College of Engineering
Department of Mechanical Engineering

# New Concept Wheel Chair

Project Team:

| | |
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Assessment III: Graduation Project

# Statement of Purpose

1- To design a new concept of wheelchair that can be manufactured using available resources and manufacturing techniques

2- Using SolidWorks program to design all the parts and assembly

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# Introduction

Over the past several years, there has been increasing interest in the wheelchair among inventors, design engineers, and the general public. This is probably because the wheelchair has come to symbolize the person with handicaps. For example, the national symbol for handicapped access is an abstract image of a person in a wheelchair.

# Scope of Project

## Designing of new concept of Wheelchair

- **Ratchet Mechanism**
- **Gears Ratio**
- **Material Selection**
- **Fasteners**

***Assumption*: Maximum Hand Force Applied needed to start moving = 50 N**

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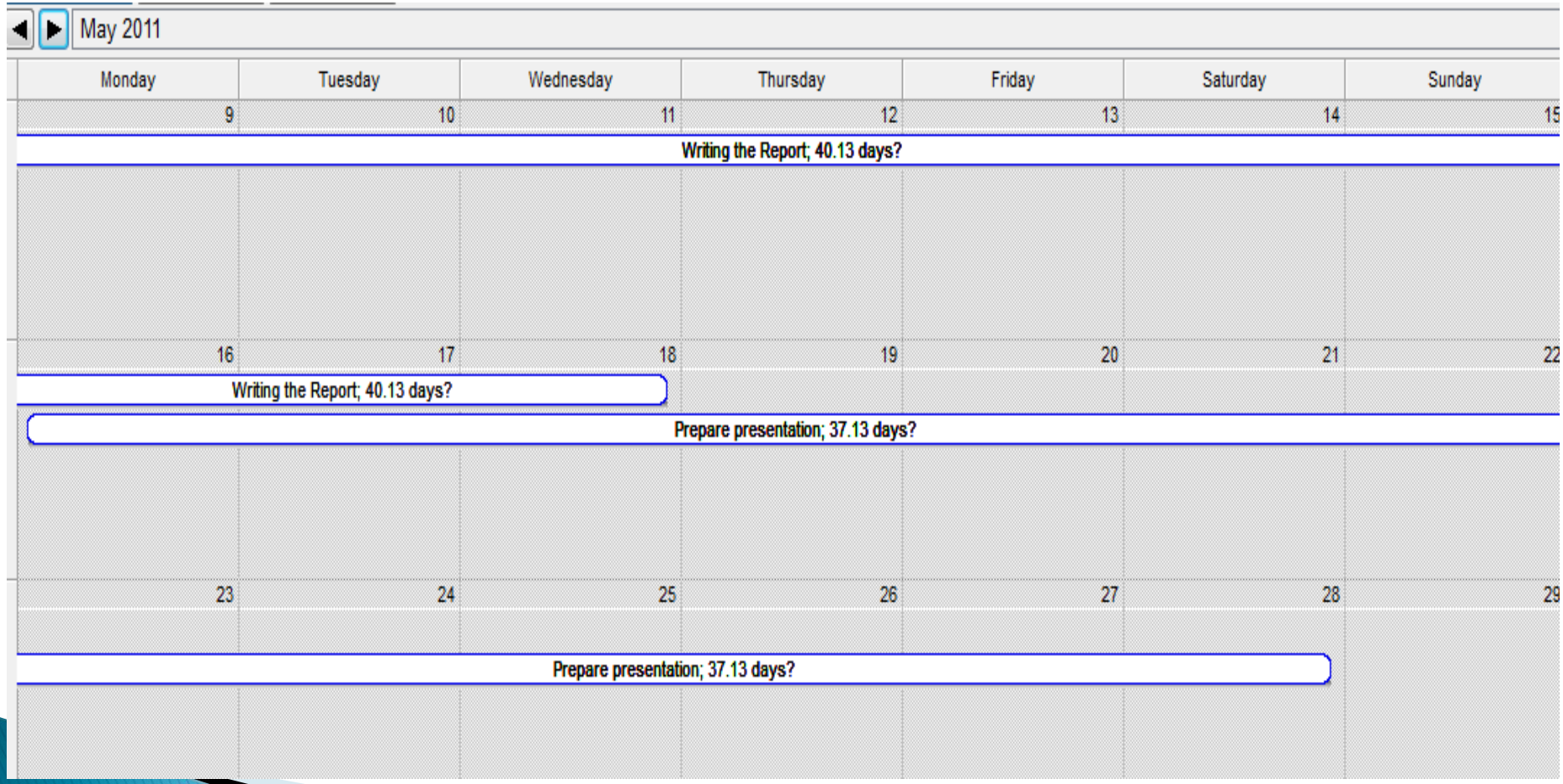
and Faleh Al Dossary

# Design Approach

1. Group Brainstorming
2. Gathering Information from the Internet and group discussions
3. Identify components
4. Sizing and load calculations
5. Prototyping by SolidWorks®

# Wheelchair GANTT Chart 3

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## Comparing between New Concept wheelchair & electric wheelchair

| Factors | New Concept of Wheelchair | Electric wheelchair |
|---|---|---|
| cost | Low | High |
| Maintenance | Less | High |
| Environment | No pollution | Produce pollution |
| Weight | Light | heavy |
| Safety Factor | low | high |

# Specifications of new concept wheelchair

| Dimension | mm |
|---|---|
| Armrest Height | 760 |
| Seat height | 485 |
| Eye level height | 1090-1295 |
| Overall width | 660 |
| Overall length | 1065 |
| Foot rest width | 455 |
| Seat width | 380 |
| Seat length | 375 |
| Front wheel size | D= 224 |
| Rear wheel size | D= 66 |

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# Ratchet Mechanism

- A ratchet mechanism is based on a wheel that has teeth cut out of it and a pawl that follows as the wheel turns. Studying the diagram you will see that as the ratchet wheel turns and the pawl falls into the 'dip' between the teeth. The ratchet wheel can only turn in one direction - in this case anticlockwise.

- A wheel provided with suitably shaped teeth, receiving an intermittent circular motion from an oscillating or reciprocating member, is called a ratchet wheel. A simple form of ratchet mechanism is shown in Figure 8-1.

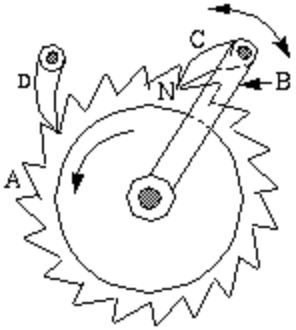
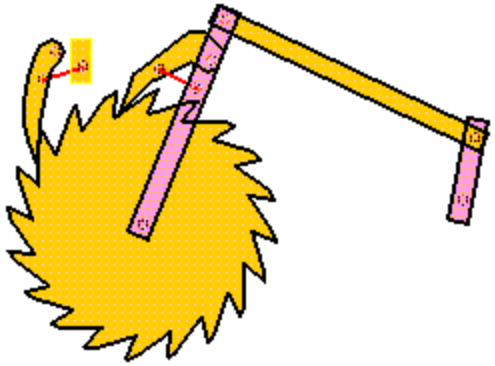



Figure 8.1



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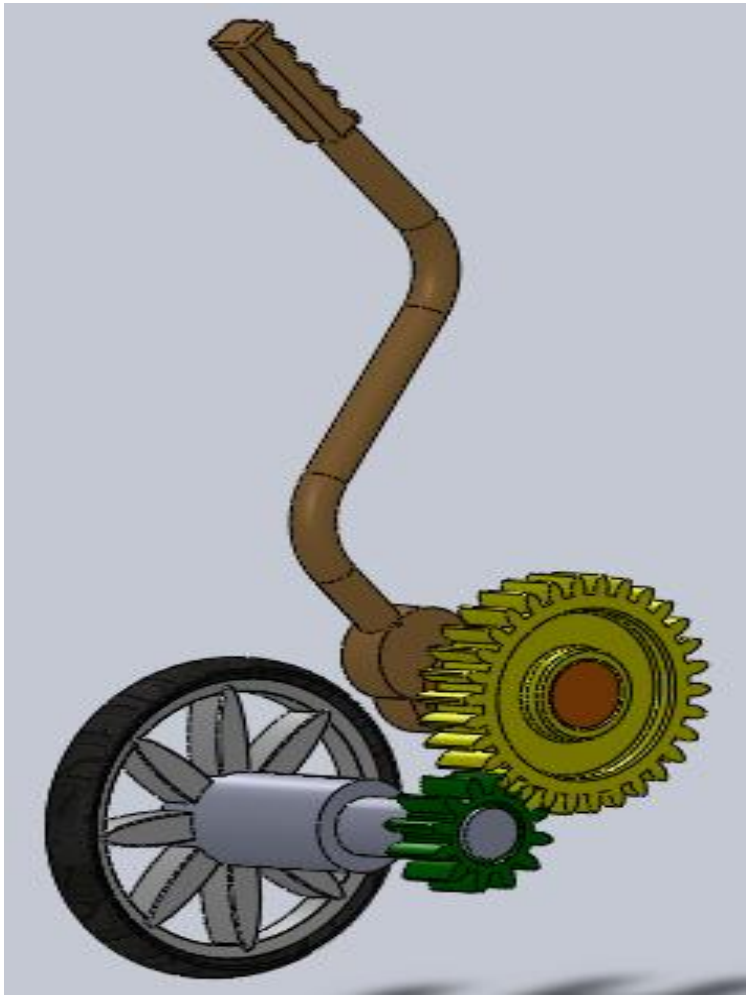
# Drive and Driven Gears

- These are drive and driven gears connecting to ratchet and wheel



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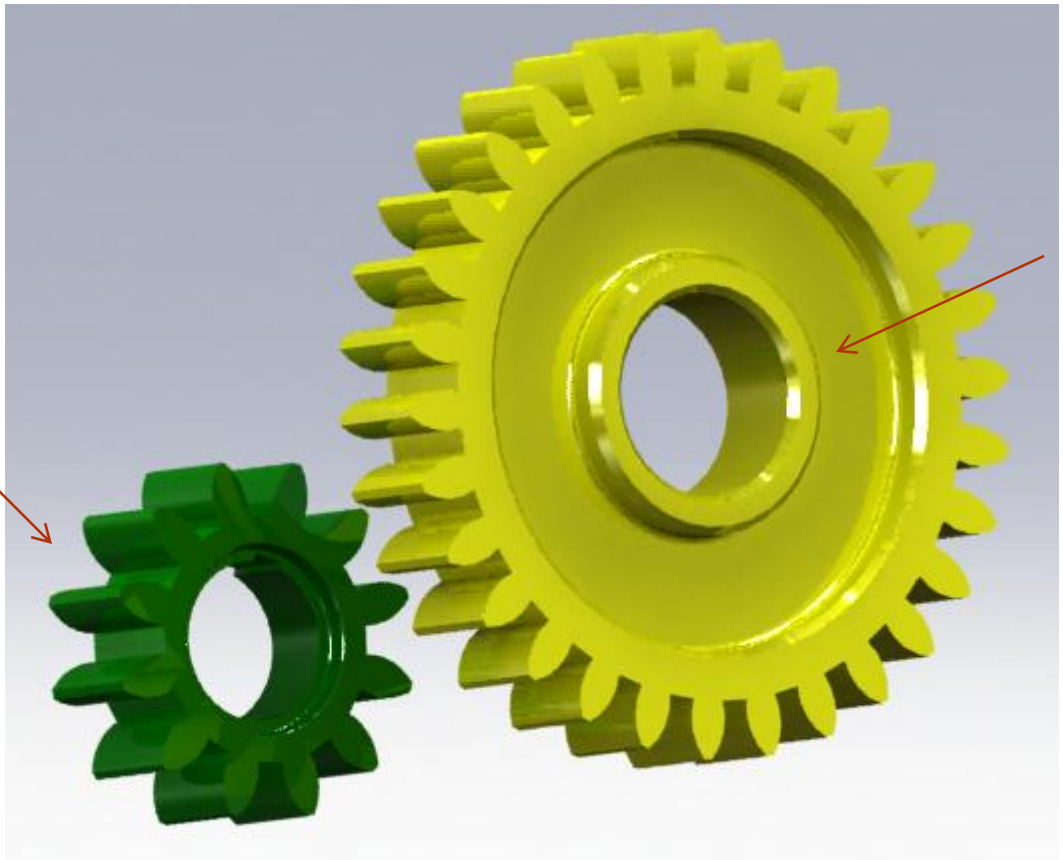
# Design Calculation

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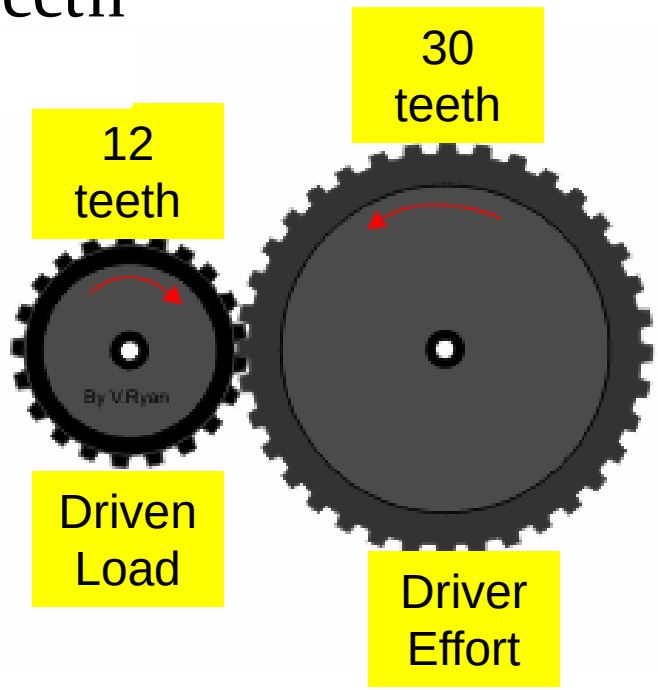
# Gears Ratio

- Work out the Velocity Ratio (Gear Ratio);

$$\text{GearRatio} = \frac{\text{Number of Driver Teeth}}{\text{Number of Driven Teeth}}$$

$$\text{GearRatio} = \frac{30}{12} = 2.5$$

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# Critical Components

a. Ratchet mechanism
b. Gears
c. Handle
d. Seat
e. Back rest
f. Footrest
g. Armrest
h. Wheels

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# Design Calculation

- Generated speed for handicapped to move
- Assumption $F_{initial} = 50$ N, $\theta = 35^{o}$
- Torque $_{driven} = r * F$,
- r = length of arm = 0.52 m
- $T_{driven} = r * F \sin\theta$

$= 0.52 * 50 \sin 35$

$= 14.91$ N.m

Rotational speed = 30 rpm

# Design Calculation

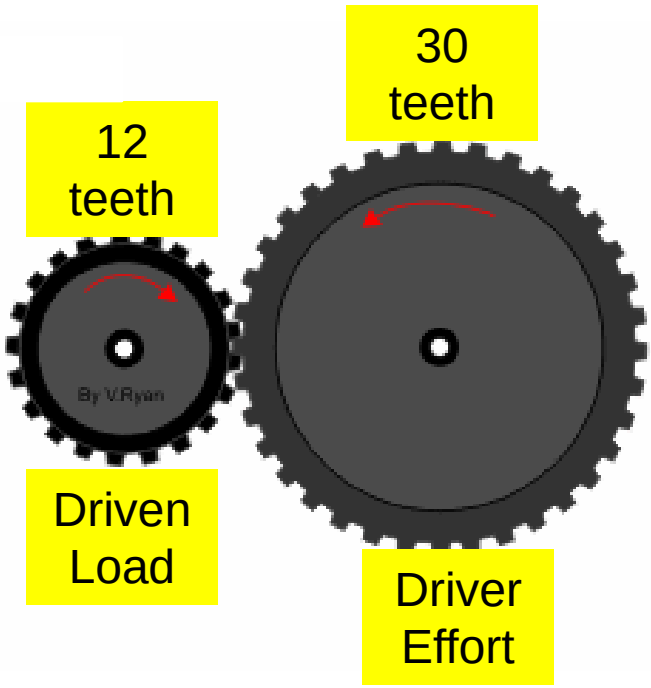
- Torque driver = torque driven +(r1-r2)*F

  = 14.91 + (0.070-0.025) * 50

  = 37.3 N. m

- Rotational Speed = Gear Ratio * 30rpm

  = 2.5*30 = 75 rpm

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# Design Calculation

- Load Calculation
- Maximum load (weight)=mass* gravitational acceleration

$$= 120 * 9.81$$

$$= 1176N$$

Based on this load we have selected the material after we did stress analysis on SolidWorks®

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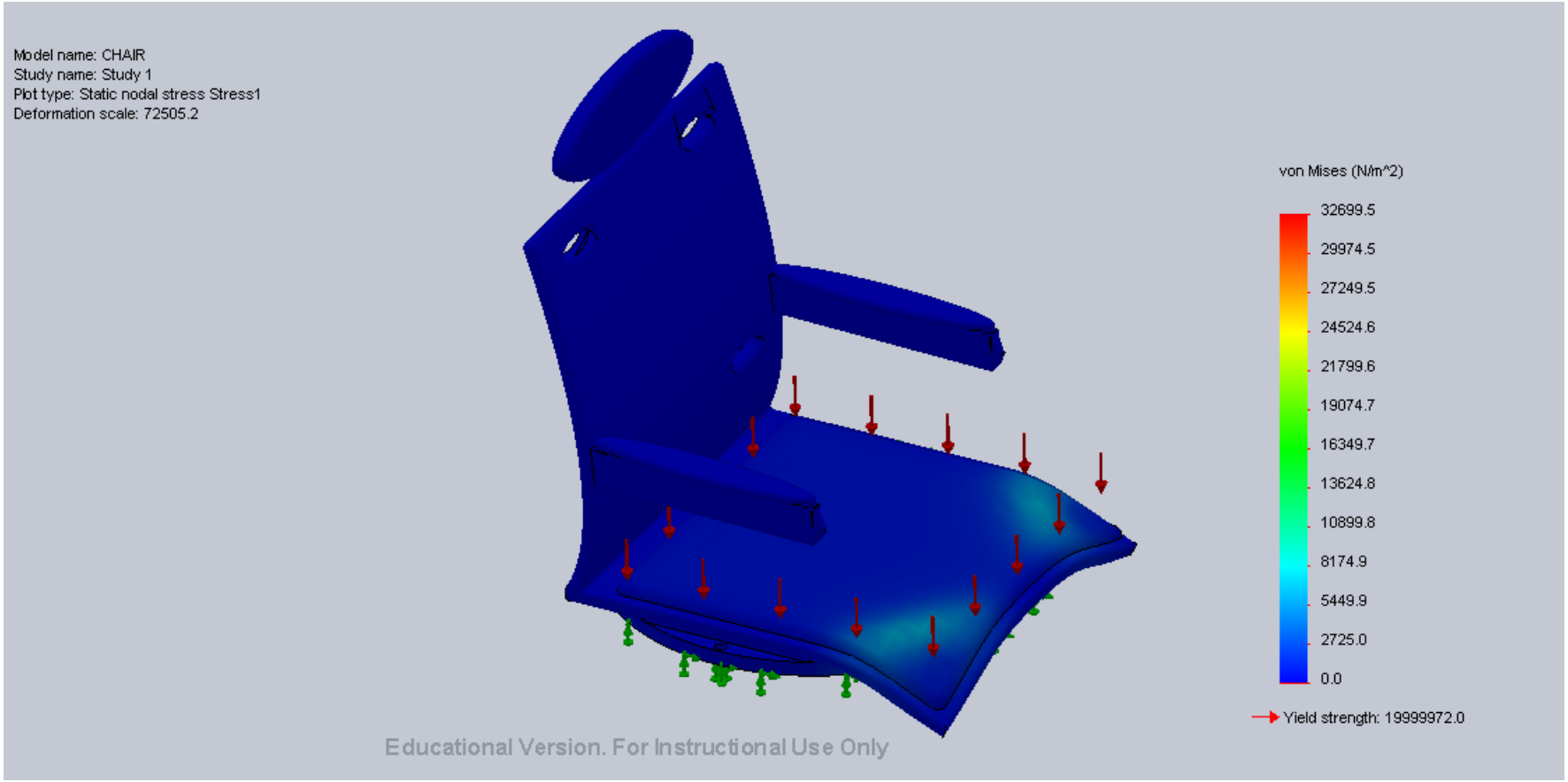
# Chair Stress Analysis

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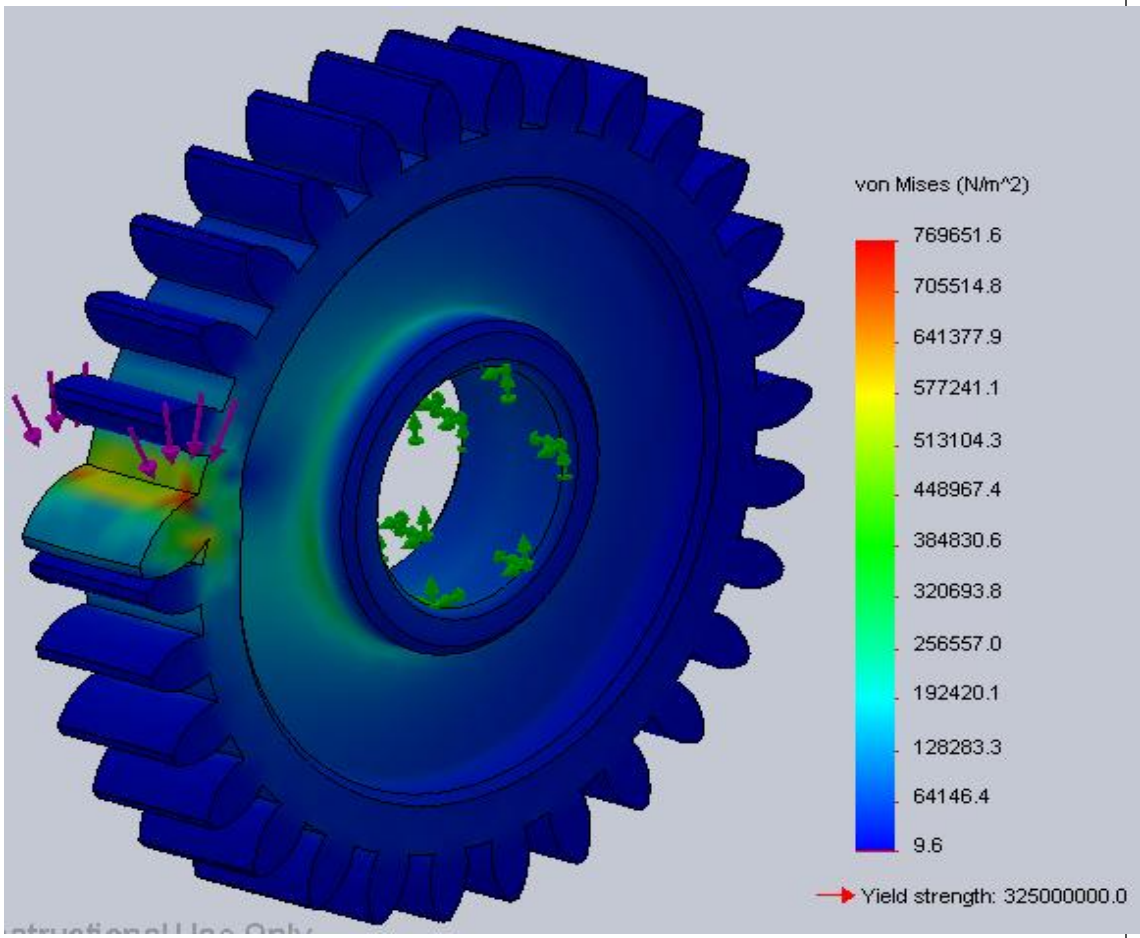
# Stress Analysis

- As you can see front wheel holder we did stress analysis based on selected material ( AISI 1020 ).
- The results shows the highest stress is 0.769 MPa . Much less than Sy
- Sy = 325.0 MPa

Very safe design

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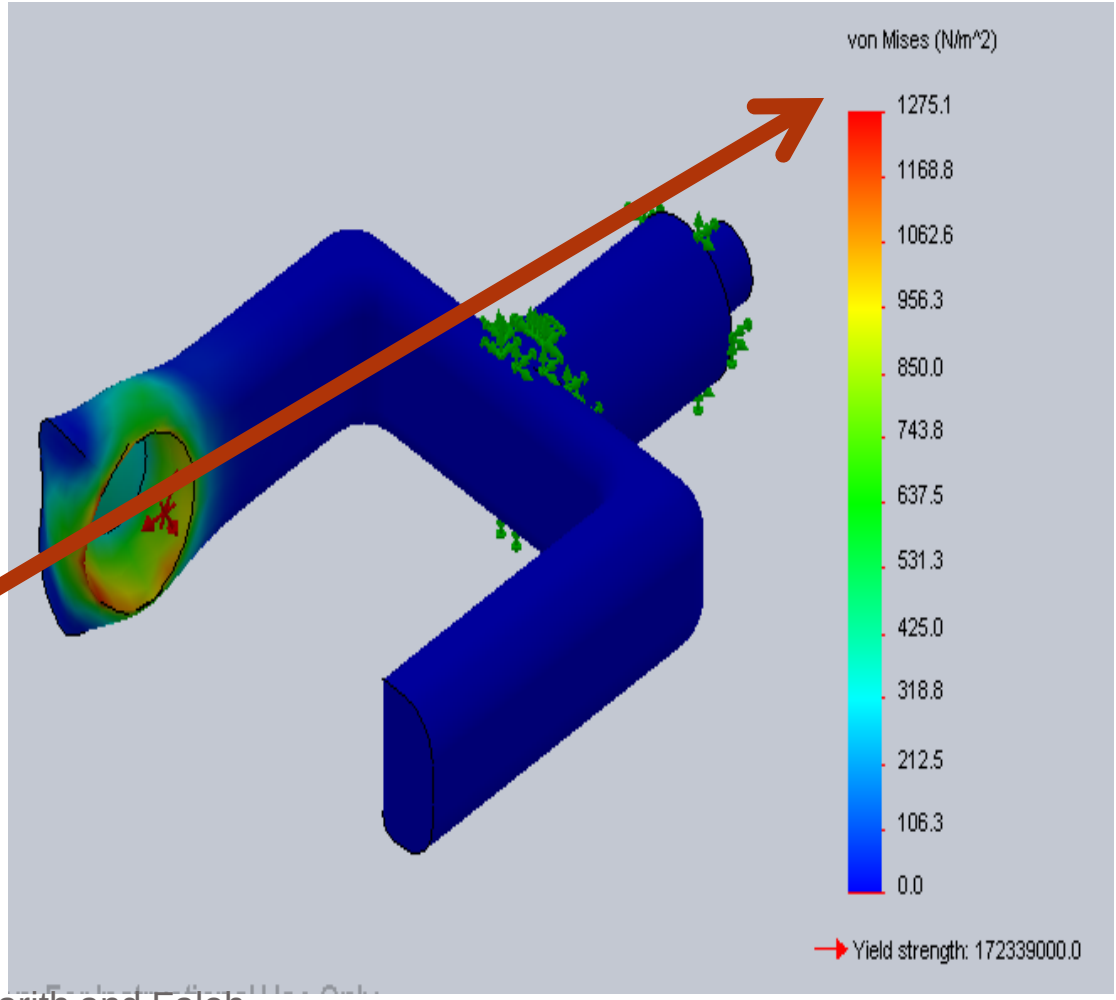
# Stress Analysis

- As you can see front wheel holder we did stress analysis based on selected material ( AISI 1020 ).

- The results shows the highest stress is 1.275 Mpa much less than Sy
- Sy = 172.339 MPa

Very safe design

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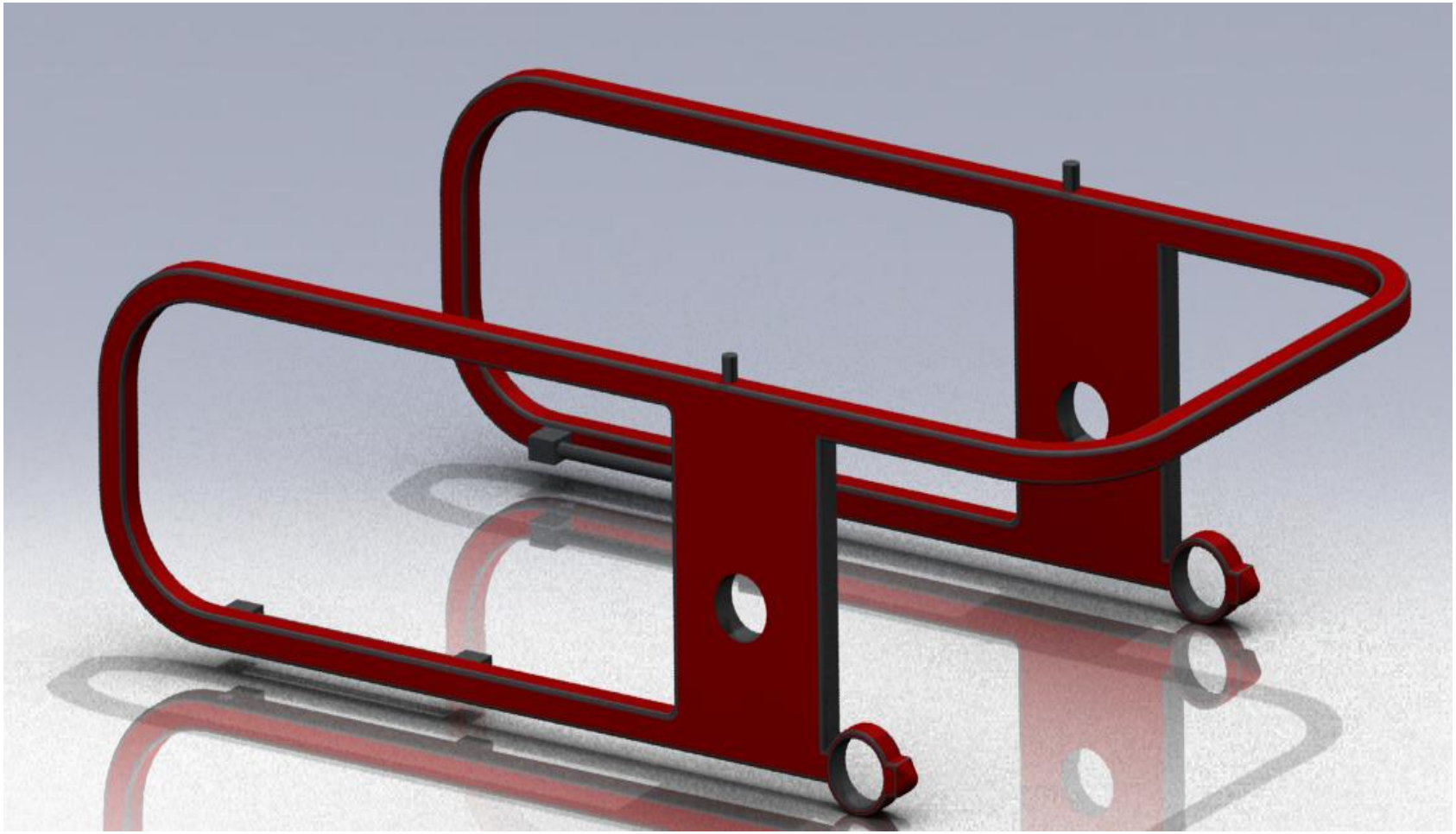
# Frame



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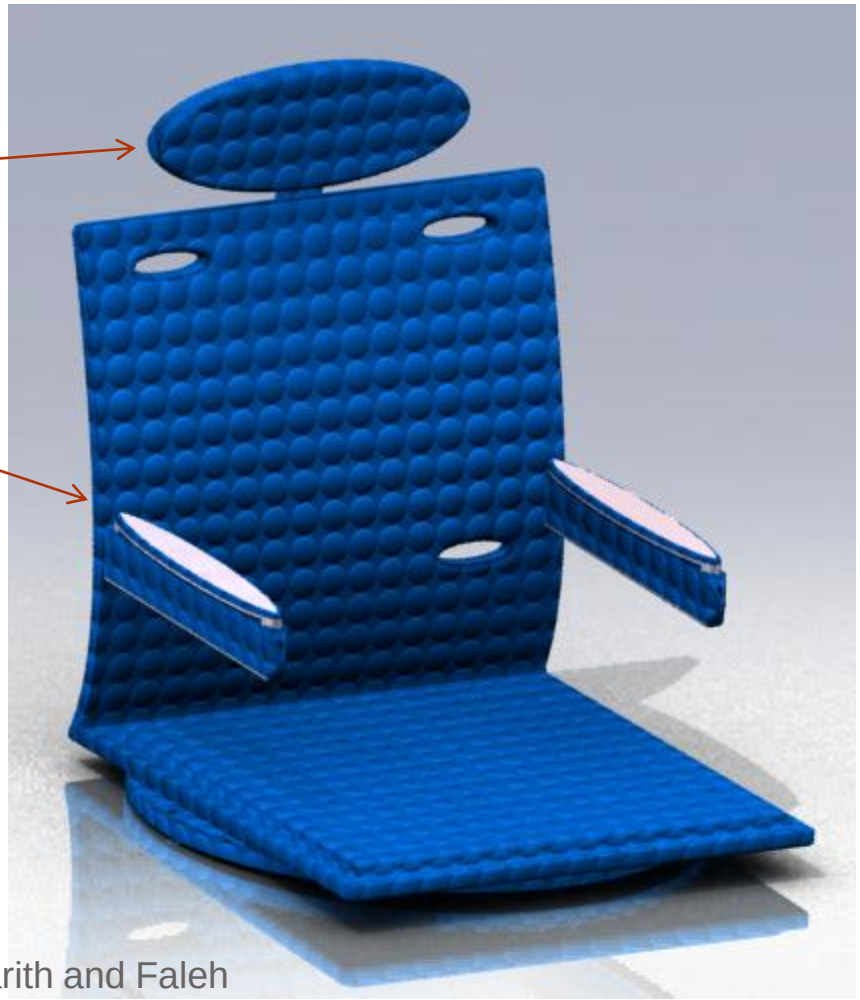
# Chair

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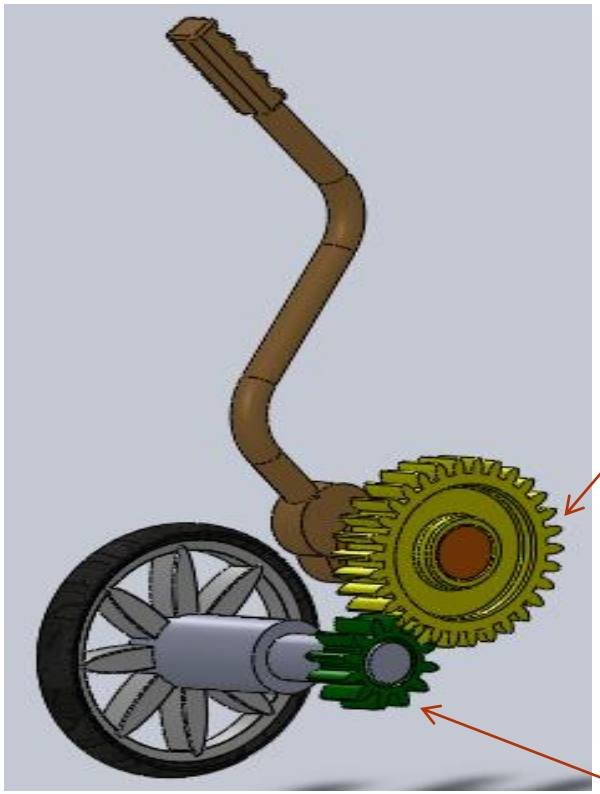
# Ratchet Mechanism

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# Digital Prototype

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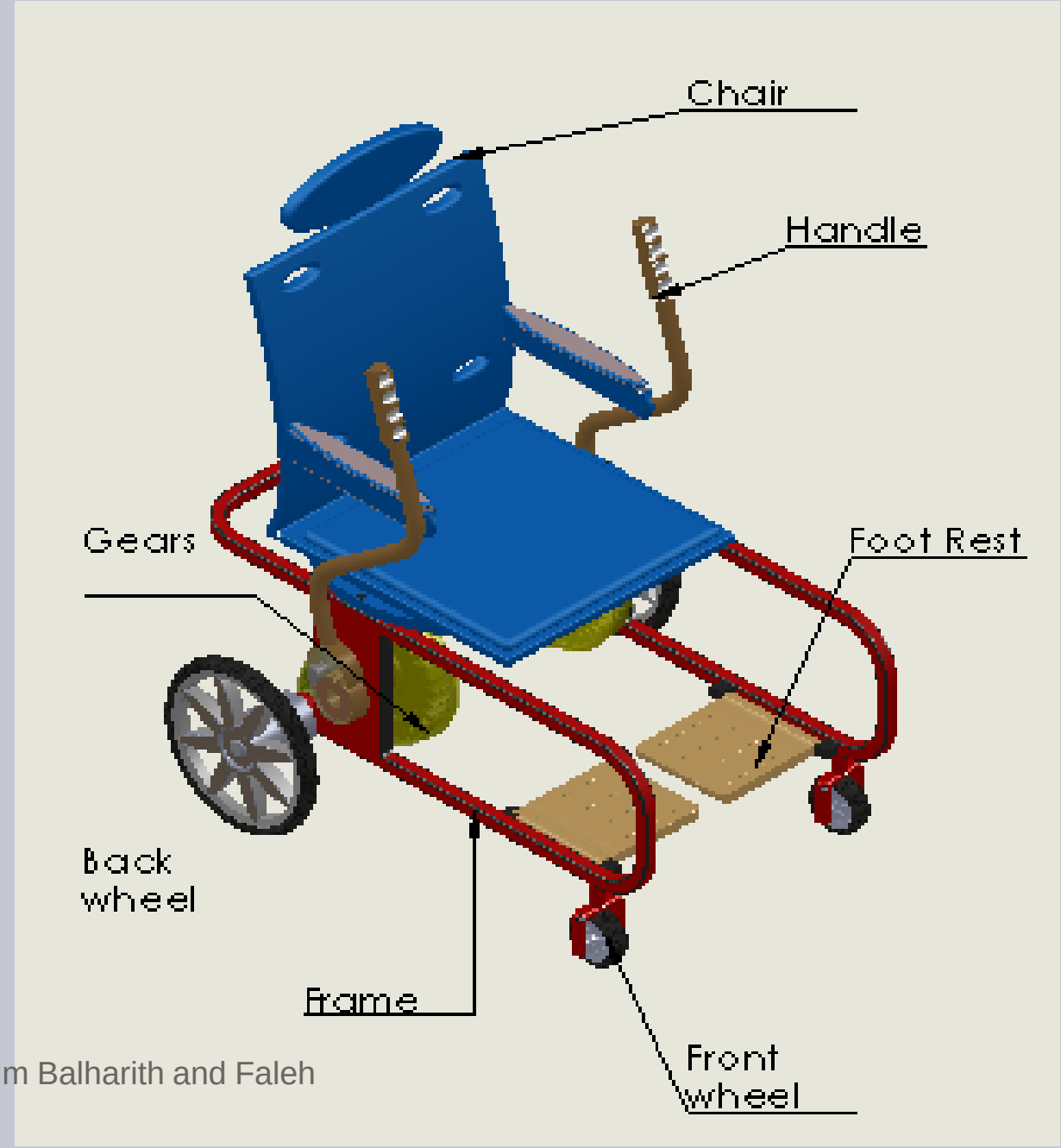
## 3-D front view

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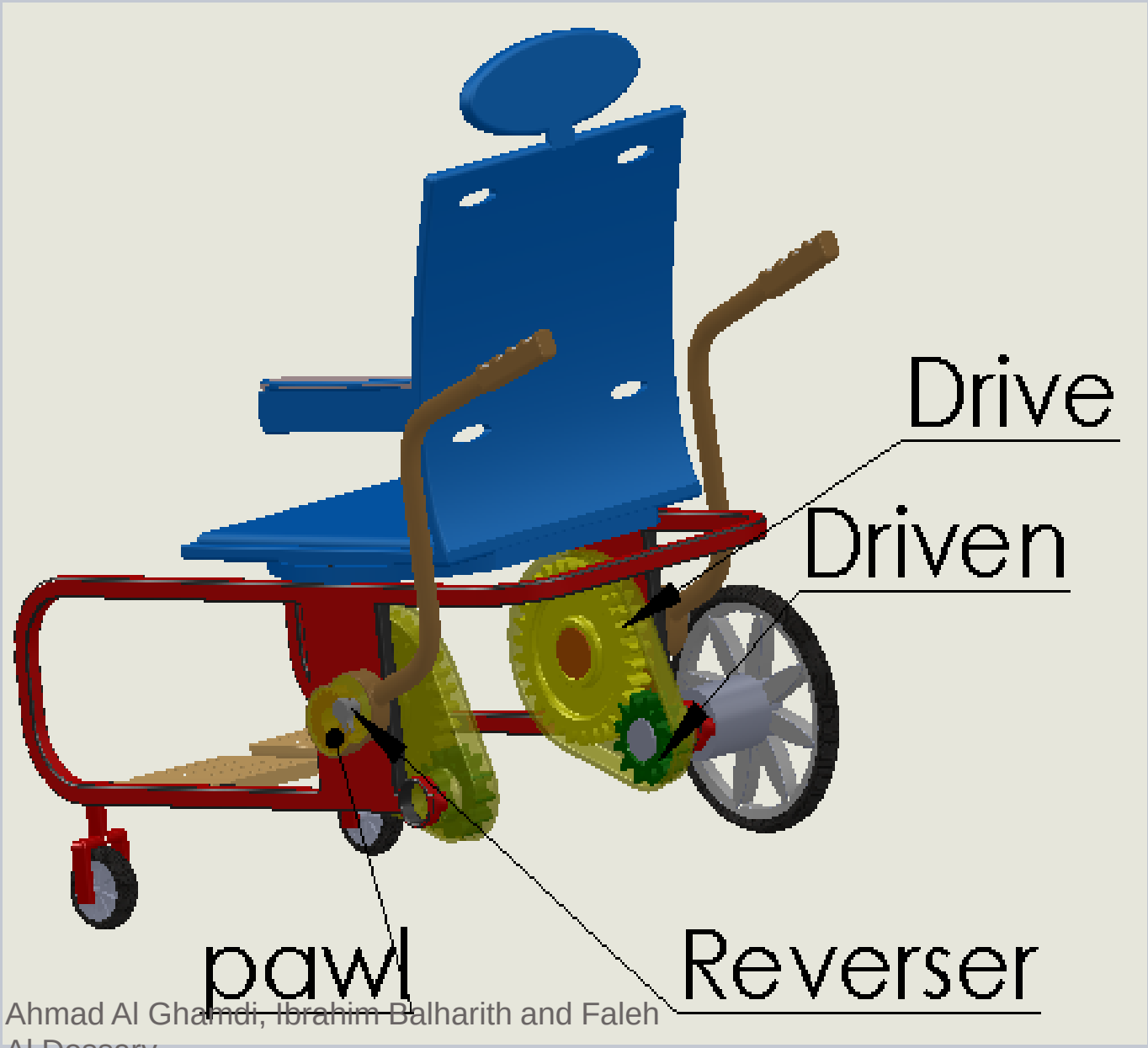
## Back side view

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# Animation

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