Design and Implementation of Wheel Chair cum Stretcher Using Servo Control Mechanism

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***Abstract*— This work represents the design and implementation of wheel chair cum stretcher for carrying the physically disabled persons in easier way and manufacturing cost is also quiet low. The servo control mechanism can convert a wheel chair into stretcher or vice versa. When servo control mechanism is stretched the down position of the seat including with footrest goes horizontal till the level of seat of wheel chair and simultaneously the back support goes down and make horizontal with seat of wheel chair, now it become stretcher and when same system operated vertically and it converts into wheel chair from stretcher. It is design and implement in such a way that a patient or physically disabled persons could be used in a single clicked and self-drive by joystick.**

***Keywords*— Servo Mechanism, Powered Wheel Chair, DC Motor**

I. INTRODUCTION

Robotic technologies have the potential to improve the lifestyles of people suffering from one or more disabilities. Related developments are often grouped under the terms Rehabilitation Technologies or Assistive Technologies. They attempt to restore human abilities that have been reduced or lost by disease, accident, or old age. Mobility is one such function. There are many reasons why a person may not be able to travel freely, including motor control problems, spinal injuries, and amputation. A wheelchair is a mechanical device that can often assist. It effectively uses wheels and mechanical

support to overcome a loss of legs or leg control. Manual wheelchairs can be operated by persons who have the use of their upper body or someone available to assist. Powered wheel chairs have been developed for when either of these cases does not apply. However, these devices typically require a high level of user control and this is something precluded by many severe forms of disablement. In recent decades many groups have researched the possibilities of robotic wheelchairs. These endeavors are aimed at creating intelligent devices that can sense information from their environment and respond in useful ways.

There are different types of wheel chair like manual self-propelled wheel chair, manual attendant propelled wheel chair, powered wheel chair etc. [1-4].

The aim of this work is to implement the powered wheel chair into power wheel chair cum stretcher. Wheel chair is one of the easiest process to carrying the patient or physical disable person from one place to another place now if we implement it by self-driving powered wheel chair cum stretcher that will be quit easier for injured and disable person to go one place to another place without depending any external help. This implementation by using hydraulic or pneumatics can improve the efficiency but it had drawback as it may so bulky and not so easily to control also manufacturing cost is high but the servo control mechanism is much lighter than other and easier to control.

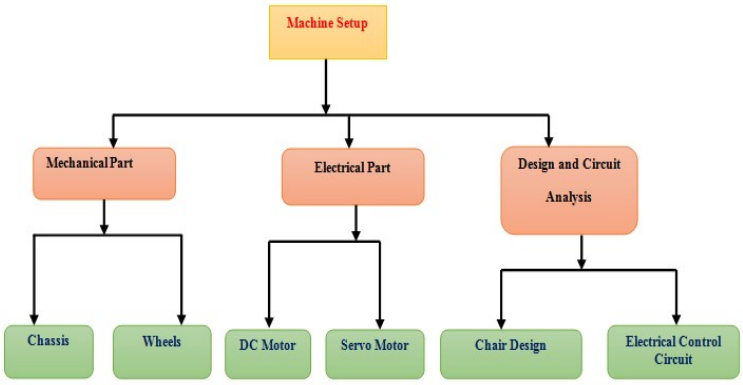


Fig. 1 Layout of Design

II. TYPES OF WHEEL CHAIR

i) Manual wheel chair ii) Motorized wheel chair

I. Manual Wheel Chair—

Manual wheel chair is those which required manual human power to move it. It can be self- propelled or need external help. A manual wheelchair is congregate a chassis seat foot rest and four wheels. Normally the main wheels are in the side portion, wheels are like bicycle wheel and in the front usually two caster wheels are there. On the side of large wheels usually it have push- rim of slightly smaller in diameter, these are help the user to maneuver the chair by pushing on those without require any external help. If the pushing force applied on the rim in same force in forward direction then chair goes forward and if it is applied backward then it goes to backward. If different force is applied in same time on rim then it may turn left or right depending on applied force. If force applied in right hand side the chair goes to left

hand side and if left hand side then chair move in right direction.

II. Motorized Wheel Chair—

Power wheel chairs are used by the users who are unable to use a manual wheel chair. Power chair is congregate a chassis, wheel, motor, power source, controlling system etc. It can be many types. It may classified by driven wheels, controlling system etc. In our project Design have two powered wheels drive. Main component of motorized wheel chair are motor battery controlling unit. But we add some extra mechanism with servo motor to implement our powered wheel chair into a stretcher.

III. EQUIPMENT'S

1. Dc Motor (2 pic)
2. Servo Motor(2 pic)
3. Relay Module
4. Joystick
5. Arduino Mega
6. Lipo Battery
7. Wheels
8. Caster Wheel
9. Poly Acrylic (for chassis)
10. Wire, Gums etc.

IV. EQUIPMENT'S DETAILS

I. DC Motor—

A brushed electric Dc motor is mainly having a two-pole rotor (armature) and permanent magnet stator. It converts direct current electrical energy to mechanical energy.

Fig. 2 DC Gear Motor

II. Servo Motor—

In servo motor servo name come from its servo mechanism. It is also have brush type DC motor and contains reduction servo gear box by the rotary encoder it give the feedback to the controlling board.

Fig. 3 Servo Motor

III. Arduino Mega

Arduino mega is a microcontroller board on the bans of at mega1280. It has 54 digital input or output pins which of those pins 14 can be used for pwm output, in that 16 analog inputs pin. It simply connected to computer via USB cable.

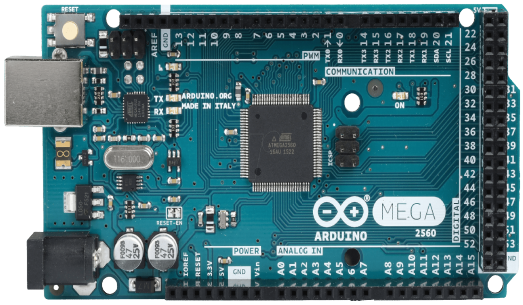


Fig. 4 Arduino Mega

IV. Relay Module—

Relay is defined as an electrically operated switch. It is mainly use to control the circuit by the low power signal or several circuits must be controlled by one signal.

Fig. 5 Relay Module

V. Joystick—

Joystick is an input device consisting sticks that pivots on a base and reports is angle or direction to the device which it is controlling.

Fig. 6 Joystick

V. METHODOLOGY

At the very beginning a proper design has to make with perfect dimension. After that the poly acrylic glasses are cut into different required pics and made the base of the chassis. After those motors clamped are attached then motors and wheels are connected with base chassis. At the mid position of the base attach a servo motor it shaft is in vertically direction from the base chassis and on the shaft a seat is attach. After proper attachment of seat on the shaft of servo motor, it may check its properly movable or not because seat will also movable up to (0 degree - 90 degree - 180 degree) 90 degree of the motor position is the main position of the wheel chair, that means seat can move left or right depending on position without moving base classis. After completing the base and seat, attach hinged for the attaching of footrest and back seat. It may check that the two attachments are fully free movable or not. After that attach another servo to the side portion of main seat and attach a mechanism in such a fashion that servo rotate up to 180 degree. If the back seat (footrest become vertical to the main seat, footrest in the downward direction and back seat in upward direction), and it became wheel chair. If motor rotates in reverse direction it converts into stretcher.

VI. CIRCUIT DESIGN

Two DC motor, two servo, two joystick, one 5v, 12v power supply to be need. 5v supply connected with Arduino by GND wire. Relay connection is SPDT for moving forward and reverse direction. One 12 volt power supply for the two DC motor powers and for that dc motor one joystick is used. Joystick scale is 0 - 1023. For the servo motor control one another [2]joystick is used which scaling like 1, 1023, 0,180.

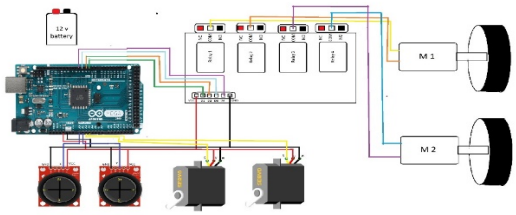


Fig. 7 Circuit Design.

2,3,4,5 digital pin of Arduino mega is connected to the D1, D2, D3, D4 pin of relay module respectively motor (M1) is connected to the relay1 and relay2, motor (M2) is connected to relay3 and relay4. The joysticks are connected in series to one another, and X, Y pin of two joysticks are connected to the analog pin of A0, A1. A2 and A3 pin of mega in connected to the s pin of servo motor and GND and VCC pins are connected to the respective pin of joysticks.

VII. MECHANICAL CONSTRUCTION

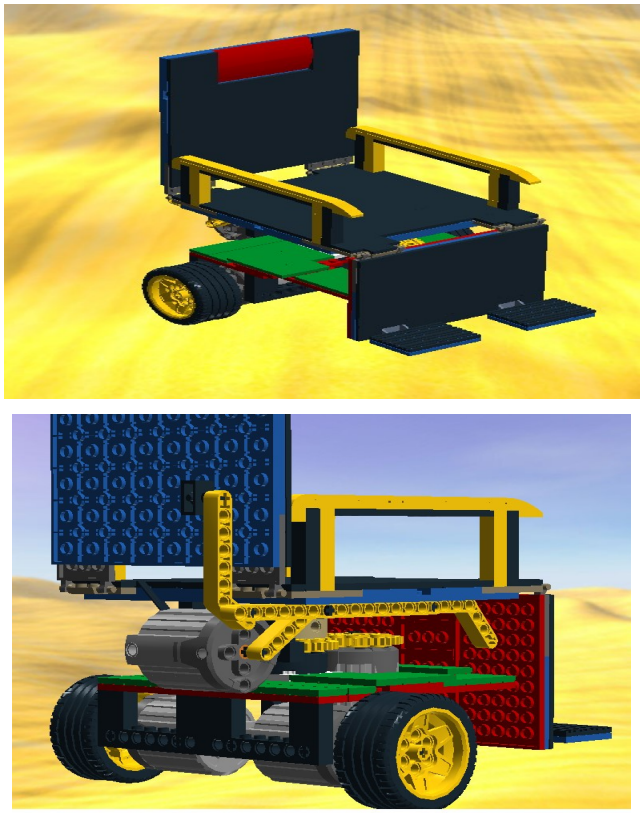
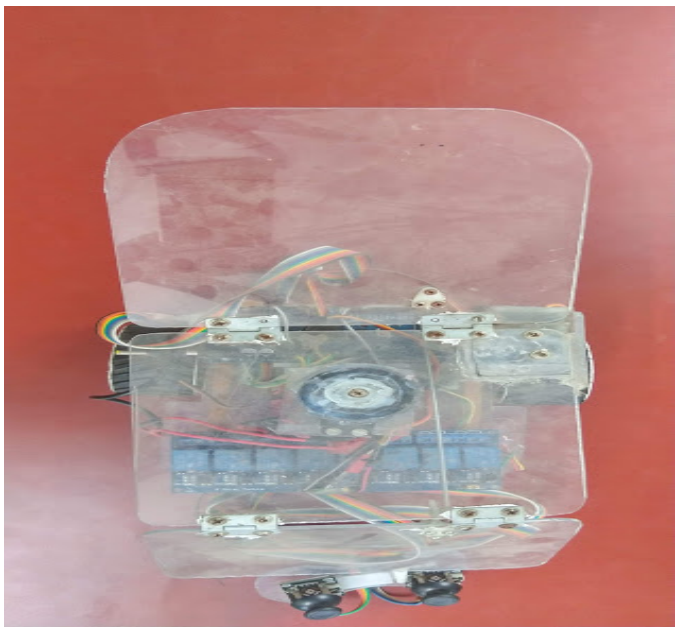


Fig. 8 Mechanical Construction



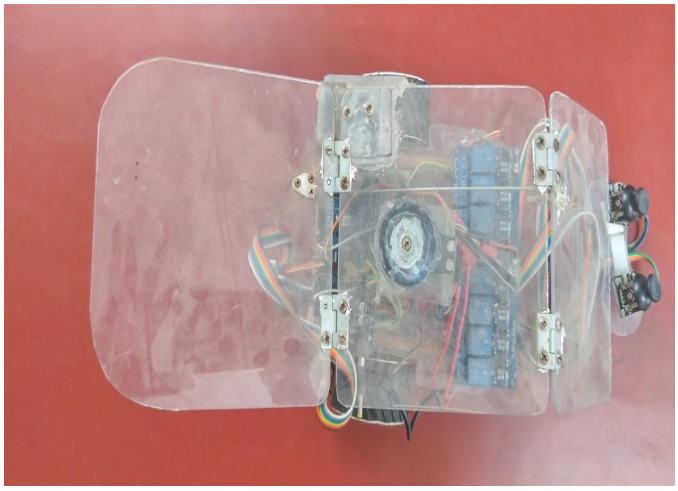


Fig. 9 Complete Model Structure

VIII. DISCUSSION

At the end of implementation of whole work, a high profile output is achieved. It is easy to control and anybody can do it. There must have to be observed that the hinged which is attached with chair is properly working or not and the mechanism also. If servo movement is more than requirement then it may have to decrease the throttle and according to the user uses it to control in joystick and how much folds the stretcher. User can make it relaxed chair also by half fold of the stretcher

IX. CONCLUSION

The entire setup is with the combinations of Arduino mega and relay module for getting the precise movement to assist with joystick. Joystick can help the user how much it needed to fold the wheel chair and speed also. Because if the throttle is more, then the speed will high and if the throttle is low then the wheel speed also low like a speed controller. It is also lighter wheel chair from any hydraulic and pneumatic control wheel chair.

X. FUTURE SCOPE

The powered wheels can be change to Omni wheels for that user can move one place to another place not to rotating the chair or stretcher. One more things total wheel mechanism may change in different mechanism for that user without any external help can climbed up the stairway.

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