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Tongue Controlled Wheelchair Using PIC Microcontroller

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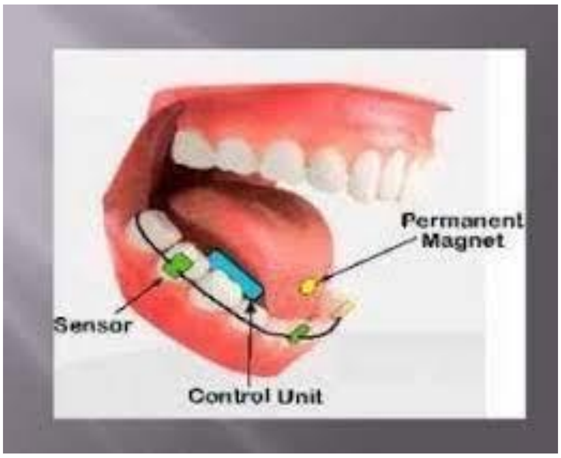
ABSTRACT

The human body is a living mechanism. It's the basis that allows us to move, play, work, and participate in all of our activities. A person's capacity to move their bodies is gone when they are paralyzed, and they must rely on others to satisfy their requirements. Since then, a new assistive device called the "Tongue Controlled Wheelchair Using PIC Microcontroller" has been employed to help the patient become more self-sufficient. The tongue controlled wheelchair is a non-invasive research project that looks at how technology might help those who are disabled. This paper describes a project based on a contact sensor called the "Hall Effect sensor" that is placed on the tip of the user's tongue and activated by tongue movement, as well as receiving sensors on the user's cheek bows that determine the wheelchair's motion, apply the command to the motors to function and let the person to travel right, left, forward, and even halt according to his demands.

***Key Words*:** PIC Microcontroller, Hall Effect sensor, Crystal Oscillator, Motor drivers, RF Transmitters, RF Receivers, Decoder, Encoder, DC Motors, Power Supply.

1. INTRODUCTION

The project's main purpose is to design and manufacture tongue-controlled wheelchairs for physically disabled people. The user can wear this gadget on their head and operate the wheelchair in front, left, and right directions using a Hall-effect sensor and a simple tongue movement.

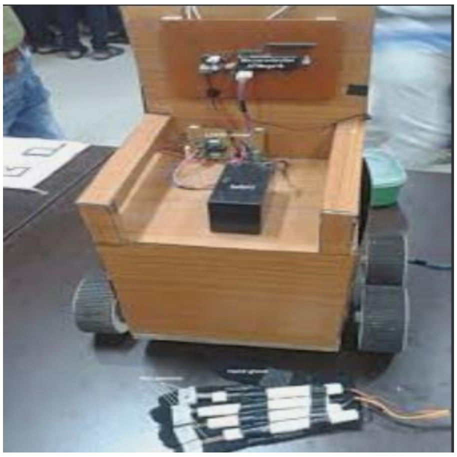


Depending on the input, this hall-effect sensor locates the magnetic field, activates the electrical devices, and declares the fundamental requirements. If the user places a magnet in front of the first sensor, the robot will move forward, the second sensor will move to the left, and the third sensor will move to the right. This technology is extremely beneficial to people who are paralyzed or physically handicapped. This gadget is portable, and the entire system is powered by wireless technology. The user may wear it around his head like a band and control it with his tongue.

This project uses RF technology to communicate wirelessly between the head and the chair; DC motors are utilized to drive the wheelchair, and a Hall Effect sensor is used to regulate the wheelchair's directions. The PIC Microcontroller is the project's principal controlling device, which is programmed using embedded C instructions. The transmitter and receiver modules can communicate with this microcontroller.

1.1 EXISTING MODEL

Aside from work in general scientific domains such as autonomous navigation techniques, mapping, and self-localization algorithms, the wheelchair is controlled via joystick/head-joystick, and a paralysis person cannot control this wheelchair if one side of the body is affected and this effect is also called as unilateral paralysis.



1.2 PROPOSED MODEL

It is a primary structure that allows us to move, play, and work, as well as perform all other functions. If a person loses the ability to move his or her body or becomes paralyzed, he or she believes that life has come to an end and lives in a depressed and bleak environment. The loss of muscle function in a part of the body is known as paralysis. It occurs when the transmission of messages between the brain and muscles is disrupted. It might affect a small region, the entire body, one side of the body (unilateral), or both sides of the body (bilateral). If the paralysis affects both legs and the bottom portion of the body, it is referred to as lower-body paralysis (Paraplegia). Furthermore, if it affects both the arms and legs, it is considered severe. It's known as (Quadriplegia).

The majority of paralysis is caused by strokes or injuries such as a broken neck, which results in generalized paralysis. While this can be devastating, it does not mean that having fun and being a part of the good things in life is over. Due to the movement of their tongues, this project is used in a very useful way to assist individuals with serious disabilities in getting over their sadness and allowing them to lead a more active and self-reliant life. The tongue was chosen as the system's controller because, Unlike the feet and hands, which are linked to the brain via the spinal cord, the tongue and the brain are linked directly by a cranial nerve. If a person suffers a significant spinal cord injury or other trauma, the tongue will remain movable to activate the system.

2. METHODOLOGY

2.1 EMBEDDED SYSTEM

An embedded system is a computer system that is designed to execute one or a few specific functions, frequently under real-time processing restrictions. It is frequently incorporated as part of a larger device that includes hardware and mechanical components. A general-purpose computer, such as a personal computer (PC), on the other hand, is built to be versatile and to fulfill a wide range of end-user demands. Many items in regular usage today are controlled by embedded systems.

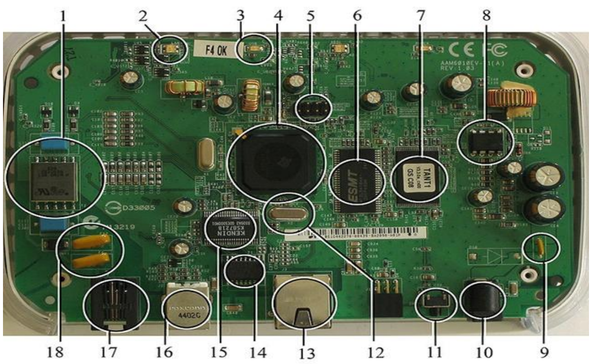


Fig 2.1 Internal Structure of Embedded system

One or more primary processing cores, which are commonly microcontrollers or digital signal processors, control embedded systems (DSP). The crucial trait, though, is being committed to completing a certain goal, which may necessitate the use of extremely powerful processors. Air traffic control systems, for example, can be properly seen as embedded, even though they entail mainframe computers and specialized regional and national networks connecting airports and radar stations. (Each radar is likely to have one or more embedded systems of its own.)

Because the embedded system is dedicated to a single job, design engineers may optimize it to decrease product size and cost while increasing reliability and performance. Some embedded systems are mass-produced, taking advantage of economies of scale.

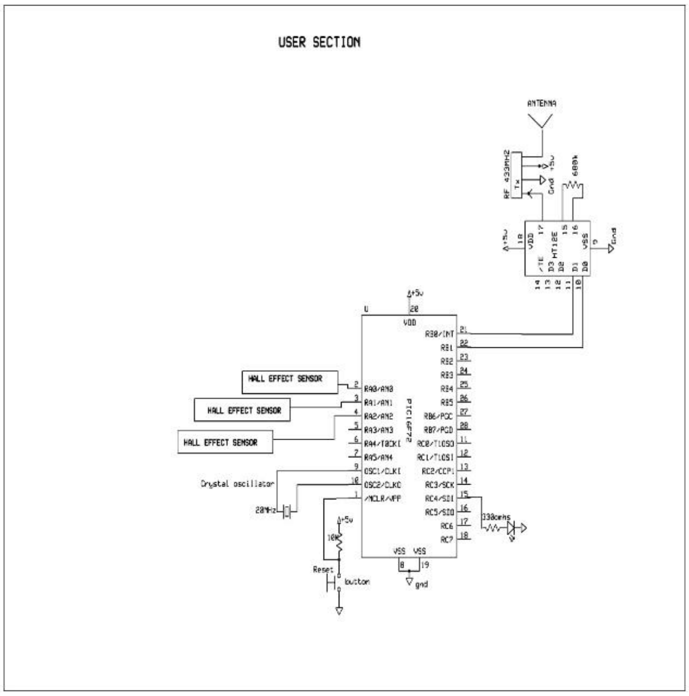
2.2 ARCHITECTURE

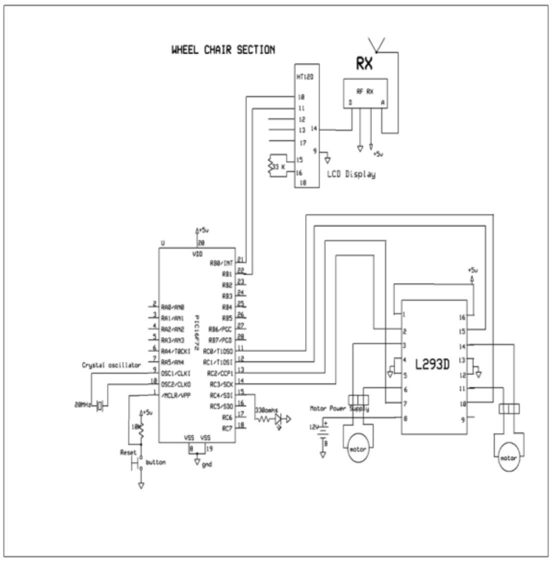
It was time to start thinking about how the command supplied by the sensors would be translated to make the wheelchair move after picking the proper sensor to install on the headgear.

The control section was built by developing a circuit with computer software that included all of the necessary components and gates to take the signal and send it to the triggered motors. Figure The simulation was then run to ensure the desired results. To begin, a power supply, such as a 12-volt battery, is connected to a voltage regulator to provide the circuit with the necessary voltage to operate the components. The voltage regulator is then connected to switches, which are touch sensors on the headset that the patient activates based on his wants, as depicted.

Furthermore, the signals from the switches are routed via several logic gates, which convert the patient's needs into orders that cause the transistor to send the voltage at its emitter to the H-bridge. There are two H-bridges in the control circuit, each controlling the forward motion of a single motor. This motion will be translated into a rotating movement for the wheelchair by combining both bridges. Each H-bridge is made up of three relays that control the motor by manipulating the signal.

The motor will revolve to drive the wheelchair ahead if the current flows from R1 to R2 forward. The chair will move to the left if the current passes





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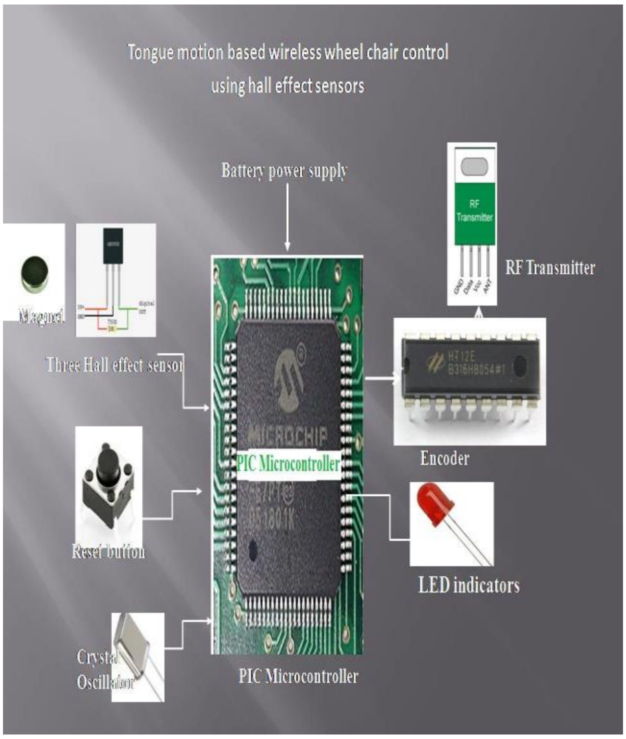

Fig 2.1.1 the circuit layout of the Tongue gesture wheelchair

2.3.1 Microcontroller (PIC16F): In embedded system products, microprocessors and microcontrollers are commonly employed. It's a gadget that can be programmed. It is used to save a program that has been written. Because FLASH memory can be programmed and cleaned several times, this microcontroller is well suited for device development.

Fig 2.1.2 PIC Microcontroller

2.3.2 Crystal oscillator: The crystal oscillator has a frequency range of DC to 20MHz and may be connected to the PIC microcontroller. A 20Mhz oscillator is typically used with the CCS C compiler, and it is reasonably priced. To the 20 MHz crystal oscillator, a 22pF capacitor should be attached. More information may be found in my circuit diagram.

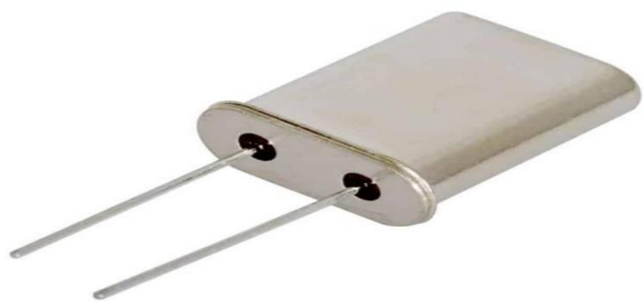

Fig 2.1.3 Crystal Oscillator

2.3.3 Regulated Power Supply: A rechargeable battery, sometimes known as a storage battery or an accumulator, is a type of electrical battery. It's a type of energy storage device made up of one or more electrochemical cells. It is referred to as a secondary cell because its electrochemical activities are electrically reversible. Rechargeable batteries come in a range of shapes and sizes, ranging from button cells to megawatt systems used to sustain an electrical distribution network. Some of the most common chemical combinations include lead-acid, nickel-cadmium (NiCd), nickel-metal hydride (NiMH), lithium-ion (Li-ion), and lithium-ion polymer (Li-ion polymer).

Fig 2.1.4 Regulated power supply

2.3.4 Hall Effect Sensor: The Hall Effect is defined as the generation of a voltage differential (the Hall voltage) across an electrical conductor that is transverse to an electric current and perpendicular to the current. This phenomenon was discovered in 1879 by Edwin Hall. The ratio of the induced electric field to the product of the current density and the applied magnetic field is known as the Hall coefficient. It is a property of the conductor's material since its value is determined by the kind, quantity, and qualities of the charge carriers that make up the current.

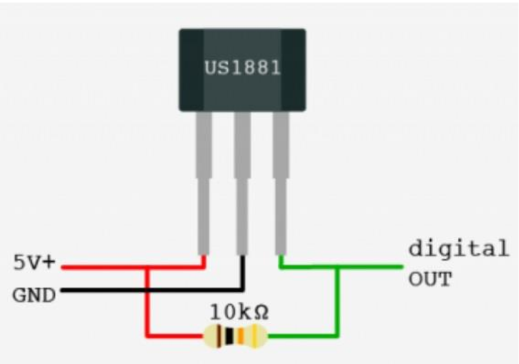

Fig 2.1.5 Hall Effect Sensor

2.3.5 LED INDICATORS: A light-emitting diode (LED) is an electronic light source (LED). LEDs are increasingly being used in a range of applications for lighting and as indicator lamps. When LEDs were initially developed as a functional electrical component in 1962, they produced low-intensity red light, but today's LEDs are available in visible, ultraviolet, and infrared wavelengths, with exceptionally high brightness. The internal structure and parts of a lead are seen in Figures 3.15 and 3.16, respectively.

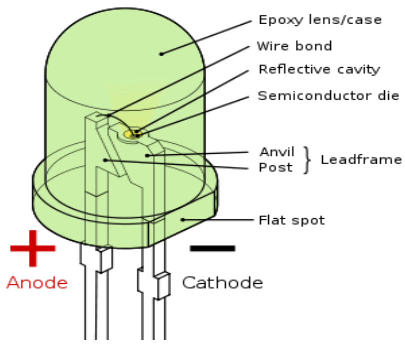

Fig 2.1.6 LED Indicator

2.3.6 MOTOR DRIVERS (L293d): The quadruple half-H drivers L293 and L293D have a high current rating. The L293 is intended to provide bidirectional driving currents of up to 1 A at voltages ranging from 4.5 V to 36 V. The L293D is capable of bidirectional driving currents of up to 600 mA at voltages ranging from 4.5 V to 36 V. Both devices are designed to drive inductive loads like as relays, solenoids, dc and bipolar stepping motors, and other high-current/high-voltage loads in positive-supply applications. On all inputs, TTL compatibility exists. It's a complete totem-pole drive circuit since each output contains a Darlington transistor sink and a pseudo-Darlington source. 1,2EN enables drivers 1 and 2, and 3, 4EN enables drivers 3 and 4. The connected drivers are engaged when the enabled input is high, and their outputs are active and in phase with their inputs when permission is given.

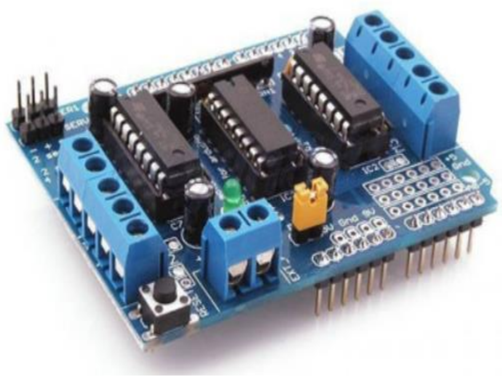

Fig 2.1.7 L293D Motor Driver

2.3.7 DC MOTORS: A direct current motor turns electrical energy into mechanical energy by interacting magnetic fields with current-carrying conductors. The opposite action is performed by an alternator, generator, or dynamo, which generates electrical energy from mechanical energy. Electric motors and generators of various sorts can be used interchangeably. The input to a DC motor is current/voltage, and the output is torque (speed).

Fig 2.1.8 DC Motors

2.3.8 RF TRANSMITTER: ST-TX01-ASK, an ASK Hybrid transmitter module. The Saw Resonator designed the ST-TX01-ASK, which is inexpensive in cost, small in size, and simple to use for design. GND: The STT-433 is ideal for remote control applications requiring a low cost and a longer range. The transmitter operates on a 1.5-12V supply, making it ideal for battery-powered applications. In the transmitter, a SAW-stabilized oscillator is employed to ensure flawless frequency control for optimal range performance.

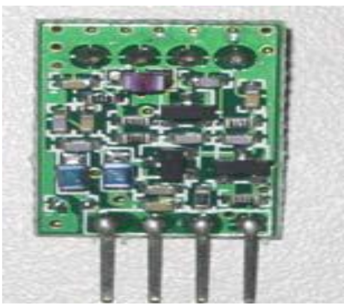

Fig 2.1.9 RF Transmitters

2.3.9 RF RECEIVER: The STR-433 is ideal for low-cost, short-range remote-control applications. The receiver module, except for the antenna, does not require any other RF components. It emits nearly few pollutants, making FCC and ETSI certifications a breeze. The super-regenerative design exhibits exceptional sensitivity at a low cost. Because of its manufacturing-friendly SIP style packaging and low cost, the STR-433 is suited for high-volume applications.

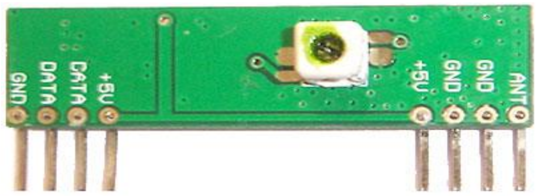

Fig 2.1.10 RF Receiver

2.3.10 ENCODER (HT12E): The 212 encoders are a CMOS LSI series intended for use in remote control systems. They have N address bits and 12 N data bits for encoding information. For each address/data input, one of the two logic states can be chosen. When a trigger signal is received, the programmed addresses/data are communicated together with the header bits through an RF or infrared transmission channel. The 212 series encoders' application adaptability is further increased by the ability to select a TE trigger on the HT12E or a DATA trigger on the HT12A. The HT12A additionally has a 38 kHz carrier for infrared systems.

Fig 2.1.11 Encoder

2.3.11 DECODER (HT12D): The 212 decoders are a type of CMOS LSI that is used in remote

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monitoring. They are compatible with the Holtek 212 encoder series (see the encoder/decoder cross-reference table for further information). To ensure correct operation, an encoder/decoder pair with the same number of addresses and data format should be used. The decoders receive serial addresses and data from a configured 212 series of encoders that are sent by a carrier through an RF or an IR transmission channel. They match the serial input data to their local addresses three times in a row. If no mistakes or mismatched codes are found, the input data codes are decoded and then delivered to the output pins. The VT pin goes high when the transmission is successful.

Fig 2.1.12 Decoder

2.4 FLOW CHART

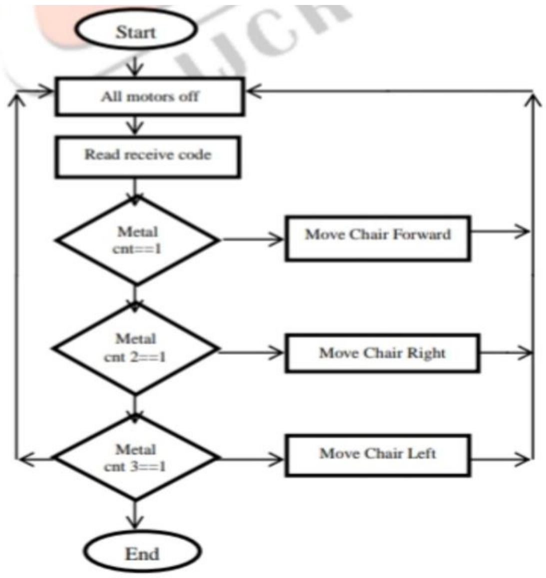

Fig 2.4.1 Flow Chart

3. ADVANTAGES

- Simple tongue movement-based operation.
- Wireless data transmission.
- Using RF technology.
- Wheelchair control through tongue motion.
- It is flexible to use and easy to operate.
- It offers better privacy to the user.
- Adoptive control over the environment.

4. RESULT

The project "Tongue Gesture Wheelchair Using PIC Microcontroller" was created as a tongue motion-controlled wheelchair to assist the physically disabled.

S.No	Metal Contact 1	Metal Contact 2	Metal Contact 3	Motor 1	Motor 2	Direction
1.	OFF	OFF	OFF	OFF	OFF	STOP
2.	OFF	ON	OFF	Clock wise	Anti clockwise	FORWARD
3.	OFF	OFF	ON	Anti-clockwise	Clock-wise	RIGHT
4.	ON	OFF	OFF	clock-wise	clockwise	LEFT

Fig:4.1 The Tabular Representation of the operation

5. FUTURE SCOPE

It took a lot of time and work to achieve our aim in this project, which was to have the wheelchair move according to the tongue order. Based on the plans and timetable followed, successful results were produced, but to make it much more professional, here are some ideas for future enhancements: A different sort of sensor may be employed. This sensor may be more sensitive and does not require the use of a headset. To maintain easier and quicker movement, larger motors might be employed. A medical chair can be mounted on the wheelchair's chassis to allow the patient with widespread paralysis a more comfortable seating position. Based on wireless communications, a simpler circuit might be employed.

A broader software that allows the wheelchair to travel in a variety of directions. Instead of using the tank-like steering mechanism, an innovative approach for steering the chair has been developed. The control switches might be situated in such a manner that the patient takes them about with him all the time, allowing him to operate the chair wirelessly and move it closer to him. A technology that could allow this paraplegic patient to lift his chair higher by instructing his mouth. These suggestions may boost the patient's self-assurance. A collection of sensors that prevents the patient from colliding with a wall in front of them might also be employed.

6. CONCLUSION

It is intended to unify functionality from all hardware components employed. The existence of each module has been carefully examined and organized, resulting in the optimum possible operation of the unit. Secondly, by employing extremely advanced ICs with the support of increasing technology, the project has been effectively executed. As a result, the project has been created and tested effectively.

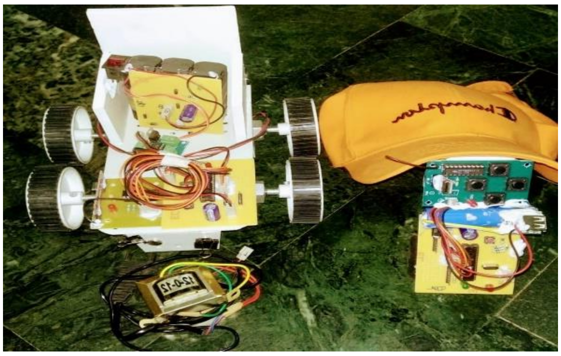

FIG: 7.2.1 Experimental Setup

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