DESIGN AND DEVELOPMENT OF OMNI DIRECTIONAL WHEEL CHAIR

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ABSTRACT

The aim of the project is to design and contrive of a omni directional wheel chair which can maneuver through static and dynamic obstacles and narrow aisles. When compared with conventional platforms it has vast advantage in terms of mobility under congested environments. Omni-drive systems operate by having typical Omni wheels apply torque in one direction in the same way as a regular wheel, but are able to slide freely in one direction (often perpendicular to the torque vector). Omni-directional vehicles are able to drive in any direction in the 2D plane as well as rotate at the same time. In other words, they have three degrees of freedom. The main parts of the omni directional wheel involves hub, both side rims, centre pole. The main applications for this wheel is vast, where they can used in different fields like defence, transportation and many more.

Keyword – *Omni direction , Mecanum wheel.*

1. INTRODUCTION

Navigating a wheelchair through a confined or congested space can be extremely difficult. Conventional wheelchairs require an accurate approach path and a large amount of free space to undertake simple maneuvers such as driving through a doorway. One solution to this problem would be the development of a wheelchair that was able to drive directly sideways; otherwise known as an omni-directional wheelchair. Omni-directional vehicles are able to drive in any direction in the 2D plane as well as rotate at the same time. In other words, they have three degrees of freedom. These vehicles differ from conventional drive arrangements (such as the Ackermann arrangement found in automobiles or the differential drive arrangement found in many scooters) in their ability to drive sideways.

1.1 Components of mecannum wheel

Wheel rim :

The rim is the outer edge of the wheel holding the tyre. It makes up the outer circular design of the wheel on which the inside edge of the tire is mounted on vehicles such as automobiles. For example, on a bicycle wheel the rim is a large hoop attached to the outer ends of the spokes of the wheel that holds the tire and tube. The term *rim* is also used non-technically to refer to the entire wheel, or even to a tire.

Rollers :

Rollers are materials which are used for movement in mecanum wheel. The angular position of these rollers play major role in omni directional movement. Without rollers we can't able to achieve the omni directional movement. Here we have used Polyvinyl Chloride (PVC) as a machining material for roller.

Spacer :

Spacer is an structural element present in between the two rims for separating the rims between each other.
An addition polymer made from the monomerpropylene, it can be produced in a variety of structures giving rise to applications including packaging and labeling, textiles, plastic parts and reusable containers of various types, laboratory equipment, automotive components, and medical devices. It is a white, mechanically rugged material, and is resistant to many chemical solvents, bases and acids.

2. OTHER COMPONENTS USED

2.1.MOTOR

The omni-directional wheelchair uses 4 motors to drive it's 4 independent Mecanum wheels. The 12V brushed DC motors used are made by Fortress and are commonly found on scooters used by the disabled .They are rated to 15A, but generally only ever use up to 3A in normal operation. The motors have built in brakes as well as a switch which provides two modes for the brakes.

Fig -1: **12V dc Brushed Motor**

2.2. BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. We are using battery of 12V power of 12A rechargeable battery.

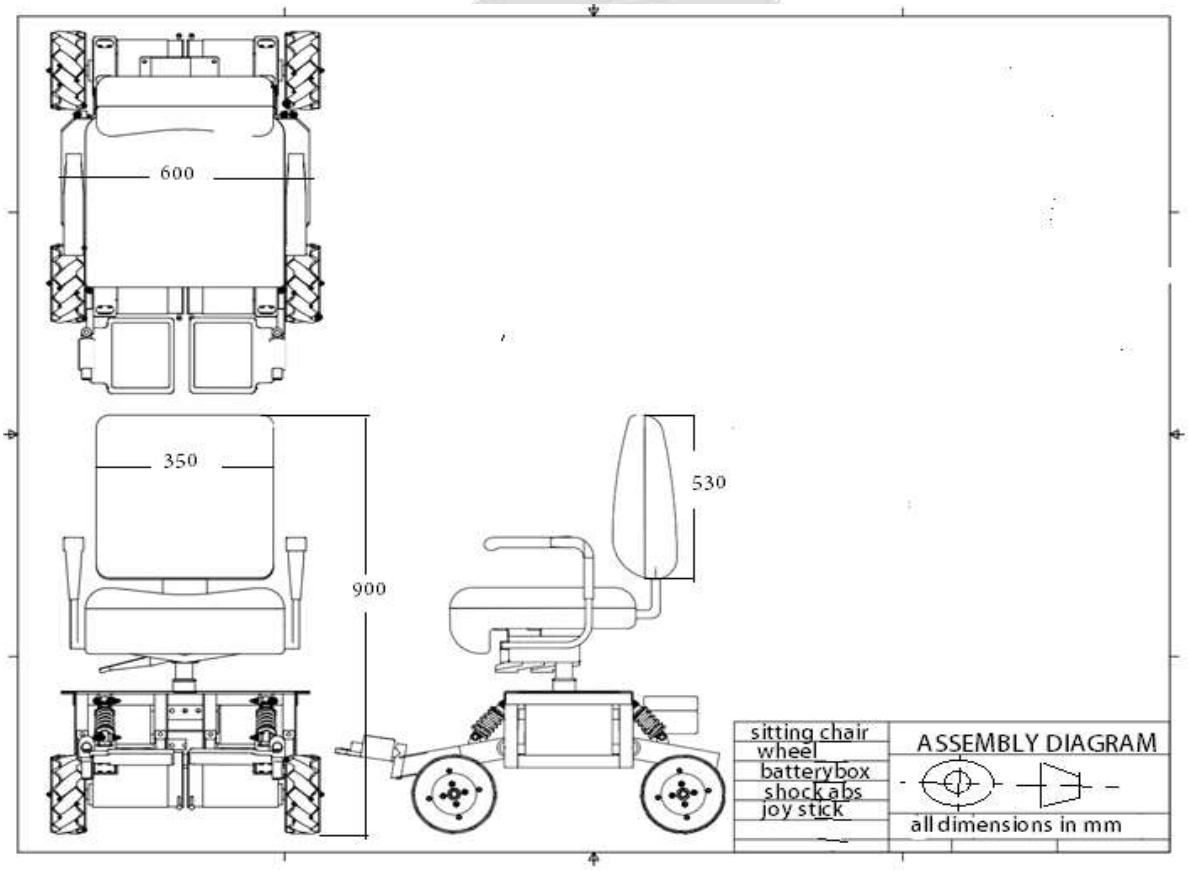
Fig -2: **12V Rechargeable Battery**

2.3. DPDT SWITCH

DPDT stands for double pole double throw relay. Relay is an electromagnetic device used to separate two circuits electrically and connect them magnetically. They are often used to interface an electronic circuit, which works at a low voltage to an electrical circuit which works at a high voltage. Relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc.

Fig -3: **DPDT Switch**

3. BASIC LAYOUT



4. WORKING PRINCIPLE OF WHEEL CHAIR:

With the use of the prototype motor drive board and test software to programming the micro controller output as list in the basic mobility control was gained via programming the basic motion software to the microcontroller. This setup allowed the following motions

- Forward - all four wheels forward in.
- Backward - all four wheels move backward at the same speed.
- Right slide – wheel 1 and 4 forward, wheel 2 and 3 backward.
- Left slide – wheel 2 and 3 forward, wheel 1 and 4 backward.
- Clockwise – wheel 1 and 3 forward, wheel 2 and 4 backward.
- Counter- Clockwise - wheel 1 and 3 backward, wheel 2 and 3 forward .

By varying the individual motor wheel speed we can achieve driving direction along any vector in X-Y axis.

5. CONCLUSION :

The omni-directional wheelchair being developed allowsthe user to easily manoeuvre in what would otherwise be an extremely complicated environment. This project made improvements to the Mecanum wheels, batteries, motor driver cards, human interface, control software, chassis and suspension system. These improvements transformed the partially working prototype into a fully usable wheelchair. The result is much higher driving accuracy and a greatly improved overall experience for the user in both comfort and easy of use. On the whole, the project was extremely successful and will provide a very solid testbed for advanced driving and mapping projects in the future.

6. REFERENCES :

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