FACE RECOGNITION BASED SECURED LOCKER CONTROL AND GESTURE BASED HOME APPLIANCE CONTROL FOR DISABLED PEOPLE

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Abstract: Automation is the essential need for the present world. There are various types of automation like building automation, industrial automation, Home automation, Artificial Intelligence, etc. can be a potential application which provides support to all the persons. Home automation is the use and control of home appliances remotely or automatically. Day by day the gap between machines and humans is being reduced. Nowadays hand gesture based home automation is getting more importance. Gesture recognition refers to recognizing the motion of the human parts like hand, face, etc. Most of the electronic components manufacturers focus on the hand gesture basis. In this proposed work we will be using artificial intelligence which recognizes human gestures with the help of a camera without the use of any kind of sensors and also an additional security is provided using face recognition and if the registered human is successfully detected then the locker is unlocked along with the gesture recognition. If an unauthorized person attempts to unlock the locker an alert is sent to the user's mobile application. In the case of general home appliances only the human gestures are recognized to effectively operate the devices. Thus, our project aims at discovering an automation system without the use of sensors or a mobile app with the help of artificial intelligence.

Keywords: Face recognition, gesture based home appliance control, light, fan , secured locker control, ESP WiFi Module, Security App.

1. INTRODUCTION

An efficient and accurate home security and access control to the locker system which is based on face recognition is very important for wide range of security application. Security is an important aspect or feature in the smart home applications .The most important major part of any locker security systems are identifying accurately the persons who open the locker. Face recognition is probably the most natural way to perform authentication between human beings. In this paper, we have attempted to provide a secure locker control system and home automation system using Deep learning, Artificial Intelligence and Mobile Application.

Disabled people can easily on/off the light or fan by correctly showing the hand gestures. The disabled person can open the locker by showing the hand gesture for the locker and then a second step verification(i.e : face recognition) will be done. If it is the authorized person's face then the locker will be opened. If some other intruder tries to open the locker, then a notification is sent to the owner's mobile through the securelocker app and the IP webcam shows the live telecast of the person who is trying to access the locker.

2. OBJECTIVE

The main objective of the project is to determine the gestures of human using deep learning. It automatically switches on the particular device(light or fan) based on the gesture of the person. It effectively provides a solution to improve the locker security. It makes the lives of the physically challenged people easy by automatically turning on/off the light/fan by just recognizing the hand gestures .It saves the time of the people. It accomplishes automation with the help of AI without use of sensors. The locker security is established with the help of hand gesture and face recognition.

3. LITERATURE SURVEY

Andrea Bandini, José Zariffa focussed on the hands using egocentric vision, categorizing the existing approaches into: localization (where are the hands or parts of them?); interpretation (what are the hands doing?); and application (e.g., systems that used egocentric hand cues for solving a specific problem). Moreover, a list of the most prominent datasets with hand-based annotations is provided.

Xu Liang, David Zhang designed a novel red-green-blue and depth-based four-camera system that can capture the palm-related images separately in real time. The techniques of region-of-interest (ROI) location, ROI alignment, and light-source intensity optimization were studied. The ROI location method is modified to increase the robustness of hand gesture variation. Based on the depth information, we proposed the

coordinate mapping and inclination rectification methods to obtain aligned ROI pairs. Using this device, we collected a video-based multimodal palm image database. After the parameter optimization and information fusion, the equal-error-rate of our approach on this database is lower than 0.47%. The recognition rate obtained from the support-vector-machine-based fusion is higher than 99.8%. The experimental results prove that the proposed system achieves advantages of anti-spoofing, high speed, high accuracy, and small size.

Feng Duan,Xina Ren,Yikang Yang proposed a novel gesture recognition system, in which three channels of sEMG signals can classify nine gestures. In this recognition system, the time domain features, root mean square ratio, and autoregressive model, were selected to extract the features of the sEMG signals as compared with the time–frequency domain features. Furthermore, the linear discriminant analysis was adopted as the classifier. Consequently, the average accuracy rate of the presented system was 91.7%. Therefore, the proposed gesture recognition system is feasible to identify more gestures with less sensors.

4. DRAWBACKS OF THE EXISTING SYSTEM:

The previous systems were not reliable if there was no internet facility available. The previous systems used sensors in order to achieve the goal. Failure of sensor modules will lead to inefficient automation. The accuracy of the previous systems did not meet its expectations.
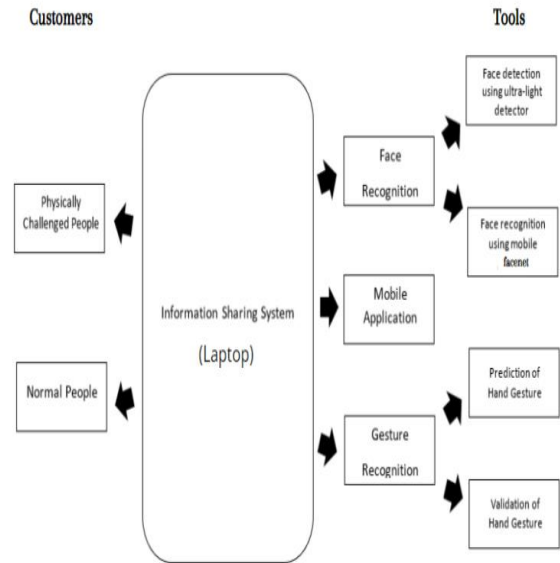
5. SYSTEM ARCHITECTURE:

Figure 1: System architecture which includes all the modules

5.1 GESTURE RECOGNITION:

When the disabled person shows the hand gesture for light(i.e: 1), the system processor identifies that the person wants to either on or off the light. Then the person shows the gesture for turning on the light(hand fully opened) or the gesture for turning the light off(fist).

When the disabled person shows the hand gesture for fan(i.e: 2), the system processor identifies that the person wants to either on or off the fan. Then the person shows the gesture for turning on the fan(hand fully opened) or the gesture for turning the fan off(fist). When the disabled person shows the hand gesture for locker(i.e: 3), the system processor identifies that the person wants to open the locker.This is followed by a second step ie:face recognition of the person who tries to access the locker.

5.2 FACE RECOGNITION:

The person who tries to open the locker is recognized by the camera and if it's the authorized person, then access is given. Otherwise an alert message is sent to the owner's mobile via an app.

5.3 MOBILE APPLICATION:

When the person trying to access the locker is not the authorized person, then a theft detected message is sent to the owner's mobile phone via the

securelocker app. The securelocker app needs to be installed in the owner's mobile phone. The username and the password should be set and the app will be successfully installed.

ESP-01s Wifi module is required to connect the hardware components to the mobile app. The live telecast of the unauthorized person whose trying to access the locker will be displayed to the owner via the IPwebcam app.

6. COMPONENTS:

6.1 WEB CAMERA

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware.

Figure 2: Web camera that detects the hand gestures and face

6.2. ESP-01S WIFI MODULE.

The ESP-01S WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP-01S is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. It's a very economic module and has a huge and growing community support. It can be used in any application where you need to connect a device to your local network or internet. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area.

Figure 3: ESP-01S that contains TCP/IP socket

6.3: 230V LIGHT BULB

An electric bulb is a device which produces light when electricity is passed through its terminals. The bulb has two thick contact wires in the center with a thin wire attached between them. This thin wire is called filament.A bulb is said to be fused if the filament gets broken.

Figure 4: Light bulb which glows when 1 is shown

6.4 FAN MOTOR

A fan is a powered machine used to create a flow of air. A fan consists of a rotating arrangement of vanes or blades, which act on the air. The rotating assembly of blades and hub is known as an impeller, rotor, or runner. Usually, it is contained within some form of housing, or case. This may direct the airflow, or increase safety by preventing objects from contacting the fan blades. Most fans are powered by electric motors, but other sources of power may be used, including hydraulic motors, handcranks and internal combustion machines.

Figure 5: Fan motor that runs when 2 is shown

6.5 LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.

Figure 6: LCD Display that shows the locker open/close status.

6.6 PYTHON

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library. The code required for this project is done using python.

6.7 VISUAL STUDIO

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft

software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

Visual Studio includes a code editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger.

7. MODULE DESCRIPTION:

The system's architecture can be divided into three modules namely:

I) HOME APPLIANCES:

- **Light on/off:** When the disabled person shows the hand gesture for light(i.e: 1), the system processor identifies that the person wants to either on or off the light. Then the person shows the gesture for turning on the light(hand fully opened) or the gesture for turning the light off(fist).
- **Fan on/off:**When the disabled person shows the hand gesture for fan(i.e: 2), the system processor identifies that the person wants to either on or off the fan. Then the person shows the gesture for turning on the fan(hand fully opened) or the gesture for turning the fan off(fist).

II) LOCKER (OPEN-CLOSE MODULE)

When the disabled person wants to open his locker there are 2 steps:

- Hand Gesture recognition:The authorized person needs to show the secret hand gesture which is used to open the locker
- Face recognition: the system checks where the authorized person is the one who needs to open the locker by detecting the face using web camera.

III) ALERT MODULE : MOBILE APP

When an unauthorized person tries to open the locker, an alert notification will be sent through the app to the owner.

7.1 HARDWARE COMPONENTS

- ➢ ESP8266 (Wi-Fi module)
- ➢ Laptop
- ➢ Web Camera
- ➢ 230V Light bulb
- ➢ Fan motor
- ➢ LCD Display

7.2 SOFTWARE COMPONENTS

- ➢ Visual Studio
- ➢ Python
- ➢ IPwebcam app
- ➢ Securelocker app

8. WORKING:

This system uses deep learning and artificial learning to recognize human hand gestures without the use of any kind of sensors with the help of a camera and also an additional security is provided using face recognition. When the user shows a hand gesture to control the appliances, the camera detects the gesture and compares it with fed data, if it is valid then the respective appliance operates. For Locker control, the user shows the hand gesture which is again cross checked to verify if it is correct and then for additional security we use face recognition. The user shows his face and the system compares it with the fed data and if the registered human is successfully detected then the locker is unlocked.

If an unauthorized person attempts to unlock the locker an alert is sent to the user's mobile application.

9. RESULTS AND DISCUSSIONS:

Gathering information about the hand gestures: The datasets are created by collecting many images in all possible angles so that the accuracy turns out to be what was originally expected.
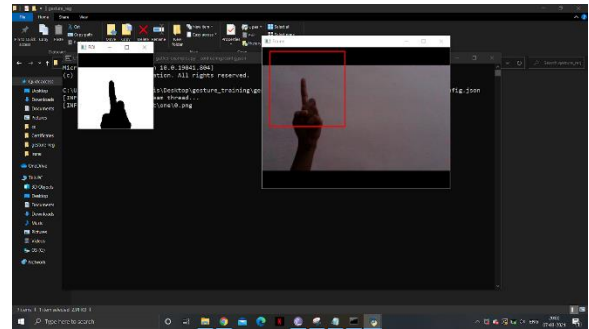
Figure 7: Gathering information about the hand gestures

Figure 8: Adding the image to the respective datasets
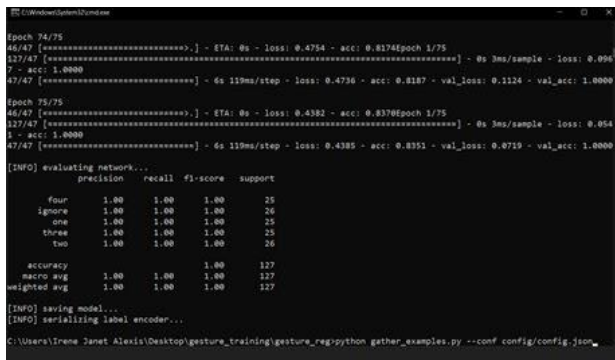
Sample Gathered Datasets

Figure 9: Hand gesture dataset that represents light

Figure 10: Hand gesture dataset that represents fan

Training the hand gestures

The python code is executed and the hand gestures are trained

Figure 11: Training the hand gestures

10. CONCLUSION:

This face recognition based Secured Locker Control System was developed for assisting visually challenged persons and normal people to secure the lockers by using hand gesture recognition and face recognition system. Also the hand gesture recognition based home appliances control system was developed mainly for the visually challenged people and the ordinary people to control the home appliances with the help of cameras. A webcam of the system is used for recognizing the face and the hand gestures. A mobile application is also developed for the alert message notification. The need of this system is to make the lives of the physically challenged people easy by automatically switching on the home appliance using hand gestures and to improve the locker security by using face recognition.

11. FUTURE ENHANCEMENTS:

Locker security systems can be enhanced to real time scenarios and by not stopping with just Fan and Light, we are planning to implement it for all home appliances. Along with this we are planning to expand it to the doors as well. We are also planning to enhance the mobile app by sending the theft notification to the nearby police station and also the videos can be recorded. Hand gesture based home appliances control system and Face detection based locker security system is to be implemented in all working places.

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