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Assisting System for Paralyzed Patients

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ABSTRACT

The current social Health Insurance structure does not allow paralyzed patients to be constantly monitored by medical caretakers or family members. To address this issue, we have developed a patient health monitoring system that utilizes IR sensors to detect eye movements for the purpose of switching electrical appliances on or off. This system employs sensor technology, a microcontroller, and a GSM module to send emergency messages to guardians when necessary. The microcontroller processes the data and displays specific messages based on the input it receives, which are then displayed on an LCD screen. By doing so, the Automated Paralysis Patient Care System provides a fully automated solution for caring for patients with paralysis, ensuring timely assistance when needed.

Keywords:GSM Module, IR sensors, LCD, Microcontroller, SMS, IDE

INTRODUCTION

This work involves the use of eye movements for individuals with paralysis caused by damage to the brain stem, which results in the paralysis of facial and body muscles while leaving higher functions intact. Patients with this condition are often aware of their surroundings but are unable to use their arms and legs or express themselves through anything other than facial expressions. For many of these patients, the only means of communication is through limited eye movements. The system described in this work translates the patient's eye movements into various functions.

Individuals with paralysis who are unable to perform basic tasks or move their bodies may find it challenging to operate electrical appliances. To address this issue, we have developed a system that utilizes eye movement to enable paralyzed individuals to communicate their basic needs. Eye ball sensors are used to detect the movement of the eye, which allows the user to control various electrical appliances conveniently. Embedded systems have greatly improved the quality of life for physically challenged individuals, and there are a variety of control systems currently available, as well as in development stages, that cater to individuals with disabilities and disorders. This proposed solution is particularly useful for paralyzed individuals who struggle to perform basic tasks, such as turning on fans and lights, as well as sending emergency SMS messages when needed.

METHODS

This system primarily comprises of an IR sensor, an Arduino Nano microcontroller board, a GSM module, and a relay module. The IR sensor is utilized to detect eye movement, while the Arduino Nano with its ATmega328 processor is responsible for processing the movement of the eyeball. The output side of the system employs a GSM module to send messages to the patient's caregiver. A relay module, which is an electromagnetic switch, enables the control of larger electric currents with a small electric current. In our project, the IR sensor detects eye movements and transmits this information to the microcontroller, which interprets the direction of the eye movement, such as left, right, or up. The left direction controls the light, the right direction operates the fan, and the up direction sends SMS messages to family members in the event that the patient requires life support.

IMPLEMENTATION

A. ARDUINO NANO

The Arduino Nano is a compact, versatile, and breadboard-friendly board based on the ATmega328P. It offers similar functionalities as the Arduino Duemilanove, albeit in a different form factor. Unlike the Duemilanove, it lacks a DC power connector and instead utilizes a Mini-B USB cable.

In this work, the primary component is the Arduino Nano, which receives and transmits signals from the IR sensor, GSM module, and Relay module. It sends signals to other components, enabling them to operate as per the programming in the Arduino Integrated Development Environment (IDE) software. The pin diagram is shown in Figure 1.

Figure 1: Arduino Nano

B. ATmega328P

The Microchip Power 8-bit AVR RISC-based microcontroller is a high-performance device that integrates 32KB ISP flash memory with read-while-write capabilities, 1024 Byte EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The microcontroller as shown in Figure 2, can operate between 1.8-5.5 volts and executes powerful instructions in a single clock cycle, achieving throughputs approaching 1 MIPS per MHz. This allows for a balance between power consumption and processing speed.

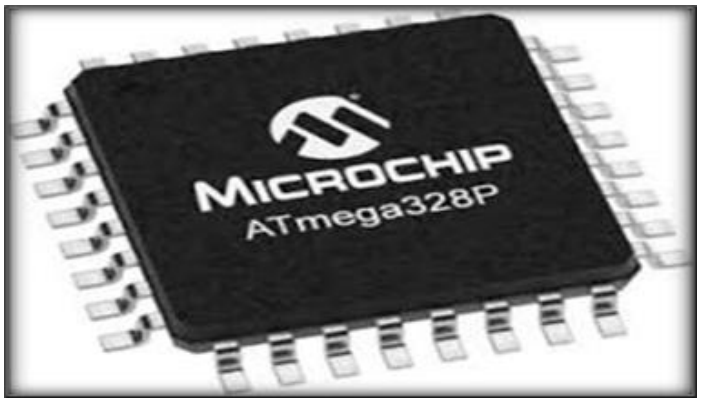

Figure 2: ATmega328P

C. IR Sensors

The basic concept of an Infrared Sensor which is used as an obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver. There are five basic elements used in a typical infrared detection system as shown in Figure 3, an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength can be used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response

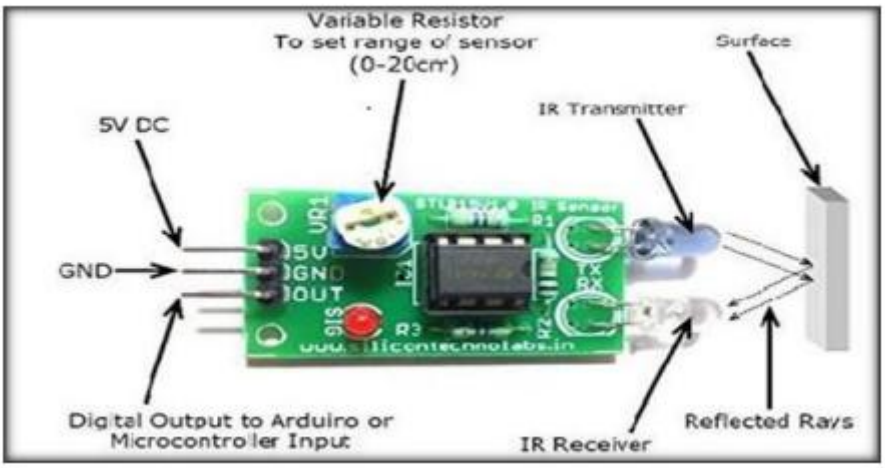

Figure 3: IR Sensors

D. Relay Module

A relay is an electrical switch that operates through an electromagnet. When activated by a low voltage, such as 5V from a microcontroller, the electromagnet pulls a contact to make or break a high voltage circuit. It is essentially an electromagnetic switch that can control a considerably larger electric current using a relatively small electric current. A channel relay is shown in Figure 4.

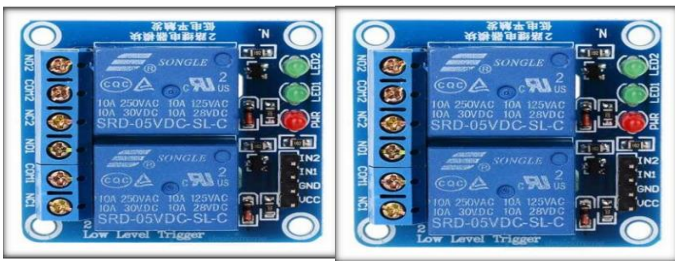

Figure 4: Channel relay

SOFTARE IMPLEMENTATION

To implement the proposed system, we need to write software code using Arduino Nano and install it on our computer. The installation requirements include a computer running Windows, Mac, or Linux, an Arduino-compatible microcontroller, and a USB A-to-B cable or any other suitable method to connect the microcontroller to the computer. Programs created using the Arduino software are called sketches, which are written using a text editor and saved as a file. The editor includes features like cut, paste, search, and replace. During export and storage, the software provides feedback and detects errors.

The console displays text generated by the Arduino software, including error messages and other data. The bottom right corner of the window displays the configured board and serial port. The toolbar contains buttons for opening the serial monitor, creating, opening, and saving sketches, as well as verifying and uploading programs. The five menus - File, Edit, Sketch, Tools, and Help contain additional commands. Since the menus are context- sensitive, only relevant options are available for the task at hand.

A. Algorithm

Step 1: Initialize the Process
Step 2: Defining the Input and output pins of the Arduino Nano.
Step 3: Set the Threshold.
Step 4: Calculating the analogue data which is present in the Pins A0, A1&A2 of the Arduino Nano.
Step 5: Assign the Analog data for A0, A1& A2 of the three directions of LS, RS and US respectively.
Step 6: Compare the eye Threshold with the assigned value. Here an assigned Threshold value is 100.
Step 7: Compare LS value with threshold. If it is greater than the threshold, Control the Light.
Step 8: Compare RS value with threshold. If it is greater than the threshold, Control the Fan.
Step 9: Compare US value with threshold. If it is greater than the threshold, send an SMS.
Step 10: If none of the conditions are true then move to step 1.

RESULTS AND DISCUSSIONS

Individuals with paralysis caused by brain stem injury experience muscle paralysis in their face and body. While these individuals are aware of their surroundings, they are unable to communicate effectively and can only express themselves through facial expressions or limited eye movements. Research work have focused on developing new communication tools to aid these individuals, such as devices that translate eye movements into suitable signals. However, disabled individuals face challenges beyond communication, such as carrying out daily activities like turning on a light or fan. Figure 5 and 6 shows the eye movement detector.

Figure5: Eye Movement Detector

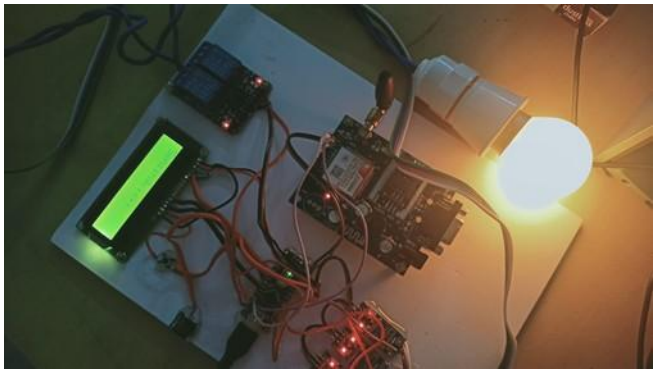

Figure 6: Device showing activation anddeactivation of appliances

CONCLUSION

A low-cost eye movement based detection device for controlling home appliances has been discussed in our project. 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 movement 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 De-activation of appliances such as Fan, bulb and sends an SMS to the family member when the patient is in need of help. Eye movement communicating system can be used by the paralysis patients and armless persons to perform simple tasks. This project describes the acquisition and analysis of eye movements for the activation of home appliances for paralysis patients. The proposed method here uses an eye movement sensor for eye movement acquisition thereby reducing the occurrence of artifacts. Basically, they are used for providing better usability of this system for people, including disabled people. Further following a simple circuitry for implementation of signal processing, this 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

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