

# SOLAR POWER MOTORIZED WHEELCHAIR- DESIGN AND DEVELOPMENT

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## Abstract

This project aims to develop a Solar based Wheel Chair System for the physically handicapped people at an accessible cost. An assistive technology known as motor controlled with solar power chairs is used to deal with loss of mobility for the patients who are not able to walk normally due to some injury or some other age related walking disabilities (permanent or under treatment). There is a vast development in the field of wheelchairs. Researchers are going on to develop reliable, low cost and easy to use devices. Out of all the advantage of using Motorized System when patients become completely paralyzed, the only resource available to them for moving is wheel chair. Non bio-signal based devices provide 100% accuracy and require less training for patients but the usage of these by using the solar power for charging of the battery flexibility in usage increases. Wheel chairs is limited to patients with partial or complete flexibility in their body parts. People are switching over the renewable source of energy for their requirements, Solar energy is one of the source which is free of cost and present in abundance so by automating the wheelchair with the help of power generated by solar energy it can cut the overall cost of fuel and become eco-friendly in nature and can set a limit in the world of Automation. In this paper "Solar Powered wheelchair", its construction, working and component used is studied in detail, and all the project work is done in Nagpur In today's world there are many disabled persons who find it difficult to perform movements or perform daily activities. This types of persons are mainly dependent on others for their assistance. But they can become self-independent and perform some daily activities on their own with the help of assistive devices. The most widely used assistive devices are Wheelchairs. Wheelchairs 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.

**Key words:** Wheels, DC gear motor, Solar PV panel, Lead acid battery, Voltage regulator, Motor controller, Charge Controller

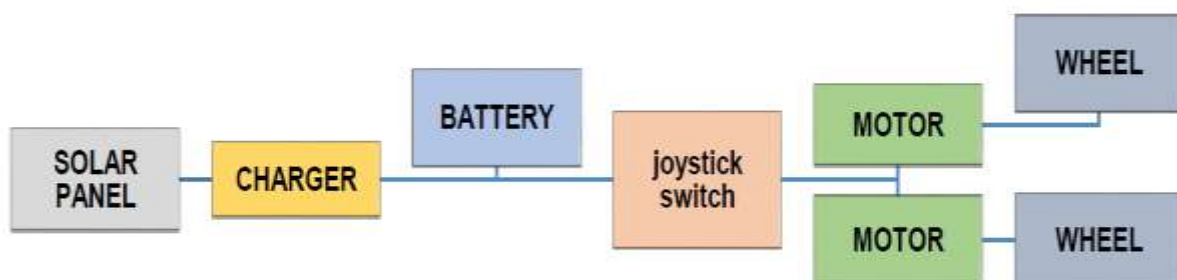
## Introduction

As the horizontal of Technology is increasing day by day the whole world is moving towards Automation a wide range of wheelchair working on the Motion control ,Gesture control, Bluetooth control etc. are continuously launching in the market. Most of the wheelchairs either requires AC supply for charging the battery or fossil fuels (for the fuel engine type wheelchair). This drawback can also be eliminated by introducing a renewable source of energy for supplying power, that is Solar energy. Solar energy is one of the major source of energy which is present in abundance and free of cost. Our project “Solar Powered Wheelchair” is based on the Automatic wheelchair which is driven by the DC motors and it gets the power generated by the Solar Panel. The Automation involves the movement of the wheelchair forward, backward, right, and left with the help of Joystick which is connected to the PCB circuit board. The whole wheelchair works on the 12 volt DC supply to the motors through the relay circuit .This paper gives an idea about the construction, working and component used in the Automatic Wheelchair and supplying energy to this Wheelchair through solar energy (solar panel) which ultimately reduces fuel cost and creates the whole wheelchair eco-friendly. A motorized wheelchair or electric-powered wheelchair is a wheelchair that is propelled by means of an electric motor. Motorized wheelchairs are useful for those who are not able to impel a manual wheelchair or who may need to employ a wheelchair for distances or over terrain which would be strenuous in a manual wheelchair. They may also be used not just by people with conventional mobility, but also by people with cardiovascular and fatigue based conditions. Electric wheelchairs have enhanced the quality of life for many people with physical disabilities through the mobility they afford. The most fundamental job of the chair is to take input from the user, usually in the form of a small joystick .

## Components

In below block diagram, we can see that the system consist of following major components

1. Solar panel : Solar energy can be stored to utilize at night and when there is a cloudy conditions. Storage is an important issue in the development of solar energy because continuous availability is a vital requirement of modern energy use. Solar energy is only available in the hours of daylight. A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells
2. Wheels : These are called wheel hub motor, (also called wheel motor, wheel hub drive, hub motor or in-wheel motor) an electric motor that is incorporated into a hub of a wheel and drives directly. Hub motor electromagnetic fields are supplied to the stationary windings of the motor.
3. Battery : 12 V, 8 Amp Battery is high power battery easily handle all the function. Main things are to collect electrical energy from solar panel and provide to various components For running specific function. An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices.
4. Charge controller
5. Switch and Toggle : **switch** is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch removes or restores the conducting path in a circuit when it is operated.
6. Motors : DC motor is an electrical machine that utilizes electric power resulting in mechanical power output. Normally the motor output is a rotational motion of the shaft.



**Fig.-1** functional block diagram**Description**

The solar wheelchair is made up of DC motor, a battery, wheels, solar panel. The Solar panel is a charging system which charges the battery while in operation. The D.C. motor forms the heart of the machine and provides the driving force for the drives the wheels. The system is powered by an electrical switch which completes the circuit comprising the DC motor and the battery.

Solar Wheelchair are based on the use of small but powerful engine that provides enough torque to carry the weight of person. In most cases, the motor is situated separately from the wheels with the help of chain but in solar wheelchair motor is in direct contact with wheels. There also a mechanical support is provided for balance the chair. It uses the photovoltaic panel to generate the energy needed to power the solar wheelchair.

Fig 1 shows the functional block diagram of the solar wheel chair .This diagram represents how the solar wheelchair works. The battery is charged by solar power. Batter charge controller or charge regulator saves the battery from overcharging. The direction controller is also connected with the battery bank the direction controlling process is shown in table 1. When the joystick is in left direction the DC motor R moves forward and DC motor L has no movement to rotate in left direction. When the joystick is driven forward both the motors move forward to give a speed in forward direction. When the remote is in right direction the DC motor L moves forward and DC motor R has no movement to rotate in right direction. When the remote is driven backward both the motors move backward to drive it in backward direction.

The two motors gets conduction in such a way that the wheel chair can move in front, right, left and back direction The proposed solar power wheelchair is appropriate for those who are unable to propel a manual wheelchair. It also reduces the strain on shoulders and arms so one can continue to perform transfers safely. Our proposed solar power wheelchair facilitates user in different way. The features are:

- \_ Implementation of the controlling circuit and fixed it in a specially designed wheelchair.
- \_ Solar panels in this solar wheel chair are constructed with lightweight plexi glass where the standard glass sheeting is nowadays used in solar panel construction. The advantage of light weight plexi glass is it is approximately 18 times strong than normal glass.
- As it is a light weight glass it is comparatively easy to move with it in the wheel chair.
- \_ Cost efficiency.
- \_ It has speed close to normal peoples walking speed. So no chance of accidents to cause.
- \_ There will be no strain in moving the joystick.
- \_ There is a button for tilting the seat as required. So a long sitting on the chair will not affect the patients backbone.
- \_ The wheelchair has a great balance. The design is made keeping the balance.

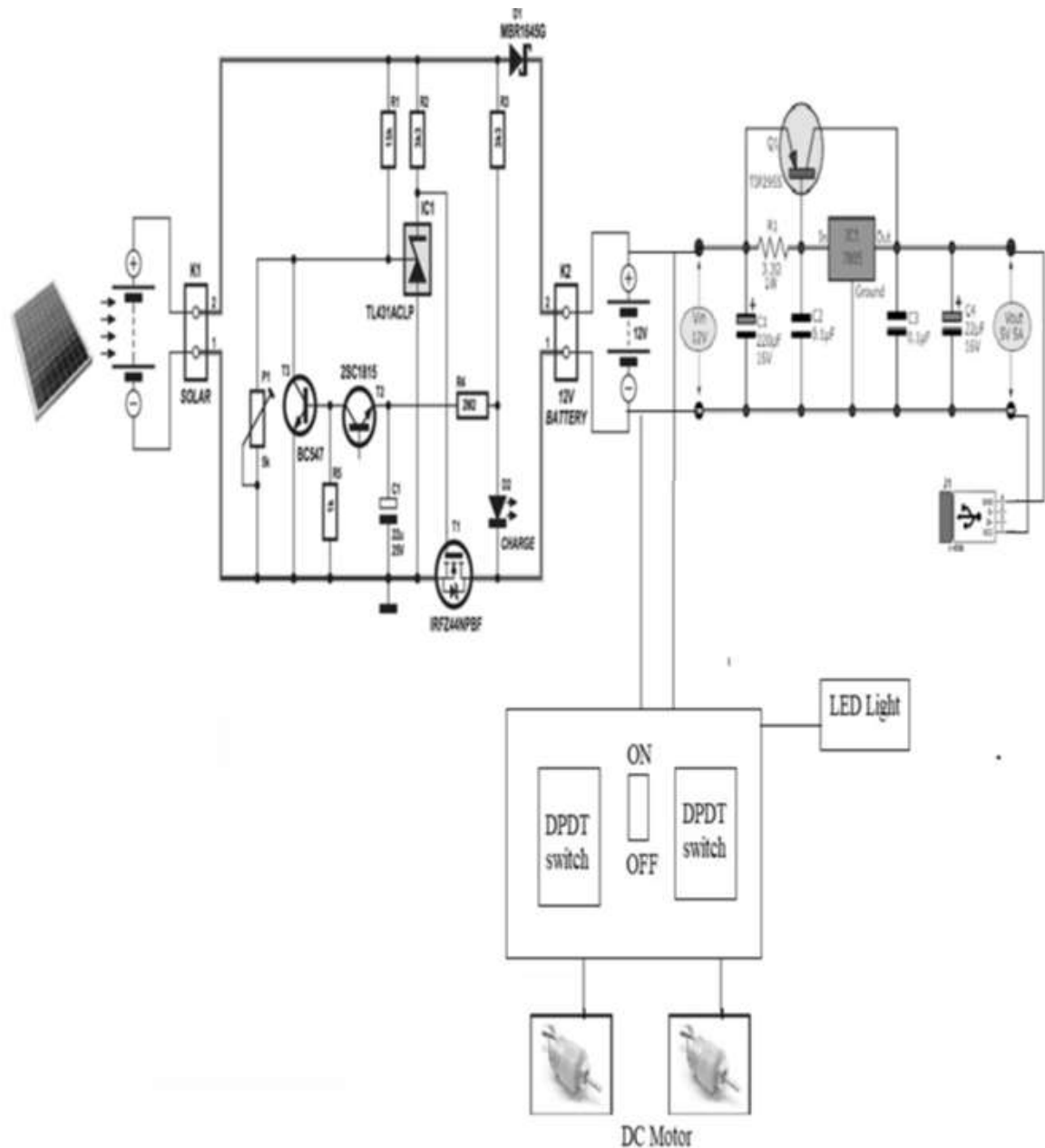


Fig.:- Circuit Diagram

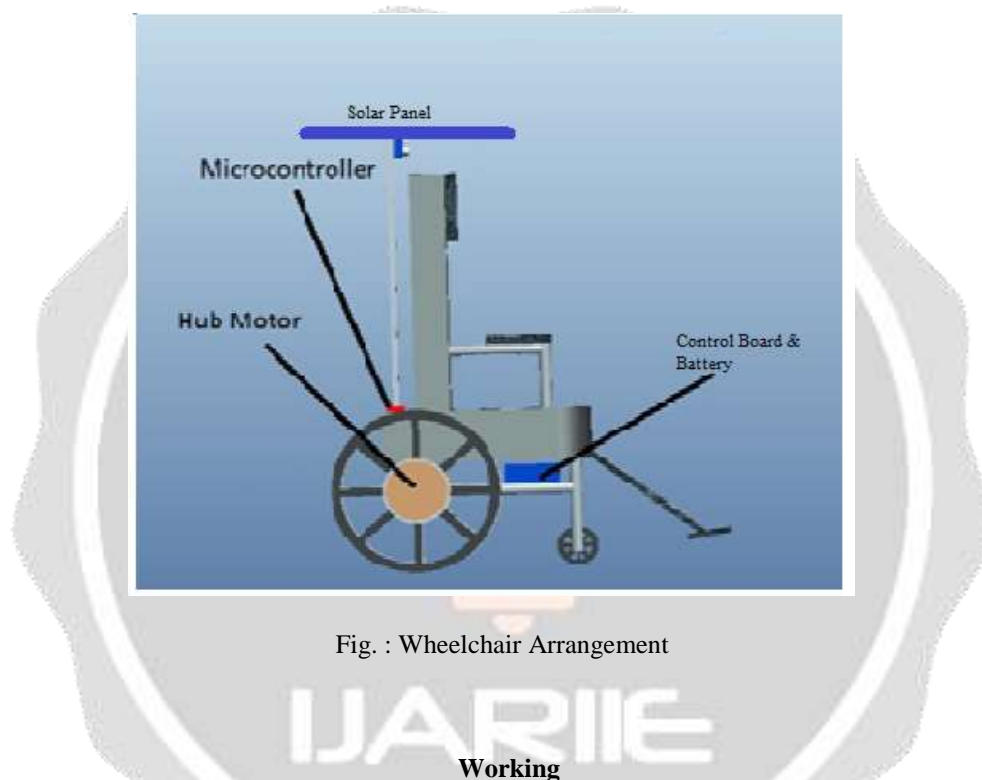
**Structural Design**

A general wheelchair built into the location become used to launch it because the basic infrastructure of the version. The front wheels of this wheelchair can flow in any route whether or not the rear wheels are moved or no longer by means of pushing them via hand. the primary parts or parts of a wheelchair are dc motor, wheels and many others.

- DC Motor helps rotate the tire wheel.
- Caster wheel on the the front structure that allows for easy rotation in any route.

- It's miles a simple, reliable and powerful method of shifting strength from motor to shaft.

Principal changes are being made to this building design. as opposed to the use of a standard shaft, switches are changed with DC vehicles related to the wheels. An aluminum tray is sold underneath the seat for dc gear motor and battery. single-cell dry batteries are used for electricity. The control circuitry is located underneath a chair protected with a field. And the sun panel is located on top of the EWC. Joystick mounted on EWC's right manage. energy comes from a cable that is transmitted by means of cable. This cable is going to the control unit and is hooked up to the motor. After completing the electromechanical mechanical connection, a wheelchair-installed structure is provided in Fig. below.



The “Solar Powered Wheelchair” works on the power generated by the solar panel 20Watt/12V which gives approx. 500 milli Ampere current and then the same power is feed to the Lead-acid battery. As we know that solar power is not constant in supply so it needed to be stored first for the constant supply to the DC motors. There is a placement of a charge controller before the battery to limit the overcharging of the battery. There is also a provision to charge the battery through rectified AC supply via charge controller in extreme weather condition when the sunlight is not enough to generate the power. In between battery and solar panel there is a control circuit that is for direction control and known as directional control circuit (PCB circuit). The direction control circuit is isolated in two parts. The one section where the operating voltage is 5v and the other section where the operating voltage is 12v with the help of opto-coupler. The reason behind isolating the circuits into two is to protect the microprocessor ATmega16. In case of failure of relays the electromagnetic coil in the relay get highly energized due to high rush in current which ends up changing the logic of the microcontroller ATmega16 and in some case damage the battery as well. The capacitor is charged through the battery and discharged in the same circuit. On the other section we have the components like relays and resistors, diodes and transistors. There is placement of 4 DC relays, 2 for on 1 DC motor and 2 relays for other DC motor. The relay of 7A,12V\250V works on the NO and NC contactor objective. There is approx. 2 milli Ampere current loss in the each relays. The resistors function to control the flow of current to other components when large amount of current rush in a circuit during any abnormal condition occur in the PCB. The diode’s function in this circuit is to allow an electric current to pass in a single direction, while closing it in the opposite direction. After

the directional control circuit the power is feed to the DC motors with the gear assembly attached to it for smooth motion.

### Conclusion

The attempt created in fabricating a solar powered Wheel Chair with the obtainable autochthonous material is self-made. The operating of the wheel chair shows the autochthonous infrastructure and therefore the capabilities of the wheel chair. The Recharging capability of the panels is satisfactory, the specified practicality of the steering system is achieved. This project "Solar powered Wheelchair" has been with success developed, and has achieved its aim and objective with success. It's capable to regulate the chair motion for disabled folks exploitation renewable supply of solar energy that's alternative energy. Enhancements will be created by running the chair on direct alternative energy without battery.

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