Wheelchair Operated by Tongue Motion

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Abstract:- One of the most popular pieces of assistive technology used by people with mobility issues to move around on their own or with carer support and enhance their quality of life is a wheelchair. A wired wearable assistive device called the tongue controlled wheelchair allows the patients with severe impairments to steer their wheelchairs by using their tongue motion. This study describes the use of tongue movements to control a moving wheel chair. The tongue drive system is an Assistive Technology()AT tongue-operated device designed for persons with severe disabilities to manage their surroundings. This technology employs an array of Hall Effect magnetic sensors positioned on a mouthpiece connected to the helmet, as well as a tiny permanent magnet implanted on the tongue. The magnetic field created by the tiny permanent magnet is sensed using these Hall Effect sensors. The detected signals are transferred via wireless connection and processed by a microprocessor to control the wheelchairs movement. Many assistive devices were developed in the early days, and each design had significant drawbacks. This study provides an efficient, low-cost solution to all of the flaws found in priordesigns.

Keywords:- *TDS - Tongue Drive System , AT - Assisstive Technology*

I. INTRODUCTION

People with severe impairments can benefit the most from assistive technology in order to live independent, self-sufficient lives. People who are severely incapacitated, whether from catastrophic brain and spinal cord injuries or stroke, find it incredibly challenging to do daily duties withoutongoing assistance. This group of peoples quality of lifewould be enhanced, and perhaps even their ability to find employment, by the use of assistive technology that wouldenable them to effectively convey their objectives and regulatetheir environment, particularly when operating a wheelchair. After a damage to the sensory-motor system at the cervicallevel of the spine, a persons quality of life changesdramatically. A severe handicap limits the person to a wheelchair and need the daily aid of a carer. Several research teams have attempted in recent decades to partially restore or compensate for a handicapped persons lost capability. Interfaces utilising the intact functioning of the voice, brain,eyes, head, and tongue have been designed to enable control ofassistive equipment to augment the impaired persons mobilityand communication abilities.

People with severe disabilities can benefit the most from assistive technologies, which can help them live independent, self-sufficient lives. people with severe It is extremely difficult for people who are incapacitated from conditions like stroke, traumatic brain injury, and spinal cord damage to perform daily duties without ongoing assistance. This group of peoples quality of life would be enhanced, and perhaps even their ability to find employment, by the use of assistive technologiesthat would enable them to effectively convey their objectives and regulate their environment, particularly when operating a wheelchair. Utilizing electrical impulses generated by brain waves or muscle twitches can help those with severe motor impairments who are unable to benefit from mechanical movements of any body parts. Major research efforts have been focused on such brain computer interfaces, whether they are intrusive or not. These technologies rely largely on signal processing and intricate computational methods, whichmight cause delays or incur a lot of expenses. Think-a-Move Another interface technology platform that uses the ear as an output device is called inner voice. Changes in air pressure in the ear canal brought on by speech, tongue movements, or thoughts are detected by a tiny earpiece. These modifications are converted into commands for controlling the device usingsignal processing.

II. LITERATURE REVIEW

In a voice-controlled wheelchair, the wheelchair is controlled by a speech processing system using voice commands. In a real-world setting, however, sounds around the user may mix with the users voice. As a result, it will cause a difficulty for the person in the wheelchair. It is tough to use in congested and loud areas. This may make it difficult to use this gadget in loudsurroundings. The user must wear a headset in order to operatethe wheelchair with their tongue. Sensors used to detect user commands via the tongue may have a limited lifespan owing to constant contact with saliva. A screen would always be in front of the operator/patient for operating the wheelchair using eye movement.

The most prevalent type is the joystick-controlled wheelchair. Aside from the greater purchase and maintenance expenses, there are also other disadvantages to such sorts of wheelchairs. The expense of fixing and maintaining a joystick-based wheelchair can be higher than that of a standard wheelchair, as can the difficulty of movement. The joystick will get weak and damaged as a result of the quick movement. It takes a lot of focus and effort to move the joystick.

An automated method was developed to control a wheelchair's motor rotation based on a paralysed person's head movement. The only part of the body that can move for those with this illness is their head. These people have an accelerometer gadget connected to their foreheads that enables independent movement . One limitation of these devices is that they are only accessible to people with limited head motion . The user's head must also always be in range of the device's sensors, which is another restriction.

Using an eye-tracker makes moving the mouse cursor on a computer screen straightforward. It is not appropriate for mobile use since it necessitates placing a camera in front of the user's face, which may obstruct the line of sight. The fact that these devices require more eye movements than usual, which could interfere with common visual tasks like reading, writing , and viewing , is one of their major drawbacks.

The Tongue Drive System (TDS), a wireless, wearable AT that recognises a user's voluntary tongue movements by processing changes in the magnetic field generated by a small magnetic tracers on the tongue and translating them into user-defined commands, was developed to address some of the forementioned issues.

III. BLOCK DIAGRAM

Four digital hall effect sensors are equipped to detect the presence of magnetic field. The data from the sensors are given to the microcontroller's digital port. The output from the controller is given to the motor driver usually relays and the two motors are controlled. Two relays are used for each motor for controlling the direction at which the motor rotates. A LCD dispaly is also used to display the corresponding movement.

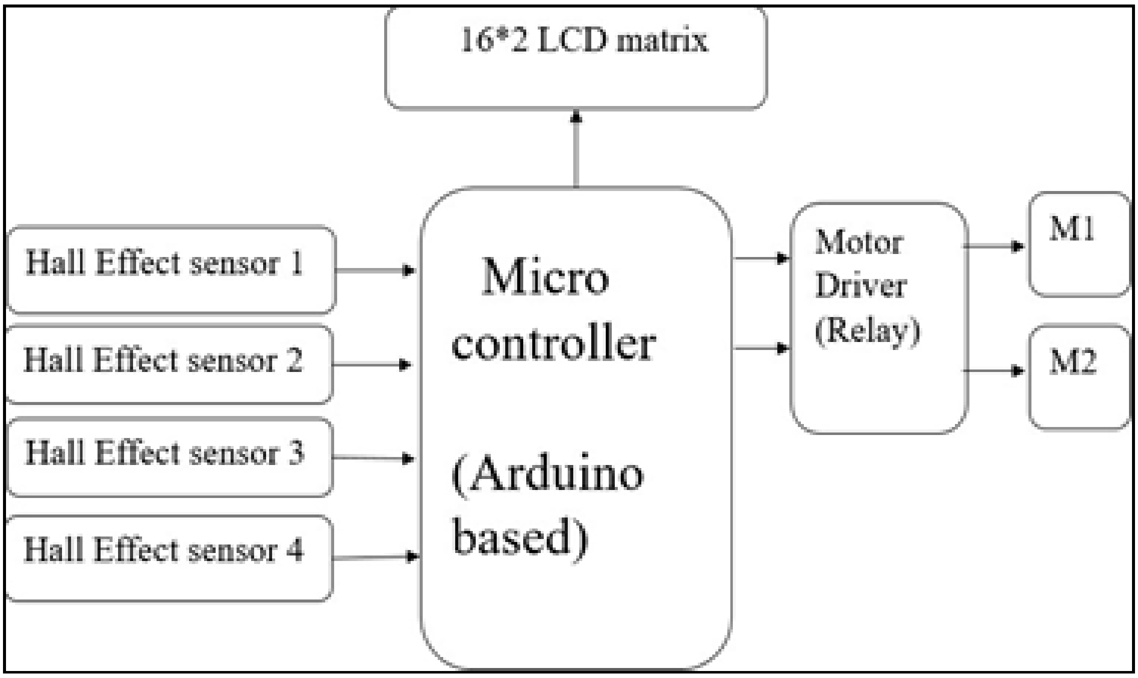

Fig 1 Block Diagram

In this technology, motor drivers are utilised in wheelchairs to provide power and manage the direction of the motors. These motor drivers are operated using relays. However, relays use a current of around 100mA, which exceeds the capacity of a microcontroller. To overcome this difficulty, a transistor is used in the circuit to endure huge currents while functioning with a low base supply. The rotational orientation of the motor relies on the flow of current through it. Each motor is attached to two relays, each featuring three terminals: common, generally open, and normally closed. The common terminals of the relays are attached to the motor terminals. One of the remaining terminals is coupled to VCC and the other toground.

It is important to design a mouthpiece that is comfortable anduser-friendly for prolonged use.

Ensure that the technology is affordable and accessible for everyone.

Educate and assist users so that they can master the technologyand regain some independence.Educate and assist users so that they can master the technology and regain some independence. Enhance its usefulness and usability continuously by conducting research and development.

IV. CIRCUIT MAP

➢ *According to the Proposed System Design, the Circuit DiagramLooks like this: follows,*

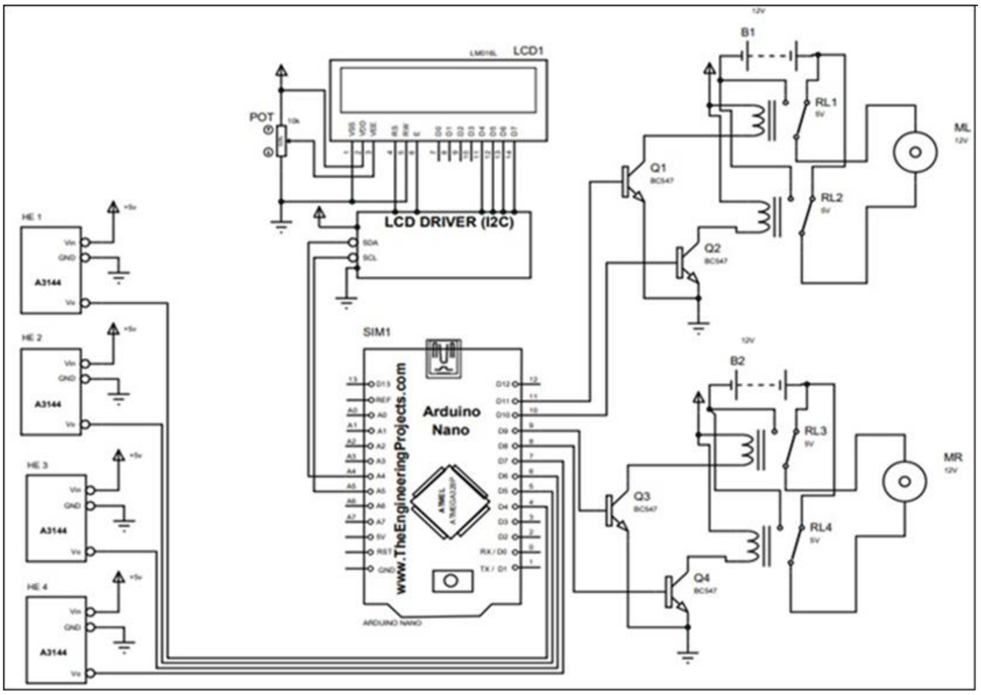

Fig 2 Circuit Diagram

➢ *Outcome of Simulation*

Based on the simulation results, the following results were obtained. It contains the differnt motion of the motors in the circuit diagram:

➢ *Objectives*

The goal of this project is to develop an assistive device that allows patients with severe disabilities to navigate their environment, especially their wheelchair, using their tongue movements.

Develop a system based on Hall Effect magnetic sensors and a CPU that detects and analyses tongue movements.

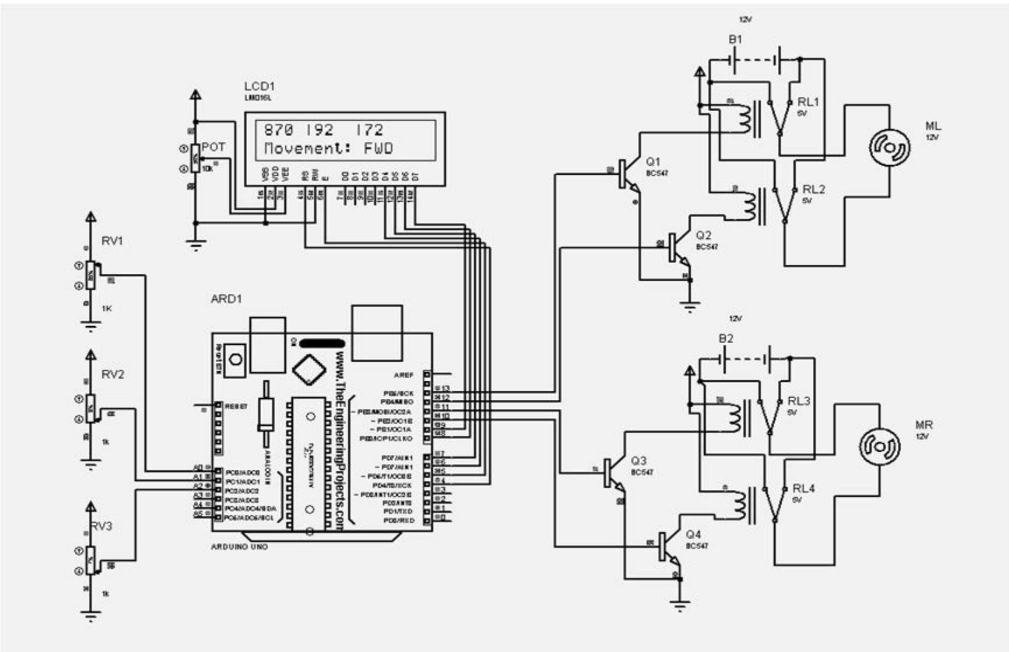

Fig 3 Circuit Diagram for Forward Movement

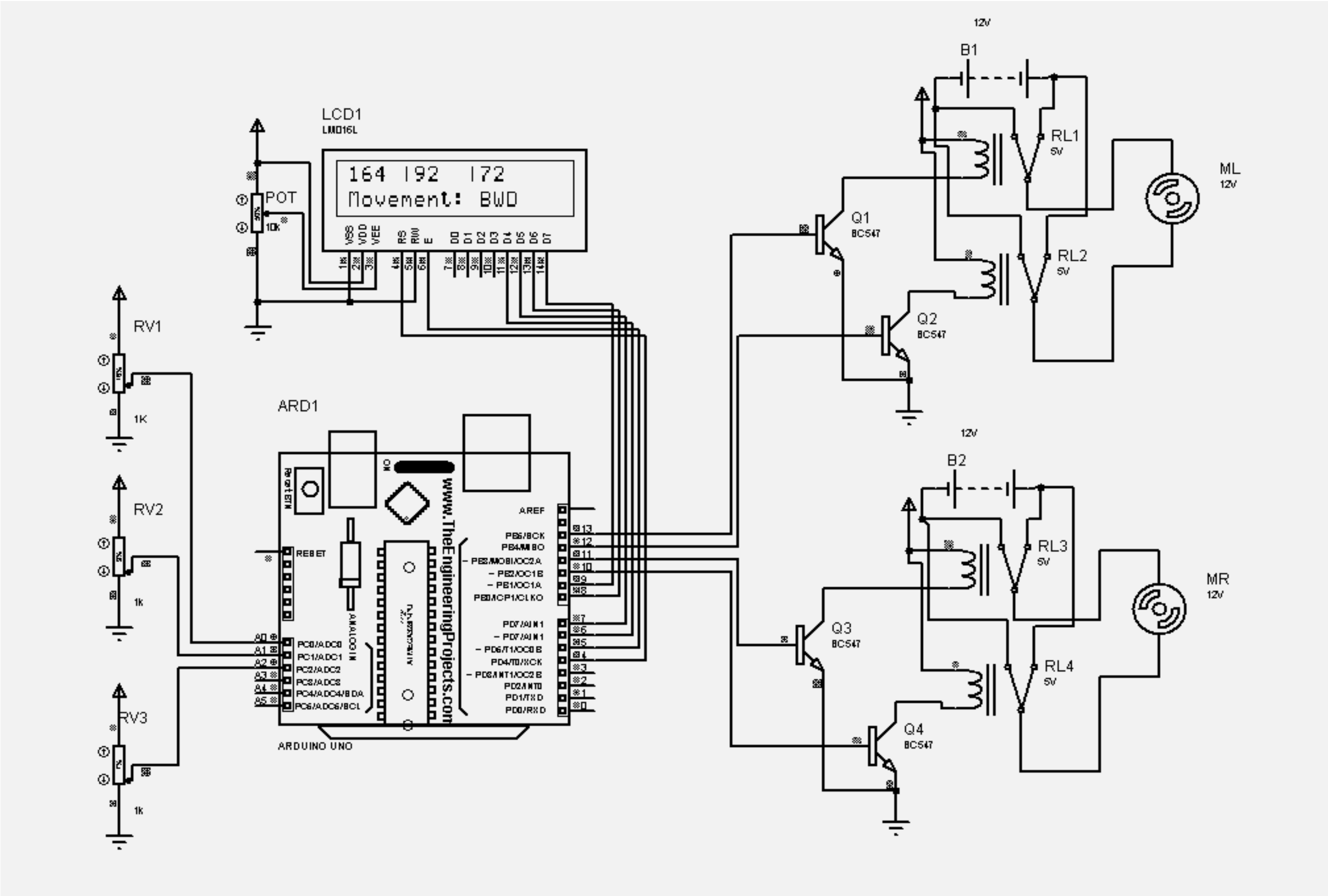

Fig 4 Circuit Diagram for Backward Movement

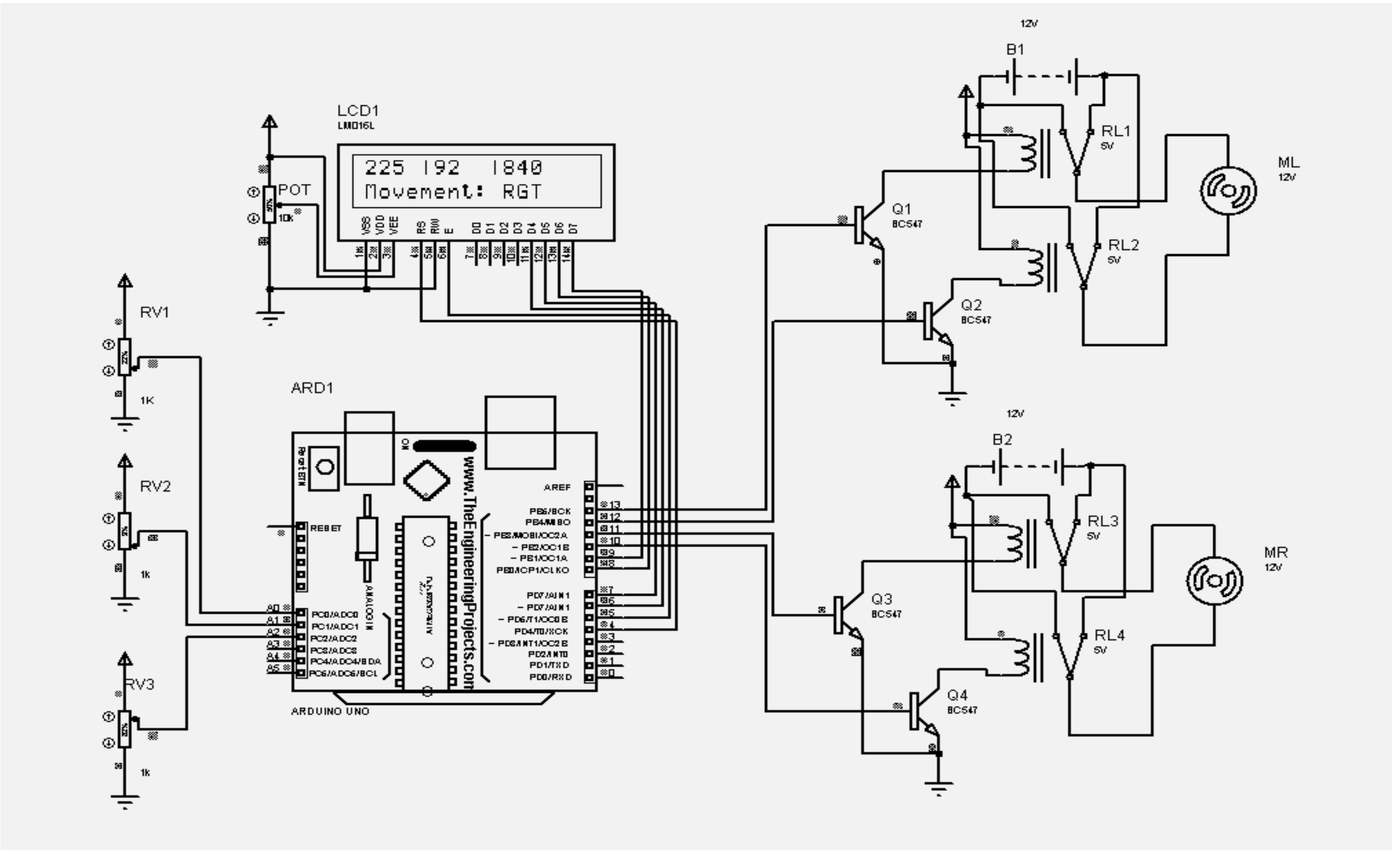

Fig 5 Circuit Diagram for Right Movement

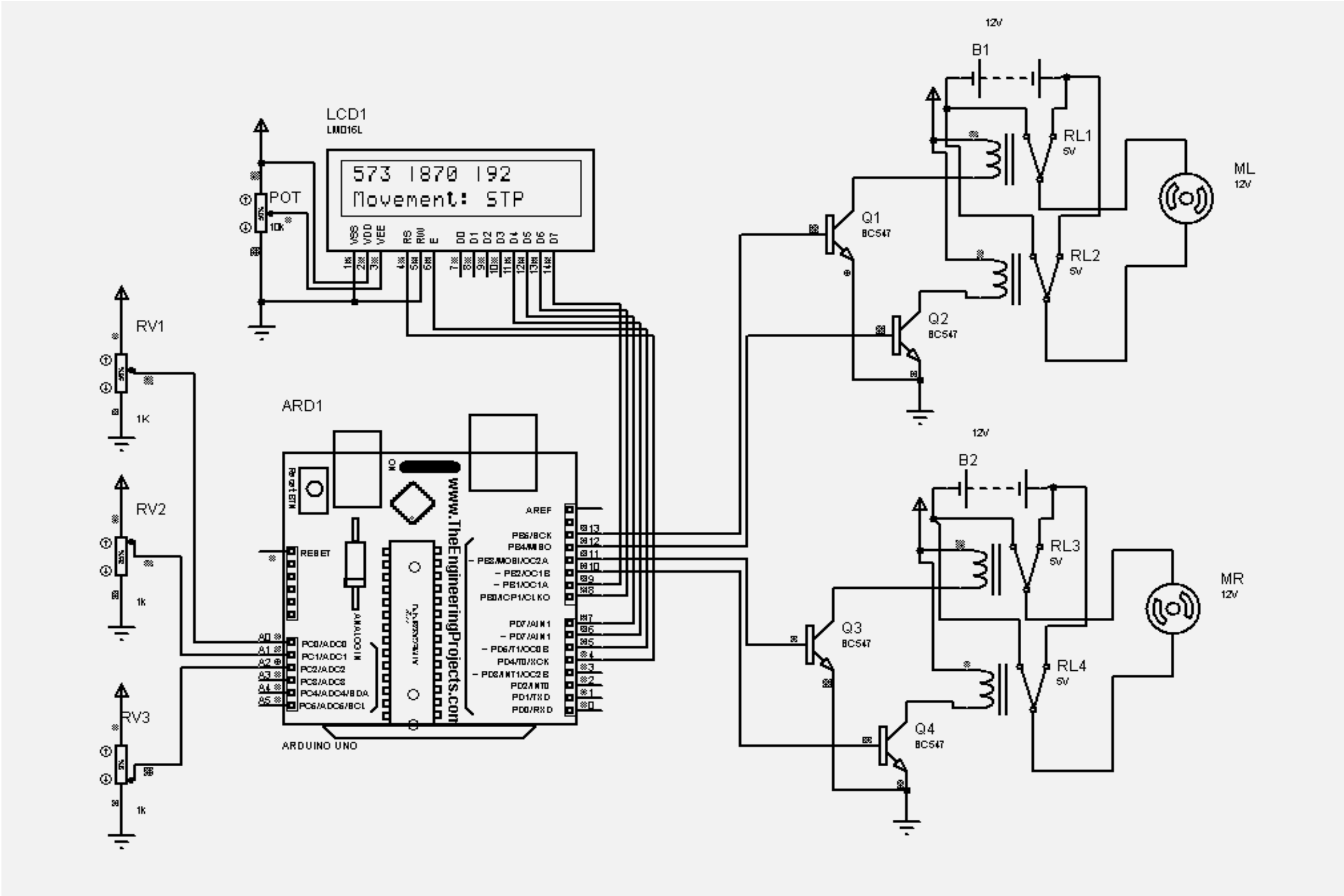

Fig 6 Circuit Diagram for Stop

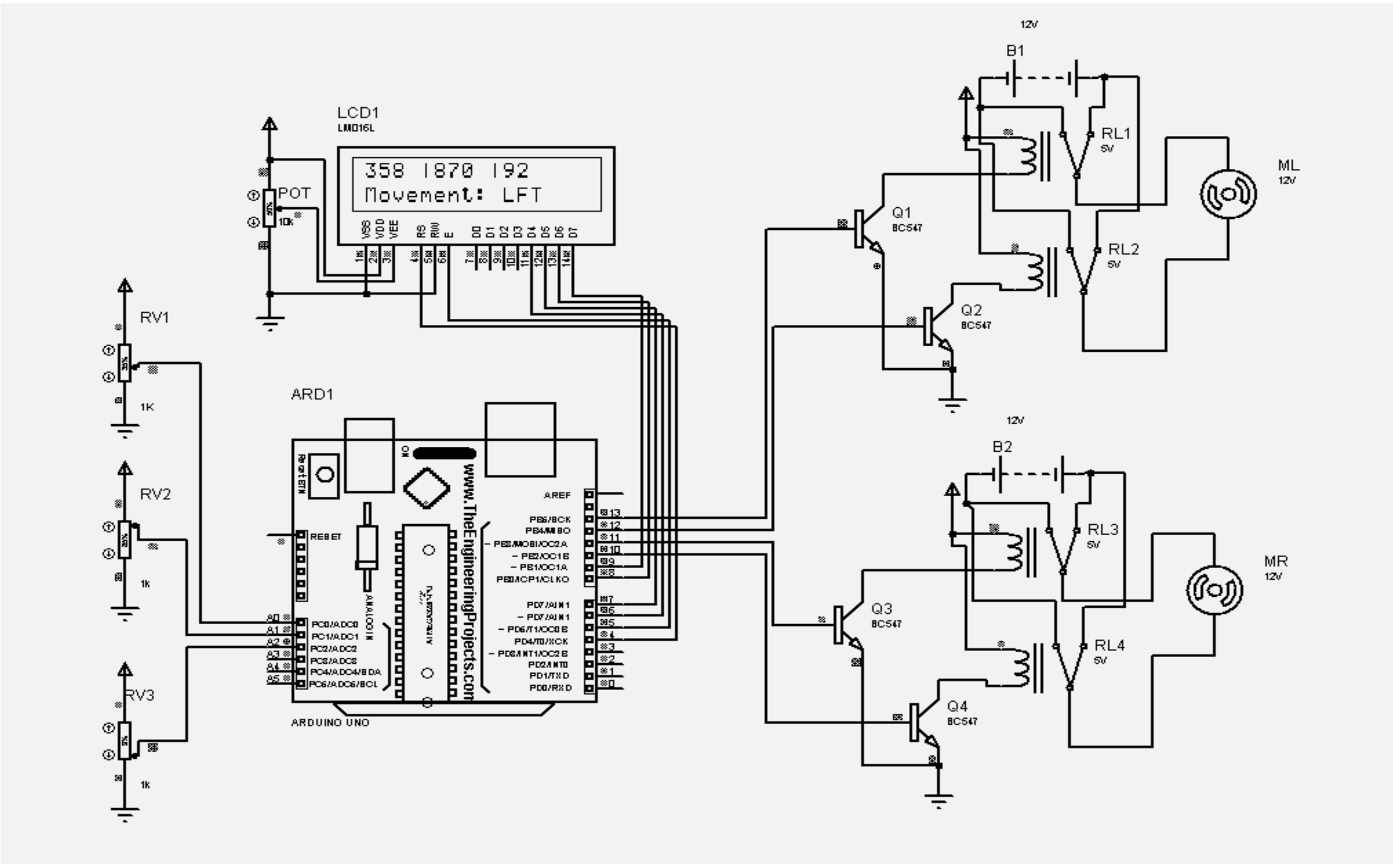

Fig 7 Circuit Diagram for Left Movement

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V. PROCEDURE

Neodymium magnet and digital Hall Effect sensors are employed to control the movement of wheel chair. The neodymium magnet is placed in the user's tongue using a tongue cap or can be studded on the tongue. The sensors detect the change in the magnetic field with the tongue movement. These changes in magnetic field is communicated to the arduino nano microcontroller which thereby produces the command for movement (forward, backward, left, right) based on the programme given to the microcontroller. For establishing these motions to the motor, the controller uses two relays which are connected to the wiper motors in a H-bridge configuration. This helps in controlling the current flow and direction of the rotation of motors. By activating the relays in different patterns using the npn transistor, the motors can be spinned in both direction so that the wheelchair can be movedin the desired direction.

There are mainly two components which makes up the tranmsitter side: a neodymium magnet and array of digital Hall Effect sensors. The headgear which consists of magneticsensors which are arranged infront of the mouth. It obtain thepresence or absence of magnetic field based on the movement of tongue on which the magnet is attached. To turn the wheelchair left, user should move the tongue towards the sensor which is equipped for the movement to left. The sensor detect the presence of magnetic field and it becomes low because initially the sensors will be at high position and with the presence of magnetic field it becomes low. So based on the data from the sensors and the program given to the microcontroller, arduino nano sends the command to the relays through activating transistors resulting in the movement of wheel chair.

Hall effect sensors of four numbers and a small strong magnet are employed to makes the wheelchair movement. The participant wears a helmet that is coupled with four hall effectsensors. These four sensors are arranged in the level of mouth and by changing position of neodymium magnet connected tothe tongue, various readings are obtained from the differnet sensors. These readings should be analysed and after that programming criteria for the different motions should be selected. So the four movements are forward, backward, left, and right are generated. Unless any of the conditions for these movements are not satisfied, the wheelchair is in STOPcondition.

Two wiper motors are needed for the project, since its torque and power are ideal. Relays are connected with the motorsto control the direction of current through the motors as well as the direction of motor rotation. A 12V 7A UPS batteryis mounted to the wheelchair for power. A switch is used for turning on the motion criteria unless the wheelchair may unintentionally move and cause pain or injury. Thus, a switch is added to activate the wheelchair action. Only when the switch is turned ON, the hall effect sensors begin to read values from the magnet.

VI. INSTALLATION

- *The following is the Hardware Implementation for the Suggested Design:*

Fig 8 Side View of Wheel Chair

Fig 9 Front View of Wheel Chair

Fig 10 Wiper Motor Connection

VII. CONCLUSION

A tongue controlled wheelchair based on the movement of tongue has been designed to provide help to the people with severe movement disabilities to live self-supporting and autonomous lives by using AT systems. This device works by using a array of digital hall effect sensor modules which detects the presence of magnetic field of the neodymium magnet attached on the user's tongue. In future, wirelessly transmitted data can be used for control. As a result,it provides a faster, more streamlined and more practicalresponse than current AT systems.

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