Applied Science & Engineering Journal for Advanced Research
ISSN (Online): 2583-2468
Volume-1 Issue-3 || May 2022 || PP. 23-27 DOI: 10.54741/asejar.1.3.4

Tongue Control System for Individuals with High-Level Injuries and Paralyzed

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Received: 01-05-2022 Revised: 13-05-2022 Accepted: 28-05-2022

ABSTRACT
Wheelchair control methods for people with tetraplegia and other disabilities that prevent them from using the standard joystick are critical. Users with severe spinal cord injuries will be able to control their wheelchairs with their tongue movements thanks to this project. On a system of inductive tongue control, this device is based. When a severe spinal cord injury or neuromuscular disease affects the brain and spinal cord, it is rare for the tongue to be damaged, so it is used to control the system instead of the feet and hands. Aside from that, "tongue movements are also quick, precise, and do not require much mental effort." As a tongue-operated assistive technology, the Tongue Control System (TCS) has the potential to help people with a variety of disabilities control their environment. In order to understand what the user intends, it analyses and categorises their tongue movements. With a Tongue Control system, a small permanent magnet embedded inside a nonmagnetic fixture is used to measure the magnetic field generated by the tongue, which is tracked by a series of Hall-effect magnetic sensors. In order to measure the captivating field from various angles and provide continuous real-time analogue outputs for controlling wheelchairs and electrical devices, the magnetic sensors are equestrian on a dental allowance and attached outside the teeth.

Keywords*: *hall effect sensor, magnet, arduino, voice module, lab view

I. INTRODUCTION

People with severe disabilities may benefit from the Tongue Drive System (TDS), inconspicuous wireless assistive equipment that is tongue-operated. It uses a small enduring magnet at the tongue and also with the array of compelling sensors mounted on the mouth or an orthodontic headset outside brace inside to detect and classify the user's voluntary tongue motion. Using an external TDS prototype, we also developed custom interface motherboard and executed four different control strategies for a very powered wheelchair (PWC).

Design and build a tongue-controlled wheelchair with wireless device switching using RF technology as the primary goal. Using wireless technology, this device can be taken anywhere, and the entire operation of the system is based on this technology. Simple tongue movements are all that is required for wheelchair control, and the voice module can be used to request basic necessities like water, food, or medicine.

The microcontroller and Hall Effect sensor make up the control system. The RF transmitter transmits the encoded data that is collected by the microcontroller from the sensor. The data is decoded and fed to the microcontroller at the receiver end of the RF receiver. The controller moves the wheelchair in the appropriate direction.

Microcontroller Units, a Wheelchair with Relay and Hall Effect Sensor, and wireless communication through RF technology are all part of this project. High torque motors power the wheelchair. Driven by a set of instructions from the Hall Effect sensor, geared DC motors can have their direction changed using Embedded C programming on their internal microcontrollers. On board computer (microcontroller) receives information from the RF transmitter and determines whether the instruction is to move to the right or left based on the motion of the tongue. All of this system's functions are powered by wireless technology, making this a portable device.

An APR-9600 voice chip is used to make audio announcements, DC motors are used to move the wheelchair, and a Microcontroller is programmed using embedded C instructions. The transmitter and receiver modules can communicate with this microcontroller. Microcontroller (on board computer) receives information from the Hall Effect sensor, which measures tongue movement, and determines whether the instruction is right or left movement. The controller then controls the operation according to the instruction. LabVIEW is used to connect the Arduino to the sensors.

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II. BLOCK DIAGRAM

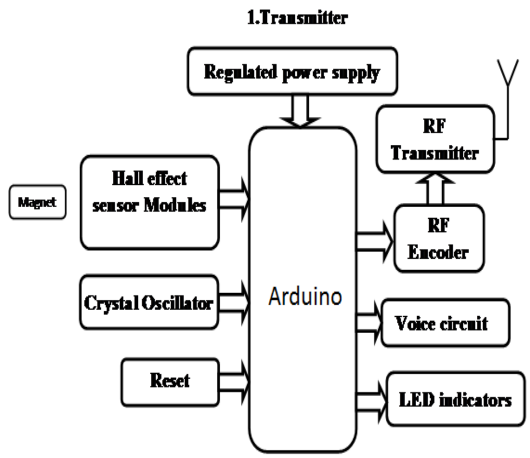

Figure 1: Transmitter

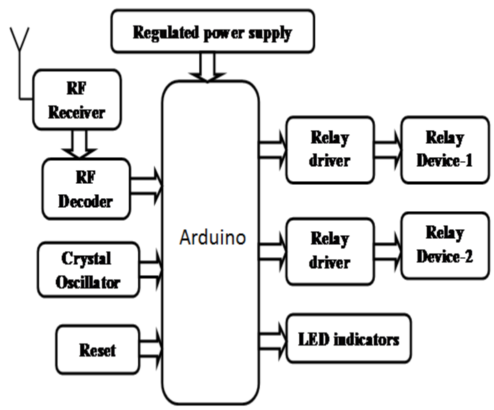

Figure 2: Receiver

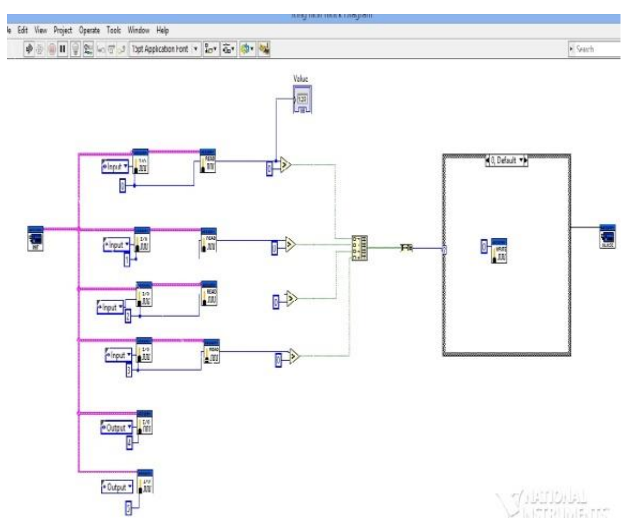

Figure 3: Lab view for modesetup

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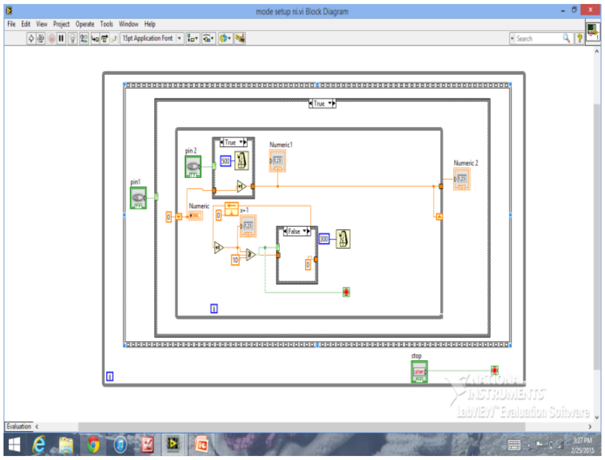

Figure 4: Lab view for switching

III. TECHNICAL REQUIREMENTS

3.1 Hall Effect Sensors

To put it another way, the Hall effect is the generation of a voltage difference (the Hall voltage) across a wire that runs counterclockwise to the current in the wire and perpendicular to the current's magnetic field. To calculate the Hall coefficient, you divide the induced electric field by the product of the applied magnetic field's density and current density. The Hall Effect is caused by the way current flows through a conductor. Many small charge carriers, such as electrons or holes, are involved in the flow of current. When a magnetic field is perpendicular to the motion of the charged particles, a force known as the Lorentz force is exerted. If there isn't a strong magnetic field, the charges move in a straight line. A perpendicular magnetic field, on the other hand, curtails the path of the charged particles, causing them to collect on one side of the material. As a result, on the other side, where mobile charges are scarce, the equal and opposite charges are exposed. If applied magnetic field and line of sight path are perpendicular, then the Hall element's charge density distribution will be perpendicular to both. Charge separation creates an electric field that prevents further charge migration, resulting in a stable electrical potential.

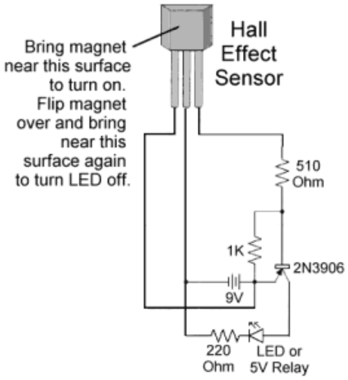

Figure 5: Hall Effect Sensor

3.2 Specifications

- Custom Designs Available
- Zero Speed to 20 KHz
- High Temperature Operation to 150°C
- Robust
- Thermally Stable
- No Moving Sensor Parts
- Lightweight

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3.3 ARDUINO

Microcontroller board are based on ATmega328 is Arduino Uno. It also has a total of 14 digital input/output pins and six analogue ones. Ceramic resonator, USB, power supply, and reset button are all included in the device. The hardware platform is an ATmega 328 microcontroller. All other components (accelerometers, motors, RF modules, etc.) are connected to it because it is the controlling unit. One of these microcontrollers is used at the transmitting end and the other at the receiving end in this project.

3.4 Voice Module

Audio/voice quality is now a must-have for today's buyers. They want the best possible sound quality, no matter where they are, in any format they prefer. APLUS is a provider of audio and voice enhancement technology. At the heart of the aPR33A series is a powerful and straight processor with high concert audio ADCs and DDACs. aPR33A series (DACs). High performance and unmatched integration with analogue digital processing, input, and analogue output are all features of aPR33A series.

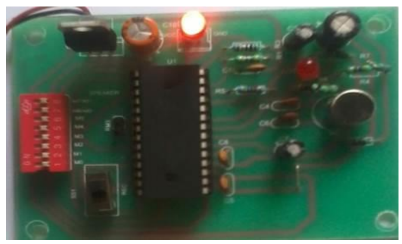
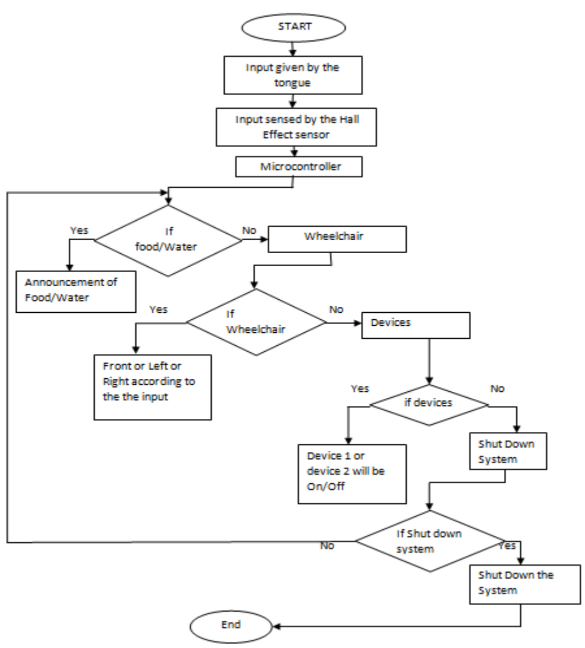


Figure 6: Apr33a3 Voice Module

While order to handle the most demanding audio/voice applications, the aPR33A series includes all of the necessary features. Because of its integrated analogue data converters and the full collection of quality with improving features such as sample rate converter, the aPR33A series can be used to implement high quality audio/voice systems with lower bill-of-material costs.

For simple key triggers, the aPR33A series C2.0 is designed to record and playback messages for 1, 2, 4, or 8 voice messages. The simple interface and their need to limit the length of a single message make it suitable for a variety of applications. This mode, on the other hand, serves as a power-management tool. When not in use, the chip can be set to sleep mode. It can meritoriously reduce the current consumption to 12uA and extend to the battery life of any battery-powered project.

IV. PROJECT FLOWCHART



V. CONCLUSION

It has been designed to integrate all of the hardware components. Every module has been carefully considered and placed, resulting in the unit's optimal performance. As a follow-up, the project has been implemented successfully using cutting-edge ICs and the advancing technology. Consequently, the project's design and testing have been a success.

The primary goal of our "Tongue Controlled Speaking Wheel Chair" project is to create a wheel chair that can be operated solely with the movement of the tongue, which will be especially helpful to people who are physically disabled or paralysed. Hall Effect sensors and a wheelchair connected to the controller make up the system. The RF transmitter transmits the encoded data that is collected by the microcontroller from the sensor. The data is decoded and fed to the microcontroller at the receiver end of the RF receiver. Using a voice module, the controller performs the necessary actions to move the wheelchair, and the user's approval can be heard.

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