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Eye Closure Duration -Based Control of Electrical Application for Paralytic Patient

Dr. P. Loganthurai[1], M. Haritha[2], P. Venishriabhirami[3], S. Kayalvizhi[4]

*[*1] Associate professor, Department of EEE, K.L.N College Of Engineering(An Autonomous Institution, Affiliated Anna university)Pottapalayam,Sivagangai, Tamilnadu, India.*
*[*2,3,4]Second UG scholars, Department Of EEE,K.L.N College Of Engineering(An Autonomous Institution, Affiliated Anna university)Pottapalayam , Sivagangai, Tamilnadu, India.*

Abstract - *People who have paralysis because of nerve and muscle problems or spinal cord injuries have a time doing everyday things like using electrical devices at home. This research paper is about an smart control system that uses how long a person closes their eyes to help people with paralysis be more independent. We used a sensor that detects when a person blinks and it sends a signal. This signal is then processed by a computer and turned into a command to control things.*

We used this system to control things like lights and fans in a house. It is safe and will not hurt anyone. This way of controlling things is better than using switches or voice commands or joysticks because it does not need the person to touch anything it is easier to use. It is very helpful for people who cannot move very much. This device works very well. It also uses systems that make it work even better.

The experiments we did show that this device is very good at doing what it is supposed to do and it is not expensive. It is also very easy to use. This system does not just help people with paralysis it also helps them to not need others to do things for them. The paralysis patients can use eye closure time to control household devices like people, with paralysis to be more independent and live a life.

***Key Words*: (Arduino UNO, IR sensor, Assistive Technology, Embedded system)**

INTRODUCTION

The condition of "paralysis" is caused by damage to the nervous system and may be the result of a spinal cord injury, stroke or neurological disorder; it produces partial or complete loss of voluntary muscle movement which severely limits an individual's ability to carry out their daily activities within a normal range. Quadriplegic patients experience extensive loss of muscle control and have no ability to utilize their hands, arms, feet or legs to perform everyday tasks, including mechanical operation of devices such as electric lights, fans or kitchen appliances. As a result, individuals who become paralytic will generally rely on assistance from other people to perform these basic tasks and they will lose a significant amount of their personal independence and dignity.

The use of home automation systems has grown dramatically in recent years, primarily due to the increased convenience of these types of systems and their overall efficiency. Most of the home automation systems currently in use were originally designed for general users and utilize various types of input methods (i.e., push button switches, mobile device applications and voice commands) to control automated devices. Many of the input methods currently in use are not suitable for paralytic patients, particularly patients with no residual use of their limbs, hands and/or voice. Therefore, there is an urgent need for a new, alternative, simple-to-use, reliable control method that can be used by paralytic patients to operate automated devices.

Eye movement and blinking are two forms of human body movement used successfully as an input mechanism; both methods have proven to be very reliable, since eye movement and blinking are both still functional in patients who are in a state of extreme paralysis. Eye blinking has been utilized by numerous researchers as an accepted, natural and controllable form of interactive motion whereby paralytic patients utilize their eye blinks to communicate and/or to execute commands associated with operating automated device and This project introduces an eye-closure duration-based control system that enables paralytic patients to operate electrical appliances using their eye activity

Proposed System

The proposed method uses eye blinking to control electrical appliances. It is designed using the hardware parts of the system. The IR sensor sends infrared rays toward the eye and receives the reflected signal. When the eye is open, the reflection is normal. When the eye is closed, the reflection changes because of the eyelid.This change is converted into a digital signal and sent to the Arduino Uno. The Arduino checks the signal and detects when the eye is closed. Once the eye is closed, the system

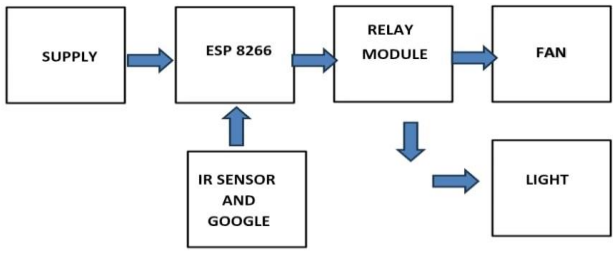
starts measuring how long the eye remains closed using its internal timer.

After the eye opens again, the measured time is compared with preset time values. Based on the blinking duration, the system decides the control action. For example,a medium blink duration is used to switch the LED ON or OFF, while a longer blink duration is used to control the DC fan.

The Arduino then sends signals to the relay module through its output pins. The relay works like an electrical switch and helps the Arduino control appliances connected to the 5V supply. It also provides safe operation and electrical isolation.

This method allows control of multiple appliances using a single eye blink input without making the system complex.

Block Diagram



1. Arduino UNO

The Arduino Uno is powered by the ATmega328P (microcontroller); This microcontroller is based on 5V power. The Arduino Uno has 14 Digital I/O and 6 analog inputs. Clocked at 16 MHZ, this board features 32 KB of Flash memory, 2 KB of SRAM & 1 KB of EEPROM memory. Powering the board can be accomplished via USB or an outside supply (7 to 12 VDC). Communication methods supported by the Arduino UNO include UART, SPI, and I2C. This makes it an ideal candidate for Embedded applications.

2. Relay Module

Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, NodeMCU, etc.The relay is the device that opens or closes the contacts to switch ON/OFF other appliances operating at high voltages. It is also used in safety circuits where it detects the undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area through ON or OFF.

3. Fan

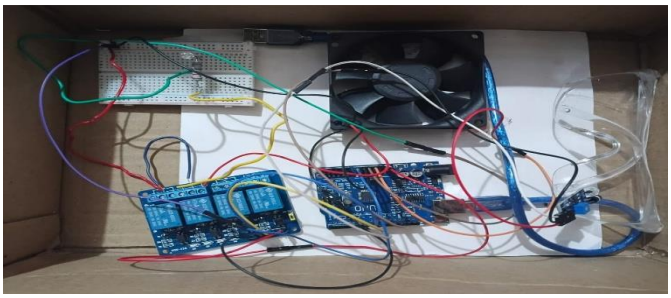
An electrical tool that generates airflow is known as a fan. A fan generates airflow by turning blades with an electric motor that causes the air to move throughout the space where the fan is located.
In homes, fans can be used to reduce heat, circulate air and improve comfort. The power used by fans can be from DC sources.

4. LED

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Its application is everywhere due to its compact size, low consumption of energy, extended lifetime, and flexibility in terms of use in various applications. LEDs can be seen in TV Backlighting, Smartphone Backlighting, LED displays, Automotive Lighting and Dimming of lights.

5.IR Sensor

An Infrared (IR) Sensor is a type of electronic device designed to monitor objects and detect changes by emitting infrared light emitted by the device and measuring the changes in this light based on how it reflects off an object. If an object is present in front of the IR sensor (for instance, the human eye), when the object is detected, the amount of reflected IR light from that object will change and therefore create an electrical signal that the device can use to determine whether or not that object is in front of it.



Software Specification

Arduino IDE

An Integrated Development Environment (IDE) is software that you use to write, compile and upload programs to your microprocessor board such as an Arduino Uno. The IDE has an easy-to-use interface to write code with a programming language that supports C/C++

and control the code's downloads to your microcontroller with a USB connection.

The IDE is composed of a code editor, compiler (to check your code for correctness) and a serial monitor (for testing and debugging). The IDE is free and open source, making it easy to use as well as well-known for creating projects related to embedded systems. For this project, the IDE will allow the control of eye blink signals that will turn appliances on and off.

Algorithm

Step 1: Start the program.
Step 2: Initialize the input and output pins.
Set the sensor pin as input.
Set the relay pins as output.
Step 3: Initialize variables for timing and appliance states.
Set LED and fan initial states as OFF.
Step 4: Start continuous execution of the program.
Step 5: Read the signal from the sensor.
Step 6: Check whether eye closure is detected.
Step 7: If eye closure is detected, record the start time.
Step 8: Wait until the eye opens again (sensor signal changes).
Step 9: Measure how long the eye remained closed using the time difference.
Step 10: Compare the measured time with predefined ranges.
Step 11: If the duration is between 2 to 4 seconds, switch the LED ON/OFF.
Step 12: If the duration is between 5 to 6 seconds, switch the fan ON/OFF.
Step 13: Send control signals to the relay module to operate the selected appliance.
Step 14: Add a short delay to avoid multiple triggering.
Step 15: Repeat the process continuously.
Step 16: Stop

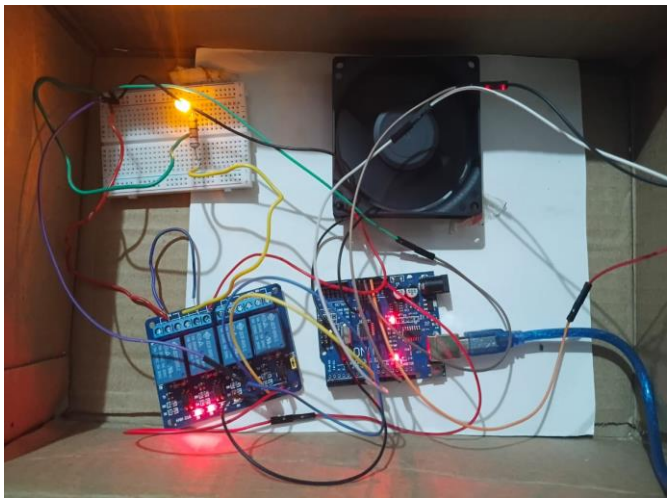
Eye Closure Duration	Application Executed
2 to 3 seconds	LED will be turned ON and another 2 to 3 seconds of eye closure duration, the LED will be turned OFF.
5 to 6 seconds	FAN will be turned ON and another 5 to 6 seconds of eye closure duration, the FAN will be turned OFF.

Result and Discussion

The developed eye closure duration-based controller has successfully controlled some basic household electrical appliances (fan, light) through IR sensor using a microcontroller. The results demonstrate that the system can detect "Eye Closure" signals with a high level of accuracy and easily differentiate between short and very long closures; therefore, there will be no confusion when controlling multiple devices at one time.

The response time of the controller was very fast, and it operated consistently under regular lighting conditions; thus, the relay module switched ON and OFF the appliances based on received processed signals, thus providing for a safe and effective operation. The design of the sensing system was designed for user comfort; therefore, it was also very suitable for use by paralytics to operate their devices hands free.

In addition, the controller application had a very high degree of precision when calibrated properly. ln comparison with currently available systems (e.g., Voice Control, Camera-Based Eye Tracking), this proposed approach is simpler and less expensive



Conclusion

Eye-closure duration control system provides a useful, user-friendly way for paralytic patients to operate household electrical devices. The eye activity is converted into useful control commands using an infrared (IR) sensor and a microcontroller, making this a successful alternative to existing systems. This shows that eye movement is a reliable input method for real-time control of appliances.

The system is low-cost, compact, and easy to use, which means it is suitable for use in real-life situations when providing assistive technology. Patients will be less dependent on caregivers due to this system, which

increases their independence, comfort, and overall quality of life. Compared to existing methods, the proposed method is simpler and easier to access than other similar solutions, is not expensive or complicated to set up, and does not use complicated components.

There are some opportunities for enhancing the system to work better. These include being more accurate, reducing the number of false triggers, and adding features such as remote monitoring through IoT devices. This project shows how embedding systems in health technologies can lead to new improvements and to giving everyone the ability to participate fully, especially those who are physically disabled

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