JIBEBE:ELECTRIC VEHICLE PROJECT

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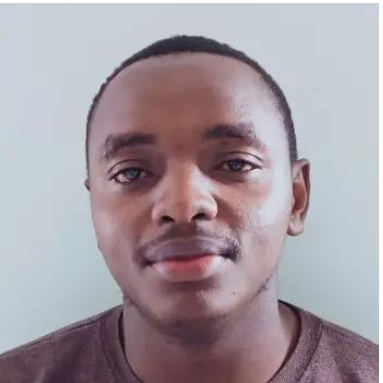

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INTRODUCTION

HUMAN POWERED TRICYCLE

Specifications

- ❖ Human powered tricycle
- ❖ Rubber brake shoes-operated by a brake lever

Limitations

- ❑ Tedious
- ❑ Ineffective brake system

Main Objective

Design fabrication and testing of an electric tricycle

Specific objectives

i. Determine the power requirements for the e-tricycle
ii. Design and fabricate the drive train
iii. Implement mechanical disc brakes

Key Content Activities

- Power requirements-max speed of 16km/h-1200W-BLDC Motor
- Drive train

Design of rear axle

At 600rpm for the 1200W , T_{max}=19.10Nm

Using the maximum shear stress theory (Guest's theory)

$$\sqrt{M^2 + T^2} = \frac{\pi}{16} \times \tau_{max} \times d^3$$

Diameter= 15.62mm

Chain drive design

❑Design for the sprockets

Speed ratio=3.5

The larger sprocket=47T

Smaller sprocket = 15T

❑Design for the chain

D=180mm

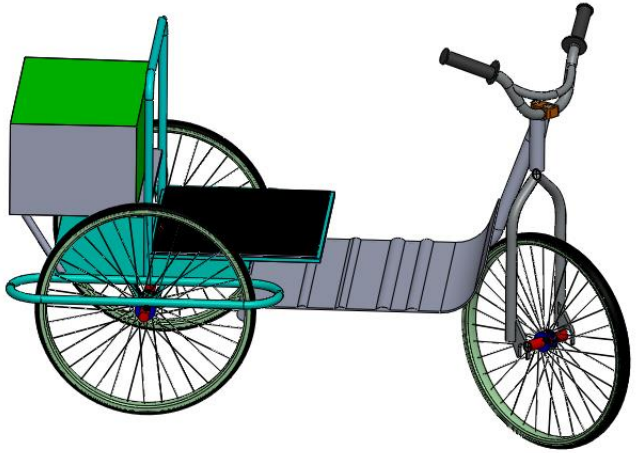
d=70mm

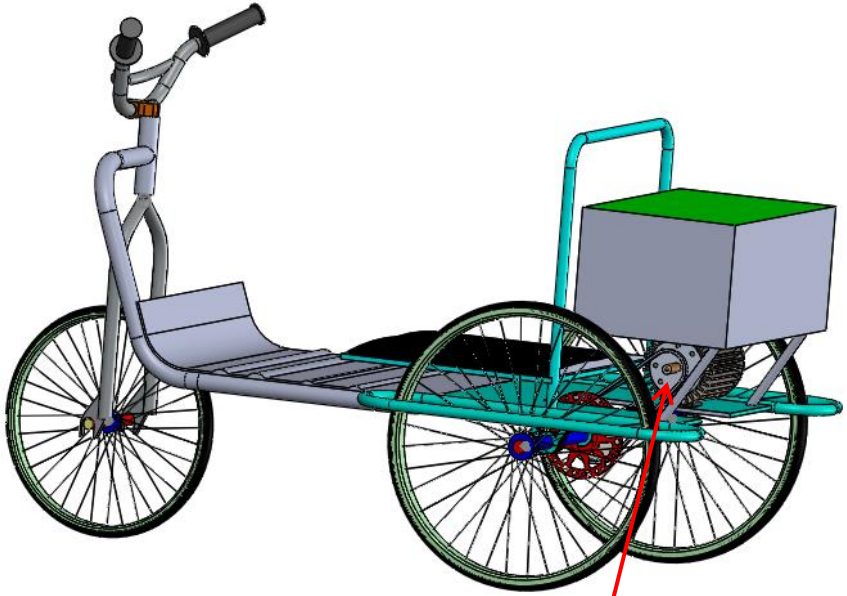
Center distance ,x= 170mm

Chain length=$\pi(R + r) + 2x + \left(\frac{R-r}{X}\right)^2$

L=760mm

3D modeling of the tricycle





Parts redesigned

- Steering
- Braking mechanism
- Rear wheels
- Motor positioning

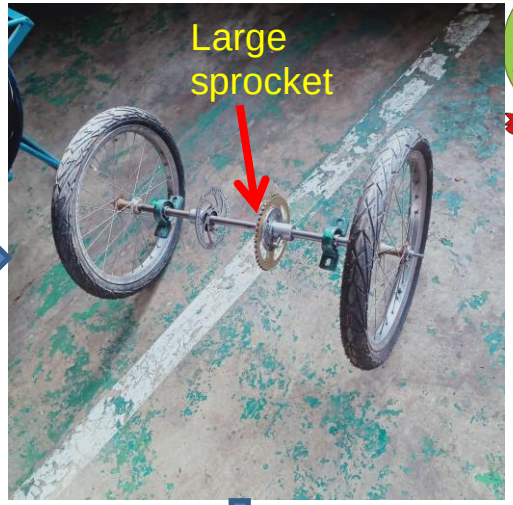
Fabrication and assembly of components

1.**Steering**-handle bars –
easy steering and other attachments i.e throttle,brake shifters

2.**Braking mechanism**
Mechanical brakes-both front and rear

Drive train

Chain



BLDC motor

Attachment on the motor

Motor

Chain

Sprocket

Assembly and testing of the e-tricycle

Recommendations

1. Implement a suspension system for better ride comfort
2. Centre alignment of the handle bars to improve steering and better handling

Main Objective

Design fabrication and testing of an electric tractor

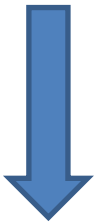
Specific objectives

i. Determine the power requirements for the e-shujaa tractor
ii. Stress and vibrational analysis of the e-tractor chassis
iii. Redesign the transmission system
iv. Assembly and testing of the e-tractor

POWER REQUIREMENTS FOR THE SHUJAA E-TRACTOR

Case 1:Working mode
Power required when the tractor is accelerating(0-11km/h) and ploughing= 6.7923 kw

Case 2:Transport mode
Power required when the tractor is accelerating(0-30km/h) but NOT ploughing= 6.855kW



15kW motor

TORQUE REQUIREMENTS FOR THE SHUJAA E-TRACTOR

Case 1:Working mode
Working speed=11km/h
Torque from motor=27.28Nm
Torque required at the driving wheels=1800Nm

Gear ratio=47.98

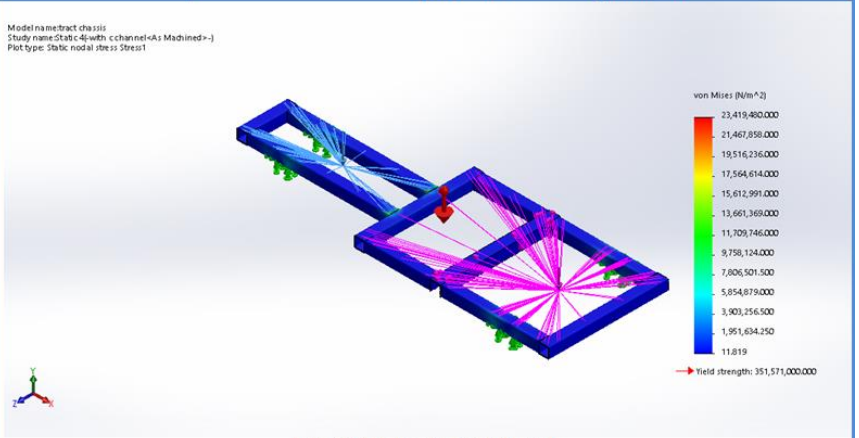
Case 2:Transport mode
Working speed=30km/h
Torque from motor=27.28Nm
Torque required at the driving wheels=479.98Nm

Gear ratio=17.59

Static and vibration analysis of the tractor chassis

Static analysis

Name	Type	Min	Max
Stress1	VON: von Mises Stress	11.819 N/m^2 Node: 34237	23,419,480.000N/m^2 Node: 5663



tract chassis-Static 4-Stress-Stress1

FOS=15

Frequency analysis

Freq No	Rad/sec	Hertz
1	2986.7	475.34
2	5540.9	881.86
3	11383	1811.7
4	13137	2090.9
5	13327	2121.1

For a top speed of 3500rpm
Operating frequency of the motor is 58.33Hz (366.52rad/s)

Thank you