A Smart Independent Load Controlling System for Paralyzed People

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Abstract: The Application focuses on paralysis patient to operate the electronic device independently without the help of their caretaker. This system provides hand gesture recognition, eyeball movement recognition, in which various gestures represents control for certain electronic appliances. A particular type of gesture can be preprocessed and can be used in case of some emergency. When the patient uses this emergency gesture, the application immediately sends an alert message to the caretaker's phone. The system also contains a voice control system, where electronic appliances can be controlled using voice command through a mobile application. This system includes a Mobile Application which can be used to control and monitor electronic devices even when they are away from home. Thus enabling them to manage devices, no matter wherever they are.

Keywords: Internet of things, Global System for Mobile Communication, Matrix Laboratory, Short Message Service, Universal Asynchronous Receiver/Transmitter, Unified Modeling Language, Global Positioning System.

I. INTRODUCTION

In today's world, there are many difficulties faced by the paralyzed people who are mostly affected by Monoplegia, Hemiplegia, losing voice due to facial paralysis. One of the main challenges faced by them is being dependent on the caretaker's help for basic needs. Thus we are developing a system for them to independently operate the electronic load devices at home without the need of their caretaker.

II. EXISTING SYSTEM

The Existing System consists of an individual application which uses Principle Component Analysis for Hand Gesture Recognition, and another application is on detecting Eye Blink of the paralyzed person to operate the electronic devices. We have overcome all the flaws of the existing system, used an advanced and latest algorithm in our proposed method.

III. PROPOSED SYSTEM

The proposed system focuses on developing a smart, independent system for paralyzed people. This system contains Hand gesture recognition, Eyeball movement recognition system, Voice control system and an IOT mobile application. The electronic devices are connected with the microcontroller through Arduino mega. For a specific type of paralyzed people who can speak can make use of voice control system. This voice control system works through Bluetooth. Once the phone is paired with the Bluetooth, voice commands are given using the mobile application, which turns on the particular device based on the voice command. This proposed system consists of three mode switches that can be used to on hand gesture system, eyeball movement recognition system and the IOT mobile application. For Hand gesture recognition system, Matlab software is used . the software and the Arduino is connected through a Zigbee module which acts as both transceiver and receiver. Multiple gestures are trained using the Background Subtraction and Object Tracking algorithm with the software, where each gesture represents a particular load device. The Eyeball movement recognition is also implemented using Viola Jones algorithm with the Matlab software and connected to the hardware using the Zigbee module. Here eye movement to the left side is trained to a load and eye movement to the right is trained to on another load. Only two devices can be turned on with eyeball movement recognition system. The last mode is the IOT mobile application, this is applicable when the paralyzed person staying far away from the house and still wants to control the devices at home. Here the devices are connected through the internet with IOT hardware module. The changes made in the mobile application is reflected in the server and the IOT hardware module reads from the server and transmits the change to the Arduino. Thus making the device that was selected on/off.

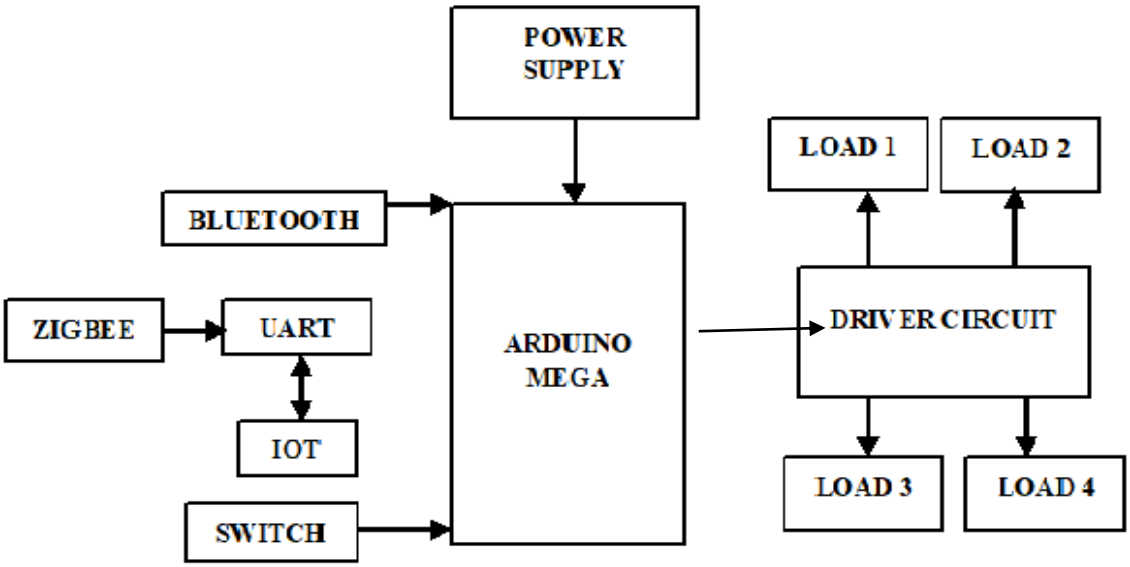

Figure 1: Proposed Architecture Diagram

IV. MODULE DESCRIPTION:

- Hand Gesture Recognition System
- Eye Ball Movement Recognition System
- Voice Control System
- IOT Mobile Application

HAND GESTURE RECOGNITION SYSTEM:

The Hand Gesture Recognition System focuses on detecting the hand gesture shown in the camera by the paralyzed person. This system is useful for leg paralyzed person and dumb people. The algorithm used is Background subtraction and object tracking. The Background subtraction, also known as Foreground Detection, is a technique in the fields of image processing and computer vision wherein an image's foreground is extracted for further processing (object recognition etc.). This algorithm takes a background model image as a reference image, to identify the background first. Later when some gesture is shown in the same background, it is converted into a foreground mask image which is a black and white image. The gestures are trained and preprocessed and saved as trained image dataset. Once the foreground mask image shown by the paralyzed person is matched with the trained dataset, the load device associated with that particular gesture gets turned on. In our system, we have three load devices namely light, fan, motor (to adjust the bed position) and a gesture for an emergency message to the caretaker. Hence four hand gestures are linked to the three load devices and an emergency message. The data from the Matlab software is sent to the Arduino board through Zigbee, which acts as a transmitter and a receiver. This data received to the Arduino will now make the device to turn on with the help of a microcontroller, which gives the required power voltage for the device. The emergency message is sent with the help of GSM.

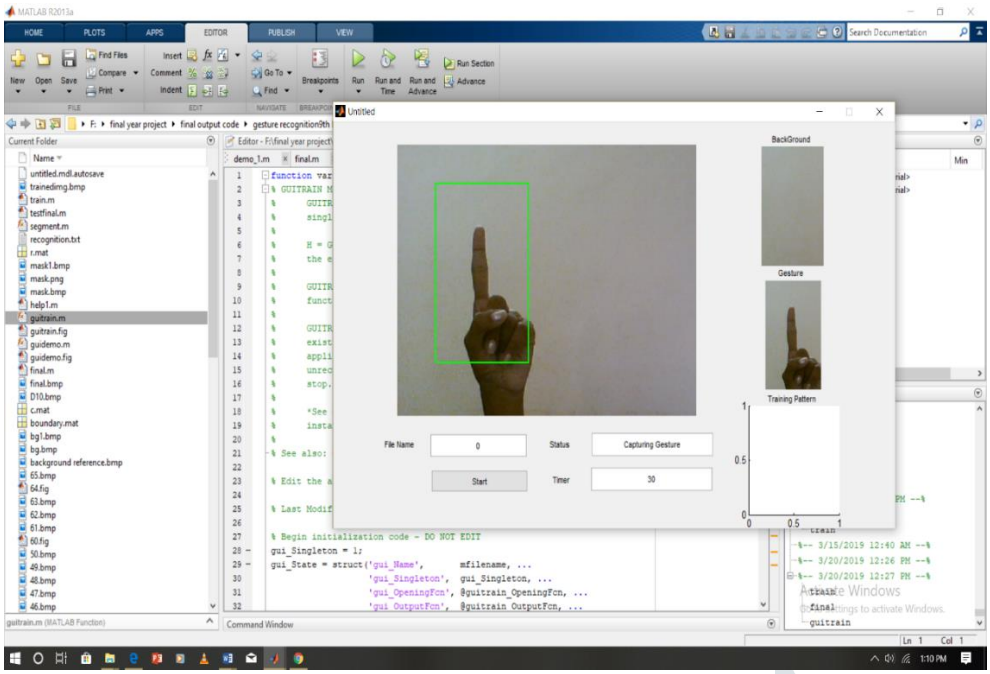

Figure 2: Hand gestures for controlling load devices

EYEBALL MOVEMENT RECOGNITION SYSTEM:

The Eye Ball Movement Recognition System focuses on detecting the eyeball movement to either the left or right side. The algorithm used in this system is the Viola Jones algorithm for face detection. This algorithm detects various parts of face like eyes, nose, mouth. Viola Jones algorithm consists of four types namely Haar feature selection, creating an integral image, Adaboost training, Cascading Classifier. The Cascading Classifier detects in a subwindow, the face of the person and shows the result as 'face detected' or 'face not detected.' The Haar feature selection is used to detect the eyes from the face. Once the eyes are identified, the movement of the eye towards the left or right side is achieved with the coding. To track the eyeball, we count the number of white spaces in both the eyes. The side the white space in the eye is maximum, the eye movement is in that side. Thus detecting the eyeball movement is towards left or right side using Matlab software. Now the Matlab software and the hardware is linked through the Zigbee module. The Zigbee module acts as a transceiver and receiver. Once the eyeball movement is detected, it is transmitted to the Arduino using the Zigbee receiver. Now the microcontroller gives sufficient power supply to turn the particular device on.

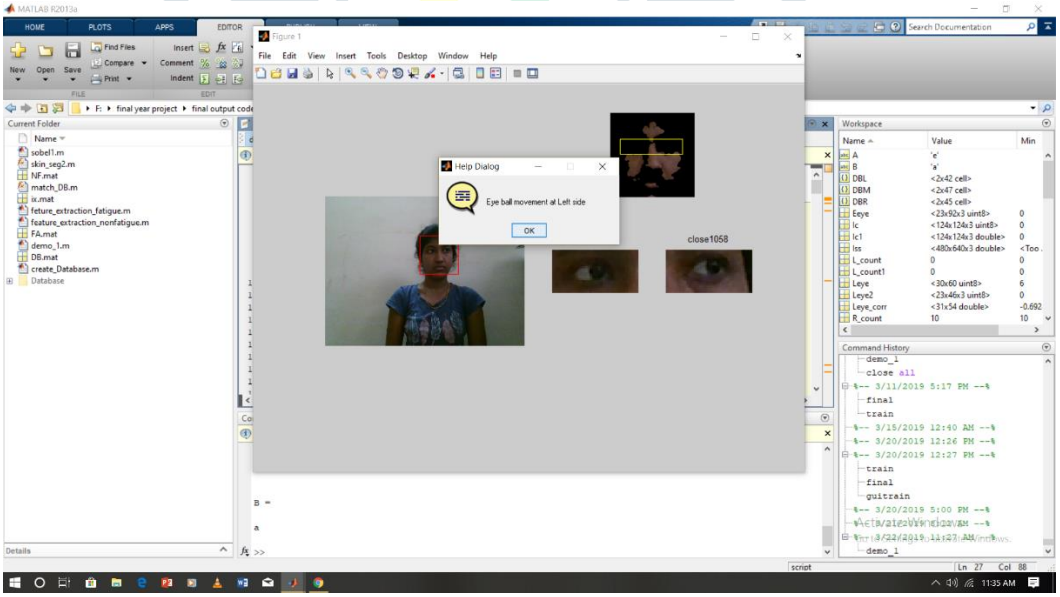

Figure 3: Eye Ball Movement Recognition

VOICE CONTROL SYSTEM:

The Voice Control System includes a mobile application which can control the load devices using voice commands. This system entirely works on Bluetooth module. This type of system is suitable for any kind of paralyzed people who can speak.
The module works by pairing up with the Bluetooth device that's available, and once the device is successfully paired up with the Bluetooth module, the paralyzed person can control or on/off the devices using voice command. The electronic load devices that can be controlled in our system is light, fan, motor and additionally, they can contact their caretaker in case of some emergency situation.
Each electronic device has its own command and the voice commands are embedded within the Arduino using Arduino code. For example, to turn the light on, the voice command used is 'light on' and to turn off the device the command has to be 'light off'. To turn the fan on, the voice command has to be 'fan' and to turn off the fan, the command has to be 'fan off'. Now to turn the motor on, the command has to be 'run' and to turn the motor off, the command has to be 'stop'. Here the motor is kept has as a load device to adjust the bed position of the paralyzed person. In case of some emergency for the paralyzed person, they can immediately notify their caretaker with the command 'emergency'.

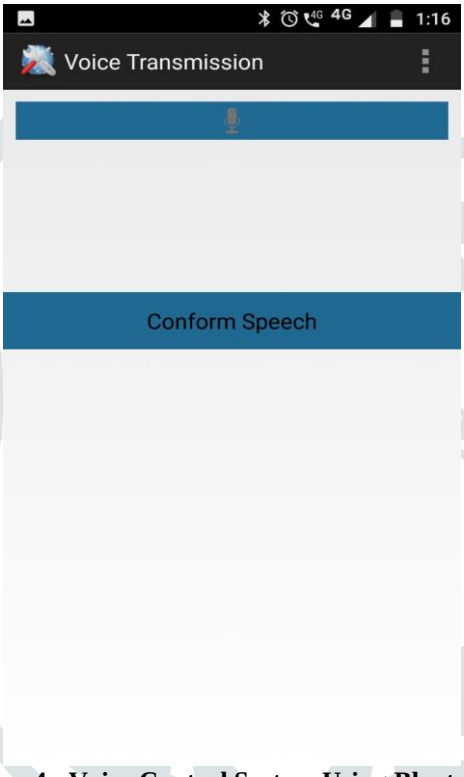

Figure 4 : Voice Control System Using Bluetooth

IOT MOBILE APPLICATION:

The IOT Mobile Application includes a mobile app that can control various electronic load devices like light, fan, motor. This app also includes a GPS system where the caretaker person can track the location of the paralyzed person. Here both the IOT hardware module and mobile application have IOT Server in common. The Care taker's mobile number can be updated using the mobile application so that the paralyzed patient can send an emergency message along with his location when needed.
This module is mainly used when the paralyzed person wants to control the load devices even when they are away from their home. Before the person leaves they have to turn the IOT mode on. This makes them be connected to the load devices through the mobile application.
The working of the IOT module is that the paralyzed person can choose to turn on/off any load devices from the mobile application. This change is immediately uploaded into the server. The server acting as an intermediate between the IOT hardware module and the mobile app, makes the corresponding change in the IOT module. The IOT hardware module is connected with the Arduino device, which makes the microcontroller to produce 5V of power supply to the particular device for the device to be turned on. But that 5V of microcontroller being insufficient for the device, additional power supply of 12V is given by the driver circuit. Thus making the device that was chosen from the mobile application to on. In case if they want to turn off the device, it works in the same way and once it is updated in the server, the power supply is cut from the microcontroller. Thus making the device to turn off.

Figure 5: IOT Mobile Application

V. CONCLUSION:

In the proposed system, we introduced a home automation system for the paralyzed people to control the devices at home and send an emergency message along with the user's location to the caretaker. This helps the user to control devices at home even when they are far from home. This system uses two mobile applications – one for voice recognition based load control and the other for IOT based load control which is mainly used when the user is away from home. It also allows the user to control devices and send an emergency message to caretaker using hand gesture as well as eyeball movement.

VI. FUTURE ENHANCEMENTS:

In the future, tracking of the top and down movement of the eye will be enhanced and also Provide Home Automation for multiple devices which will make the lives of patient and caretaker easier.

VII. REFERENCES

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