Tongue Motion Controlled Wheel Chair

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ABSTRACT

Most serious accidents and injuries often end with various motorist disabilities usually resulting in a limited control of the muscles of various body parts and in some worst case scenarios even the whole body. Tongue driven system is a new wireless assistive technology which is used for handicapped or it is specially designed for paralyzed person. Tongue driven system consists of Hall Effect sensor. Tongue driven system provides people with minimal or no movement ability in their upper limbs with an efficious tool for environment control. Tongue driven system consists of an array of Hall Effect magnetic sensors and permanent magnet which is held on tongue using tissues adhesive and tongue piercing. As a result of tongue movement magnetic field generated by magnet that will vary around the mouth. These variations are sensed by an array of magnetic sensor which is mounted on the headset outside the mouth. The sensors output are wirelessly transmitted to the microcontroller and microprocessor will process the signal to control the movement of power wheel chair. This technology provides faster advanced smoother and more convenient control..

1. WHY WE USE TONGUE?

We use the tongue to operate the system because unlike the feets and hands ,which are connected by brain through spinal cord, the tongue and brain has a –direct connection through cranial nerve that generally escapes damage in severe spinal cord injuries or neuromuscular disease. Tongue movements are fast, accurate and do not required much thinking, concentration or effort.

Fig.no.1 Small Permanent Magnet Attached on User's Tongue Using Adhesive.

2. INTRODUCTION

Wheelchair is controlled by tongue motion as its name implies. We can use the tongue for controlling wheelchair. There are two sections transmitter section and receiver section. Transmitter section is placed in the user's mouth and receiver section is placed at the back of the chair. We can design this project for handicapped or particularly for paralyzed person who have to depend on the other person for their day to day activities. In the transmitter section we can place the magnet at the center of the tongue and the three Hall Effect sensors are placed at the outer side of the teeth.

We can fix the magnet either permanently or temporarily. The permanent magnet fixing method is known as tissue piercing and temporarily magnet fixing method is known as tissue adhesive. When magnet is touched to the left sensor then chair can be moved to the left side. when magnet is touched to the right sensor then wheel chair can moved to the right side. we can fixed the magnet parmanently by using operation of temporarily by using one type of liquid.
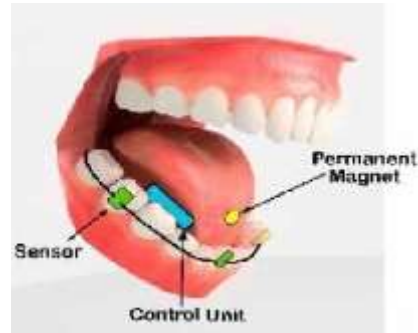
Fig.No.2 Tongue driven system

Tongue Drive system (TDS) is a tongue-operated unobtrusive wireless assistive technology, which can potentially provide people with severe disabilities with effective computer access and environment control. It translates users' intentions into control commands by detecting and classifying their voluntary tongue motion utilizing a small permanent magnet, secured on the tongue, and an array of magnetic sensors mounted on a headset outside the mouth or an orthodontic brace inside. We have developed customized interface circuitry and implemented four control strategies to drive a wheel chair using an external TDS prototype. The magnetic sensors are nothing but hall-effect sensors. A Hall Effect sensor is a transducer that varies its output voltage in response to changes in magnetic field. In its simplest form, the sensor operates as an analogue transducer, directly returning a voltage. With a known magnetic field, its distance from the Hall plate can be determined. The control system consists of Hall Effect sensor and RF Transmitter. The data from sensor is given to transmitter and RF transmitter transmits the encoded data through the RF transmitter. At receiver end RF receiver receives the data through the decoder and fed as input to the micro controller. The controller performs the corresponding actions i.e., wheel chair movement. This Project consists of Microcontroller Units, Wheel chair and Hall Effect sensor and wireless communication through RF. Wheel chair is made up of High torque Geared DC Motors, the Motors Directions can be changed through the set of instructions given from the Hall Effect sensor and the action of these Instructions is already loaded into the Microcontroller using Embedded C programming. The RF receiver provides the information to the microcontroller (on board computer) from RF transmitter and the controller judges whether the instruction is right movement or left movement based on the tongue movement and controls the direction.
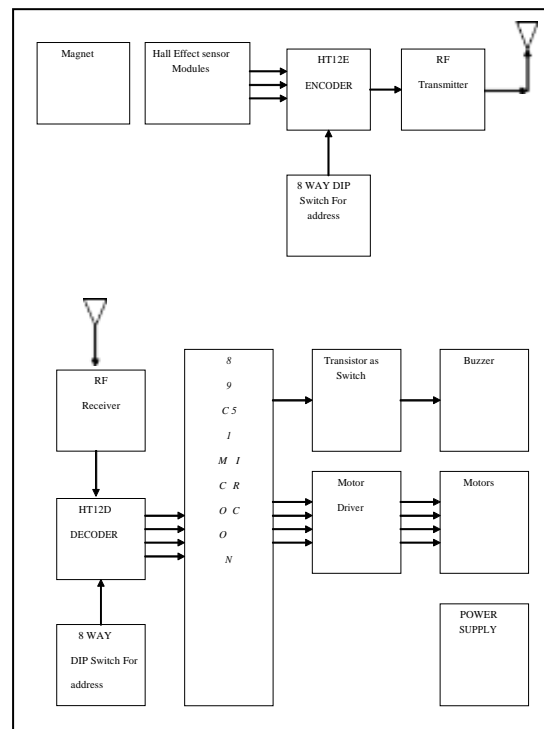
3. BLOCK DIAGRAM

Fig. 3 Block Diagram

4. WORKING OF SYSTEM

The magnet output is given to the Hall Effect sensor module. The Hall Effect sensor Converts the magnetic field into electrical energy. Hall Effect sensor does not affect due to any external environment conditions. It does not suffer from a contact bounce, there is isolation between magnet and Hall Effect sensor it consisting of a material such as gallium arsenide, indium arsenide. The Hall Effect sensor has four bit output. As tongue is move to the left sensor it goes from high to low. At that time right sensor and front sensor output remains high. This code is transmitted to the encoder. The output of a Hall Effect sensor connected to the encoder. Encoders convert the parallel data into serial. It is from CMOS LSI series. It also receives 8 bit address from DIP pin output of this connected to RF transmitter. RF transmitter has a frequency of 434MHz.Operating range 0f RF transmitter is 100m in open area and 30m in built up area.

RF receiver receives the data from transmitter output of this is given to the decoder. Decoder 8 bit address is checked with local address and if it is matched then it converts the serial to parallel. The output of decoder is given to the microcontroller 89C51. Microcontroller outputs are given to the buzzer motor and motor driver.

4.1 Block Diagram Description:
Wireless Control of Wheelchairs with Tongue Motion has following blocks:
• Microcontroller
• Motor driver and Motors
• Transistor as switch
• Buzzer
• Power supply
• HT12 E Encoder
• RF Transmitter
• RF Receiver
• HT12 D Decoder
• Hall effect sensor module

i) Microcontrller:
It is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash Programmableand Erasable Read Only Memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the MCS-51™ instruction set and pin-out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer, which provides a highly flexible and cost effective solution so many embedded control applications

ii) Motor Driver And Motor:
The L293D is a quad, high-current, half-H driver designed to provide bidirectional drive currents of up to 600 mA at voltages from 4.5V to 36V. It makes it easier to drive the DC motors. The L293D consists of four drivers. Pins IN1 through IN4 and OUT1 through OUT4 are input and output pins, respectively, of driver 1 through driver 4. Drivers 1 and 2, and drivers 3 and 4 are enabled by enable pin 1 (EN1) and pin 9 (EN2), respectively. When enable input EN1 (pin 1) is high, drivers 1 and 2 are enabled and the outputs corresponding to their inputs are active.

Similarly, enable input EN2 (pin 9) enables drivers 3 and 4.In our project we are using DC gear motor. These motors are connected at the output of motor driver. The direction of motor will decide the direction of the chair.

iii) Transistor As Switch:

When data is received from tongue we have to turn on the buzzer but output of micro-controller is not sufficient to drive the buzzer directly. Therefore to drive the buzzer we are using transistor as switch.

iv) Buzzer:

This is output device. When data is received from tongue then Buzzer turns ON. Otherwise buzzer will be turned off..

V) Power Supply:

In our project, we require +12Vdc, and +5 Vdc supply.

+5 volts is required for Micro-controller 89C51 board etc.

+ 12 Volts are required for Buzzer, motor driver and motors. Our chair is moving so we can't use 230Vac supply. Therefore we are using 12VDC battery

vi) Encoder Ht12e:

The 212 encoder are a series of CMOS LSI for remote control system applications. They are capable of encoding information that consists of N address bits and 12 N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E further enhances the applications flexibility of the 212 series of encoders.

vii) Transmitter Module:

This is a 433.92Mhz ASK transmitter module with an output of up to 8mW depending on power supply voltage. The TLP transmitter is based on SAW resonator and accepts both linear and digital inputs can operate from 2 to 12 Volts-DC, and makes building RF enabled products very easy. Typical range of this product is around 100 meters (300 feet) in an open area and 30 meters (100 feet) in a built up area when used with the corresponding. The results may vary Considerably depending on the surroundings, operating voltage of the transmitter and the antenna. A single piece of wire used as a ¼ wave antenna works out to be 17cm long.

viii) Receiver Module:

The size and simplicity of these units make them a professional and economical solution for many wireless applications. They have a sensitivity of 3uVRMS and operate from 4.5 to 5.5 volts-DC with both linear and digital outputs. The typical sensitivity is -103dbm and the typical current consumption is 3.5mA for 5V operation voltage.Typical range of this product is around 100 meters (300 feet) in an open area and 30 meters (100 feet) in a built up area when used with the corresponding. The results may vary considerably depending on the surroundings, operating voltage of the transmitter and the antenna.

ix) Decoder Ht12d:

These decoders are a series of CMOS LSI for remote control system applications. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 2^{12} series of decoders are capable of decoding information's that consist of 8 address bits and 4 data bits and are designed for use with the HT12E Encoder

11. Hall Effect Sensor Module:

Module can detect a small magnet at a few millimeters. The Hall Effect sensor is connected to a LM393 voltage comparator IC with adjustable trigger level (R6). The LED indicator turns off when a magnet is detected (Output LOW when in Magnetic field). The sensor has two flat sides and is polarity sensitive. One side detects the North Pole and the other detects the south pole of the magnet. The output can be connected directly to a micro-controller port.
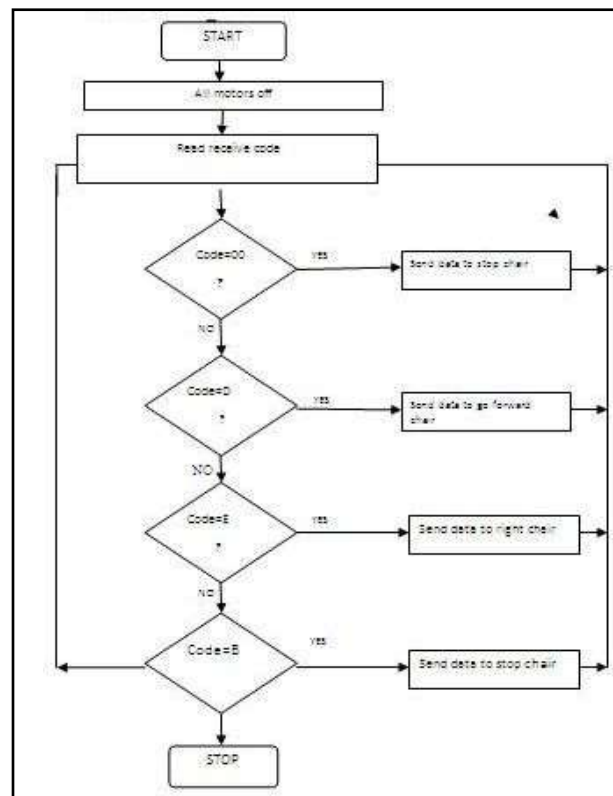
5. FLOWCHART

Fig. 4. Flow Chart

6. RESULT ANALYSIS

No magnet=5v Magnet=0v

INPUT TAB *TABLE NO.1*

LEFT	FRONT	RIGHT	I/P CODE	I/P TO MICROCONTROLER
1	1	1	7	STOP
1	1	0	6	RIGHT
1	0	1	5	FRONT
0	1	1	3	LEFT

OUTPUT TABLE: *TABLE NO.2*

M2		M1			
D3	D2	D1	D0	O/P CODE	MOTOR DIRECTION
0	1	0	1	5	FRONT
1	0	0	1	9	LEFT
0	1	1	0	6	RIGHT
0	0	0	0	0	STOP

Table no1 is input table which provide signal from tongue and table no.2 is output table which provide signal

to motor from microcontroller. When input signal 7 receives it indicates patient want stop the chair according to that microcontroller send code 00 to motor for stop. When input code 6 receive to microcontroller then microcontroller send 6 code to motor move right direction. When input code 3 receive to microcontroller then microcontroller send 9 code to motor move left direction. When input code 5 receive to microcontroller then microcontroller send code 5 to motor move right direction.

7. CONCLUSION

Our ultimate goal in developing the TDS is to help people with severe disabilities experience and preserve an independent, self-supportive life. The system uses an array of magnetic sensors to wirelessly track tongue movements by detecting the position and orientation of a permanent magnetic tracer secured on the tongue. Our future directions include improving the TDS hardware and SSP algorithms to make them smaller, faster, and more efficient Also the possibilities of integrating the autonomous navigation features, such as environment sensing, path- finding and remote audio-visual tracking and control for the care personnel need to be determined.

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