

Eye Controlled Home-Automation For Disables

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Abstract: Paralysis is one amongst the major neural disorder that causes loss of motion of one or more muscles of the body, wherein depending on the cause, it may affect a specific muscle group or region of the body, or a larger area may be involved. In pursuit of rehabilitation, the eye can be regarded as one of the organs that can help a paralyzed person to communicate suitably. Eye movement can be used by the paralysis patients and armless persons to perform simple tasks. This paper describes the acquisition and analysis of eye movements for the activation of home appliances for paralysis patients. The proposed method here uses a eye blink sensor for eye movement acquisition thereby reducing the occurrence of artifacts, further following a simple circuitry for implementation of signal processing, which is also cost effective and useful from the user point of view. And this processed signal can be used as an input for a microcontroller in order to control home appliances.

Keywords: Eye Blink, Home Automation, Paralysis, Microcontroller.

I. Introduction

Paralyzed stroke patients are unable to normally communicate with their environment. For these patients, the only part of their body that is under their control, in terms of muscular movement, is their eyeballs. Some research in this area has focused on investigating new efficient communication tools for paralyzed patients for translating their eye movements into appropriate communication messages. . The biggest problem that paralyzed patients face is leading their own life without anyone else's help. This includes basic day to day operations like switching on an appliance or increasing the speed of fan. Most of the existing system use sophisticated hardware and software to make the control easier and efficient. But the biggest problem which a paralyzed patient faces while using these system is accessibility. Papers [1] and [2] use PLC's to control appliances but the main disadvantage of this type of system is the fact that they need a PC to control the appliances at all times. The user needs to access the PC in order to control the appliance. In recent times, use of network enabled devices and internet has enabled control of home appliances through long distances. This type of system typically uses SMS or internet to control appliances. Papers [4] and [5] use a very similar approach to solve this problem. But again the problem is accessibility. This paper tries to solve their problem using a blink sensor. A blink sensor is a transducer which senses an eye blink, and gives an output voltage whenever the eye is closed. The device also incorporates an alarm and GSM module that alerts during an emergency.

II. Methodology

Fig. 1 is the simplified block diagram of the system. Here a blink sensor is used to process the input in real time and send appropriate control signal to a microcontroller. The microcontroller takes appropriate decision based on various sets of inputs and the output of the microcontroller board is used to control the appliances.

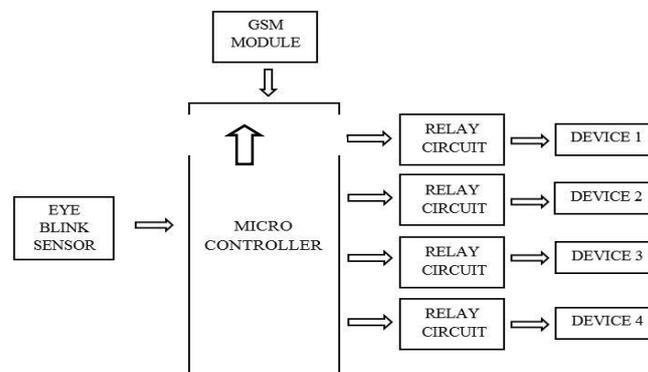


Fig.1.Block Diagram

Here microcontroller board is used to check the correctness of the blink sequence. Opto-couplers are used to isolate the low power circuit from the high power circuit and a high current driver IC is used to activate the relays which switches ON/OFF the appliances. A 12V adapter is used to provide constant voltage to the IC's and relays. LED's are used to indicate the output status of the system.

III. Circuit Diagram

Fig. 2 shows the circuit diagram of the system. The circuit consists of the following parts

1. **Microcontroller Board:** The Arduino Uno is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

2. **Blink Sensor:** The blink sensor used here is an IR based blink sensor which gives an output of 0V (Logic '0') when the eye is open and gives +5V (Logic '1') when the eye is closed.

3. **Relay Driver ULN2803:** ULN2803 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. It allows to interface TTL signals with higher voltage/current loads. The chip takes low level signals (TTL, CMOS, PMOS, NMOS - which operate at low voltages and low currents) and acts as a relay of sorts itself, switching on or off a higher level signal on the opposite side.

4. **Relay:** Relays play a key role in switching between two circuits that are completely separate. This property of the relay makes it more convenient for our application. They are applied to interface a low voltage electronic circuit (5v) to an electrical circuit which operates at a very high voltage (230v). In our application a Darlington pair formed from two transistors are used to interface microcontroller with the relay (5 pin), thus driving the appliances conveniently.

5. **GSM Modem:** This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging.

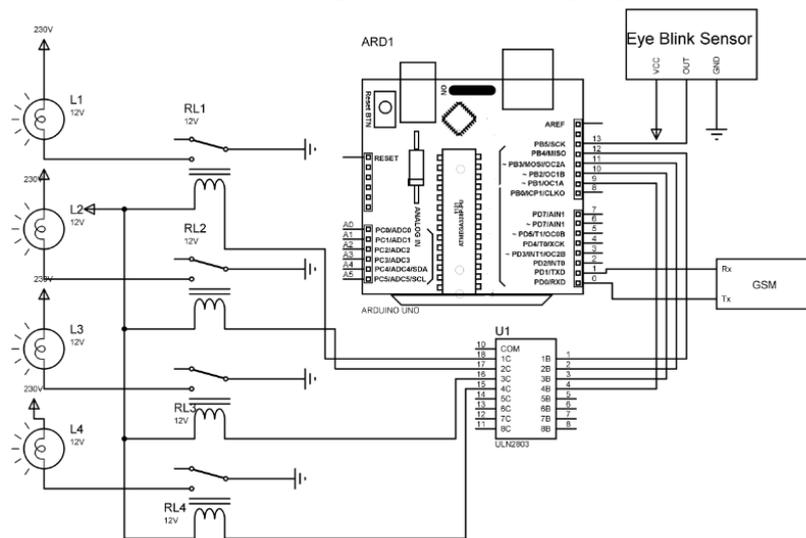


Fig.2. Circuit Diagram

IV. Working

The circuit diagram of the system is as shown in fig.2. The system consists of three major sections namely the blink sensor, microcontroller board and the drive circuit. The eye blink sensor is an IR based blink sensor. If the eye is closed, it means the output is high otherwise the output is low. Here the input is sampled three times per blink; these input blinks are classified as a short or long blink. Since eight appliances are being controlled simultaneously (which is also equal to 2^3 appliances), three blinks are used to control the appliance. A blink is considered as a short blink if the eye is closed for more than $1/3^{\text{rd}}$ of a second but less than $2/3^{\text{rd}}$ of a

second. If the eye is closed more than $\frac{2}{3}^{\text{rd}}$ of a second and less than a second, then it is considered as a long blink. Here a timer program is used to count the time for which the eye is closed. A short blink is assigned a value '0' (Logic LOW) while a long blink is assigned a value '1' (Logic HIGH). Since three inputs are required to control an appliance from "000" (Short, Short, Short) to "111" (Long, Long, Long) which is the binary equivalent of 0 to 7 in octal. Each appliance is assigned a number and is switched ON/OFF depending on the blink sequence. If an appliance is selected, the pin corresponding to that appliance is made HIGH. When 5V appears across the pin, the opto-coupler connects control circuit to the main circuit without making any electrical contact. This activates a current driver IC which is used to provide sufficient driving current to the relay. When an appliance is selected, the corresponding relay coil gets energized and it closes the main circuit switching ON the appliance. When an appliance is de-selected, the relay coil gets de-energized opening the main circuit and causing the appliance to switch OFF. Here the appliance is connected to a 230V, 1 Φ supply where the relay is connected in series with the supply.

Blink Sequence	Binary Equivalent	Appliance Number
Short,Short,Short	000	1
Short,Short,Long	001	2
Short,Long,Short	010	3
Short,Long,Long	011	4
Long,Short,Short	100	5
Long,Short,Long	101	6
Long,Long,Short	110	7
Long,Long,Long	111	8

Function Table

V. Conclusion

A low cost eye movement based detection device for controlling home appliances has been discussed in this paper. The device is developed mainly for the paralyzed people, for whom mobility is a point of concern. The device is based on the acquisition of eye blinks which is comparatively inexpensive, efficient in terms of linear relationship of the signal over the eye movements that makes it suitable for the application. The device here incorporates activation and deactivation of appliances such as fan, bulb, GSM and alarm etc. EOG acquisition is a more primitive method for tracking eyeball movements, technical capability of this method is due to poor noise to signal ratio & also precise filters are required for this method. The method of eye tracking using camera requires a fully dedicated system with image processing software during the entire working of the unit. But while using eye blink sensor we not need pc support & future expansion is possible.

Towards the future, this method can be extended by employing a RF Transmitter and Receiver that will help to operate in a wider area.

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