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Morse Code to Text Converter using Arduino

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***Abstract*— Amyotrophic lateral sclerosis is a disease that affects nerve cells in the brain. It is indicated by the loss of muscle control which leads to difficulty speaking. Morse code is a communication tool that uses dots and dashes to represent letters. Morse code is an effective communication method for people diagnosed with ALS Since they lose the ability to speak or type with their fingers as the disease progresses. This paper proposes a system for converting Morse Code to text using Arduino Nano and an eye-blink sensor. The proposed system will monitor the eye and the duration of a closed eye (blink) determines the DOT and DASH. Eventually, the dots and dashes are translated into text and displayed on a 16X2 LCD..**

***Index Terms*— Arduino Nano, Eyeblink Sensor, Morse code, ALS Disease, LCD.**

I. INTRODUCTION

Lou Gehrig's disease, aka ALS, is a neuro degenerative disease that causes the breakage of nerves. Individuals diagnosed with this illness find it difficult to speak or communicate. Various techniques can assist these patients in speaking, a few of which are alternative and augmentative devices, which are specialized devices that allow them to select pre-programmed phrases, and there are also eye- tracking devices that serve the same function as stated above. "MORSE CODE" is the best alternative to enable communication for individuals affected by this ALS disease. Morse code was named after Samuel Morse, who devised it in the nineteenth century. It is a technique that uses aseries of dots and dashes to represent a text or a digit. Individuals can communicate by pressing a button, tapping, or, with face or finger recognition, an eye blink that yields a sequence of dots and dashes pertaining to text in Morse code. In this paper, we propose a system to allow effective communication for ALS patients employing an eye blink sensor, which detects dots and dashes from eye blinks, and an Arduino Nano

II. LITERATURE SURVEY

The authors [1] combined a character-by-character matching method with a least-mean square algorithm to Identify applicable funding agency here. If none, delete this. recognize Morse code. This method overcomes the problem of irregular typing. Dots and dashes are identified as a set in this paper. Adaptive Variable Ratio Threshold Prediction Algorithm was proposed in [2] for morse code recognition, which is cheaper and faster than Artificial Neural Network. This system is highly sensitive as it uses two LMS predictors. C.H. Yang et al. [3] also described the LMS algorithm for morse code recognition in people having poor hand coordination. Morse code decoder is implemented on TMS320C6748 DSP Kit and decoded output is displayed on VGA monitor [4], [9].

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This method can also detect morse code from noisy signal.
In the study [5], [10] eyelid motions were converted into Morse code using an infrared sensor linked to a pair of spectacles or other comparable objects. Using an Arduino Uno, it is converted into text. As stated in [5], there were a few issues with the design, such as the Infrared sensor being irradiated by other objects and the potential for cataract formation around the eye due to prolonged IR sensor use.
With a camera, Morse code is recognized using finger movements [6]. This system recognizes the finger gestures from captured frames and converts them into ASCII. The only issue with this system is the finger should be very close to the camera otherwise it will be unclear, and the system cannot detect morse code. The literature [7] describes how morse code can be recognized using touch sensors and decoding it using an s-morse dictionary. Authors [8] used Open Source Computer Vision (open CV) to detect the morse code from eye blink. Advantage of this method is that it is not expensive when compared to AAC Devices, but the problem with this approach is to train with different databases and create data model to identify face pattern.

III. Design And Implementation

Hardware and Software Deployed

A. Arduino Nano

The Arduino Nano board is driven by the ATmega328 microcontroller and is based on AVR architecture. Arduino Nano can be powered either by a mini-B USB connection or an external battery of 5V. It has 14 digital pins and 8 analog inputs, as well as a 16 MHz crystal oscillator which is used as a clock, a USB connection, a power jack, an ICSP header, and a reset button. It is programmed using the Arduino IDE.

B. Eye Blink Sensor

An eye blink sensor is a device that can detect the eye blink of a person. It has 3 pins V_{cc}, *Gnd*, and *Out*. This sensor is often used in applications where it is important to monitor a person's eye movements, such as in driver assistance systems. Eyeblink sensors can function in a variety of ways, but one typical option is to utilize an IR sensor to determine when the eye is closed. The sensor can then send a signal to amicrocontroller like Arduino to perform a specific action. Eyeblink sensors can be useful for a variety of purposes, including detecting fatigue or inattention in drivers, helping people with disabilities to communicate, and enhancing the realism of virtual reality experiences

C. I^2C LCD

Liquid Crystal Display is commonly used in electronic devices. It works by using a layer of liquid crystals sandwiched between two layers of glass. The liquid crystals rearrange themselves to permit or obstruct the passage of light when an electric current is applied to them. This allows the display to show different images and text. An I2C LCD uses the Inter-Integrated Circuit (I2C) protocol for communication with a microcontroller. The I2C protocol is a widely used, communication protocol that allows devices to exchange data with a microcontroller or computer over a two-wire bus. The wiring needed to connect an LCD to a microcontroller can be minimized by using I2C communication as only two wires are needed.

D. Arduino IDE

Arduino Integrated Development Environment is a software application that provides an interface for users to write, upload, and debug code on an Arduino board. It supports avariety of programming languages, including C++, C, and Python. The Arduino IDE also includes a library of pre-written code that can be used to control various hardware components.

IV. Experimental Setup

In our system, we used a spectacle that contains an eye blink sensor. The eye blink sensor consists of two parts: Tx and Rx. Tx will emit the infrared wave, and Rx will receive the infrared wave when the eye is closed. In the proposed system, whenever an eye is closed, it is detected as a blink and the length of the blink determines whether the user is providing a DOT or DASH as input. The duration of DOT and DASH are 1s and 3s, respectively, with a tolerance of ±0.7s. When the user closes an eye for 0.3 to 1.7 seconds, Arduino detects it as a DOT, and an eye closure ranging from 2.3 and 3.7 seconds is recognized as a DASH. If the eye-blink sensor cannot detect anything for 3-3.5 seconds after detecting dots and dashes, Arduino analyses the previously recorded dots and dashes, convert them to text and display the text on the LCD screen. When there is no blink for six seconds, space between characters or words can be generated. Output can also be viewed on the Arduino IDE serial monitor.

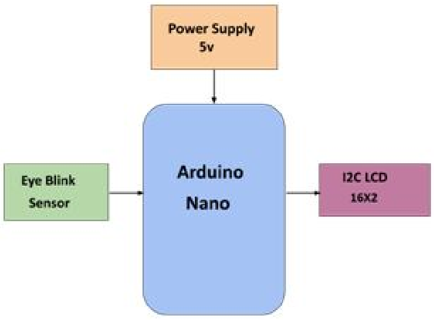

Fig. 1. Proposed System

Fig. 2 illustrates the schematic of the proposed system. From Fig. 2 SDA and SCL pins of the LCD are connected to the $A4$ and $A5$ pins of the Arduino Nano. V_{cc}, and Gnd pin of the LCD are connected to the 5_V and GND pins of the Arduino Nano. The OUT pin of the eye blink sensor is connected to the $D6$ pin of the Arduino Nano, and the V_{CC} and GND pins of the eye blink sensor are connected to the 5_V and GND pins of the Arduino nano.

V. Results

The proposed system performs admirably. The accuracy of the conversion process from morse code to text was high, with few errors detected during testing. The converter had a minimal conversion time of about 3-5 seconds and was able to process input at a very good rate. During our testing, we encountered some problems, such as the user needing some practice in ”morse code” to provide precise dots and dashes input. Upon becoming acquainted with it, communication can be done very easily. Eye blink sensor plays an important role in collecting data from eye blinks, but we’ve also seen that they occasionally fail to recognize a closed eye, usually as a result of poor positioning on eyeglasses. Overall, the proposed system demonstrated that it was easy for users to operate and understand, and also there were no significant usability issues.

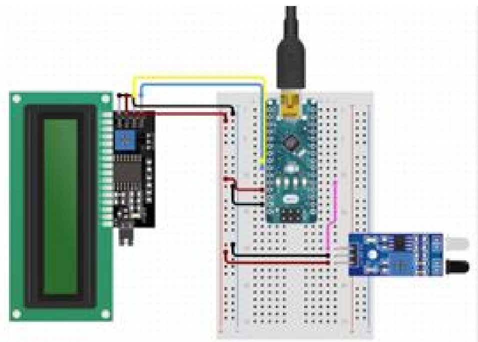

Fig. 2. Circuit Diagram of the Proposed System

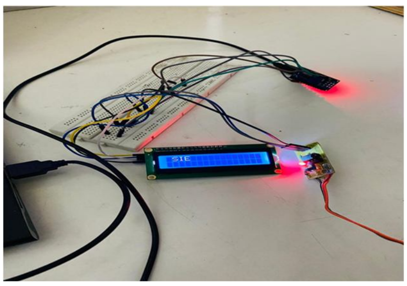

Fig. 3. Output Obtained from Eye Blink

Fig. 4. Displaying Word ”IEEE” on LCD Screen from Morse Code

Fig. 5. Output from Serial Monitor

VI. Conclusion

We have implemented a morse code-to-text converter using an Arduino nano and eyeblink sensor, which is simple and effective. The positioning of an eyeblink sensor on spectacles plays a crucial part in detecting morse code accurately. One of the drawback of the proposed system is that the eyeblink sensor should not be used for an extended period of time as it might harm the eyes. The proposed system can be enhanced by including a text- to Speech converter, which will make it more appealing. Our system is very useful for individuals diagnosed with Amyotrophic Lateral Sclerosis to communicate effectively.

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