



LOW COST SOLAR POWERED WHEELCHAIR

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Abstract

Wheelchair is a special type of chair for the transportation of a disable person who is unable to walk as a result of illness, injury or disability. Earlier, a mechanical wheelchair was used by the disable person, but it was very tough to handle by disable person. Presently, a user friendly electric controlled wheel chair is available for those people. One can get an electrical wheel chair from the online or offline market. To buy an electrical wheel chair one has to pay a minimum amount of Rs. 40,000/- in India. In this work, a prototype solar wheel chair is fabricated with an optimal cost of Rs. 5700/- for physically disabled people. Silicon solar panel is installed on the top of the wheel chair for charging the battery and/ or directly uses the solar power during day time. The whole prototype of the wheel chair is about 1-1.5kg in weight, and it can carry up to 5kg weight.

1. Introduction

Now a day in rural areas, people are not getting sufficient power or no power supply. Disable people with low income from these areas cannot use costly electric wheel chair, so they face difficulties with mechanical wheelchair. The cost of the available electric wheelchair is very high, nearly

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Rs. 40000/- [1] in India. Middleclass disable people are unable to afford such type of wheelchair. For the use of these chairs need charging the battery frequently according to the capacity of the battery. In rural areas, where people are not getting sufficient power or no power supply, disable people cannot use electric wheel chair, so they face difficulties with mechanical wheelchair. Disable people from remote rural places are used mechanical wheelchair. People using electric wheelchairs; have to pay more for charging the battery in a continuous interval. Disable people from remote rural places are used mechanical wheelchair. People using electric wheelchairs; have to pay more for charging the battery in a continuous interval. We have fabricated a prototype solar wheel chair with an optimal cost for physically disabled people to make their normal life easy. Solar power is used for charging the battery of available electric wheel chair to reduce the cost of electric charging system [2-4]. A silicon solar panel can be installed on the top of the wheel chair for charging the battery and/ or directly use the solar power during day time. Such system may reduce the overall cost of the wheelchair.

2. Block Diagram

From the block diagram one can get the basic idea of project. There are mainly two block diagrams. One is about the whole solar powered wheel chair and another is about only the controlling unit of the wheel chair.

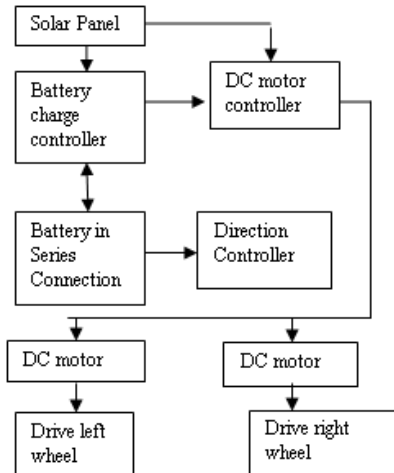


Figure 1. Functional block diagram of Solar powered wheel chair.

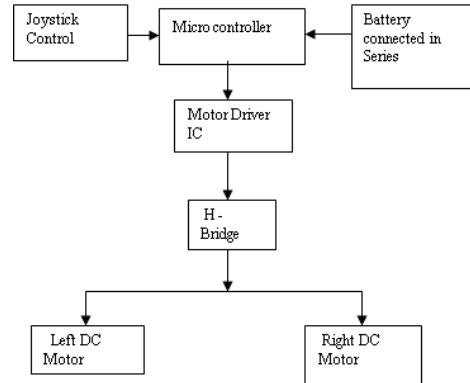


Figure 2. Block diagram of the controlling circuit of wheel chair.

3. Feasibility Analysis

On direct Sun light, a solar panel can charge battery of wheel chair and use this power for operation. Figure 1 represents the block diagram of solar powered wheel chair. During day time DC motor controller can directly take power from the panel and during night from the battery. The directional controller circuit controls two DC motor and gear circuits through DC motor controller unit. DC motors and gears circuits control the movement of left and right wheels of the chair.

The controlling system of the chair is shown in figure 2. The joystick control switch is connected with a PIC microcontroller. The microcontroller is programmed in such a way it drives the motor driver IC according to the input commands of the joystick. The left and right DC motors are connected with motor driver IC through *H*-bridge for front and back movement of the chair smoothly.

Remark 1. Environmental feasibility for the application

- It can be used in all season.
- It can work even in partial absence of solar energy due to the presence of battery.
- Solar panel is fixed in such a way that it provides shade to the person using it.

Remark 2. Application Range/Impact:

- The solar powered wheelchair will help physically challenged people a great deal in their day to day movements.
- The battery which is used to run motors in the wheelchair can be charged by exposing it to sunlight while in use or before.
- The prototype is designed in such a way that charging the battery can be done both by using solar panel and also if required by power supply (230v, 50Hz).

4. Cost Analysis

This project is also economically feasible. One can purchase this 'solar powered wheel chair' as a product in a very lost cost. The total cost of a product depends on the costs of each and every components used for manufacturing the product. The components used in the 'Solar powered wheel chair' are less expensive, so it is named as 'Low cost solar powered wheel chair' and it is cheaper than any electrical wheel chair available in the market.

A brief cost analysis of a prototype of the solar powered wheel chair is given the table format.

Components	Quantity	Cost(Rs)
Power Supply		
Solar Cell	4	1500
Battery (3.7V Rechargeable)	3	900
Charging Circuit	3	300
For Wheel movement		
DC motor	2	600
Stepper motor& Driving Circuit	1	300
Joystick	2	1000
H-Bridge Circuit	1	300
Arduino UNO Board	1	300
*Wheel Chair setup (for model chair)		500
Total		5700

5. Implementation Details

There are three dotted blocks shown in the block diagram section. The header block is basically the **PSU** (Power Supply Unit). In this section all the power supplier components are connected properly, like solar panel is converting the solar energy into the electrical power and via charging circuit that power is storing into the batteries which are connected in series. The right handed block below is the **CU** (Controlling Unit). In this block all controlling parts or components are connected. The Arduino board, which is a microcontroller, is the brain of the total CU. There are two joystick switches, connected with the arduino, to control the motion of the dc motors and the position of the stepper motor. The left handed block is about the **wheel chair system**. This section is describing that two DC motors, connected with two wheels, are connected in the back side of the wheel chair and one stepper motor is connected with the front wheels.

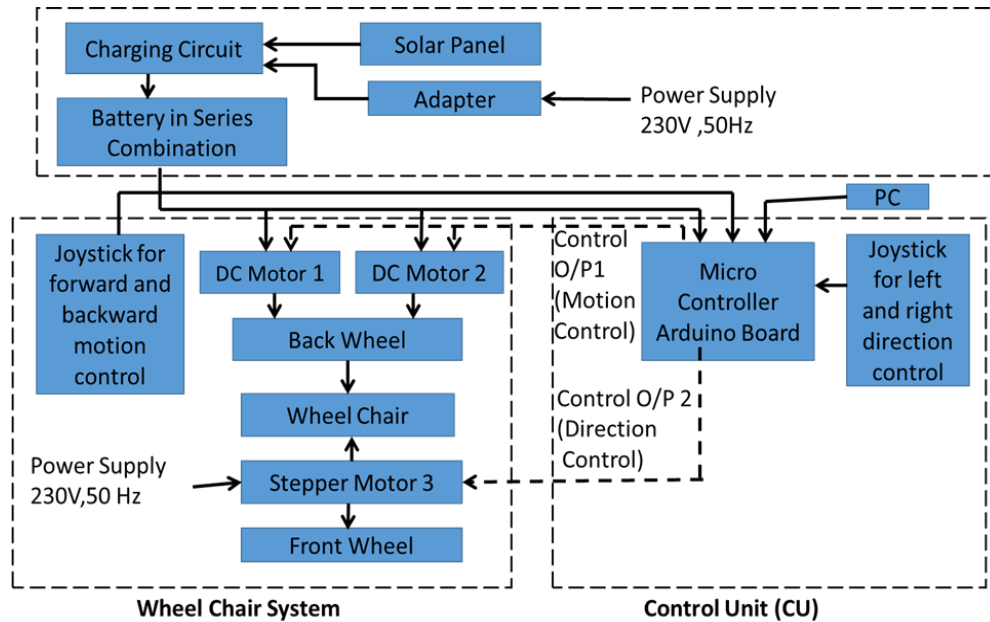


Figure 3. Block diagram of low cost solar wheel chair.

• **Circuit Diagram Description:**

The complete circuit diagram of the whole prototype is given in Figure 4. The brain of the complete circuit is the Arduino board where the program of the joystick control will be uploaded. There are four solar panels connected with each other and the output of the total solar panel is 11 volt and 600mA. Then that power is stored in the battery via charging circuit. 3 Li-ion batteries are connected in series; the output voltage of each battery is 3.7 volt. The output voltage of the battery is 12 volt. That voltage is going to the arduino board and activating the circuit. Then the arduino is distributing the voltage to many components, such as stepper motor driver, H-bridge and two joysticks. The stepper motor is getting power from the stepper motor driver; two dc motors are getting power from the H-bridge (L2930 IC). An additional buzzer is connected parallelly with the battery.

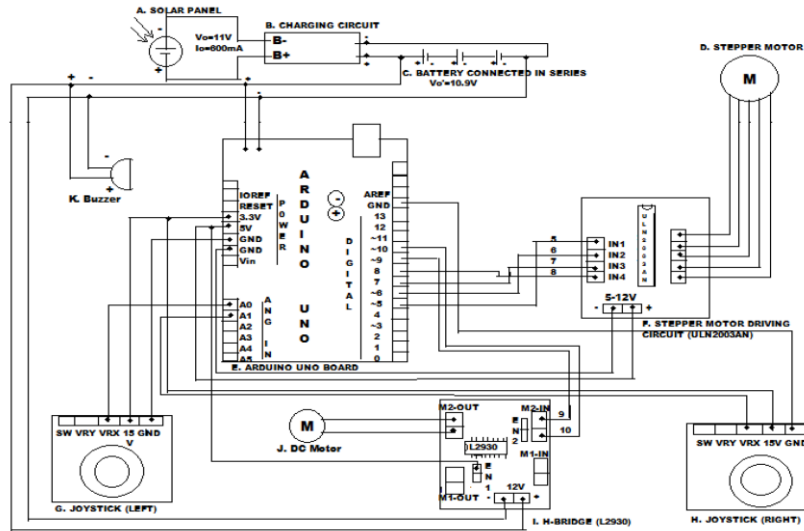


Figure 4. Circuit diagram of low cost solar wheel chair.



Figure 5. Prepared model of solar wheel chair.

6. Conclusion

The whole prototype of the solar powered wheel chair is about 1-1.5 kg in weight, and it can carry up to 5 kg weight. The solar panel takes approximately 8-9 hours to charge the battery fully. The left joystick is controlling the stepper motor which is controlling the left and right movement of the wheelchair, which is basically acts as steering control system, and the right joystick is the controlling the speed and forward & backward movement of the wheelchair.

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