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Design and Fabrication of Wheelchair CUM Stretcher

Yash Shah, Neel Patel, Nischay Patel, Shail Patel, Piyush Surani

Abstract*: The wheelchair and stretcher are very widely used in hospitals, airports, train stations, shopping malls, etc. This design here is a modified wheelchair stretcher as needed.This machine converts the wheelchair into a stretcher. The chair transforms into a stretcher when the levers are operated. The stretchers can be detached from the main frame according to the convenience of the patient and doctors can make it easier Access to the patient with less effort and transport The folding mechanism enables a large number of stretchers arranged in chair form to be accommodated in a comparatively smaller space. in hospitals, patients have to be moved from a wheelchair to a stretcher, from a stretcher to a bed, from a bed to a wheelchair or vice versa; which creates unsafe conditions for patients. A wheelchair stretcher is required to facilitate mobility for the disabled patient.

Keywords: Wheelchair, Stretcher, Space, Patient's Mobility.

I. INTRODUCTION

Theconcept of Design and Fabrication of Wheelchair cum Stretcher is useful for disabled patient's mobility.DISABILITY is the term that has been used for many decades. According to Oxford Etymology, "disability" is used in many contexts, namely 1650 as a sport called "CAP IN HAND", 1750 used in horse races, 1870 it is "Any race or competition in which the competitors try to equalize the odds, by giving an advantage to the less efficient or a disadvantage to the most efficient ". Finally, the first use of disability to designate a mental or physical disability is recorded in a caption from 1915: The disabled child. Since 1915 the word "DISABILITY / DISABILITY" has been the trade name for people with physical or mental disabilities.

II. PROBLEM DEFINITION

The proportion of patients in India is increasing day by day. In hospitals, patients have to move from the wheelchair to the stretcher, from the stretcher to the bed, from the bed to the wheelchair or vice versa; which creates unsafe conditions for patients. Moving patients to hospitals is a common problem for nurses.

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III. PROJECT SCOPE

Propose a design that reduces caregiver effort and provides safer transfer for patients in hospitals.

IV. DESIGN CALCULATION

Wheels With A Load :
Body: Mass : 35 Kg
Weight of Body (Newton) : 343.43 N
Weight of Human : 120 Kg
Human Weight(Newton) : 1177.211 N
Rack and Pinion(Follower) : Mass : 3.401 Kg
Weight of Rack and Pinion (Newton) : 33.354 N
Force : 343.43+1177.20+33.354 = 1553.904 N

Wheels with Force on each:

$$\text{Force} = F_1 = F_2 = \frac{\text{Force}}{4} = \frac{1553.904}{4} = 388.474 \text{ N}$$

Load on Back Rest:
Link Inclination : 20°
Weight of Human : 40 Kg
Frame : Mass : 10.001 Kg
$\text{Force} = (40.001 + 9.301) * 9.81001 = 483.63011 \text{ N}$
$\text{Force Actual} = \text{F} * \sin 20° = 263 \text{ N}$

Leg Rest with Load:
Inclined Link Angle : 10°
Weight of Human : 40.001 Kg
Frame : Mass : 10.001 Kg
$\text{Force} = (40.001 + 10.001) * 9.8101 = 491.501 \text{ N}$
Actual Force Magnitude = 266.8254 N

Analysis Stress:
Front Wheels Stress:

$$shaft\ Diameter\ d_1 Front\ Wheel = 10\ mm Stress(Bending) = \sigma_b = \frac{My}{I}$$

$$Moment(1)(Front) = F_{f1} * \left(\frac{l}{2}\right) = 388.474 * 20 = 7769.48\ N.mm$$

$$y = \frac{d1}{2} = \frac{10}{2} = 5\ mm$$

$$I = \frac{\pi}{64} * d_1^4 = 490.8739\ mm^4$$

$$\sigma_b = 79.13927 \frac{N}{mm^2}$$

$$Shear\ Stress = \tau = \frac{TR}{J}$$

$$Torque(T) = F_{f1} * \left(\frac{l}{2}\right) = 388.474 * 20$$
$$= 7769.48\ N.mm$$
$$R = \frac{d_1}{2} = 5\ mm$$
$$J = \frac{\pi}{32} d_1^4 = 981.7478\ mm^4$$
$$\tau = 39.56 \frac{N}{mm^2}$$

Rear Wheel Stress:-

$shaft\ Diameter\ d_2 Rear\ Wheel = 10\ mm$

$Stress(Bending) = \sigma_b = \frac{My}{I}$

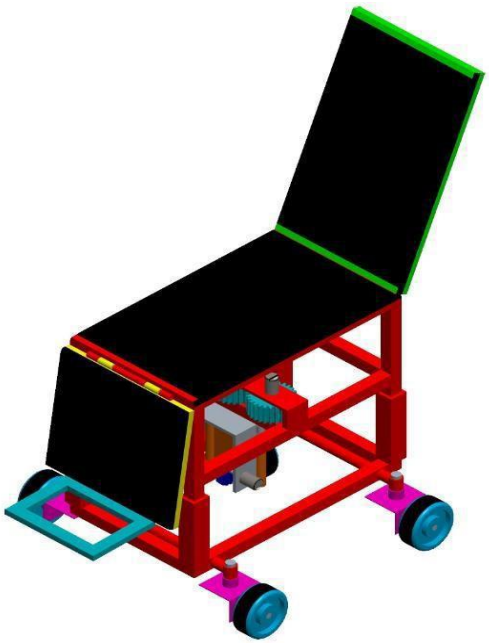
$$Moment(2)(Rear) = F_{f1} * \left(\frac{l}{2}\right) = 388.474 * 50$$
$$= 19423.7\ N.mm$$
$$y = \frac{d1}{2} = \frac{10}{2} = 5\ mm$$
$$I = \frac{\pi}{64} * d_1^4 = 490.8739\ mm^4$$
$$\sigma_b = 197.848 \frac{N}{mm^2}$$

$$Shear\ Stress = \tau = \frac{TR}{J}$$
$$Torque(T) = F_{f1} * \left(\frac{l}{2}\right) = 388.474 * 50$$
$$= 19423.7\ N.mm$$
$$R = \frac{d_1}{2} = 5\ mm$$
$$J = \frac{\pi}{32} d_1^4 = 981.7478\ mm^4$$
$$\tau = 98.92 \frac{N}{mm^2}$$

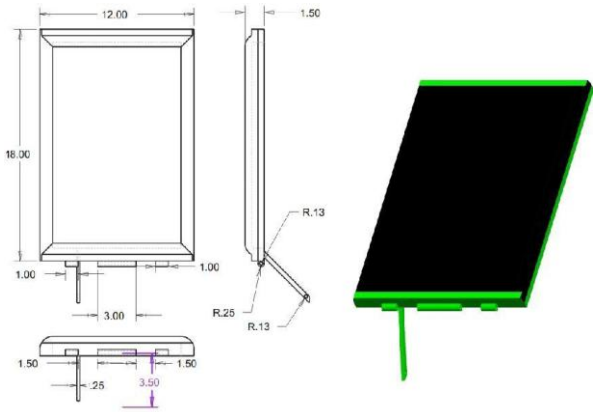
$Factor\ of\ Safety$:

$$F.O.S = \frac{Ultim\ ate\ Tensile\ Stress\ on\ Material}{Maximum\ Stress\ Generated\ in\ Material}$$
$$= \frac{500}{197.848} = 2.52$$

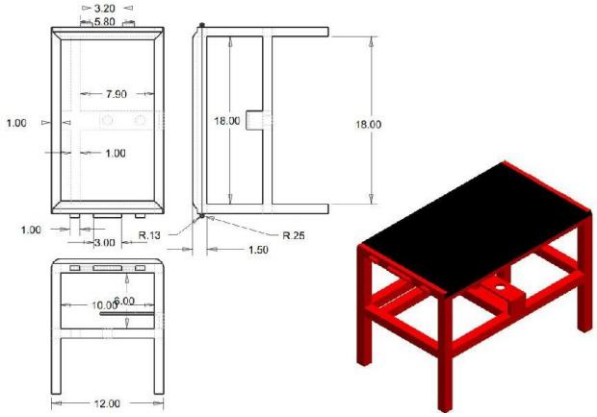
V. 3D DESIGN



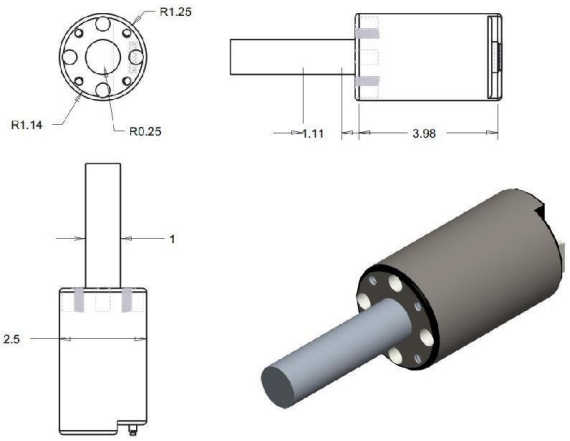
Back Frame Structure



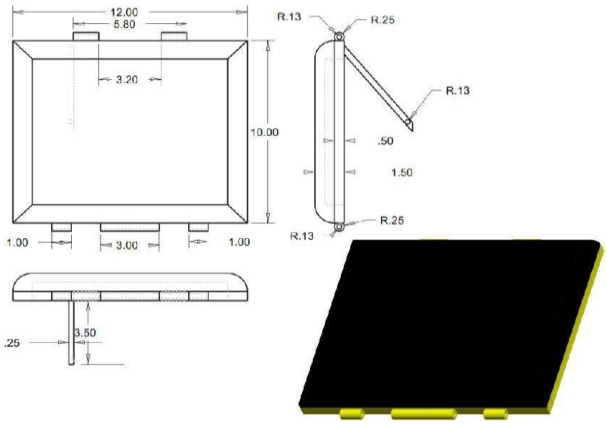
Center Frame Structure



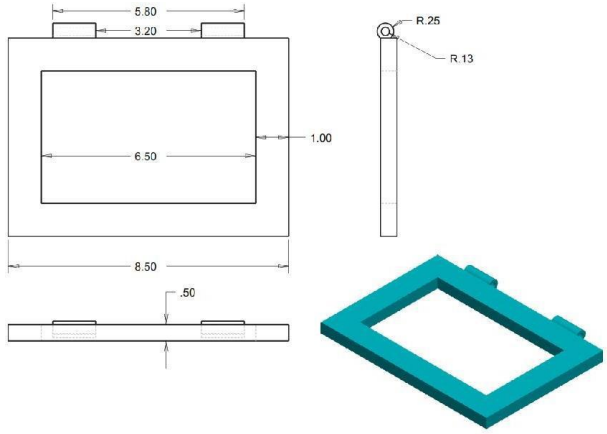
DC Motor



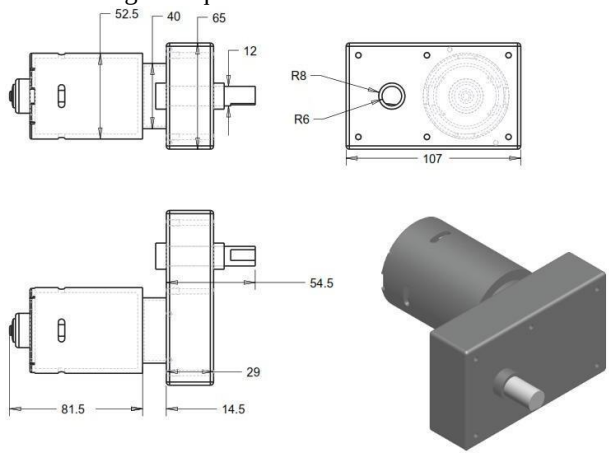
Leg Part -1



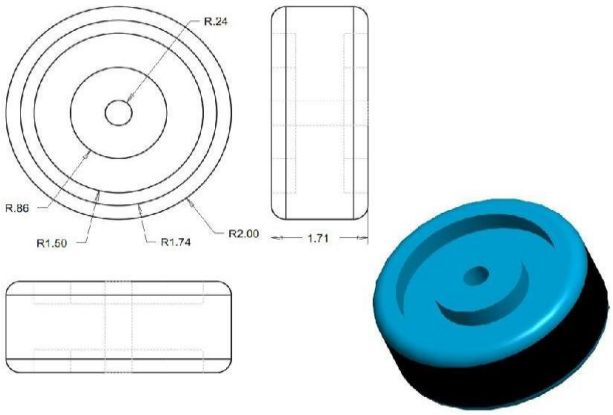
Leg Part – 2



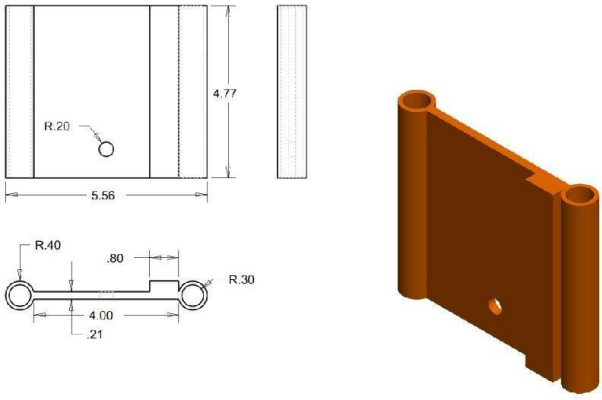
DC Motor High Torque



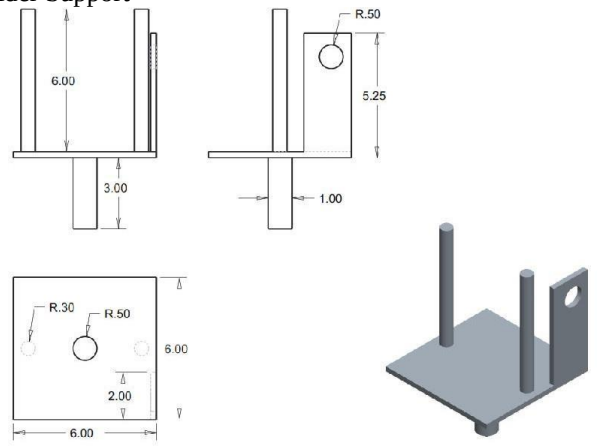
Wheel



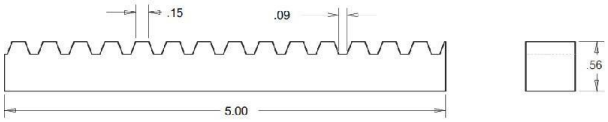
Slider



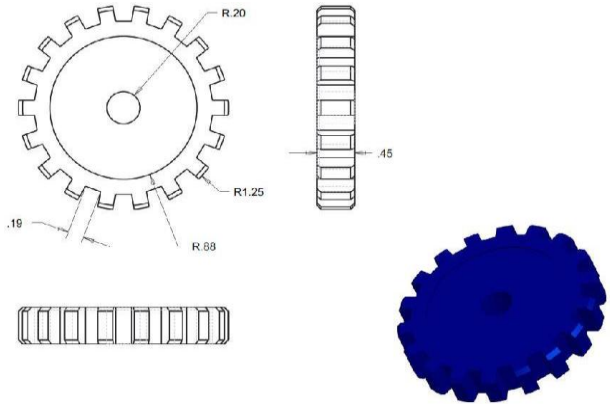
Slider Support



Rack



Pinion



Small Gear

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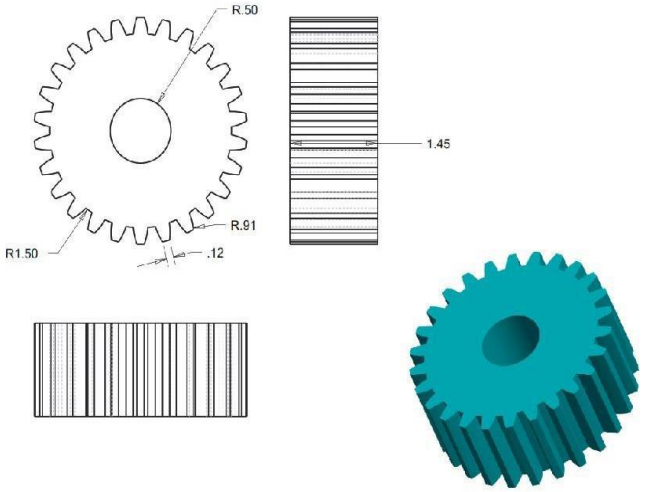
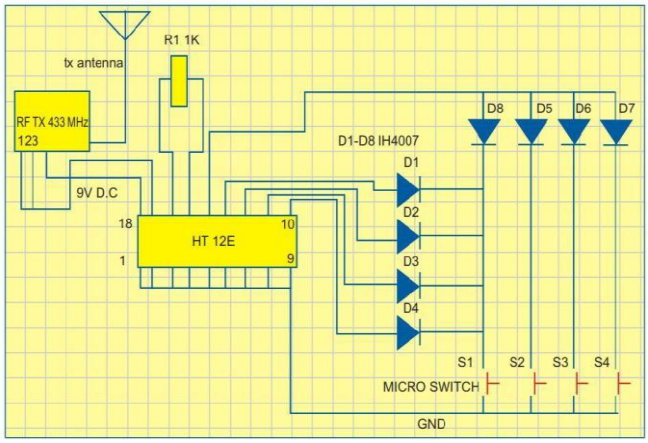


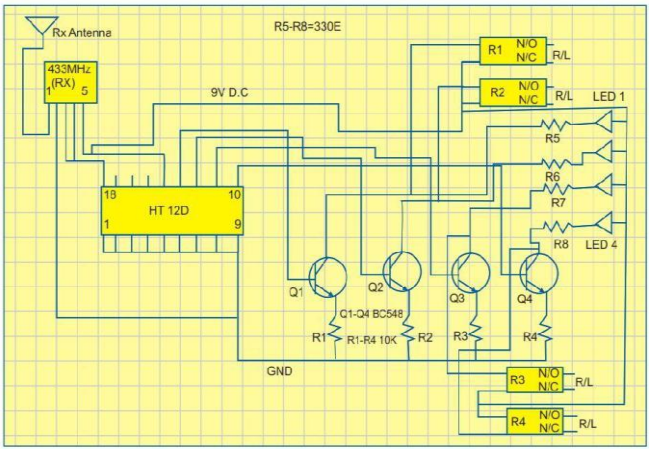
Sr.No	Part Name	Quantity in KG/Piece	Rate	Amount in RS
1	SS Box Pipe	30 feet	80	2400
2	Seat	1 Set	3500	3500
3	Iron Rod	3 feet	100	300
4	Self Rotating Trolley Wheel	2 nos	400	800
5	Spring	4 Nos	100	400
6	Locking Nobs	4 Nos	50	200
7	4 Inch HInges	8 Nos	150	1200
8	4 Inch Rubber wheel	2 Nos	240	480
9	RF Remote	1 Nos	1900	1900
10	Wiper Motor	1 nos	1600	1600
11	Rack	1 Nos	1600	1600
12	Pinion	1 Nos	400	400
13	DC motor	1 Nos	3800	3800
14	wooden Plate	1 nos	600	600
15	DC Motor Mounting Clamp	2 nos	20	80
	Total			19260

VI. CONNECTION GRAPH

Connection Graph of Transmitter



Connection Graph of Receiver



VII. LIST OF COMPONENT WITH ESTIMATION

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