



## DESIGN AND DEVELOPMENT OF SOLAR WHEELCHAIR FOR DIFFERENTLY ABLED

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**Abstract**— *The paper proposes an automated wheelchair which will help the physically challenged people and serve as a complete form of this automatic system (means of mobility). The most commonly used device for differently able peoples are wheelchair. We aimed to design a solar based wheelchair with control of joystick, for moving X-Y directions. The power backup of the solar energy is saved in lead acid battery. In this project two DC motors are used for separate wheels. Using of Arduino UNO based programming joystick work. Our smart feature of this wheelchair is solar power supply and AC power supply also for (indoor/outdoor) user/uses. This report contains all the components information related to the solar based wheelchair. The proposed wheelchair system is self-driven so it is very useful for the differently able. This is the best invention in the medical field. Early wheelchairs makes the use of grid supply for recharging batteries also the cost of those vehicles was not affordable for the mid-range persons. In this case an attempt is made to design a solar based wheelchair at an affordable cost, so it can be affordable and useful for the mid-range persons. While this solar powered wheelchair has been brought to live by adding maximum technological advancement.*

**Keywords**—Wheelchair, Solar panel, DC-motor, Lead acid battery, Joystick.

### I. INTRODUCTION

In this project have some interesting features like solar panel, joystick, DC motor, lead acid battery. These items are helpful for solar based wheelchair in automated system. But many of individuals with disabilities who need wheelchairs are satisfied with it, few members of the disabled community find it is difficult or impossible for operating a standard wheelchair. This project is included in assistive technology, For handicapped and depended disable. It is more independent, productive and enjoyable living. To perform functions a handicapped person with locomotive disabilities needs a wheelchair that requires him/her to move around. She/he can do so manually by pushing the wheelchair with his/her hands, however many of us have weak upper limbs or operate the manual mode of wheelchair too tiring. Therefore it is desirable to provide

them with a motorized wheelchair, which is controlled by moving a joystick. Since motorized wheelchair is important that it be able to avoid obstacles automatically in real time, it can move at a fair speed. Cost of this motorized wheelchair is affordable and it is useful for mid-range persons to buy it. Through research and design wise, the solar based wheelchair to control /development along with safe and effective use of the provision independent use mobility.

The help of joystick they can control the solar based wheelchair with five steps, they are:

- Forward direction
- Backward direction
- Right-side direction
- Left-side direction
- Stop condition

### II. LITERATURE SURVEY

#### A. Solar powered wheel chair:

Prof.s.s.rashinkar, “Solar powered wheel chair” the paper says in this is based on solar powered electric wheelchair for physically handicapped people. A user friendly interfacing voice recognition system and obstacle detector sensor and Keypad system has been integrated in this solar powered wheelchair. In this way we have implemented a solar powered wheelchair which can be controlled using voice commands and Keypad with the possibility of detecting obstacles by using obstacle detector sensors. In this wheelchair Keypad is provided for handicapped person for moving easily his/her hand. This project indicates great success not only in business sector but also it helps disabled people for better life. This project contains electronic system configuration, a sensor system, a mechanical model, voice recognition control and Keypad control are considered.

#### B. Smart wheelchair:

Snehlata Yadav, Poonam Sheoran, “Smart Wheelchair” in this article presents a summary of current state of smart wheelchairs. An assistive technology known as wheelchair 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.

### C. EMG Signal:

M. Shamim Kaiser et al, This paper presents the design of low cost solar powered wheel chair for physically challenged people. The signals necessary to maneuver the wheel chair are acquired from different muscles of the hand using surface Electromyography (sEMG) technique. The raw sEMG signals collected from upper limb muscles are processed to extract the desired direction of movement for the wheel chair. The accuracy of the extracted EMG signals is found to be relatively high. A prototype is developed and tests verified the objective functionalities. The analysis of life cycle cost of the solar powered wheel chair is presented. It is found that the proposed wheel chair is financially feasible for developing countries.

## III. PROBLEM SOLUTION

This project "SOLAR BASED POWERED WHEELCHAIR" aims to overcome with some benefits to use this wheelchair for differently able instead of using manually operated wheelchair. By using of joystick the user can control the solar based wheelchair with moving X-Y directions. The using of Lead acid battery with the help of charging circle is electric power as well as solar power also. So, it can help.

### A. Objectives:

- 1) Why we are choosing solar based wheelchair project that is useful for differently able, those who are use outdoor uses for work and some other purpose.
- 2) Compare with electric/normal wheelchair our project is benefit and somewhat differences in our project mobility.
- 3) Our project is not same as normal wheelchair, it seems to a small solar wheelchair look like smart mobility (Look like common persons vehicle).
- 4) The project is based on solar power as well as AC power also, so we have to take solar powered wheelchair at anywhere without fear about battery drain problem or charging problem.
- 5) The probability of choosing this project is differently able for easier and convenience use.

## IV. METHODOLOGY

The methodology of solar powered wheelchair can be understood easily. The working is nothing but simply the conversations which are shown below-

### A. Materials and Protocols:

#### 1. Sun:

It provides solar energy that will fall on solar panel. When sunlight hits a solar cell, also known as a photovoltaic cell (photo meaning "light" and voltaic meaning "electricity"), that energy can be transformed into electric current. This influx of energy knocks loose electrons from the silicon atoms, allowing them to move freely.



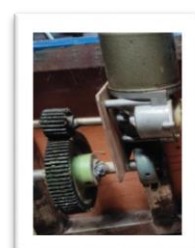
#### 2. Solar panel:

It is a photo-voltaic module which is an assembly of photo-voltaic cells. The solar cells capture solar energy and convert it into electrical energy. These cells are arranged in a grid like pattern on the surface of solar panels. The maximum power of the solar panel output is 50wattage. The voltage of the solar panel is 12volt. Solar panel Type is Mono-crystalline panel, The Optimum operating voltage(Vmp) of the solar panel is 18.3volt. Optimum operating current(Imp) of solar is 2.90A,weight:8.8lbs. The Maximum system power voltage is 600volt(Approx). Open-circuit(Voc) is 21.8volt. Short circuit current(Isc):3.10A.



#### 3. Motors:

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most of electric motors are operate through the interaction between the motor magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor shaft. This help to move/work function of the wheel moving Voltage is 12 volts and is no's is 2 quantity. DC Output of the motor is 100 watts, The Rpm of the motor is 2750rpm, Case Length of motor is 3-15/16'(100mm), Case Diameter is 2-11/16'(68mm), Drive Shaft Length of the motor is 1-1/8'(28mm), Drive Shaft Diameter is 5/16; (8mm), Mounting Hole Distance of the DC motor is 1-9/16' (40mm) 9 tooth. The chain sprocket of the DC motor is 25'.



#### 4. Lead acid Battery:

They generate electricity through a double sulfate chemical reaction. Lead dioxide and the active materials on the battery plates react with sulfuric acid in the form of electrolyte to lead sulfate. Sulfating occurs in lead-acid batteries. When they are subjected to insufficient charging during normal operation. Battery is source of power to motor. The voltage of the battery used in our project is 12volt type. The capacity rating of the battery is 7.2AH. Type of the battery is Lead-acid. Dimension of the battery the 181\*77\*170. Weight of battery is 4kg (Approx).

#### 5. Joystick:

Single joystick one can control speed as well as direction of DC motor. When joystick is at centre position the motor is rest. When joystick is moved forward or reverses the motor also rotates forward and reverse. Also the motor speed increases when joystick moved further forward or reverses.



#### Features:

1. Auto return to centre position
2. Low weight
3. Cup-type knob
4. Compatible to interface with Arduino with Micro-controller

#### Technical Specifications:

1. Operating voltage:5v
2. Internal potentiometer value:10k
3. 2.4mm pin interface lead
4. Dimension:1.57in\*1.02in\*1.26in(4.0cm\*2.6cm\*3.2cm)
5. Operating temperature:0(to)70c

#### 6. Arduino:

The Arduino UNO is an open-source microcontroller board based on the microchip ATmega32 microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.



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outputs And 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC to DC adapter or battery to get started.

Some features of this microcontroller are as follows:

- ❖ 32× 8 general purpose working registers
- ❖ Up to 16 mips through put at 16mhz
- ❖ On-chip 2-cycle multiplier

#### B. Hardware implementation:

- ❖ Phase1: Installation of motor and battery.
- ❖ Phase2: Mounting of solar panel at head of wheel chair.

#### C. Software implementation:

- ❖ Phase3: Programming for Arduino.
- ❖ Phase4: Implementation of the controlling circuit.
- ❖ Phase5: Controlling circuit fit in wheel chair.

#### 7. Relay Module:

A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have **double throw (changeover)** switch contacts as shown in the diagram.

- Relays can switch **AC and DC**, transistors can only switch DC.
- Relays can switch **higher voltages** than standard transistors.
- Relays are often a better choice for switching **large currents** (> 5A).
- Relays can switch **many contacts** at once.



#### 8. WheelChair:

1. It's a manual type wheelchair.
2. Suitable for: Standard,
3. Seat type: Hammock seat,
4. wheel type: Wire spoke wheel,
5. Tier type: Puncture proof,
6. Caster type: Solid,
7. Weight carrying capability: 100-135kg.
8. Seat height:48cm,seat width:46cm,seat depth:42cm,
9. Wheel diameter:60cm,caster diameter:20cm,
10. Width:88cm



### Software description:

The software controls the operation of the system. Hence, it is imperative that the software is developed in a flawless manner. So, it as to attain the desired result and in our project all about one desired coding is saved in micro-controller (Arduino).

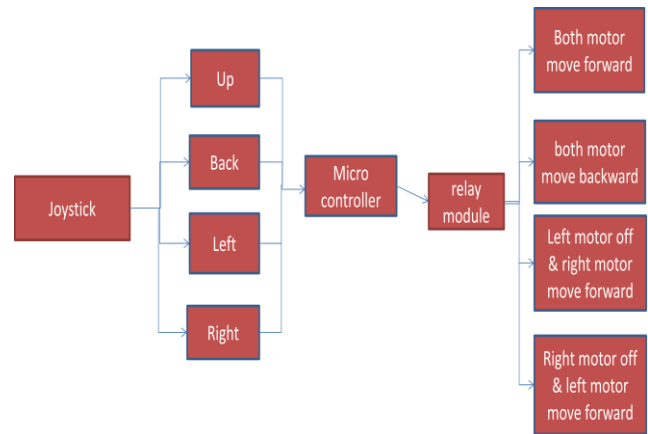
The software that controls the overall functioning of our whole system. The saved programs in a micro-controller control all the basic function of our solar based wheelchair and the operation of the device. The input are taken from program in our computer/laptop and output of the program decide action to be taken by the system Software, being a main part of our project, is going to be discussed in detail in this section.

### Choosing c' language:

C++ is a powerful and flexible language. That provides fast programming execution and imposes few constraints on the program. It allows to low level accessibility and informative commands. While, still retaining the portability and syntax of a high level language. This quality of programming is make it is a useful language for both systematic programs and general purpose programs. The flexibility comes from many ways to the programmer has to accomplish the same tasks. C++ includes bitwise operators along with powerful pointer manipulation capabilities; C++ imposes few constraints on the programmer. The main area of this program shows up is in c programming in lack of type checking. This can be a powerful advantage to an experienced programmer. But, a dangerous dis-advantage is a novice.

Another strong point of C++ language is use of modularity and Section code can be stored in libraries for re-use in future programs. This concept of modularity also helps with C++ language in portability and execution speed. The core of C++ language leaves out many features included in the core of other languages. These functions are in used instead of C++ language in standard library. An example of this concept is to be c' language to lack of built in input and output capabilities.

Input and output functions tend to slow down program execution and also is a machine independent when running optimally. For these reasons, they are stored in a library separately from the c language and only included when necessary Checking. This can be a powerful advantage to an experienced programmer, but a dangerous disadvantage to a novice



Methodology Diagram (Flow Chart)

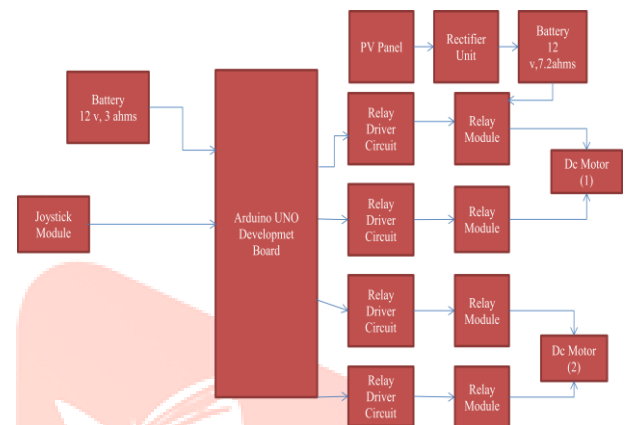


Fig.2: Proposed Block Diagram

### Prototype Wheelchair :( Model)

It presents a photograph of the prototype of our solar based wheelchair. The basic specification details of the wheel-chair are provided in above as stated previously, the wheelchair is based on the frame of a commercially available manual wheelchair and has a manual wheelchair and has a weight of 17.4kg. The auxiliary component of the wheelchair is solar panels, battery and motor.



## V. RESULT AND DISCUSSION

To provide a cost effective mobility vehicle for the physically challenged, a solar powered wheel chair is fabricate with the indigenous materials. The wheelchair is powered by rechargeable battery of capacity 12v. A solar panel of 50w capacity is provided for charging the battery on grid. The cost can be further minimized by using optimization techniques and improved designed

methodology. The height of the solar frame can be adjusted by using the fasteners provided at the back rest. The speed is limited to 5km/hr (Approx) for them safety purpose and to avoid vibration of the solar frame/panel. Therefore, it is desirable to provide them with a motorized wheelchair. This is controlled by moving a joystick. Since motorized wheelchair is important that it be able to avoid obstacles automatically in real time, it can move at a fair speed. Cost of this motorized wheelchair is affordable for many handicapped people as possible, as well as for organizations that support.

#### G. Scope and Application:

Smart wheelchair mobility has a wide-range application of following steps given below:

#### ❖ Physically Challenged:

Physically challenged can use it as per their purposes. They can able to operate the wheelchair with using of joystick for X-Y directions.



#### ❖ Patients in the Hospitals:

People's suffers from certain paralysis can use either for our extension of project in future use, may be it will come 2021 with a smart feature of Bluetooth connectivity. We can operate the wheelchair in using of mobile application.

#### CONCLUSION:

The attempt of wheelchair is made in fabricating a Solar Powered Wheelchair with the available of the indigenous material is successful for our solar based wheelchair project. The working of the wheelchair shows the indigenous infrastructure and the capabilities of the wheelchair. The Recharging capacity of the panels is satisfactory for Lead Acid Battery. The desired functionality of the Steering Mechanism is achieved in the module of Joystick for moving directions. The wheelchair it can travel up to 1 (or) 2 hours continuously. Thus the fully set-up is made with Solar Powered Wheelchair some features is successful in Daily Life of Physically Challenged.

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