DESIGN ANALYSIS AND FABRICATION OF HUBLESS BICYCLE

Submitted in partial fulfillment of the requirements for degree

of Bachelor of Engineering

By

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IDEAL INSTITUTE OF TECHNOLOGY, WADA
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PALGHAR

Vision

To become center of excellence in Engineering education and research

Mission

To educate students to become quality technocrats for taking up challenges in all phases of life

Department of Mechanical Engineering

Vision

To emerge as a center of excellence in academics and research in the field of Mechanical Engineering.

Mission

To create professionally competent engineers with analytical and research skills for promoting an environment of continuous learning.

Program Educational Objectives (PEO's)

1. To create excellent mechanical engineers with core competency in mathematics, science and engineering enabling development of problem solving skills.

2. To strengthen themselves professionally and personally to accept responsibilities and pursue higher education in engineering and other professional fields.

3. To use modern tools and techniques necessary for mechanical engineering and allied disciplines leading to research and development.

4. To inculcate the students to work effectively in cross-functional teams and cultivate the principles of professional ethics and social responsibilities.

5. To develop the students adaptable to change in environment and application of appropriate methodology for value addition so as to support economic growth.

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At the end of the program a student will be able to:

1. Apply knowledge of Mathematics, Science and fundamental of Mechanical Engineering.
2. Design and conduct experiments, as well as to analyze and interpret the data.
3. Use of techniques, skills and modern engineering tools necessary for engineering practice.
4. Identify, formulate and solve engineering problems.
5. Commitment to professional, social and ethical responsibility to function effectively as a team leader in engineering practices.
6. Inculcate self-discipline, self-confidence and to make the students internally driven to set personal goals.
7. Engage in life –long learning in order to maintain sustainable development even during the crisis.
8. Solve the contemporary issues with broad understanding of the impact of engineering and technology on society.
9. Understand environmental and contemporary issues.
10. Possess the skills to communicate effectively with a wide range of both engineering and non-engineering community. Apply knowledge of management principles to handle projects in multidisciplinary environment and work as a team and as an individual effectively.

CERTIFICATE

This is to certify that the project entitled "**DESIGN ANALYSIS AND FABRICATION OF HUBLESS BICYCLE**" is a bonafide work of

Shaikh Afnan

Bhushan Amolik

Submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **"Undergraduate"** in **"Mechanical Engineering"**.

Prof. Pramod Sharma	Prof. Pramod Sharma
Project Guide	Project Co-ordinators
Prof. Pramod Sharma	Dr. Bhuvan Chandra
Head of Department	Principal

Project Report Approval for B. E.

This project report entitled **"DESIGN ANALYSIS AND FABRICATION OF HUBLESS BICYCLE"** by

Shaikh Afnan

Bhushan Amolik

Is approved for the degree of **Bachelor of Mechanical Engineering.**

Examiners

1. _____

2. _____

Date:

Place:

Declaration

We hereby declare that this written submission represents my ideas in my own words and where other's ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

I. SHAIKH AFNAN **…….**

II. BHUSHAN AMOLIK …….

(Signature)

Date:-

Acknowledgement

We would like to express our deep regards and gratitude to our respected principal **Dr.Bhuvan Chandra.** We would like to tender our sincere thanks to **Prof. Pramod Sharma (Head of Department)** for his encouragement and support towards this project. We are very much thankful to our guide **Prof. Pramod Sharma** for his timely intervention and meticulous guidance. We are out of words in expressing our thanks for his guidance and encouragement. We owe our deep sense of gratitude to our **project co-ordinators** for their continuous evaluation process and guidance. We would wish to thank the non - teaching staff and our friends who have helped us all the time in one way or other. Really it is difficult to repay the debt of all the people who have directly or indirectly helped us for completing the project.

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ABSTRACT

The construction of Hubless wheel bicycle with gear train drive mechanism is designed to convert the human muscle power through pedaling work in to the mechanical work. The system is assembled with the combination of pedals, shafts, and Hubless wheel which is function as driving wheel. The pedal and shaft are receiving the human effort and convert in to rotational mechanical motion. This rotational motion is transmit up to the driving wheel via the spur gear drive train. The spur gear meshes with the internal gear and it rotates the wheel. These gear pairs not only transmit the power but also improve the gear ratio step by step. The gears and pinions of drive train are fixing with the bicycle body by using deep groove ball bearings. The spur gear in the gear train is coupled with the driving wheel through the Hubless mechanism which also performs the holding function of driving wheel. The front wheel it only perform the system balancing function without actually participate in driving and driven mechanism.

Chapter1

1.1Introduction

Today India is the second largest country in the world according to the population. India is the large market for all types of vehicles but up to till large numbers of peoples are deprived from good transportation system. There are large number of citizens are located in rural area where modern transportation facilities are not useful due to the poor condition of roads and their networks. Today the cost of the fuels is also increases very rapidly. There are several pollutants are emitted into atmosphere by these fossil fuel operated vehicles and day to day this problem becomes very critical. So, we have a need of the transportation vehicle which is able to provide service without the consumption of fossil fuels to prevent the emissions of pollutants. It should also able to conduct the goods where proper provision of road network is unavailable. Bicycle is essential to save the natural resources and it also help to keep the environment clean. There are different types of the bicycle available to provide service to customers. But there is the need to give an alternative to conventional bicycle to overcome different drawbacks. To overcome these drawbacks and to improve the quality of service we develop new mechanism which fulfills the need of customer.

1.2 Components

1.2.1. Internal Gear

Internal gear is a gear with its teeth cut in the internal surface of a cylinder and meshes with spur gears.
In its manufacturing, because of its shape, the usual hobbing machine used in spur gear production cannot be used. Generally it is made with gear shaper (or gear shaping machine) equipped with a pinion cutter. More recently, the efficiency of internal gear cutting has been improved by a different process called skiving.

1.2.2. Spur Gear

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Viewing the gear at 90 degrees from the shaft length (side on) the tooth faces are straight and aligned parallel to the axis of rotation. Looking down the length of the shaft, a tooth's cross section is usually not triangular. Instead of being straight (as in a triangle) the sides of the cross section have a curved form (usually involute and less commonly cycloidal) to achieve a constant drive ratio. Spur gears gears mesh together correctly only if fitted to parallel shafts.[1] No axial thrust is created by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

1.2.3. Supporting Ring

Supporting ring is cut from a 3mm thick mild steel sheet to facilitate mounting point of supporting gear and tyre. The ring is cut via laser cutting machine. The ring carries the load of the rider and frame of the bicycle. It is also used to connect hubless wheel to the frame. Mild steel is a ferrous metal made from iron and carbon. It is a low-priced material with properties that are suitable for most general engineering applications. Low carbon mild steel has good magnetic properties due to its high iron content, it is therefore defined as being 'ferromagnetic'

1.2.4. Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are

classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

1.2.5. Hub

The hub is the central part of your bike's wheels (front and rear), which connects to the wheel's rim via the spokes and through which the axle is fitted, enabling the wheel to freely spin on two sets of bearings.

1.2.6. Sprocket

A sprocket or chainwheel is a profiled wheel with teeth that mesh with a chain, track or other perforated or indented material name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth except for timing pulleys used with toothed belts.

1.2.7. Chain Drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. The main disadvantage of the belt drives and the rope drives is that the velocity ratio does not remain constant, but varies on account of slip. Since chain drives are positive drives there is no slip, hence the velocity ratio will remain constant.

CHAPTER 2

LITERATURE REVIEW

4.1 **Algat V.V., Bhalerao R.S., Autade K.N., Shimpi G.B., Prof. Ghodake A.P.,** explained in journal "HUBLESS WHEEL BICYCLE WITH GEAR TRAIN DRIVE MECHANISM" states that "The construction of Hubless wheel bicycle with gear train drive mechanism is designed to convert the human muscle power through pedaling work in to the mechanical work The system is assembled with the combination of pedals, shafts, one small size alloy wheel and one large size Hubless wheel which is function as driving wheel. The pedal and shaft are receiving the human effort and convert in to rotational mechanical motion. This rotational motion is transmit up to the driving wheel via the spur gear drive train. The gear drive train is the combination of four stages of gear pair. These gear pairs not only transmit the power but also improve the gear ratio step by step. The gears and pinions of drive train are fixing with the bicycle body by using deep groove ball bearings. The last spur gear in the gear train is coupled with the driving wheel through the Hubless mechanism which also performs the holding function of driving wheel. The front wheel is small in size as compared to drive wheel and it only perform the system balancing function without actually participate in driving and driven mechanism. This system has ability to reduce the fatigue on bicycle rider by improving the power transmission efficiency and by extending the maximum limit of bicycle speed."

4.2 Arthur Lidov, in the research paper "SPOCKLESS WHEEL AND SHROUND THEREFOR" explained that "a rotor is rotatable disposed and lateral bearings to laterally stabilize the rotor within the shround. A series of resiliently mounted bearings are spaced about the shround for rotatable retaining the rotor within the shround and for transmitting load and for absorbing any impact forces imparted to the rotors as it rolls over the ground.

4.3 Nanh Souvanny, in the research paper "BICYCLE DEVICE WITH DIRECT DRIVE TRANSMISSION AND HUBLESS WHEELS" explained that " A bicycle device with an internal drive train that eliminates any external mechanical drive train components. An internal drive gear is driven by user pedal input, which provides torque and rotation to a plurityof gear rods, connecting rods and disk gears. The drive train assembled at hubless raer wheel, which rotates a tire tread around a stationary hub. Overall, the present invention provides a sleek, modem upgrade to the traditional bicycle device, and incorporates several features that improve its design."

4.4 Paul E. Lew, in the paper "Hubless Wheel" states that "A Hubless wheel for a vehicle which provides advantageous weight and aerodynamic properties. The wheel includes a rotationally stationary inner hoop, coupled to the vehicle, and a rotatable outer hoop, concentric with the inner hoop. The inner hoop and outer hoop are both fabricated with a woven fiber composite shell. A ground engaging tread is disposed on the radial periphery of the outer hoop. Bearings, preferably three rotating bearings spaced circumferentially around the inner hoop at approximately 120° intervals, are mounted on the inner hoop to be rotationally stationary therewith and each include a support surface on their respective radial peripheries. The support surface is particularly contoured to operatively engage a bearing engaging surface located on the inner periphery of the outer hoop. The outer hoop is axially and radially supported relative to the inner hoop through this engagement to allow rotation there between."

4.5 Bennett Ross, in the paper "SPOKELESS BICYCLE SYSTEM" states that "A spokeless bicycle system for providing a bicycle that does not have spokes within the wheels- The inventive device includes a frame having a seat structure and handle bars, a rear bracket having rear bearings within that rotatably engages a rear wheel, a front bracket having front bearings within that rotatably engages a front wheel, and a drive train that engages the rear Wheel for driving the rear wheel. The rear rim of the rear wheel includes a rear groove that receives the plurality of rear bearings. The rear rim of the rear Wheel includes a rear gear that is engaged by a drive sprocket from the drive train. The front rim of the front wheel includes a front groove that receives the plurality of front bearings." 4.6 Andrew J. Horst, in the paper "HUBLESS WHEEL AND RELATED STROLLER" states that "A seat is disposed on the frame. The Hubless Wheels are disposed on the frame. The Hubless Wheel includes a rim, an internal sliding structure and at least one bridging component. A tire is disposed on the Hubless Wheel. The rim has an external sliding structure on an inner surface of the rim. The internal sliding structure is disposed inside the external sliding structure. The bridging component is disposed between the external sliding structure and the internal sliding structure. The bridging component revolves on its own axis.

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4.7 Mohan Radhesh Mallaya et al, discussed thatin this design, hubless wheel comprises of gear drive to transmit power from the motor to the wheel. this work focuses on using nylon MC 901 gears which is much lighter than their metal counter parts. The sun gear meshes with the internal gear ring made up of nylon MC 901 material. The power from the inner gear ring is transmitted to the rim by the bearings. The bearing are held on a bolt whose ends are connected to the stationary plates.

CHAPTER 3

3.1Problem Statement:

This chapter includes problem statement, objectives and methodology.

The old school type of wheel which is being used for centuries has been given a new design which improves the aesthetics of the cycle.
The increased chain length in conventional cycle is the problem for which the driver has to put in more effort for propelling the cycle. This is decreased in hubless cycle.
In normal cycle, the steering (i.e) the handle bar is attached to the hub of wheel. But in hubless wheel, the handle bar is attached to the wheel rim which increases steering efficiency.

The Hubless bicycle with gear train mechanism should be fulfilling the following objectives.

1.Transmission of power through high efficient drive mechanism.
2.Less fatigue on rider.
3.Maximum gear train effectiveness.
4.Maximum speed of bicycle up to 1100 rpm.
5.High load carrying capacity.
6.Decrease System weight.
7.Environment Friendly.
To make it more beautiful

3.2 Objectives

- To design a drive-system with a spoke-less/hub-less wheel.
- To reduce the effort of the driver.
- To reduce the total weight of the bicycle by eliminating spokes from the rear wheel.
- To increase the gear-ratio of the bicycle.
- To give people a new product.
- To make it more appealing.
- To make it more beautiful.
- To have less fatigue on rider.
- Environment Friendly.

3.3 METHODOLOGY

In popular we recognize that the cycle run on chain power mechanism and it is ideal and famous manner of transportation in rural as well as city area also. Due to the fact preliminary price may be very low, no gasoline is needed to run the bicycle. There is no threat to pollute the environment because of no use of fuel. But the bicycle used for many years now change only in looks of the frame of bicycle. In the traditional bicycle the rider needs to put more effort to ride because of the spokes attached to the rim of the cycle. When the rider pedals the flywheel rotates because of the chain and the spokes attached to the rim were forcefully rotated which causes the rider to put more effort to ride the bicycle. So considering it as the most objective of our venture, the hub less cycle is designed. In the hub less bicycle the rear rim have a internal gear mounted on it and the hub will behaving the spur gear mounted on it. Because of the use of gears for transmission the rider will be needing less effort to ride the bicycle and as the spokes are removed it also give a new and stunning look to the bicycle.

3.3.1 Design Process & 3D Modelling:

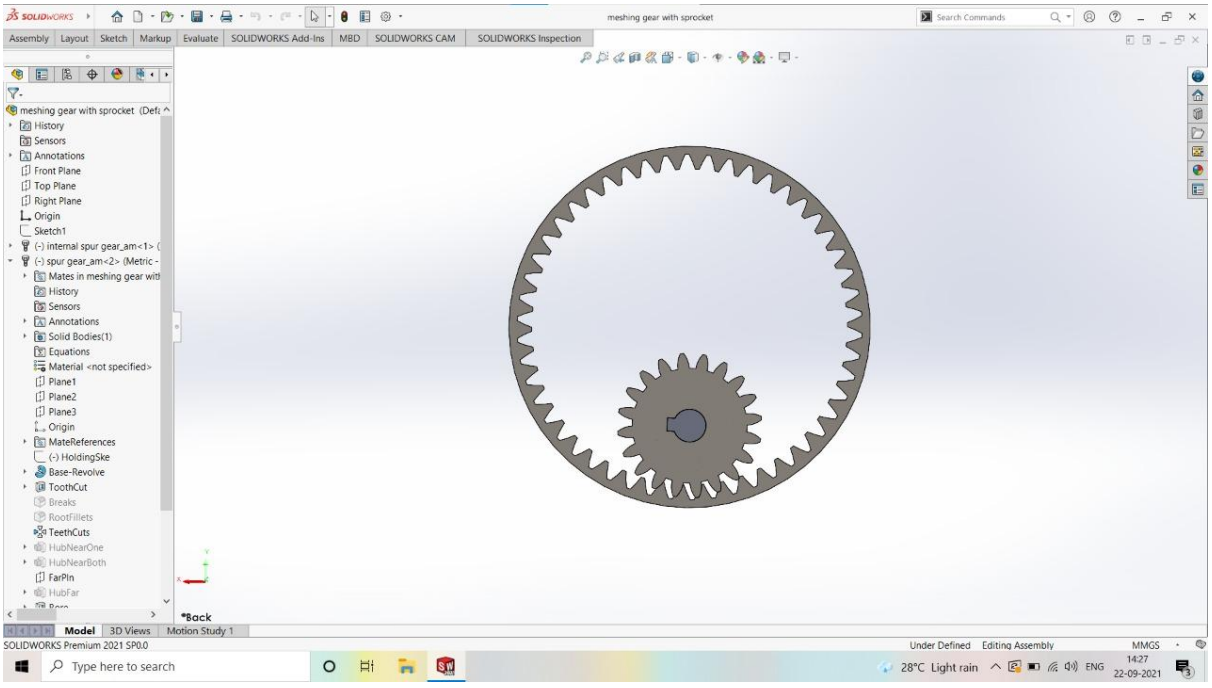
- The design of the cycle will be made on solidworks which includes

1. Cycle frame
2. Internal gear
3. Spur gear
4. Wheel rim
5. Tyre and all the other components
6. Bearings
7. Handle bar
8. Chain, sprocket, paddle

- Then by assembling the parts we will be doing the motion study of cycle

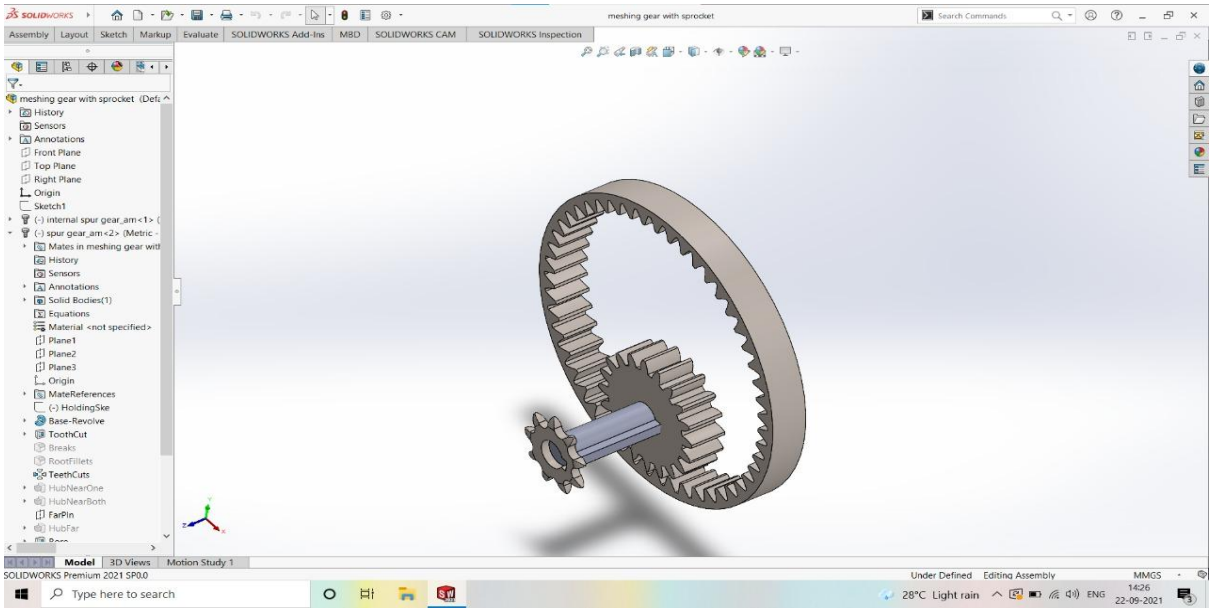
3.3.2TESTING:

- The testing of the design will be done in solidworks.
- We will be doing static analysis on design of the cycle.



3.3.3 MANUFACTURING PROCESS:

- First we will start with manufacturing of gear and axle which includes internal gear, spur gear and axle on which the spur gear and sprocket of chain drive will be mounted.
- Then we will be assembling various steel rods that we will be using to make the frame of the cycle by welding process.
- After we get both the main component of our project that is the frame of the cycle and driving mechanism, we will be starting the process of assembly of the cycle.
- All the components are designed by us.
- The components were designed on Solid Works and was also rendered on Solid Works
- The designed parts were then manufactured by purchasing the desired materials and for getting the required component we had to give the it to the Laser cutter.
- The remaining parts were made by lathe machines, gas cutter, etc.



3.3.4 CONSTRUCTIONAL FEATURES:

3.3.4.1 Pedal and Lever

Two pedal livers of 120 mm length and having cross section of 25*10 mm are used to receive the force from rider
through pedal. These are able to sustain the foot of rider.

3.3.4.2 Driving Shaft

The minimum section diameter on input shaft is kept about 14mm and at this smallest section of the main shaft lobe
plate is mounted.

3.3.4.3 Drive Train

The Four stages Gear Train is locate on frame by using bearings. All gears and pinions used in the train are of spur types having module 3 mm and face width 30 mm. The used bearings are of single deep grooved ball bearing of series 60.

3.3.4.4 Rear Hubless Wheel

This wheel uses single row deep groove ball bearing to sustain the entire load of wheel and rider. Use of Hubless nature of wheel made the design compact, unique with extra free space availability. It also plays the role of linkage between gear train and rear wheel.

3.3.4.5 Front Wheel

The front wheel is made of alloy type. In this system conventional method of use of same size wheel is replaced by the use of small size of front wheel. As only the rear wheel is participated in driving function and not the front wheel. Front wheel is used for balancing the structure so reduction in size of front wheel is made good in order to reduce the system weight without any affect on bicycle performance.

3.3.4.6 Assembled Model

The different Functional parts and mechanisms are assembled systematically to form the finished required system of bicycle

CHAPTER 4

DESIGN, CALCULATION & COST ESTIMATION

4.1 Design and Calculations

MATERIAL FOR FRAME:

Using an existing cycle frame.
AISI 4130 is the one to go for, it is bog-standard cro-mo steel. All bikes at the cheaper end of the market are made from this. It's cheap, easy to work, and strong, and widely available.
AISI 4130 alloy steel contains chromium and molybdenum as strengthening agents. It has low carbon content, and can be welded easily. The datasheet below provides further detail.

ELEMENT	CONTENT
Iron, Fe	97.03 – 98.22
Chromium, Cr	0.80 – 1.10
Manganese, Mn	0.40 – 0.60
Carbon, C	0.280 – 0.330
Molybdenum, mo.	0.15 – 0.25
Sulphur, S	0.040
Phosphorous, P	0.035
Silicon, Si	0.15 – 0.30

MATERIAL FOR GEAR:

S45C is one of the most commonly used steel, containing moderate amounts of carbon (0.45%). S45C is easily obtainable and is used in the production of spur gears, helical gears, gear racks, bevel gears and worm gears.

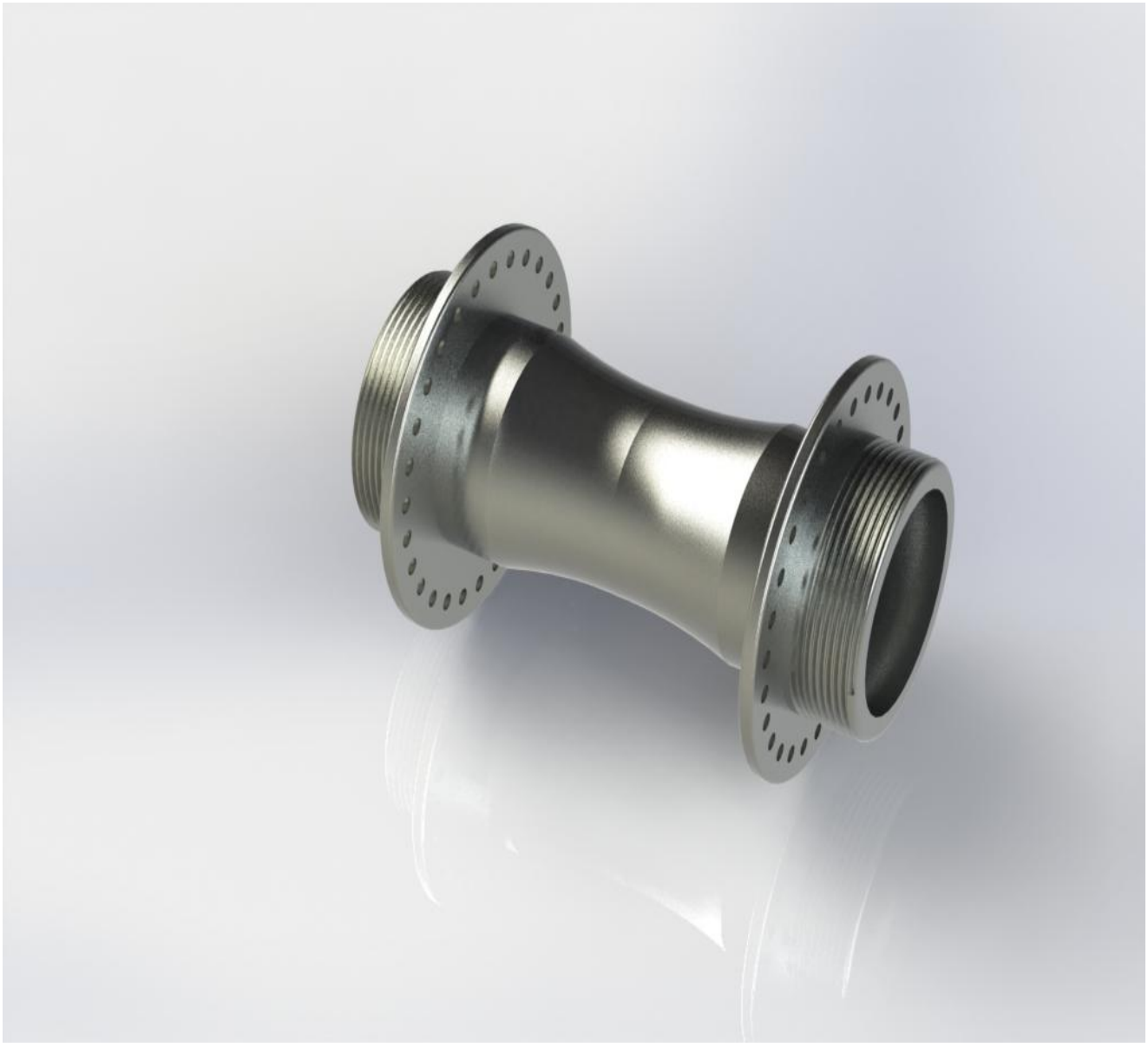
Standard
Grade
C
Mn
P
S
Si
JIS
G4051
S45C
0.42-0.48 0.60-0.90
0.03
0.035
0.15-0.35

FRAME :

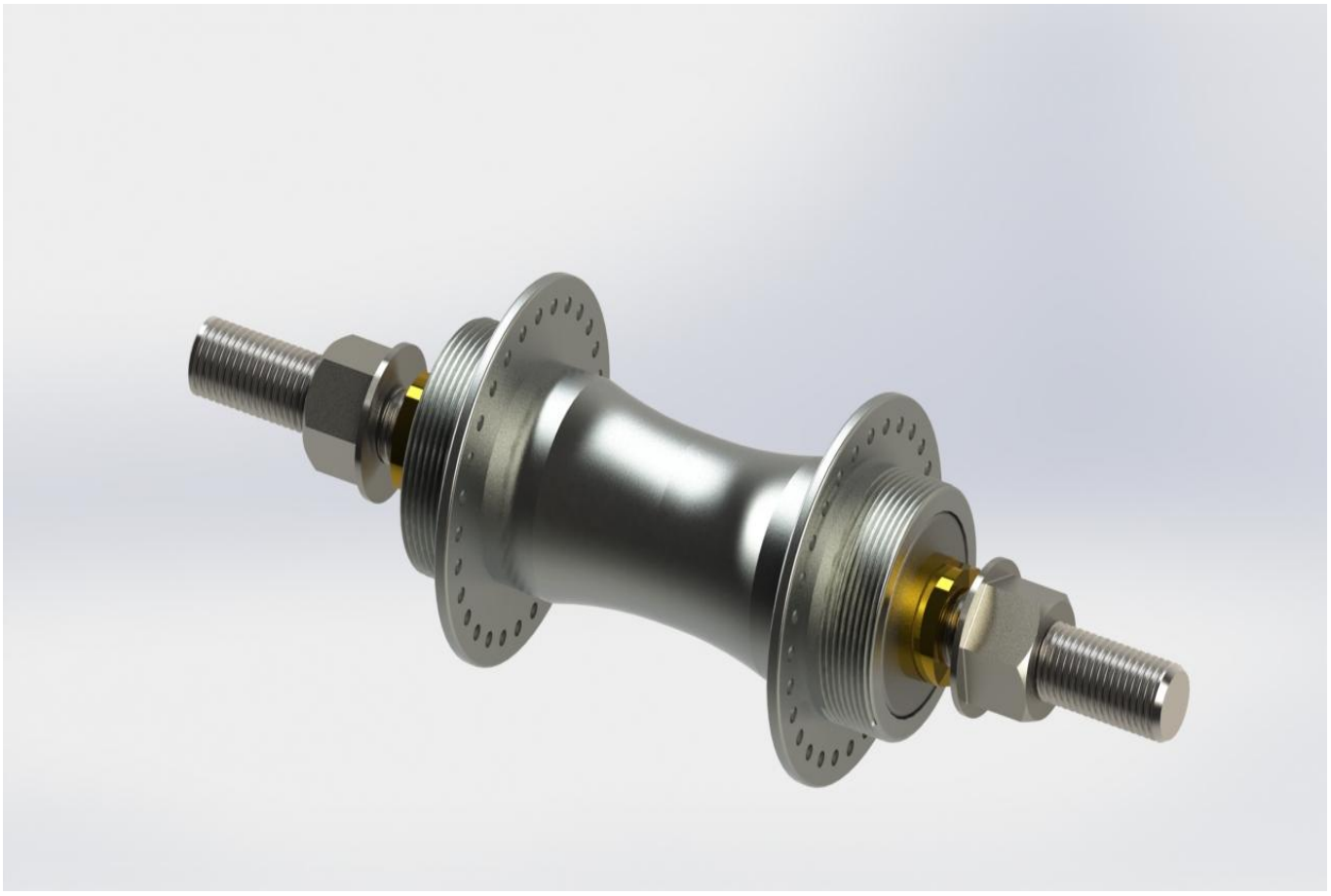
INNER GEAR, HUB AND SPUR GEAR :

SPUR GEAR IN-MESH WITH INNER GEAR :

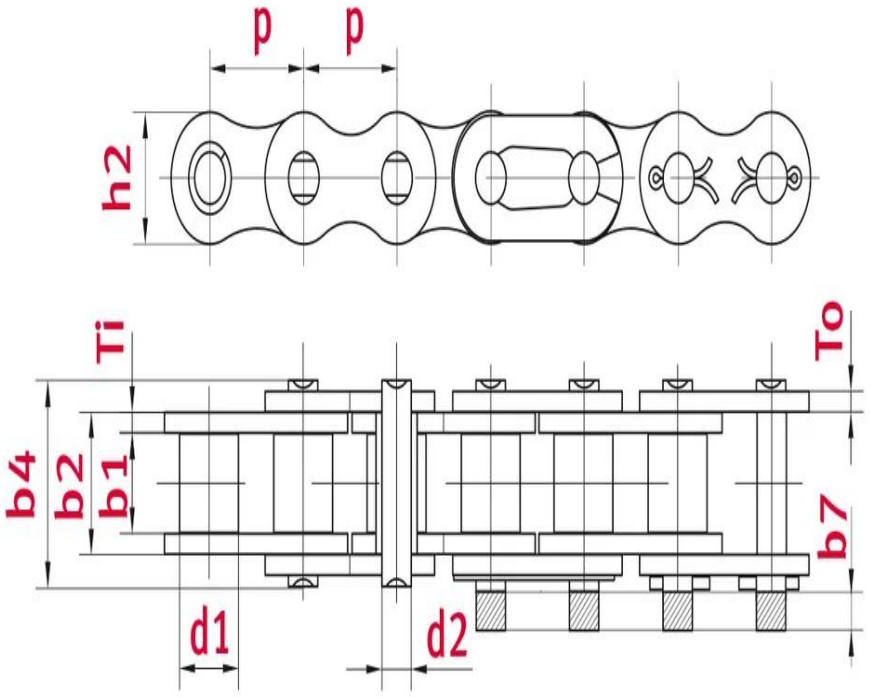
HUB :



HUB WITH AXEL :



CHAIN AND ITS DIMENSIONS :



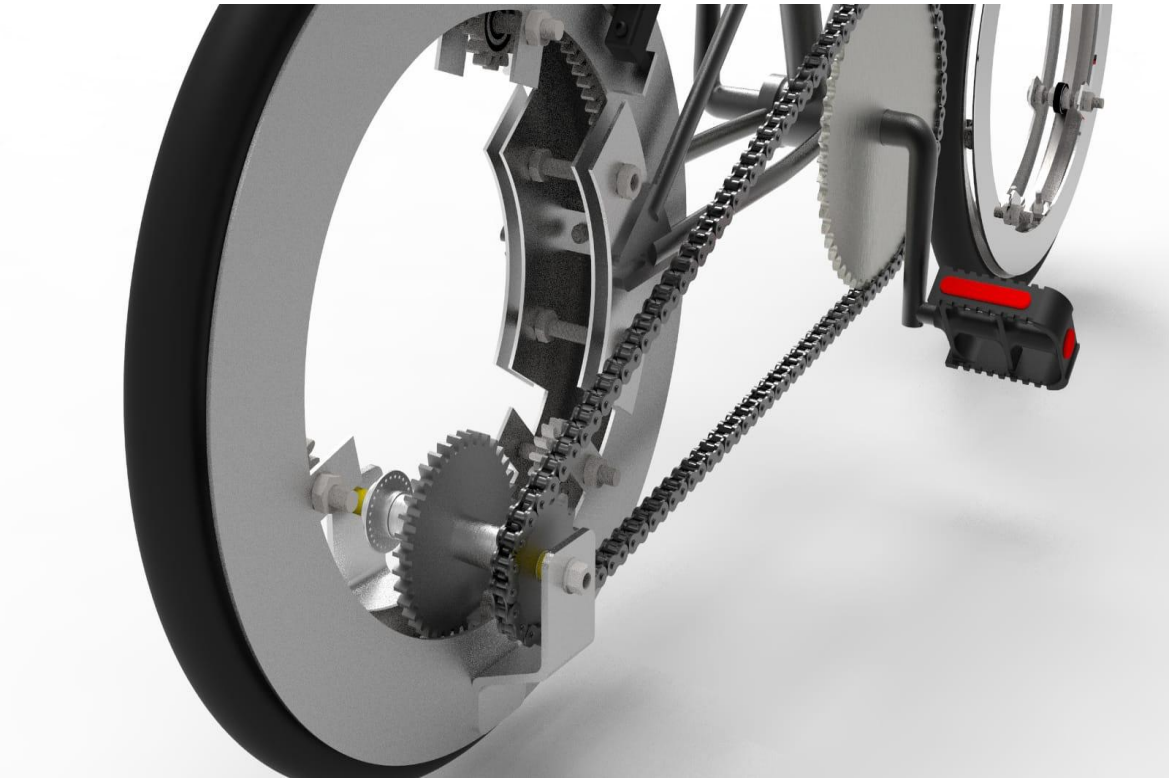
FREE WHEEL :

FREE WHEEL ON HUB :

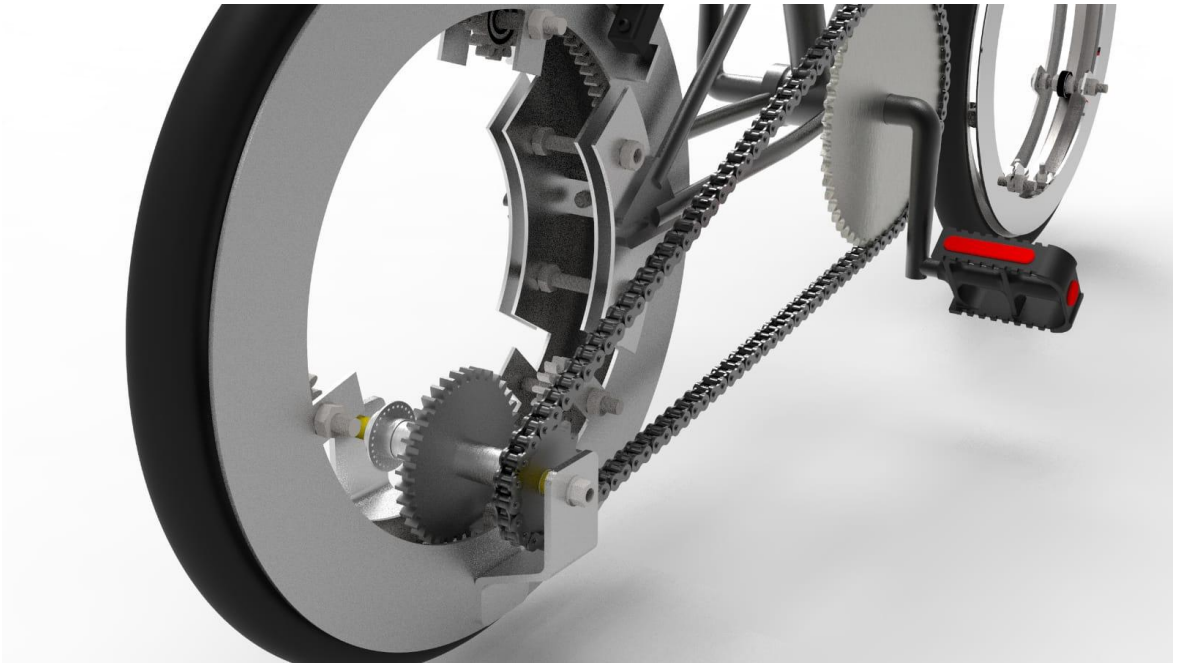
BREARING ASSEMBELY :

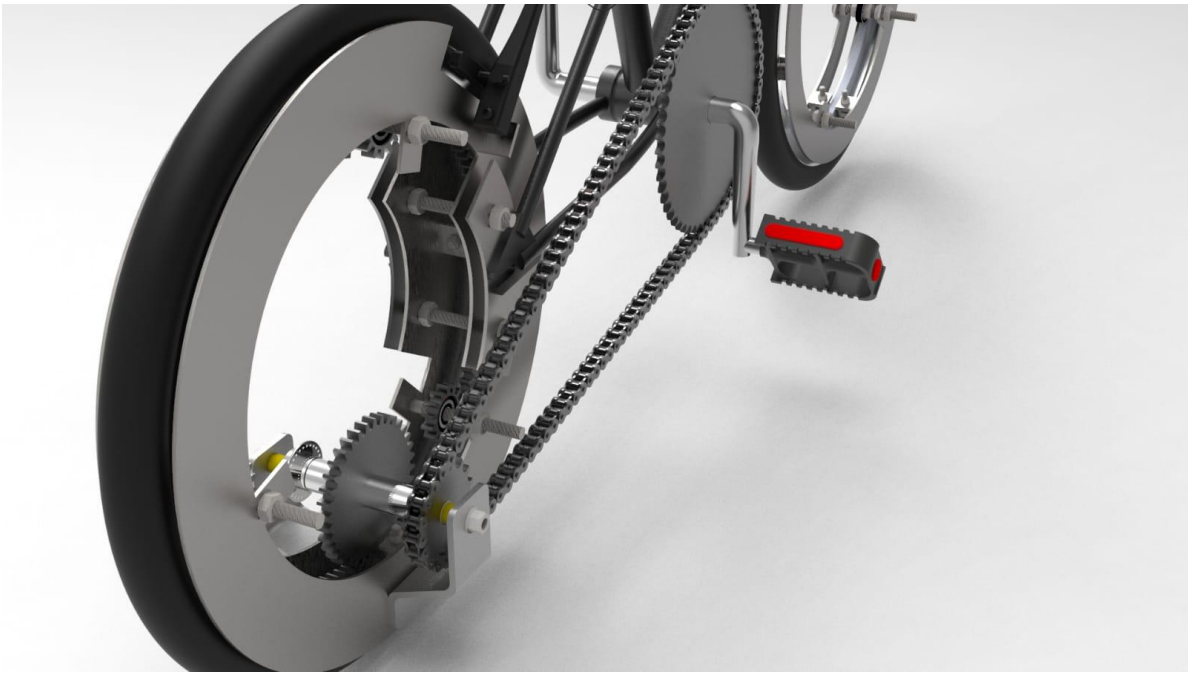
SUPPORTING GEARS :

REAR WHEEL :

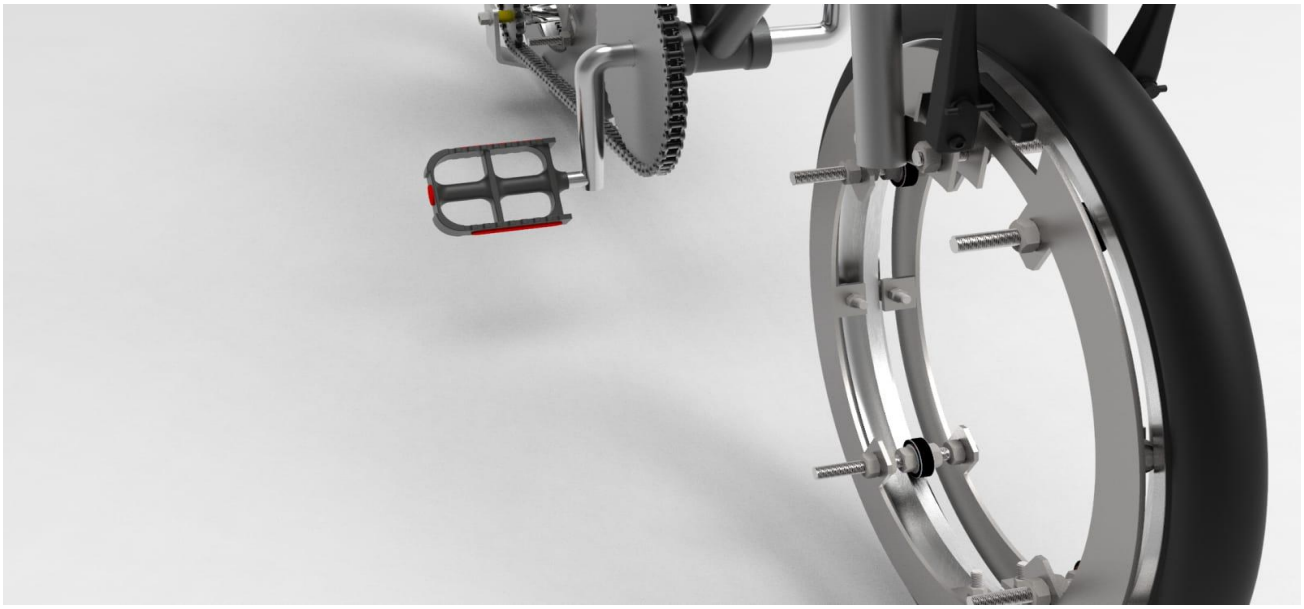


SOLID WORKS RENDERED :





FRONT WHEEL :



4.2 Cost Estimation

4.2.1 Introductions

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involve in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

4.2.2. Purpose of Cost Estimating

Cost estimating is the predictive process used to quantify, cost, and price the resources required by the scope of the project, to better manage budgets and deliver projects that do not exceed the identified scope, and that are on time throughout the development process. The need to solidify the estimation process can be seen in four areas:

1. State financial plan
2. Creation of public satisfaction and a positive response
3. Project control
4. Problems currently being encountered

The state financial plan is affected as cost estimates are used to obtain and allocate funding for the overruns of the estimated project costs. This leads to the second reason for the need for cost estimates: influencing public opinion. Public satisfaction is increased if transportation projects show and prove to the general public that they are timely and within budget. Public declaration of the estimated cost of projects needs to be thoughtfully provided only after care is taken to produce a well-documented, quality estimate.

Project control relies on cost estimates to help keep projects within the appropriate fiscal boundaries. Although not necessarily a “check and balance” format, the existence of the original estimate will keep the project from growing and expanding beyond its spending limit. As projects encounter problems, and their estimates come “under fire,” great scrutiny is given to the project and its associated estimates. The ability to confront and solve problems and obstacles relies in large part on the quality of the estimate and the documentation, which, if done properly, will provide critical support to project success.

4.2.3. Types of Budget Estimation

- Material Cost Estimation
- Machining Cost Estimation

4.2.4. Material Cost Estimation

Material cost is the cost of materials used to manufacture a product or provide a service. Excluded from the material cost is all indirect materials, such as cleaning supplies used in the production process. Add the standard amount of scrap associated with manufacturing one unit.

These materials are divided into two categories:

a. Material for fabrication:

In this the material is obtain in raw condition and is manufacture or processed to finished size for proper functioning of the component.

b. Standard purchased parts:

This includes the parts which were readily available in the market like sprocket, bearing, gear motor, wheel, chain, blower etc. A list is forecast by the estimation stating the quality, size and standard parts, the weight of raw material and cost per kg for the fabricated parts.

4.2.5. Machining Cost Estimation

Machining cost includes total cost for performing different machining operations such as cutting, milling, turning, drilling, welding etc.

4.3 Raw Material & Standard Material Cost

Sr. No.	Part Name	Material	Quantity	Cost In Rs.
1	Cycle frame	Steel	1	1500
2	Rims	Stainless Steel	2	900
3	Spur gear	Steel	1	350
4	Inner geaar	steel	1	2000
5	Hub	Stainless steel	1	400
6	Bolts 4inches	Steel	26	468
7	Bolts 7inches	Steel	12	240
8	Bearings	Aluminium	16	320
9	Cotter joint	Steel	1	200
10	Strip	Steel	2	400
11	Plate	Steel	1	200
12	Chain	Alloy steel	2	300
13	Sprocket	Steel	1	400
14	Fasteners	Steel	16	32
15	Washers	Steel	14	20
16	Spring Washers	Steel	30	50

17	**Free wheel**	**Aluminium**	**1**	**200**
18	**Front wheel's inner ring**	**Steel**	**1**	**800**
19	**Brakes**	**Aluminium**	**2**	**600**
20	**Airless Tires**	**Rubber**	**2**	**400**
21	**Grinding Wheels**		**14**	**200**
22	**Polish wheels**		**2**	**40**
23	**Spray paint cans**		**2**	**360**
24	**Nuts**	**Steel**	**40**	**200**
25	**Sand paper**		**5**	**50**
26	**Grease**		**1\2 kg**	**200**
27	**Supporting gears**	**Steel**	**4**	**400**

4.4 Machining Cost

Welding, Drilling and other machining cost: Rs. 9950

Total project cost = Raw material & Standard material cost + Machining cost

Therefore;

= 11230 + 9950

Total project cost = Rs.21,180

CHAPTER 5

Advantages and Disadvantages

5.1 Advantages :

1. Power transmission efficiency of the drive mechanism can be improved and hence fatigue on rider reduces.
2. Gear train effectiveness is improved up to 1.8 times of conventional bicycle.
3. The weight of the bicycle is reduced. The load carrying capacity & service life of wheel bearing mechanism is more compared to the hub.
4. Due to compact and unique design of Hubless wheel more free space is available.
5. The maximum speed limit of drive mechanism is improved.
6. Generation of Noise and friction is minimized so lubrication is also required in less quantity.
7. The operation is pollution free and eco-friendly.
8. It stands out of the crowd.
9. It is unconventional.
10. It makes the cycle more appealing.
11. They have more traction and faster acceleration and torque.
12. It is pollution free.

5.2 Disadvantages :

1. The overall mechanism makes the cycle heavy.
2. The cycle is not that reliable.
3. The it will be costly until mass produced.

CHAPTER 6

CONCLUSION & FUTURE SCOPE

6.1 Conclusion

The main objective of our project is to reduce the fatigue on bicycle rider, to improve the efficiency of transmission system and lowers the weight of the system. By improving the design and mechanisms we are able to achieve the goal. The results are calculated by taking the readings of required parameter during its working and using theoretical methods. The output results are compared with the conventional model's output. This system also helps to reduce maintenance, to improve the load carrying capacity and also lowers the generated noise level. From the total works experience it has been seen that, this system plays an important role for the more utilization of bicycle.

Hubless is future generation wheel which eliminates hub and spokes. In the current scenario, safety and accessibility is prime concern. Hubless wheel provide the solution of all them. Elimination of hub and spokes introduces safety in the device and ride experience also increase the better stability of the vehicle. In the presence of non complex component in the design. Hubless wheel more serviceable and accessible.

6.2 Future Scope

The spoke-less cycle was aimed at reducing weight of the cycle by replacing the conventional hub and the spokes and providing more space for utilization. And even overall design being sturdy is even compact and simple with no braking system required as the pedaling stops so does the cycle. This cycle being self braking type can be used on slopes as slipping can be avoided. Due it's rim being mild steel is weigh bearing capacity is even higher compared to conventional cycles.Future scope includes motorizing the cycle which is quite possible due to the space availability and even super alloys can further reduce weight and due removal of spokes we can go for fold able bike models easily.

It an innovative idea which has a lot of scope in the future as this concept is not yet commercialized. As this concept of hubless and spoke less wheels gets popular the demand of this cycle will be increasing. India is a very large market of bicycles and due to increasing fuel prices and drop in economy many people have opted for cycles as there daily commuter.

Chapter7

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