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Department of Electrical & Electronic Engineering

Title

Design and Implementation of Smart Electric Wheelchair for Disabled Person

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Declaration

We hereby declare that, project has been done by us under the supervisor of **MD. Shamsul Islam** Lecturer, Department of Electrical and Electronic Engineering. We declare that the Thesis or any part of this project can be deposited elsewhere for the award for a degree or diploma.

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Abstract

This abstract discusses the development of a low-cost, intelligent, and non-polluting electric wheelchair for people with disabilities. The project aims to provide a supporting aid that can help people move from place to place without depending on a third person. A Study on Low Cost Battery Powered Wheel Chair for Disabled People of Bangladesh This abstract discusses a Battery powered wheelchair model that is affordable, user-friendly and self-driven. The model is designed to be cost-effective and is intended to help people with physical challenges move around in their daily lives. This abstract discusses the use of six sets of DC Gear motors to control the movement of an electric wheelchair with wheels. The direction of the wheelchair is determined by the combined vectors of the Six DC gear motors.

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1. Introduction

Electric wheelchairs have evolved over time with new features such as Switching controls, suspension systems, and improved battery life. They have become a valuable tool for people with disabilities, allowing them to move with ease and improve their manoeuvrability.

Electric wheelchair, **any seating surface with wheels affixed to it that is propelled by an electrically based power source**, typically motors and batteries. The first motor-powered wheelchairs appeared in the early 1900s; however, demand for them did not exist until after World War II.

The history of the electric wheelchair includes the following notable events:

1916

The first motorized power chair was officially recorded in London.

1953

Klein's electric wheelchair was made public. The prototype was distributed with patent-free rights, which enabled mass-production of the new technology across the world.

1984

Dan Everard developed an electric wheelchair that could be used by children as young as 12 months old.

1986-1989

The "Turbo" Mark VI powered wheelchair was developed in England for children as young as two.

2. Literature Review

Perform movements or perform daily activities. This types of persons -mainly dependent on others for their assistance. But they can independent and perform some daily activities on their own with the Ag assistive devices. The most widely used assistive devices are Wheel chairs .Wheel chairs is basically a chair fitted with wheels, which can help people move around who cannot walk because of illness, disability or injury. But there are many disabled people with weak limbs and joints who cannot move the wheelchair. Thus, smart wheelchair can benefit a lot to them and everyone in society. Smart wheelchairs are electric powered wheelchairs with many extra components such as a computer and sensors which help the user or guardian accompanying wheelchair to handle it easily and efficiently. The recent development in the field of Artificial Intelligence, sensor technologies and robotics help the growth of wheelchairs with new features. This paper is to review the current state of art of smart wheelchairs and discuss the future research in this field Any condition of body or mind that makes it more difficult for the person with the condition to do certain activities and interact with the world around conducted in 2001 has revealed that around 21 million people from India i.e. 2.1% suffering from disability of some kind or another. In 2011, census reported that there has slight increase from 2.1% to 2.21%, Out of which people suffering from disability of movement is large [6]. Disability of movement is deformity of body due to which person suffering finds difficult to move from one place to another and perform daily activities. Disability of movements can occur by birth or due to accidents or various other reasons. So, use of assistive devices can prove to be of great help to such peoples. Assistive device are any devices which help to overcome people suffering from disabilities, Most commonly used assistive devices are wheelchairs. Wheelchair is nothing but a chair fitted with four wheels and can be easily moved fro place to another, Manual/traditional wheelchair require physical force by the user, which cannot be con as the efficient way because, it may cause discomfort for the user with weak limbs and bones. This i electric powered ,wheelchair are generally preferred over traditional and manual wheelchair. Electric wheel chair are easy 10 use and require minimal force to control the wheelchair them is termed as disability. Census% of total country's population are Electric and traditional wheelchair often solves the problem of mobility for disabled persons. But, there are certain segment of disabled person who suffer from low vision, visual field reduction, spasticity, tremors, cognitive deficits, etc. These people largely rely on other people for controlling the wheelchair. Controlling

wheelchair all by themselves is not safe. To solve this problem, researchers have come up with the discovery

A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually (by turning the wheels by the hand) or via various automated systems. Wheelchairs are used by people for whom walking is difficult or impossible due to illness (physiological or physical), injury, or disability. Wheelchairs today are now considered not only a means of transportation but also as a way to allow users to express their individuality. Users can find custom-made high quality ultra-light high-performance wheelchairs as well as accessories that enable them to individualize their look and style. Wheelchairs have been around for hundreds of years, but early wheelchairs were intended only to help a disabled individual move from point A to point B.As society progressed and disabled individuals became more integrated, the role of the wheelchair began to change as well. Wheelchairs today are now considered not only a means of transportation but also as a way to allow users to express their individuality. Users can find custom-made high quality ultra-light high performance wheelchairs as well as accessories that enable them to individualize their look and style

There were many attempts to connect furniture to wheels dating back to the time of Christ. But perhaps the first wheelchair was invented for King Phillip II[7] of Spain. A drawing of the King dated 1595[7] shows him in a chair with wheels, armrests and footrests. However, he needed assistance to propel it and the chair resembled more a modern baby's highchair than a wheelchair of today. In 1665 one of the first self-propelled vehicles was invented by Stephan Farfler. But it looked more like a present day hand-bike than a wheelchair as it was propelled by hand cranks attached to the front wheel. The modern wheelchair began to take shape in the late 19th century to early 20th century with the advent of push rims for self-propulsion and slings for seat and backrests[7]. The 20th century saw a rapid development in wheelchairs, from the first motorized wheelchair, to the first folding wheelchair, to lightweight and sports wheelchairs. The most recent two decades have seen the progress in the modern wheelchair accelerate. They are lighter and perform better than ever before. There are many different types of wheelchairs that are used for various reasons. It is important to understand the limitations and safe operation of whatever wheelchair we choose.

A. Manual Wheelchairs[8] Manual wheelchairs are the type that requires people to move them; there are three types of manual wheelchairs namely self-propelled, attendant

propelled, and wheelbase. Many manual chairs can be folded wheelchairs for storage or movement into a vehicle. A single-arm drive enables the user to turn either left or right while the two-armed drive enables user to move forward or backward on a straight line. Another type of wheelchair commonly used is a lever-drive wheelchair. This type of chair enables the user to move forward by pumping the lever back and forth.

B. Electric Wheelchairs[9] The electric powered wheelchair was said to be invented by George Klein who worked for the National Research Council of Canada, to assist injured veterans during World War II.A power chair can be used by someone who hasn't got the dexterity or mobility, perhaps, to drive a mobility scooter due to arm, hand, shoulder or more general disabling conditions, and do not have the leg strength to propel a manual chair with their feet. EPWs can offer various powered functions such as tilt, recline, leg elevation, seat elevation, and others useful or necessary to health and function. A power chair user might also have special seating or arm and leg rest requirements that are better served by a power chair than a mobility scooter. The technology involved in electric wheelchairs is similar to that of mobility scooters and some power chair manufacturers are offering models that look more like a mobility scooter than a traditional wheelchair. Today you will find three general styles of electric powered chairs (EPWs)[13]: rear, centre, front wheel driven or four wheel driven. Each style wheelchair has particular handling characteristics.EPWs are also divided by seat type; some models resemble manual chairs, with a sling-style seat and frame, whereas others have 'captain's chair' seating like that of an automobile. EPWs[8] run the gamut from small and portable models, which can be folded or disassembled, to very large and heavy full-featured chairs (these are often called 'rehab' chairs). The user typically controls speed and direction by operating a joystick on a controller. Many other input devices can be used if the user lacks coordination or the use of the hands or fingers, such as chin controls and puff/sip scannersPower chairs are usually controlled by a joystick on the armrest which can be fitted on either armrest to suit left or right handed use. The arm rest can usually be swung out of the way so that the user can get closer to a desk or table for example. If a joystick control isn't appropriate for the user's needs, there are other methods[12] of operating the power chair, including a head controller, a sip and puff tube, fingertip control or foot control for those with C2-3 spinal cord lesions or head injuries (the user blows into a tube located near the mouth, which controls the movement of the chair).A power chair or

electric wheelchair can bring independence and freedom to those currently reliant on others. Once you have decided on a power chair rather than a mobility scooter or wheelchair, there are still plenty of other choices to be made. Including the price, the style and size of the power chair, how portable the power chair is, and how far it goes between charges.

C. Pediatric Wheelchairs[10] Most pediatric wheelchairs fall under the following categories:Standard Wheelchairs – These are the so-called traditional styles, Small Child Wheelchairs[14] – This variety is designed for kids under the age of six, Sports/Lightweight

D. Types of Wheelchairs For Kids [11] Like adult wheelchairs, the pediatric models are available in different shapes, sizes, colors, and designs. You can even have one especially designed and custom-made based on the child's needs. You can also choose between a manually propelled and a motorized wheelchair. E. Manual Pediatric Wheelchair[11] Manual pediatric wheelchairs are the most popular type used by kids of all ages. Motors do not propel this type of wheelchair [15], so either the occupant or caregiver must push the chair around. In addition, children with severe disabilities are not advised to use such kind of mobility aid since they don't have the capacity to move without assistance. F. Draw Backs of Presently Available Wheelchairs: Used for a particular disability. A system does not monitor the surrounding conditions and health condition of patient. No systems for bed lying patients. No systems for mentally challengers. Physical barriers place additional requirements on the strength and durability of wheelchairs.

3. Methodology

The methodology of a smart electric wheelchair involves a combination of hardware and software, as well as sensors and instruments that allow the wheelchair to interact with the user and environment: We Are designing our Wheel Chair using Solid works, as it is very reliable and easy to use.

3.1 Hardware

The wheelchair itself, along with DC motors, a battery, and a chain sprocket mechanism that connects the motors to the wheels

3.2 Control Methods

Easy switching control System with Our making circuit diagram

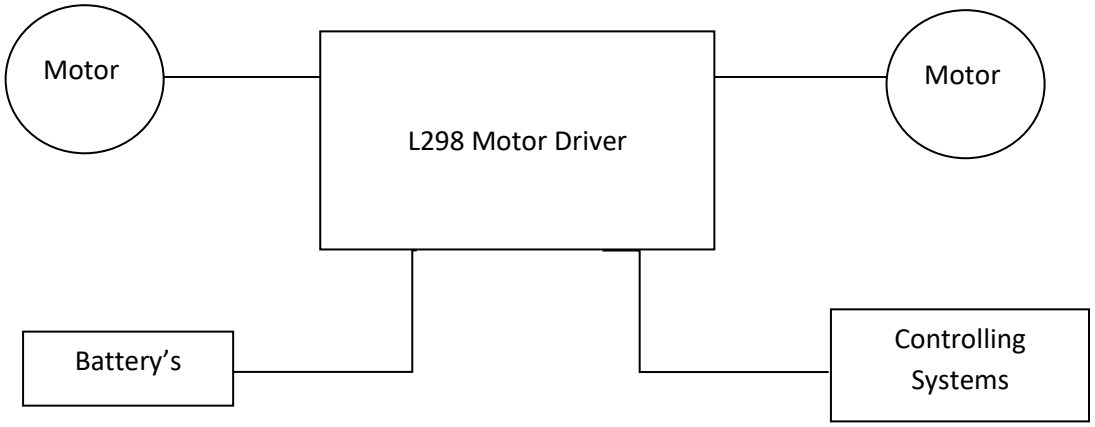

Figure: 3.1 Block Diagram of Electric Wheel Chair.

(We are tried driving six motors through L298n motor driver with self made circuit diagram without use any program)

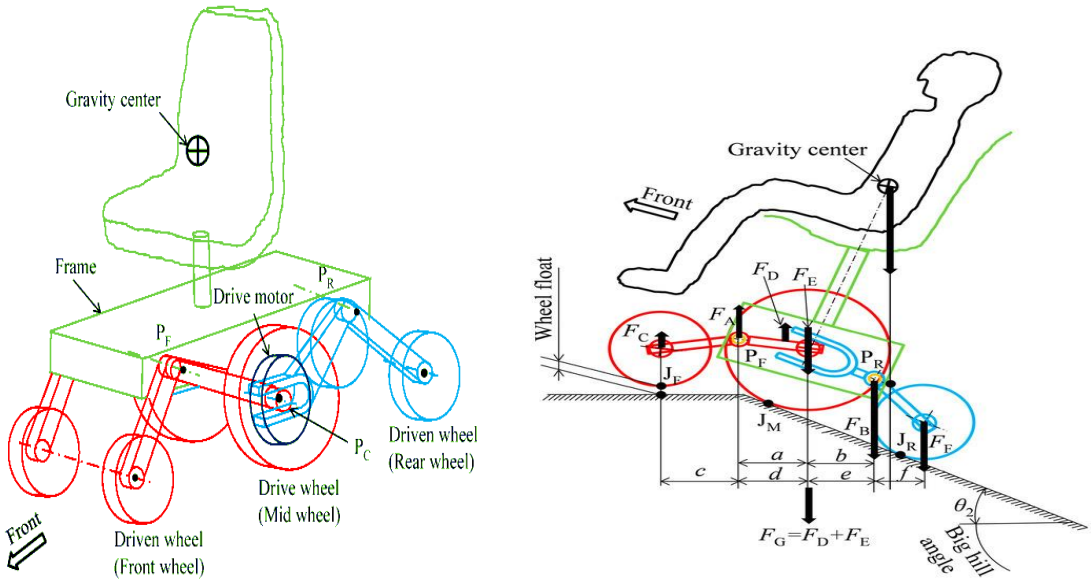

Figure: 3.2 Block Diagram Whole of Electrical Wheel Chair (A, B)

3.3 Operating Procedure

Operating modes of wheelchair is another important distinguishing factor of smart wheelchair. Operating modes of wheelchair depend upon the user ability and according to the current situation

3.1.1 On the main power

3.1.2 If you S1 Switch on you can move forward.

3.1.3 If you S2 Switch on you can go back.

3.1.4 If you S3 Switch on you can go Right.

3.1.5 If you S4 Switch on you can Left.

4. Description of Using Materials in Electric Wheel Chair

4.1 What is Double H-bridge Drive Chip: (L298N)

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two - DC motors at the same time. The module can drive DC motors that have voltages between and 35V, with a peak current up to 2A

- Current Sense for each motor: Yes
- Heatsink for better performance.
- Power-On LED indicator.
- Double H bridge Drive Chip: L298N.
- Operating Voltage(VDC): 5~35
- Peak Current (A): 2
- Continuous Current (A): 0-36mANo. of Channels: 2
- Over-Current Protection (A): Yes
- Thermal Protection: Yes

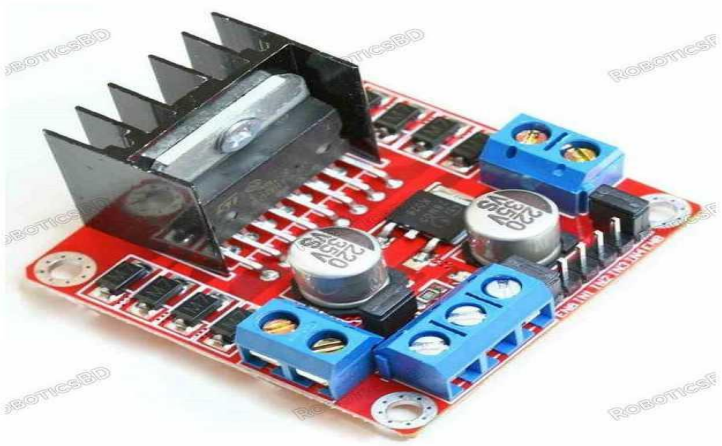

Figure: 4.1 L298N Motor driver

4.2 Diode

A diode is a semiconductor device that allows an electrical current to flow in one direction, while restricting the flow in the opposite direction:

Figure: 4.2 Diode

Function: Allows current to flow in one direction, depending on the voltage applied between the anode and cathode Components: Two terminals, called the anode and cathode

Materials: Made from semiconductor materials like silicon, germanium, or Selenium

Uses: Rectifier circuits, voltage regulators, signal limiters, switches signal modulators, signal mixers, signal demodulators, and oscillators

Symbol: An equilateral triangle with a line passing through one of its vertices

4.3 Rechargeable Battery

Rechargeable battery is a battery that can be charged and discharged multiple times, unlike a disposable battery, which is only used once. Rechargeable batteries are also known as secondary cells or storage batteries. Rechargeable batteries work by using reversible cell reactions to regain their electrical potential when exposed to an electric current. The process of charging and discharging a battery involves redox chemistry, which is the exchange of electrons between substances. Rechargeable batteries can be made from a variety of materials, including:

Lead—acid

Zinc~air

Nickel-cadmium (NiCd)

Nickel—metal hydride (NiMH)

Lithium-ion (Li-ion)

Lithium iron phosphate (LiFePO4)

Lithium-ion polymer (Li-ion polymer)

Rechargeable batteries can be more environmentally friendly than disposable because they reduce the need to constantly manufacture and dispose of single-use.

4.4 What is UPVC

UPVC stands for unplasticized polyvinyl chloride, which is a type of piping that is made from PVC plastic. It is becoming an increasingly popular choice for water and wastewater systems because of its many advantages over traditional materials like metal and concrete.

4.5 Electrical Push Switch

A push button switch is a mechanical device used to control an electrical circuit in which the operator manually presses a button to actuate an internal switching mechanism

Figure: 4.5 Electrical Push Switch

4.6 Veroboard

Veroboard is ideal for development and prototyping work, Veroboard is designed Primarily for hard wiring of discrete components, typically in analogue circuits, but is equally useful where a number of common bus or signal lines are required.

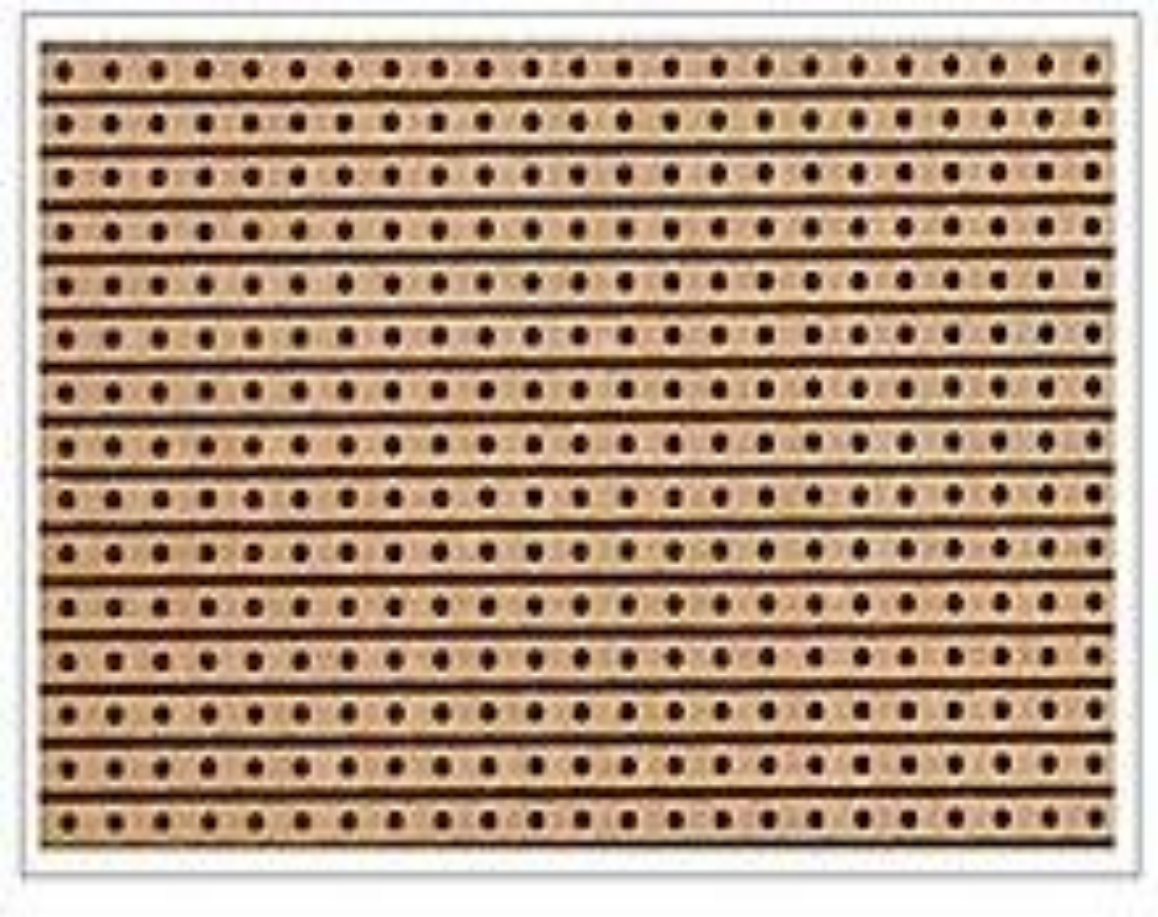

Figure: 4.6 Veroboard

4.7 DC Gear Motor

A DC gear motor is a combination of a DC motor and a gearbox. It works on the principle of electromagnetic induction, where a current-carrying conductor placed in magnetic fields, experiences a force and causes the rotation of the motor.

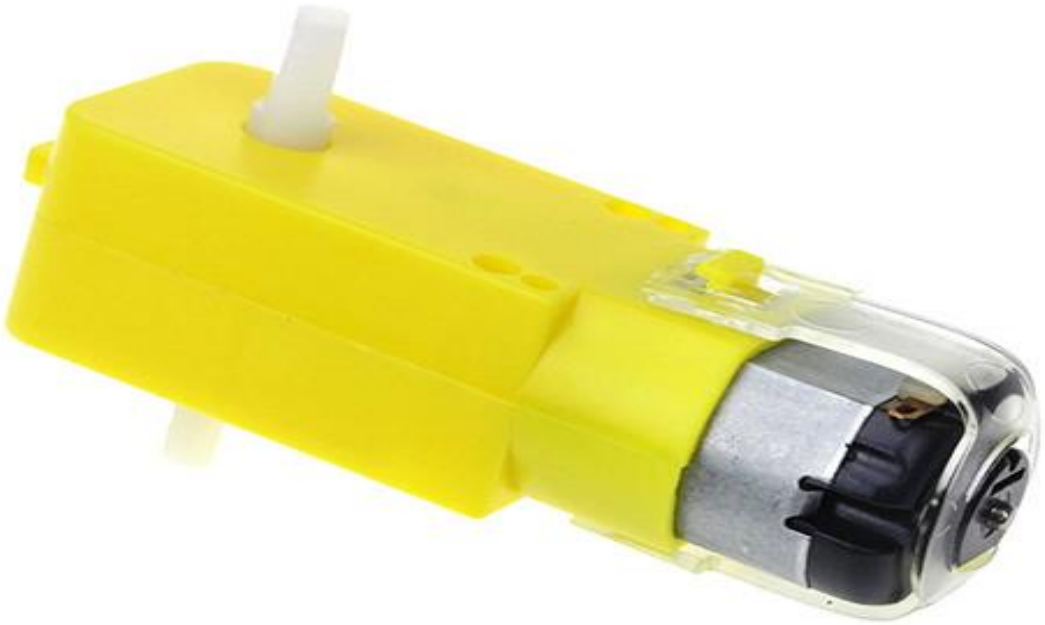

Figure: 4.7 DC Gear Motor

4.8 LED

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process.

4.9 Jumper Wire (Connector)

A jumper wire, also known as a jump wire or DuPont wire, is an electrical wire with connector pins at each end that's used to connect two points in a circuit without soldering. Jumper wires are often used with breadboards and other prototyping tools to connect components of a circuit, or to diagnose problems in a circuit. Here are some uses for jumper wires:

Prototyping

Jumper wires are an essential part of prototyping, allowing you to quickly connect components to the PINs of your microcontroller to form circuits.

Circuit modification

Jumper wires can be used to modify a circuit or diagnose problems in a circuit.

Printed circuit boards

Jumper wires can be used to connect remote electric circuits used for printed circuit boards. There are three types of jumper wires: female-to-female, male-to-male, and male-to-female

4.10 Multi Meter

An instrument designed measure Electric current, voltage and usually resistance, typically

over serial ranges of value. Two type of Multi meter such as being:

1. Digital Multi meter

2. Analog Multi meter

4.11 Digital Multi Meter

A digital multi meter (DMM) is a test tool used to measure two or more electrical values principally voltage (volts), current (amps) and resistance (ohms). It is a standard Diagnostic tool for technicians in the electrical/electronic industries.

Figure: 4.11 Digital Multimeter

4.12 Analog Multi Meters

Digital multi meters are instruments that are used to measure electrical quantities such as voltage, current, resistance, frequency and signal power. Basic functionality includes measurement of potential in volts, resistance in ohms, and current in amps. Digital multi meters are used to find electronic and electrical problems. Advanced units come with more features such as capacitor, diode and IC testing modes.

Figure: 4.12 Analog Multimeter

4.13 Measurement Types of Analog Multi Meter

Specific measurements made by Digital multi meters include DC voltage, , DC current

4.14 Cutting Pliers

Pliers are a hand tool used to hold objects firmly, possibly developed from tongs used to handle hot metal in Bronze Age Europe. They are also useful for bending and compressing a wide range of materials. Generally, pliers consist of a pair of metal first-class levers joined at a fulcrum positioned closer to one end of the levers, creating short jaws on one side of the fulcrum, and longer handles on the other side. This arrangement creates a mechanical advantage, allowing the force of the hand's grip to be amplified and focused on an object with precision. The jaws can also be used to manipulate objects too small or unwieldy to be manipulated with the fingers.

4.15 Star Screw Driver

Electrical works a lot of importance to star screw driver. Without star screw driver it is impossible to connect a lot circuitry. Many sizes are available in the market for star screw driver, There are used depending on the work. There for a lot of importance to screw driver.

4.16 Flat Screw Driver

Electrical works a lot of importance driver. Flat screw driver used in some electrical circuit. All goods that's required for the flat screw driver. Flat screw driver in a variety of market depending on the use for their work. There for a lot of importance of flat screw driver.

4.17 Soldering Iron

A soldering iron is a handheld tool used to heat solder and create a permanent bond between two work pieces. Here are some details about soldering irons: The iron's heated tip melts solder , which is then directed into the joint between the work pieces. Once the solder cools and hardens, it creates a permanent bond. A soldering iron has a heated metal tip and an insulated handle. The tip is often made of an elongated metal with a heating element.

4.18 Glue Gun

Glue guns are electric tools that melt and apply adhesive sticks. The glue is pushed through a

nozzle by pulling a trigger or manually. The glue is usually dispensed in thin strips and hardens in a couple of minutes.

4.19 Safety Precaution

- Never try to work on electricity without proper guidance and care
- Work with electricity only in presence of those per
- practical work to deal with electricity

5. RESULTS AND DISCUSSION

Figure: 5a and 5b describe the proposed electric wheelchair. The experiment is conduct with the wheelchair will operate in flat and terraced terrains. The experiment results will show that the proposed wheelchair operates smoothly, and the safety system will instantly inform the relatives of the user about emergency problems.

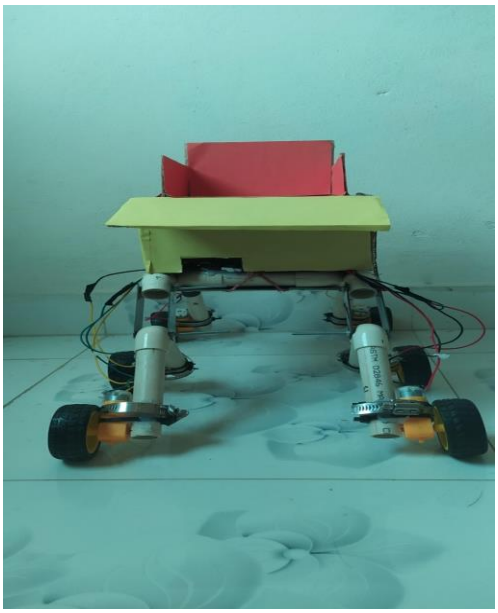

Figure: 5a The designed electric wheelchair

Figure: 5b The designed electric wheelchair.

Table: 5.1 Operating Result Chart

Direction	Right motor	Left motor
Forward	On	On
Backward	On	On
Right	Off	On
Left	Off	On
Stop	Off	Off

6. Conclusions

In conclusion, advantages of an electric (motorized) wheelchair over manual wheelchairs include: providing increased independence, less physical strain, increased efficiency, improved comfort, greater accessibility, and improved safety. Make more places accessible. Electric wheelchairs can be used indoors or outdoors, providing constant support for people who need them throughout the day. Powered chairs also offer a tight turning radius which means they are ideal for negotiating smaller spaces. Wheelchairs provide mobility, postural support and freedom to those who cannot walk or have difficulty walking, enabling them to move around, participate in everyday activities and live life on their own terms. An electric wheelchair provides significantly increased mobility and independence for individuals with physical disabilities, allowing them to participate more actively in their communities by offering easier navigation, reduced physical strain, and greater accessibility compared to manual wheelchairs, ultimately enhancing their quality of life; however, factors like cost, battery life, and terrain limitations should be considered when choosing an electric wheelchair based on individual needs.

This project elaborates the design and construction of Electronic Wheelchair with the help of Wi-Fi Module. After designing the circuit that enables physically disabled to control their wheel using an android application in their smart phones and it has also been tested and validated. This proposed system contributes to the self- dependency of differently able and older people. This project work was carried on to fulfil the requirement of Major Project of Bachelor in Mechanical Engineering.

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