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ABSTRACT

In this 21st century the humanity is shifting towards the electric vehicles due to the air pollution. But we forgot one of humanities greatest invention bicycle, which is pollution less, despite that we ignoring the bicycle because of the low speed provided by the bicycle. To overcome this issue electric bicycle was invented. But we can get the advantage of the electric power as before the battery run out of charge. So, we need to stop the bicycle to charge it. Which is waste of our precious time. How about a bicycle which can charge itself while driving it? Our e-magnetic bicycle going to satisfy this condition of charging the bicycle while riding the bicycle.

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CHAPTER 1

1. INTRODUCTION

A Bicycle also called a pedal cycle, bike or cycle is a human powered or motor powered assisted, pedal-driven, single-track vehicle having two wheels attached to a frame one behind the other. An Electric Bicycle is a motorized bicycle with an integrated electric motor used to assist propulsion. There are two types of electric bicycles they are,

- Pedal-assist e-bike with a relatively low-powered electric motor and a decent but not excessive top speed. The motorized assistance that only engages when the rider is pedaling, cuts out once. Max. Speed – 25 km/hr.
- In power on demand bicycle the rider can, ride by pedal power alone, i.e., fully human-powered, ride by electric motor alone by operating the throttle manually, ride using both together at the same time.

CHAPTER 2

1. LITERATURE REVIEW

2.1. Electric and pedal driven bicycle with solar charging:

Author: Henry M. Gannon

Patent Number & Year: EP3131185A1 & 2011

Summary:

The primary object of the present invention to provide a practical electric propulsion system with solar charging for a vehicle including though not limited to a bicycle. Object is accomplished is by solar cell arrangement which recharges the batteries during daylight hours. To position the components of the electrical propulsion system so as to arrive at optimal weight distribution and highest convenience to the operator.

Demerits: It is mostly useful only in daytime in order to get energy.

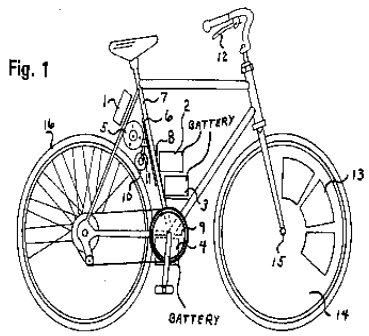

Fig2.1

2.2. Exercise bicycle with magnetic flywheel brake:

Author: Andrew P. Lull

Patent Number & Year: US8408349B1 & 2014

Summary:

A purpose of present invention to increase resistance of rotation of flywheel bicycle. The flywheel of cycle consists of symmetrical magnets with a similar distance. It is a made-up of aluminum in outside and iron in inside. We can adjust magnets; resistance

can be changed accordingly. Strong magnetic field is created because permanent magnet rejects the non-ferrous material.

Demerits: It requires high speed of input in order to get required output.

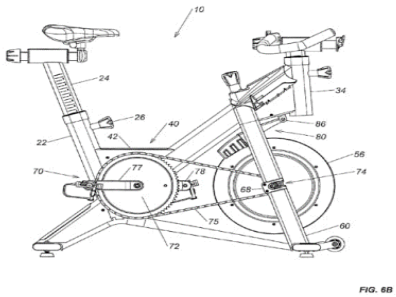

Fig2.2

2.3. Magnetic induction rotor member, non-contact power generator and bicycle non-contact light emitting device:

Author: Liao Guangyang

Patent Number & Year: US8002067B2 & 2009

Summary:

The attachment has 4 compartments. Each compartment will be 30° or 60° apart. And each compartment has 2 magnets in it. As the rim starts to rotate the attachment also starts to rotate. Which in turn rotates the shaft.

The power generation device of the present invention is attached at intervals so as to correspond to the rim of the bicycle, so it does not contact the rim, so there is no frictional resistance and the existing pedal is heavy in addition to solving the problem, it is possible to provide power to the illumination light and the flashing light.

Demerits: Difficult to maintain angle difference between with magnets arrangements.

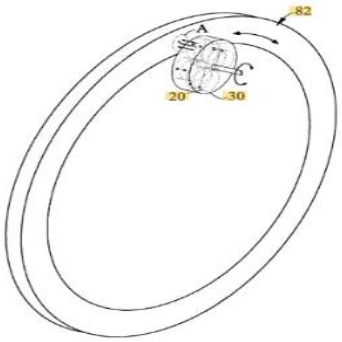

Fig2.3

2.4. Electric Bicycle:

Author: Robert P McCulloh, Stephen Hagar Smith

Patent Number & Year: CN201415738Y & 2009

Summary:

An electric bicycle employing chain, V-belt or friction pulley drives and a motor controller circuit variable. Regenerative braking and the conversion of the motor to a transformer for charging the bicycle battery is disclosed as is both tires and a rim adapter to convert a standard bicycle rim to a belt drive. It provides electrical connector for battery charging is carried by the bicycle and mechanically interlocked with the conversion of the electric motor to the transformer mode. In this invention, motor may be modified to serve as a transformer for charging the bicycle battery.

Demerits: It requires large amount of capacity stored battery for regenerating power.

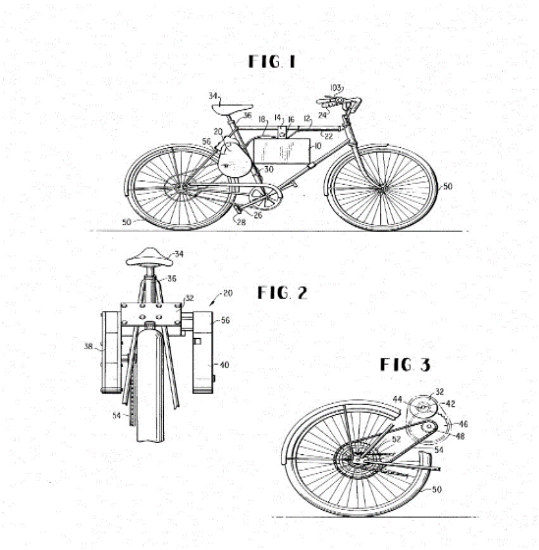

Fig2.4

2.5. Bicycle with optional power assist:

Author: Grant Young

Patent Number & Year: WO2017032832A1 &2016

Summary:

A bicycle is fitted with rear panniers that provide electric motor assist and a power supply for the bicycle when desired. Left side pannier includes an electric drive motor and motor controller, a flexible gear reduction chain drive **.** Right side pannier contains the energy source, usually a rechargeable battery. The “tri-fold” solar panel is folded to one third of its width and slides under the utility rack. The power from solar panel stored in battery. Power in battery transfer power from the motor to the rear axle, the motor drive unit consists of two connected chain or belt drives that share an axle at the center connection point.

Demerits: It requires huge amount of solar energy to get required output.

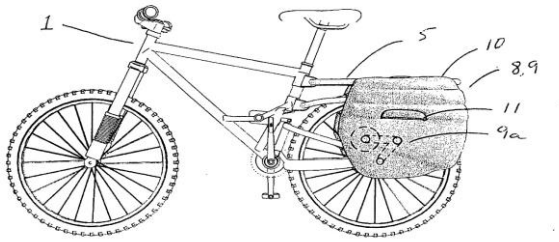

Fig2.5

CHAPTER 3

3. PROBLEM DESCRIPTION

3.1 PROBLEM SPECIFICATION:

One of the major disadvantages are inconvenience in using electric bicycles is to charge it when the charge ran out. So that the travelling distance is reduced with respect to the battery capacity and the seamless riding in the electric bicycle is affected by this. So, we came up with a bicycle named E-Magnetic Bicycle which generates electrical energy while riding it.

3.2 OBJECTIVES:

- The main objective is to provide seamless riding of electric bicycle without any need to stop the bicycle for charging it.
- To eliminate the bills paid for charging the electric bicycle.
- To promote the use of bicycle to reduce the traffic as well as the electric bicycles are eco-friendly

CHAPTER - 4

4. EXPERIMENTAL SET-UP

4.1 FUNCTIONAL DECOMPOSTION

4.1.1 COPPER COIL:

The copper coil are wound on the rim of the bicycle and the emf is generated when the copper coil falls on the variable magnetic field.

Specification:

Length of the coil = 500 – 700 mm

Fig 4.1

4.1.2 MAGNETS:

The magnets are equally placed on the mudguard of the bicycle of both sides in parallel way

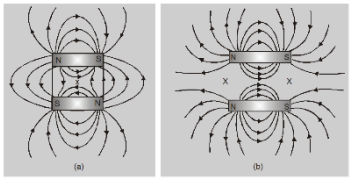

Fig 4.2

4.1.3 BATTERY

The produced emf in the copper coil is collected and stored in a battery.

Specification:

1. Voltage of Battery = 30 – 40 V
2. Current Required = 10 - 15 A
3. Battery Capacity = 300 – 500 WH

4.1.4 HUB MOTOR:

The stored current is now supplied to the hub motor to start by means of wires.

Specification:

1. Speed of Hub Motor = 250 – 400 RPM
2. Power produced from Hub Motor = 350 – 500 W

Fig 4.3

4.1.5 DISC BRAKES:

Disc Brakes generate an incredible amount of stopping power. Because of the presence of the coil in the rim, it is impossible to use the normal caliper brake. So, the disc brake is a good choice for this bicycle.

Fig 4.4

4.2 DESIGN CALCULATION:

1. The power required by the hub motor to drive the electric bicycle is = 350 W.

2. For achieving the velocity of 25 km/hr the speed (rpm) at which the hub motor need to rotate is given by,

Diameter of wheel = 622 mm

Velocity = 25 km/hr

$V = \pi DN/60$

$(25*10\text{^}3/3600) = \pi\ (0.622)\ N/60$

N=215 rpm

The amount of electricity to run the 350 W hub motor = 14 A

The magnetic field with which the magnet should have in order to produce the 14 A of current is given by,

$$\text{Magnetic field, } B = (\mu_0 * I)/2\ \pi\ D$$

here,

$\mu_0 \rightarrow$ permeability of free space = $4\ \pi * 10\text{^}-7$ m/A

$$B = [(4\ \pi * 10\text{^}-7) *14] / [2\pi\ (0.05)]$$

$$\boxed{B = 5.6*10\text{^}-5 \text{ Tesla}}$$

4.3 CAD MODEL:

4.3.1 PART DRAWING

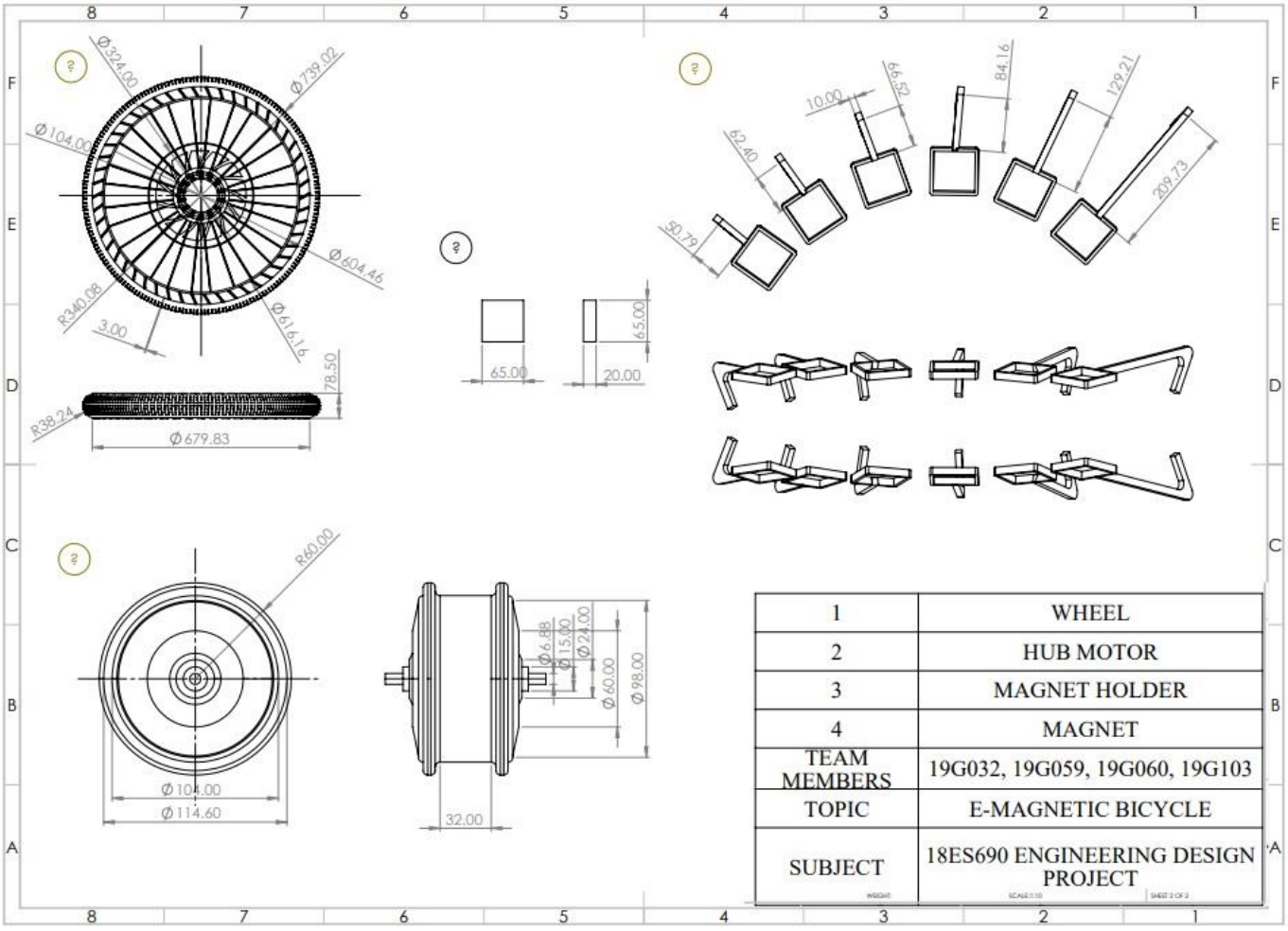

Fig 4.5

4.3.2 ASSEMBLY DRAWING

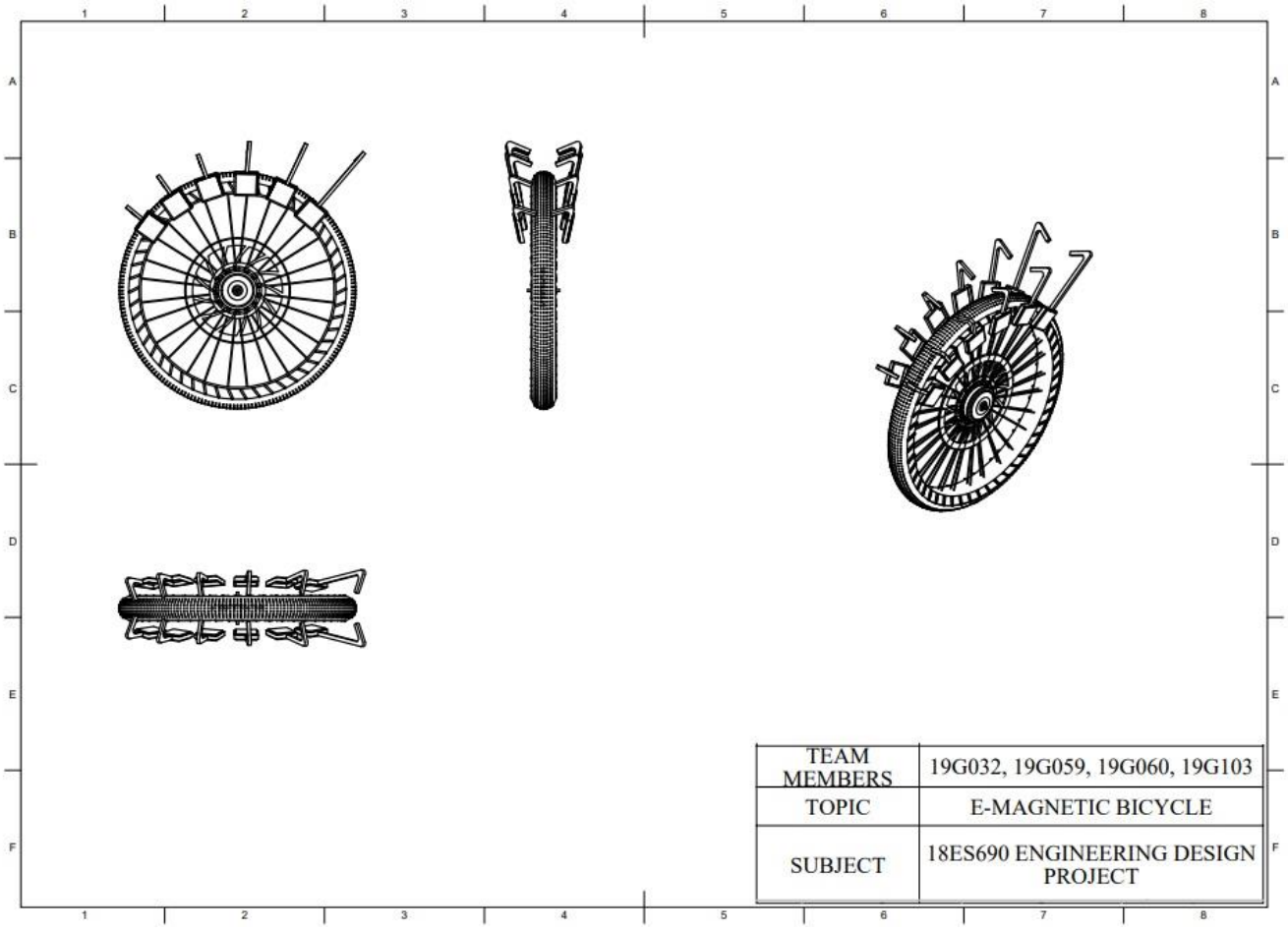

Fig 4.6

4.4 METHODOLOGY

When the wheel rotates, magnets in the mudguard begins to produce magnetic field at a certain speed of bicycle. Due to change in magnetic field, emf is generated in the copper coil which was wound on the rim of the bicycle. This produced emf is collected and stored in the battery. The stored current is supplied to the hub motor to start the bicycle and supplied by means of wires.

CHAPTER – 5

5. IMPLEMENTATION

5.1 RENDERED IMAGE

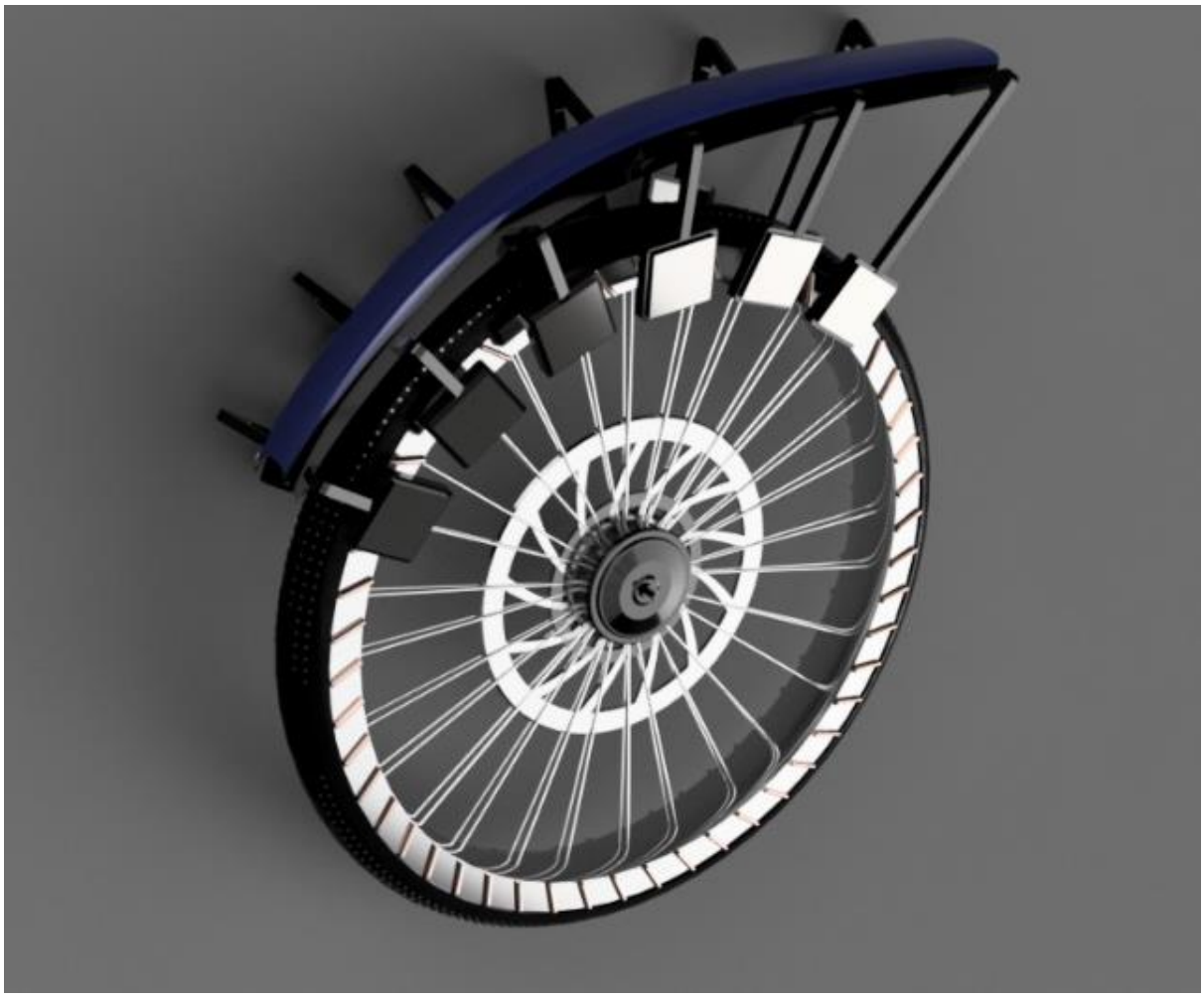

Fig 5.1

5.2 STATIC STRUCTURAL

5.2.1 FOR MAGNETIC HOLDER

Input condition for Magnetic Holder

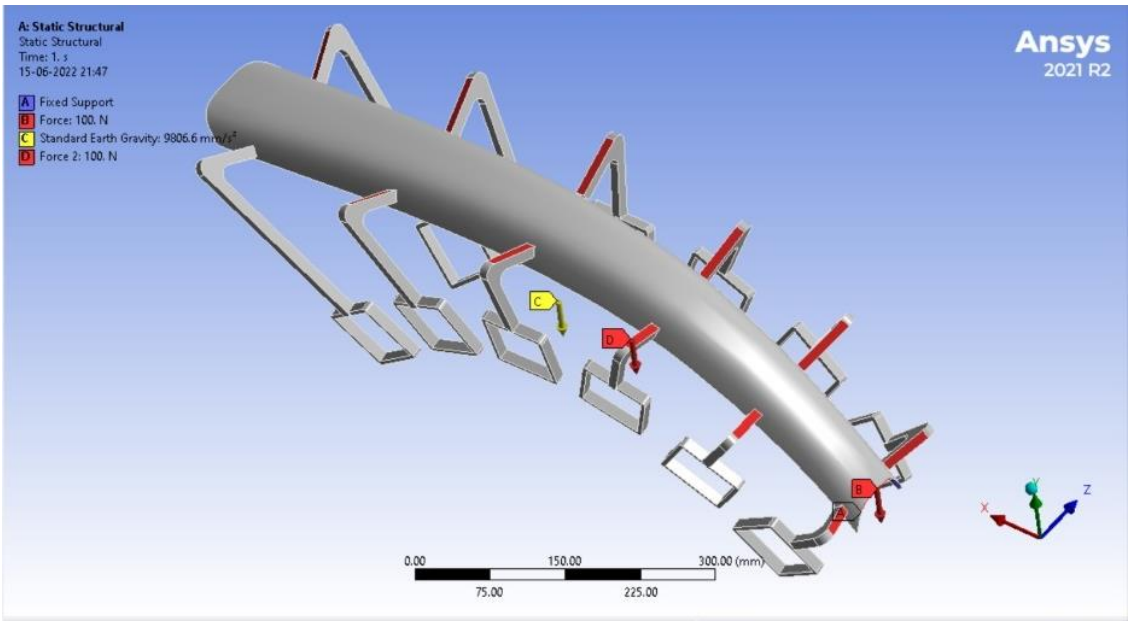

Fig 5.2

Total deformation in Magnetic Holder

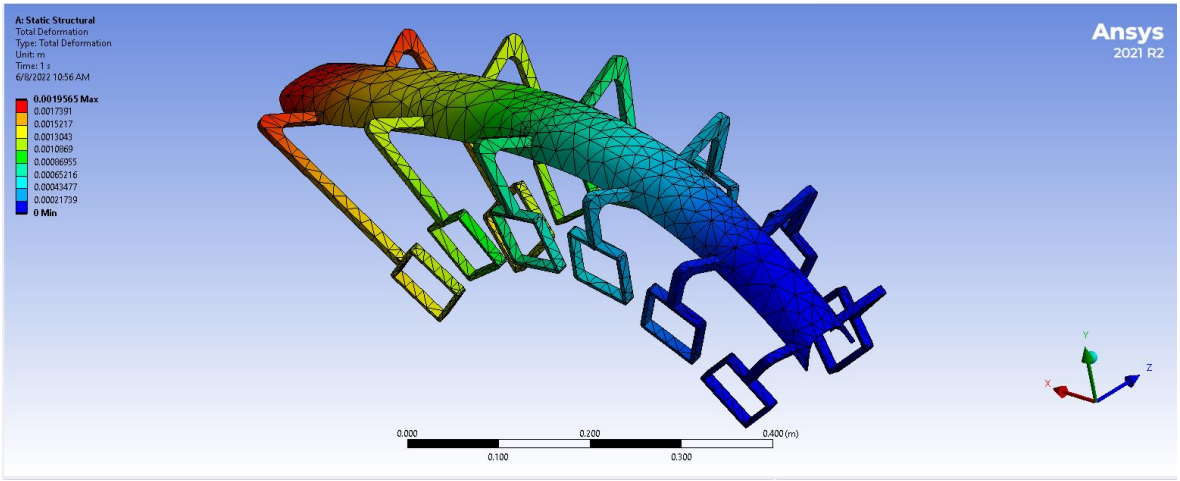

Fig 5.4

Red color region shows the maximum amount of deformation and blue color region shows the minimum amount of deformation.

Stress induced in the Magnetic Holder

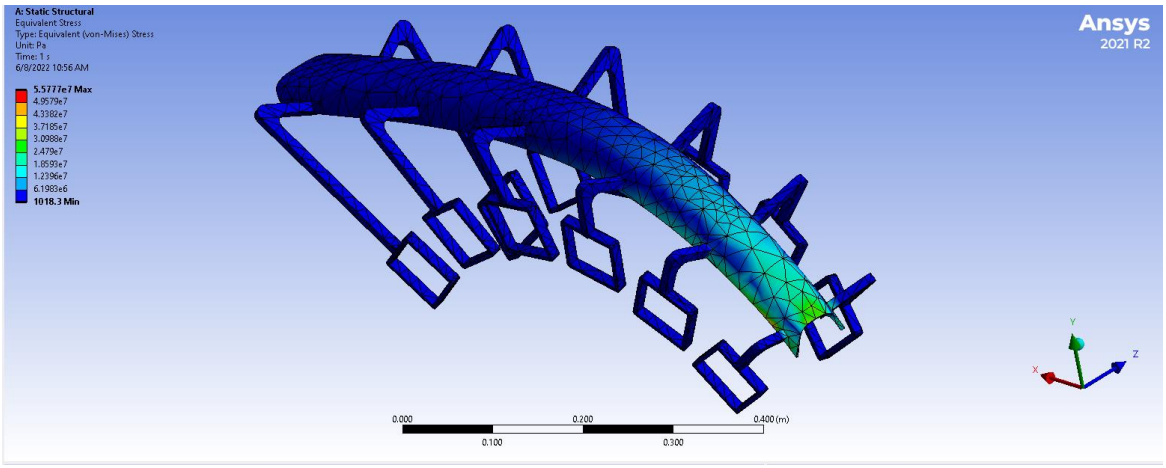

Fig 5.3

When a magnetic holder is subjected to high stress, it performs high deform on magnetic holder and performs low deform when it is subjected to low stress

Strain in Magnetic Holder

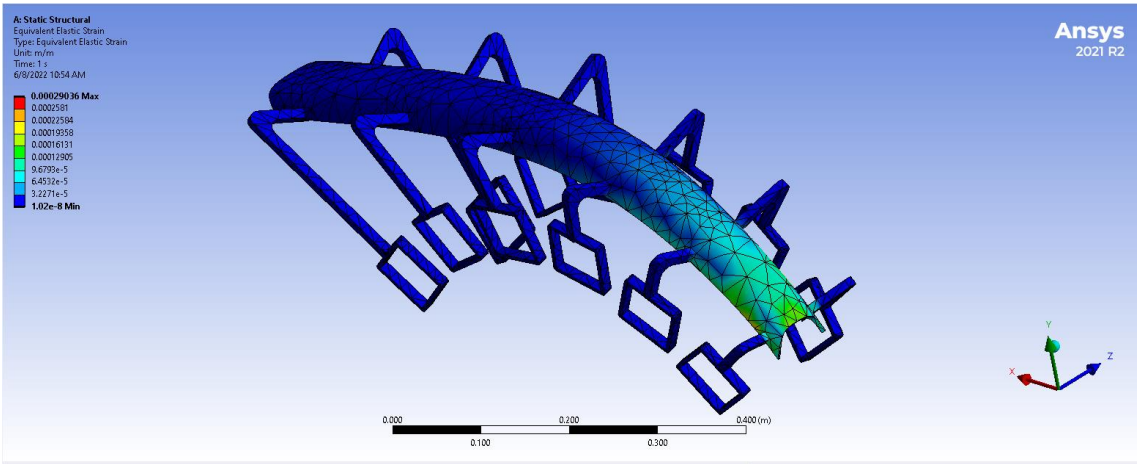

Fig 5.5

5.2.2 FOR WHEEL

Input condition for Wheel

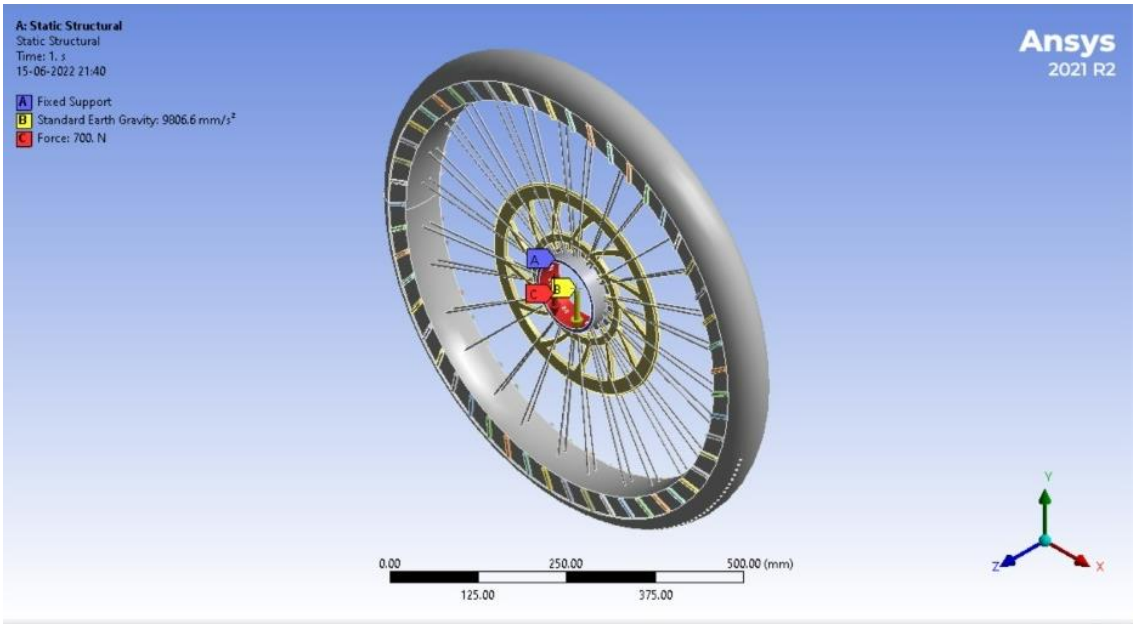

Fig 5.6

Total deformation in Wheel

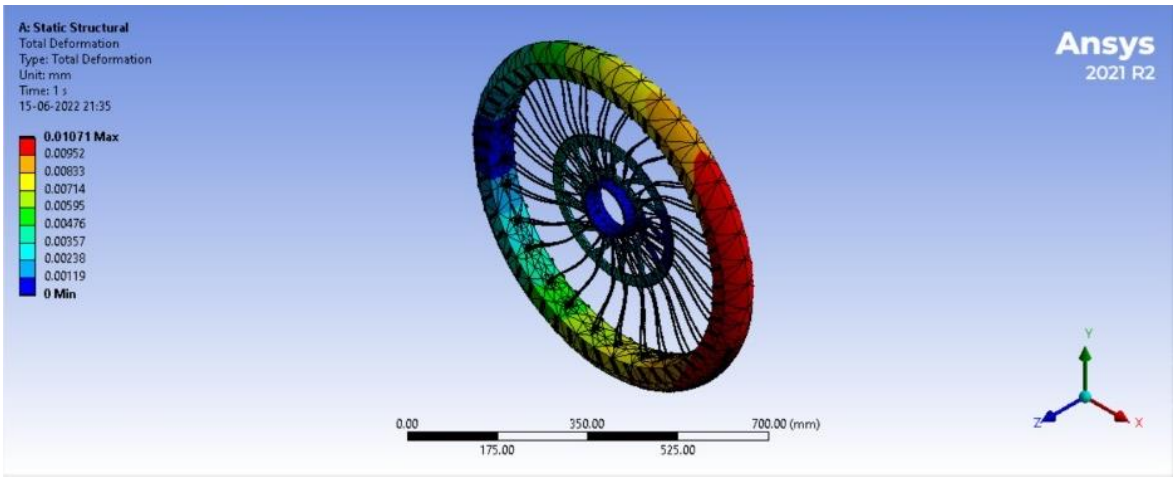

Fig 5.7

Red color region shows the maximum amount of deformation and Blue color region shows the minimum amount of deformation.

Stress induced in Wheel

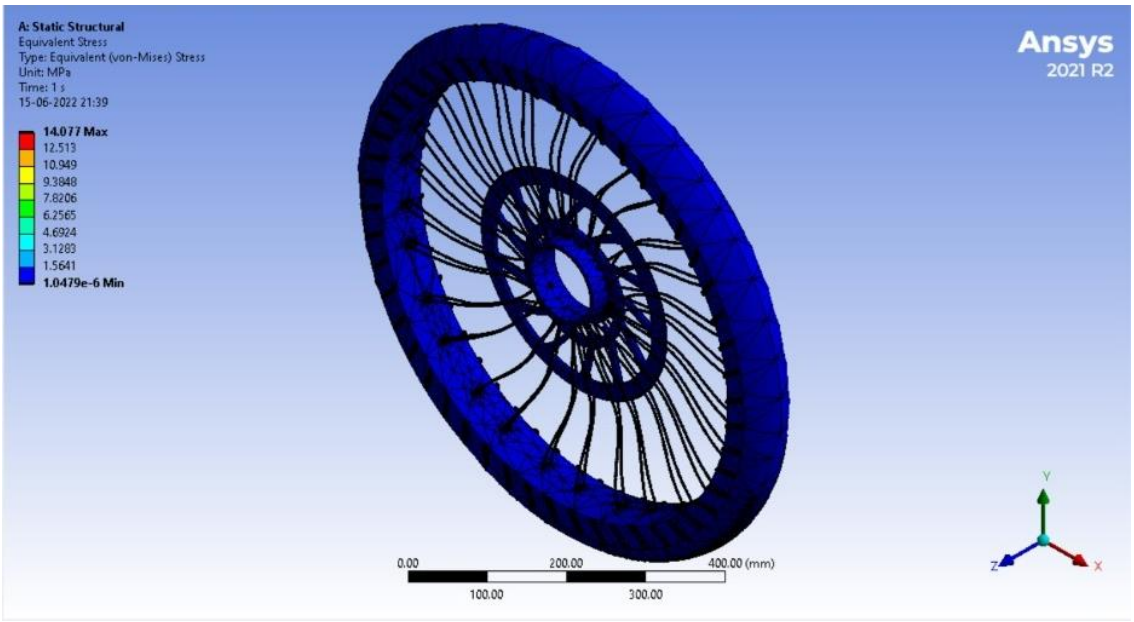

Fig 5.8

Strain in Wheel

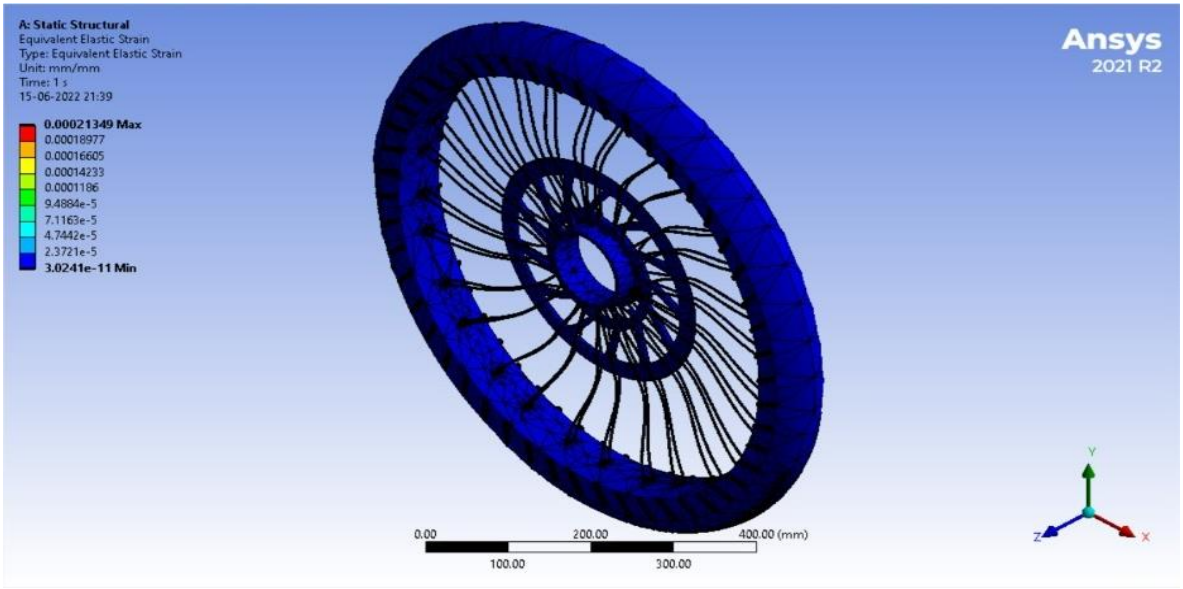

Fig 5.9

CHAPTER-6

6. RESULTS AND DISCUSSIONS

The model is designed by means of Autodesk Fusion 360 and Solidworks and it is analysed with the help of Ansys by giving appropriate input conditions and obtained the maximum values of stress that these components can withstand.

From, FMEA analysis we got maximum RPN value for the problem of disturbance of magnetic field nature. So, we decided to focus further development of our project related to that the problem.

CHAPTER-7

7. CONCLUSION

It is suitable for both city and country roads, that are made of cement, asphalt, or mud. This bicycle is cheaper, simpler in construction & can be widely used for short distance as well as long distances travelling especially by school children, college students, office goers, villagers, postmen etc. It is very much suitable for young, aged, handicap people and caters the need of economically poor class of society.

FUTURE SCOPE:

Nowadays, many start-ups started to manufacturing e-bicycles, cars, e-bikes and these electric vehicles are also gaining popularity among people. In future the electric vehicle replaces the conventional vehicles. At that time the E-Magnetic Bicycle plays a crucial part in the society.

CHAPTER-8

8. REFERENCE

[1] Henry M. Gannon (1993) proposed a method of Electric and pedal driven bicycle with solar charging.
https://patents.google.com/patent/EP3131185A1/en?oq=patents+on++electric+cycle

[2] Andrew P. Lull (2011) proposed a method of Exercise bicycle with magnetic flywheel brake.

https://patents.google.com/patent/US3921745?oq=patents+on++electric+cycle

[3] Liao Guangyang (2013) proposed a method of Magnetic induction rotor member, non-contact power generator and bicycle non-contact light emitting device.

https://patents.google.com/patent/US8002067?oq=literature+review+on+electric+bicycle

[4] Robert P McCulloh Stephen Hagar Smith (2003) proposed a method of Electric Bicycle

https://patents.google.com/patent/WO2017032832A1/en?oq=google+patent+on+electric+bicycle

[5] Grant Young (2004) proposed a method of Bicycle with optional power assist

https://patents.google.com/patent/US8408349?oq=google+patent+on+electric+bicycle