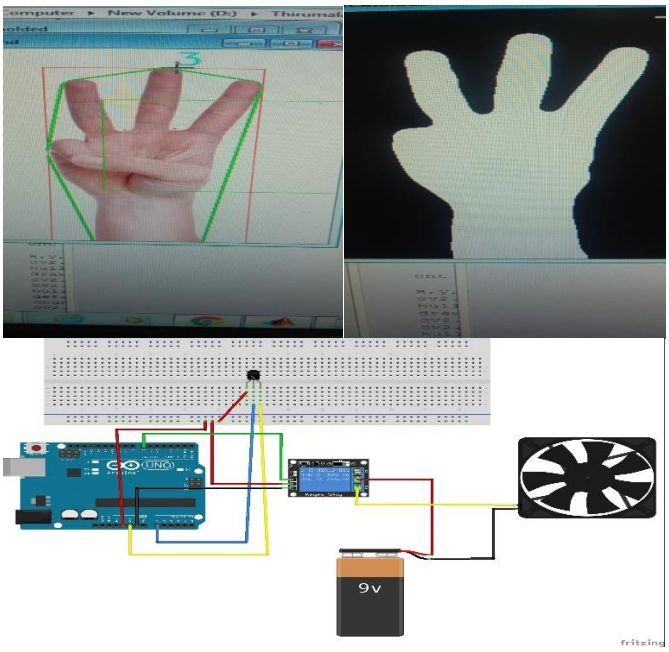

Fig 5: The sample image converted into Gray scale image to produce the output (Fan Turned ON)

The Above figure shows the one of the Hardware outputs. Here the three fingers show a two ∠90-degree angle, as per the software programmed the Fan is turned ON by the Arduino Uno which uses Relay as switching device for this project.

8. CONCLUSIONS

From the models that are developed we can conclude that it is able to handle some hand gestures provided by any person and help us to identify what the gesture is. So, the main point which we can look into is that the machine is able to understand on the images and is able to identify what the images are that is really helpful in many ways.

The expression of words has been made successfully by this work for the speech impaired people. This project also helps the patients itself to adjust the bed on their comfort. The wireless smart health monitoring system project is designed to give a better healthcare service. This system is really assisting them in not spending much time with each of the patients for monitoring.

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