An Electronic Gadget To Control Wheelchair Motion Using Tongue Gesture

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Abstract —*Tongue drive system (TDS) is a tongue operated unobtrusive assistive technology, which can potentially provide people with severe disabilities with effective access and environment control. It translate user's 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 the mouth the magnetic sensor 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. Wheel chair is made up of high torque geared DC motors, the motors direction 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. Complete system proposed in this paper has been designed around PIC microcontroller and a RF module. The design has been tested and result achieved confirms the design approach illustrated.*

Keywords: *Permanent magnet, Hall Effect sensor, DC motor, microcontroller.*

INTRODUCTION

In earlier times paralyzed patients were unable to move on their own on their wheelchair as they needed to be assisted by someone and these patients always depended on others for helping them move.

To help these patients overcome this problem eye controlled,brain controlled and hand gesture controlled wheelchairs was developed by various scientists.These assistive devices were designed for quadriplegic and paralyzed patients to reduce their need of dependency on others.

Tongue has a set of unique characteristics that makes it a suitable appendage for manipulating paralyzed individuals [1].

The proposed system is based on movements of the tongue(ie. tongue gesture) in the direction the patient wants to move and based on the movement of the tongue the wheelchair turns in the particular direction[3].This is based on tongue movement commands sent to the computer allowing user to steer their wheelchair aperture their computer and generally control the wheelchair in an independent way.Due to small markets and limited capacities of assistive technology commercial sector,appropriate assistive device may simply not exist for many specialized needs or potential users may not be aware of them [2].

People with severe disabilities like quadriplegia find it difficult to perform daily routine activities on their own and have to depend on others for performing their routine duties.We help those kind of quadriplegic patients with this tongue gesture controlled wheelchair so that they can move to various places on their own and control their wheelchair using their tongue.

The aim is achieved easily by the use of microcontrollers as they are encoded with embedded C programming.

The tongue drive system has a series of sensors mounted near the mouth region.The sensor array measures the magnetic field of a small magnet that is of the size of a tablet that is attached to the tongue by means of adhesive materials suited to stick to the tongue without causing any side effects.The sensor signals are digitized and transmitted to an external device that is kept near the mouth on the cheeks of the patient.

Before using the TDS,the user must train the microprocessor to encode it in such a way that each tongue movement represents a particular direction in which the wheelchair can be turned.

MATERIALS AND METHODS:
## TRANSMITTING CIRCUIT:

The transmitting circuit senses the signals from the sensors placed near the mouth and this analog signal from the sensors is converted into digital signal in the transmitting circuit by the use PIC 18F microcontroller and comparator compares and outputs a higher signal and the detector detects the signal in the microcontroller block.This digital signal is converted back to analog signal and sent wirelessly through the RF transmitter to the receiving circuit.

The sensitivity of the circuit can be adjusted using the potentiometer.The capacitors are used to store energy and supply to the circuit when necessary and the right amount of voltage is provided thus preventing short circuiting. The figure below shows the components of transmitting circuit.
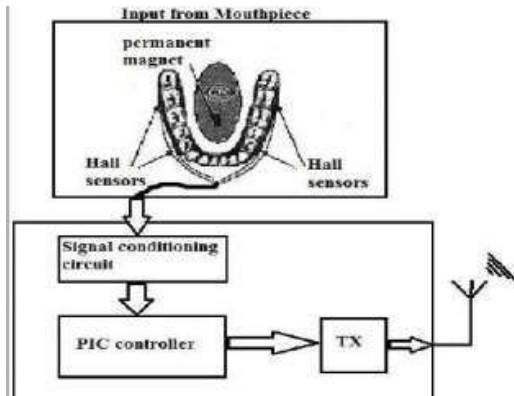
RECEVIER CIRCUIT:

This microcontroller is encoded with the program by embedded C programming so as to receive the analog direction signal from the sensors via the transmitting circuit and give directions to the wheelchair via the motor driven IC.The RF receiver receives the transmitted signal from the transmitter and helps motors drive the wheelchair.
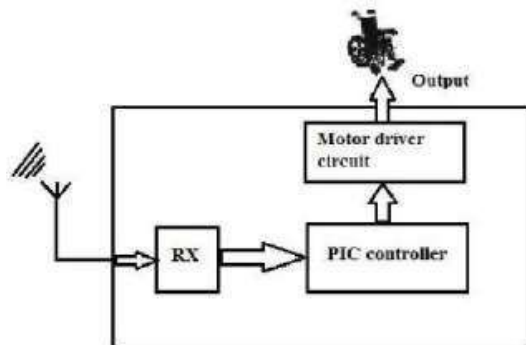
SENSOR BLOCK:

There are four halleffect sensors that are used in sensing the tongue gestures of the patient to move the wheelchair.
On the right side,
First sensor-forward direction
Second sensor-right side
On the left side,
First sensor-backward
Second sensor-left side.

These sensors are mounted near the mouth region and by the use of a neodymium magnet the sensor senses the magnetic field and moves the wheelchair in the particular direction the microcontroller is programmed by embedded C programming.

RESULTS:

The figure shows the entire setup where the sensors are attached to a mask(to be placed over the cheeks) is connected to transmitting circuit that will transmit the signals from the sensors to the receiving circuit that will make the motors to run the wheels so that the wheelchair will move in the desired direction.

DISCUSSION:
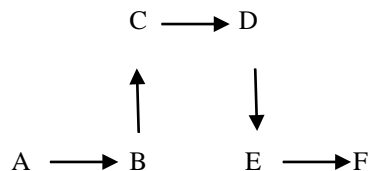
If the chair is in position 'A' and is to be moved to position 'B' , the distance between position 'A'& 'B' will be the product of the circumferencethe wheel and the RPM of the wheel . Where the circumference of the wheel is the product of diameter of the wheel and and the diameter of the wheel is 3.5cm and the RPM is 120.

	DISTANCE (cm)	TIME TAKEN
AtoB	90	10s
BtoC	60	7s
CtoD	90	11s
DtoE	70	8s
EtoF	40	4s
Total	150	40s

THE TOTAL DISTANCE TRAVELLED IS 150CM AND THE TIME TAKEN TO COVER THIS DISTANCE IS 40S

CONCLUSION

The tongue drive system is beneficial for the quadriplegic patients and provides great support for those patients. Unfortunately, these patients life is void of many happy moments of life. This system will help the paralyzed, disabled and quadriplegic patients to move and control their environment independently via the sensor mechanism by carrying the tiny magnet on their tongue. Ultimately this system will serve the humanity which is indeed our achievement.

FUTURE WORK

Our future work is to attach an obstacle detector to the wheelchair that will produce an alarm when the wheelchair is about to hit the obstacle.Fall detection and hip joint replacement is also the part of our future work.

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