Tongue driven speaking wheel chair with wireless Device control

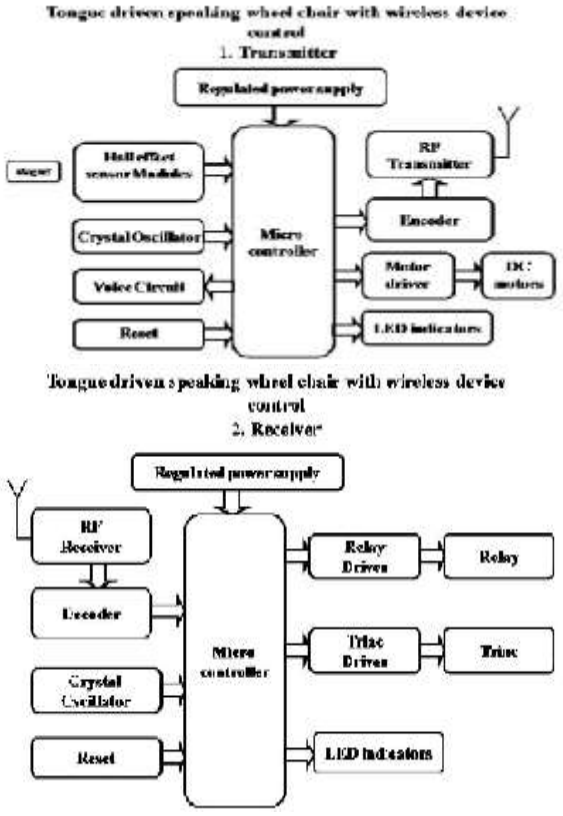
Sowmya. N, Saranya. T, Geetha.SU
Department of Electronics and Instrumentation Engineering
SNS College of Technology, Coimbatore
Sowmyanagarajan2@gmail.com,Saranthiru25@gmail.com

Abstract: **The "Tongue Drive" system is a tongue-operated device has been developed that emulate a computer mouse assistive technology developed for people with severe disability with head movements, cursor movements in these devices to control their environment. The tongue is considered an are controlled by tracking an infrared beam emitted or excellent appendage in severely disabled people for operating reflected from a transmitter or reflector attached to the user's an assistive device. Tongue Drive consists of an array of Hall- glasses, cap, or headband Tilt sensors and video effect magnetic sensors mounted on a dental retainer on the based computer interfaces that can track a facial feature have outer side of the teeth to measure the magnetic field generated also been implemented. One limitation of these by a small permanent magnet secured on the tongue. The devices is that only those people whose head movement is sensor signals are transmitted across a wireless link and .not inhibited may avail of the technology. Another limitation processed to control the movements of a cursor on a computer is that the user's head should always be in positions within screen or to operate a powered wheelchair, a phone, or other that the heads or example the controller equipment. The principal advantage of this technology is the note device sensors for example the possibility of capturing a large variety of tongue movements by may not be accessible when the user lying in bed or not processing a combination of sensor outputs. This would sit in front of a computer. To Provide the user with a smooth proportional control as another category of computer access systems operate by opposed to a switch based on/off control that is the basis of tracking eye movement from come reflections and most existing technologies. We modeled the effects of position. We built eye means. A man has a prototype system using off-the-shelf components and tested it the eye movement and major limitation and successfully by developing a graphical user interface (GUI) in they affect the users' eyesight by requiring extra eye Lab VIEW environment. A small battery powered wireless movements that can interfere with users' normal visual mouthpiece with no external component are under development. Activities such as reading, writing, and watching.**

I. Introduction

Assistive technologies are critical for people with severe organs are addressed by utilizing electric signals originated disabilities to lead a self-supportive independent life. Persons from brain waves or muscle twitches. Such brain computer severely disabled as a result of causes ranging from interfaces, either invasive, or noninvasive traumatic brain and spinal cord injuries to stroke generally have been the subject of major research activities. Brain Gate finds it extremely difficult to carry out everyday tasks without is an example of an invasive technology using Continuous help. Assistive technologies that would help them intra cortical electrodes, while Cyber link is a communicate their intentions and effectively control their noninvasive interface using electrodes attached to the environment, especially to operate a computer, would greatly forehead.

These technologies heavily rely on signal improve the quality of life for this group of people and may processing and complex computational algorithms, which even help them to be employed. Can results in delays or significant costs. A large group of assistive



Technology devices are Inner voice is yet another interface technology platform available that are controlled by switches.

The switch that banks on the capabilities of the ear as an output device. integrated hand splint, blow-n-suck (sip-n-puff) device, chin A small earpiece picks up changes in air pressure in the each control system, and electromyography (EMG) switch are all canal caused by tongue movements, speech, or thoughts. Switches based systems and provide the user with limited Signal processing is used to translate these changes into Degree of freedom. A group of head-mounted assistive device control commands. Transition outside research and psychophysical factors affect the acceptance rate of an assistive technology. Among the most important factors are the ease of usage and convenience in control. Operating the Device Pc unit it control assistive device must be easy to learn and require minimum effort on the users' part. The device should be small, unobtrusive, low cost, and non- or minimally invasive. Finally, a factor that is often neglected is that the device should be cosmetically acceptable. The last thing of a disabled person

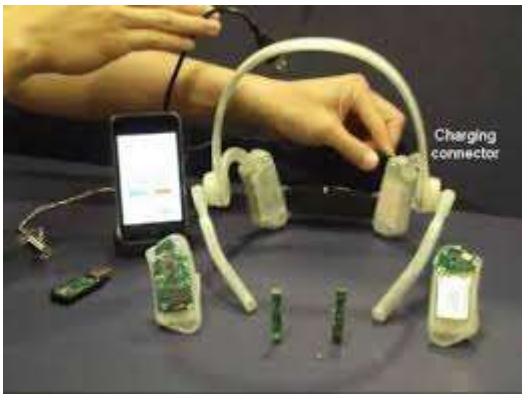


Fig. Head mounted device

II.Use of tongue for manipulation

Since the tongue and the mouth occupy an amount of Figure. Simplified block diagram of the Tongue Drive system. sensory and motor cortex that rivals that of the fingers and a dental retainer and attached on the outside of the teeth to the hand, they are inherently capable of sophisticated motor measure the magnetic field from different angles and provide control and manipulation tasks. This is evident in their continuous real-time analog outputs. Fig. shows the usefulness in vocalization and ingestion. The tongue is Tongue Drive system block diagram with two major units:

Connected to the brain by the cranial nerve, which generally one inside the mouth, the mouthpiece, and the other outside, escapes severe damage in spinal cord injuries. It is also a portable body worn controller. Small batteries such as last to be affected in most neuromuscular degenerative hearing aid button-sized cells are intended to power the disorders. The tongue can move very fast and accurately mouthpiece for extended durations up to a month. The power within the mouth cavity. It is thus a suitable organ for management circuitry scans through the sensors and turns manipulating assistive devices. The tongue muscle is similar them on one at a time to save power. The time division to the heart muscle in that it does not fatigue easily. Multiplexed (TDM) analog outputs are then digitized; therefore, a tongue operated device has a very low rate of modulated, and transmitted to the external controller unit perceived exertion. Across a wireless link. An oral device involving the tongue is mostly hidden. The signals received by the external controller unit are from sight, thus it is cosmetically inconspicuous and offers a demodulated and de multiplexed to extract the individual degree of privacy for the user. The tongue muscle is not sensor outputs. By processing these outputs, the motion of Afflicted by repetitive motion disorders that can arise when a permanent magnet and consequently the tongue within skeletal muscles and tendons are regularly used. The oral cavity is determined. Assigning a certain control tongue is not influenced by the position of the rest of the function to each particular tongue movement is done in body, which may be adjusted for maximum user comfort. Software and can be easily customized for each individual

The tongue can function during random or involuntary user. These customized control functions may then be used neurological activities such as muscular spasms. Also to operate a variety of devices and equipment’s including noninvasive access to the tongue movements is possible. computers, phones, and powered wheelchairs. The above reasons have resulted in development of B Tongue Drive System Advantages tongue operated assistive devices such as the Tongue Touch The signals from the magnetic sensors are linear Keypad (TTK), which is a switch based device. Tongue- magnetic sensors re-line Mouse is another device that has an array of functions the magnetic field, which is a continuous position piezoelectric ceramic sensor which elements can detect dependent property. Thus a few sensors are able to capture a strength and position of a touch by the tongue. The sensor wide variety of tongue movements. This would provide module is fitted within the oral cavity as a dental plate. a tremendous advantage over switch based devices in that Tongue point is another tongue operated device that adapts the user has the options of proportional, fuzzy, or adaptive the IBM Track point pressure sensitive isometric joystick for control over the environment. These would offer smoother, use inside the mouth.

The latter two

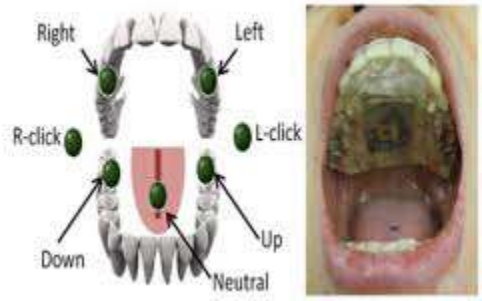


Fig. Tongue drive system

The devices have fairly faster, and more natural controls as the user is saved the large protruding objects inside the mouth, which can cause trouble of multiple on/off switch operations.

Alternative in convenience during speaking or eating. Assistive technologies that emulate a computer mouse use an additional input device such as a switch for the mouse

A. Tongue Drive System Overview button clicks besides the primary method for moving the Pointer. In the Tongue Drive system on the other hand, the In the Tongue Drive system, the motion of the tnu1S additional switches are unnecessary since a specific tongue traced by an array of Hall-effect magnetic sensors, which movement can be assigned to the button press. Measure the magnetic field generated by a small permanent magnet that is contained within a nonmagnetic fixture and the permanent magnet which generates the magnetic pierced on the tongue. The magnetic sensors are mounted on field is a small, passive, and inherently wireless component leading to user convenience and additional power saving. The mouthpiece electronics can be integrated on an application specific integrated circuit (ASIC). The ASIC along with the transmitter antenna can be incorporated into a miniaturized package that may be fitted under the tongue as part of the dental retainer. Due to the proximity of the magnet and Hall-effect sensors in the oral cavity, the Tongue Drive system is expected to be more robust against noise, interference, and involuntary movements compared to alternative technologies. Many aspects of the system can be

Customized and tuned through software for a particular individual's oral anatomy, requirements, and disabilities. Therefore, the Tongue Drive system can serve as a platform to address a variety of needs of different individual system.

III. Prototype system radio shack rare earth super magnet specifications

A.Mouth piece Material Neodymium-Iron-Boron Residual Induction (Br) 10,800 Gauss We devised a prototype Tongue Drive system, shown in Coercive Force (Hc) 9,600 Qersted, using off-the-shelf commercially available Peak

Fig. lab VIEW simulated output

Energy Density (BH max) 30 MGO components to evaluate the feasibility and performance of Magnetizing Force (Hs) 35,000 Qersted this approach in developing assistive devices. The main Curie temperature 310 °C purpose of the prototype device was to move a cursor on Density 7.4 g/cm3 Computer screen based on the location of a permanent Diameter 4.7 mm magnet (see Table 1) relative to four Hall-effect magnetic Thickness 1.2 mm sensors. Four Allegro A1321 ratio metric linear Hall Effect sensors with 5mV/G sensitivity were installed along C. Software with 0.1 if surface mount (SMD) decoupling capacitors in the transmitter mote scans through an array of 4 ADC cavities created in a Shock Doctor Max mouth guard channels in a round robin fashion. The data is organized into the sensors readily provide temperature compensated linear packets and transmitted wirelessly to the receiver. A radio voltage output proportional to the vertical magnetic field. to-serial link program running on the receiver mote sends The front two sensor outputs were used to control the cursor the packets containing sensor readings to the USB port. The movements along the X direction and the rear two, code for Telos-B/Lab VIEW interfacing has been written by movement along the Y direction The arrangement of sensors making use of the Lab VIEW serial port access resources. Was at the corners of a parallelogram, as would be in a real the packet data is deciphered to interpret the sensor setting. A set of 6 wires was needed for supply and sensor readings contained therein before being passed to the cursor output connections. Control GUI code.

B. Control Hardware and Wireless Link the GUI has 2 modes of operation: (1) Proximity

The ADC, control hardware, and wireless link were Detection (PD) Mode: The cursor movement is controlled by the sensor closest to the magnet, with a "dead zone" for this platform provides a low-power

microcontroller position of the tongue in which none of the (TI MSP430) including an 8-channel ADC and an IEEE sensor have control over the cursor. For example, if the TPPRP2, 4422O0CA mote were requirement, there is a need for the magnet to be in motion, used, either of which could be configured as a transmitter. The system looks forum movement off the magnet in' I system addition to its position relative to the sensors.

Fig. wheel chair system

Mouth piece only incorporates the Hall sensors, will not move no matter how close the magnet may be to the hard wired to the transmitter mote and powered by 4size powered. For the better control over cursor movement, for instance when a battery receiver mote sits in the USB port of a personal computer t has to be moved in small increments at a time. Motion which run the Tongue Drive systems detection is performed by comparing the derivative of each
drive power directly from that port. The motes run the open-source Tiny OS operating system, code for which is The Lab VIEW GUI developed for the prototype Tongue written in the C language. Drive system is shown in It displays a large executes a "tongue click". Left and right mouse-clicks are available in this system using the tongue movement. If the user quickly flicks the magnet towards one of the front sensors starting from the dead zone, it is considered a tongue click. These special tongue movements allow the user to select and "rag" an icon on screen represented target marker. The GUI software has tuning controls in the form of prototype Tongue Drive system

IV. Conclusion

A tongue operated magnetic sensor based wireless assistive technology has been developed for people with severe dis abilities to lead a supportive by enabling them to control their environment using their tongue. This technology works by tracking movements of a permanent magnet, secured on the tongue, utilizing linear Hall-effect sensors. The sensor outputs are a function of the position-dependent magnetic field generated by the permanent magnet. This allows a small array of The GUI developed in Lab VIEW environment for the sensors to capture a large number of tongue movements. Proto type Tongue Drive system. Thus, providing quicker, smoother, and more convenient proportional control compared to many existing assistive rectangular pink marker as a target in a random position for technologies other advantages of the Tongue Drive system tracking by a smaller circular yellow cursor. Proportional are being unobtrusive, low cost, minimally invasive, flexible, control is incorporated in the system by accelerating the and easy to operate. A more advanced version with custom cursor (moving by a larger step-size) the closer the magnet is designed low-power electronics that entirely fit within the held to a sensor. The marker disappears and reappears at a mouthpiece is currently under development.

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