

# E-Quadricycle

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## ABSTRACT

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The term e-quadricycle can be explained as the four wheel motorized cycle. The idea of making a four wheel cycle with a innovative pedaling system has been shaped in the form of our project. We have sought to make an invention in a true sense. Many features of e-quadricycle are unique. The e-quadricycle will be proving as one of the best personnel transportation vehicle for a shorter distance as well as the best exercise bike.

The vehicle comprises of four wheel mounted on a frame which supports the pedals and the transmission mechanism. The steering mechanism is designed to have a shorter turning radius. The rear wheels are activated separately by way of pedals which are linked to a crank which is connected to a cogged wheel from which a chain transmits the dynamic force towards a free sprocket, and ultimately activating the wheels. The vehicles speed is controlled by the disc brakes controlled by the levers. The pedals are activated by human power in an alternate oscillo-rotational movement, and are correlated via a roller. The vehicle also is constructed with a seat which allows for restful pedaling and support. Hence, making it an comfortable mode of transportation.

The electric motor is assembled in the quadricycle, making it an e-quadricycle. The e-drive consists of an motor driving the rear shaft by means of chain and sprocket, the throttle which controls the acceleration of the vehicle, the controller which acts as the c.p.u to the e-drive. The vehicle has two batteries of 12V each, supplying the current to the e-drive. The user can switch to the e-drive whenever necessary. Hence making it an hybrid vehicle, i.e. both the options of manual and electric drive are open at any instant of time. The user can switch to the electric drive when he is stressed or tired and enjoy the electric ride.

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## I. INTRODUCTION

A novel four wheeled pedaled vehicle, intended as a mode of transportation, propelled by human power as well as electric motor. The main advantage is that due to its construction and manner of pedaling, it addresses the interest and usage by a wide range of ages. As it can be used as a vehicle for leisure activities, gentle independence aid for the elderly or people with mobility restrictions, as well as a post injury rehabilitation and training apparatus.

The conventional bicycle's constructions are known. These constructions have a disadvantage of having a transmission of chain wheels on one side, resulting in reduction in energy. Also the slippage phenomenon may occur between the driving roll and the rear wheel. These technical issues are solved by the innovation of a four wheel cycle provided with a dual transmission.

The construction of e-quadricycle is such that it can be used by all aged groups. It can also be used as an exercise bike. The motion of pedals and the position of seating are in proper ergonomics. During the use of this cycle the ligaments are not stressed only the muscles are strained, proving it as an exercise bike. It will be proving as a weight loosing machine for weight persons. Since the

ligaments are not strained, those having knee bending problems can use this cycle as a best option for transportation and exercise. Hence this e-quadricycle will be proving its medical importance.

Hence the advantages of the innovative e-quadricycle are:

- It provides the better means of personnel transportation.
- It provides a means for gentle yet efficient exercise.
- It does not require complex manufacturing processes for its construction, hence low cost of production.

## II. LITERATURE SURVEY

We had to shape the idea of oscillo-rotational pedaling system into our quadricycle. After lots of brain storming sessions we decided to go with the TREADLE mechanism.

A treadle is a part of a machine which is operated by the foot to produce reciprocating or rotary motion in a machine such as a weaving loom or grinder. Treadles can also be used to power water pumps, or to turn wood lathes. In the past, treadles have been used to power a range of machines including sewing machines, looms, wood saws, cylinder phonographs and metal lathes. Along with cranks, treadmills,

and treadwheels, they allowed human and animal power of machinery in the absence of electric machinery.

There were bicycles in the past which worked on the treadle mechanism. In order to construct the treadle mechanism we had to study the treadle bicycle. A treadle bicycle is a bicycle powered by a treadle instead of the more common crank. Treadles were one of the mechanisms inventors tried in order to position the pedals away from the drive wheel hub before the development of the bicycle chain or instead of it. Treadles have also been used to drive tricycles and quadracycles.

Treadles were used before the advent of highwheelers on Thomas McCall's velocipede, on highwheelers themselves in an attempt to address safety issues, on alternative configurations of highwheelers, and on the first device called a safety bicycle by British engineer Henry J. Lawson in 1876. Some inventors even combined treadles and chains on the same bicycle.

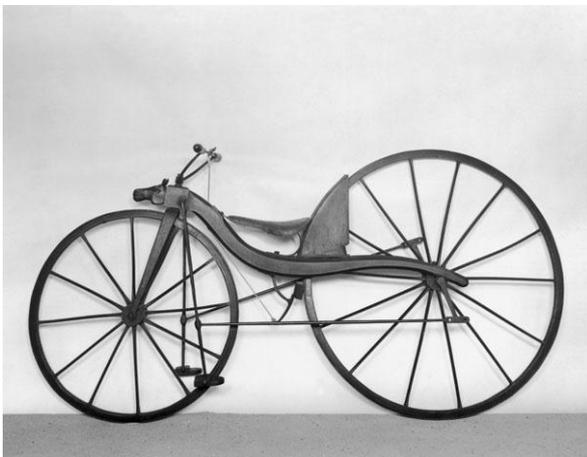


Fig: Treadle Bicycle [Ref : 3]

The picture below shows VELOCIPÈDE, the ancient four wheel cycle using the treadle pedal. Since in those times the chains were not present the quadracycle used the links to transmit the power.

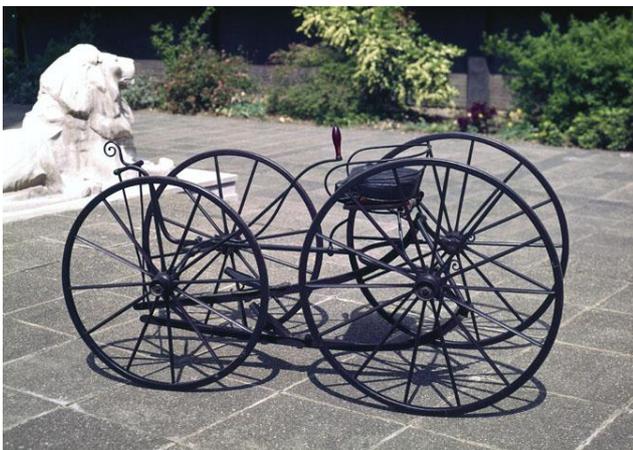


Fig: Treadle quadracycle [Ref : 3]

We also considered the treadle mechanism used in sewing machine. It also uses the links, pedals, crankshaft and wheel to transmit the power to the machine. Actually we decided to incorporate the treadle mechanism somewhat similar to the sewing machine, since it will be easy to pedal and will require less power. Incorporating the treadle

mechanism used in sewing machine will help us in using the chain drive.

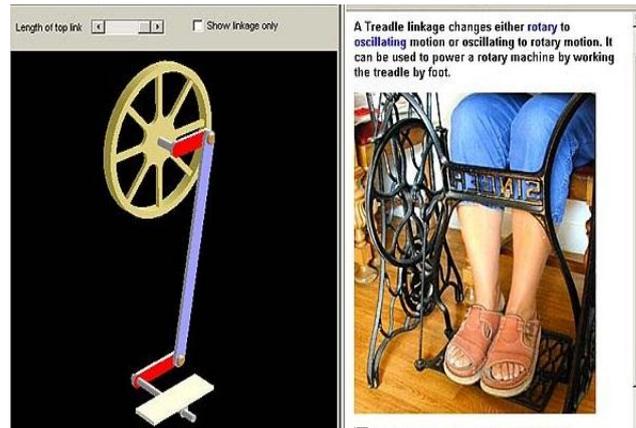


Fig: Treadle Mechanism [Ref : 4]

Since we were making the e-quadracycle, we also needed to study the electric power train used in the cycles. The electric drive was useful for the shorter distance. Instead of taking your car for buying some small things and hunting for a parking place, take your eco-friendly e-quadracycle and return in a lesser time. The electric drive consists of the BLDC motor, the gear box attached to it and the chain drive using the sprockets. We decided to go with the 250 watt BLDC motor having the 1200 rpm with the 24V battery supply to it. We required the gearbox to reduce the rpm up to 250-300 rpm.

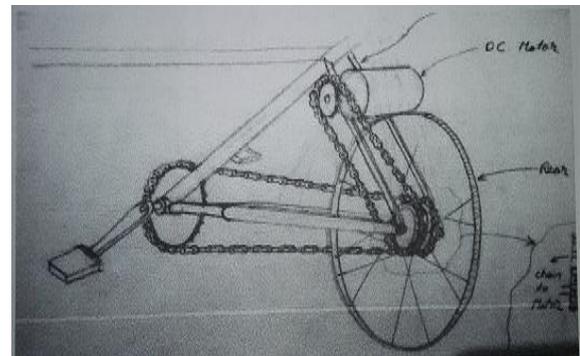


Fig: Assembly of electric bicycle [Ref: 2]

The electric drive shown above in the picture is implemented in the bicycle. It consists of motor with the gearbox, transmitting power to the rear wheel with the help of chain and sprockets. We decided to go with the same design since it was matching our requirements and would also prove economic.

### III.OBSERVATIONS OF TESTING

Sr No	Parameters	Design/Specified values	Test Value

1	Manual Speed (max.)	12 kmph	10Kmph
2	Motorised speed (max.)	15 kmph	12 Kmph
3	Manual grade capabilities	2% (considered)	2%
4	Electric transmission grade capabilities	3.5 % (considered)	3.5%
5	Distance of run/per charging	15 km	10 Km
6	Duration of full charge	3 hrs	3 hrs
7	Duration of manual drive without fatigue	30 min(considered)	25-30 min

□ Maximum Manual speed

It is one of the important specifications to be known and to be tested. The track used to test the max. Manual speed is plane track with 0% grade. The time taken was calculated for the specified distance and then the formula of Speed = distance/ time was used to calculate the speed of the vehicle at full power applied by the user.

The theoretical maximum speed was calculated to be 12 kmph and the actual speed from the test was found out to be 10 kmph i.e. approximately equal to the theoretical value. This speed was sufficiently enough for these kind of personnel transportation vehicles, Since it will be used at the city level for shorter distances.

□ Maximum speed by electric drive

It is the maximum speed of the vehicle when user is using the electric drive. The procedure used to calculate the maximum speed was the same as above but at full electric throttle. The theoretical maximum speed was calculated as 15 Kmph. The tested value turned out to be 12 Kmph. This is approximately equal to the theoretical value. This value of

speed is sufficient to provide relaxing and fun ride to the user.

□ Manual grade capabilities

Grade capabilities refer to the ability of the vehicle to climb the inclined road. Grade is the percent of inclination.

Figure 21:- Grade

$$\text{Grade} = \text{rise} / \text{run} * 100$$

450 is considered as 100% grade.

As the degree of inclination goes on increasing the power required to move the vehicle also increases, according to the tests conducted it was found that the 2% grade i.e. 1.150 of inclined road can be easily climbed without fatigue to the driver.

□ Grade capabilities by electric drive

The vehicle was comfortably able to climb the road with the 20 inclination. Hence the grade capabilities with the electric drive is 3.5%

□ Distance of run/per charging

The 24V battery is specified to run for 15 Km for 1 full charge. The specification is for bicycles. We tested the run of our quadricycle for one full charge on a normal city road, it was found out to run for 10 Km. This value is a great value, since we have designed for shorter distances.

□ Time required for full charge of the 24V battery

It requires 3 hrs to fully charge the battery. The specified time is also the same.

□ Duration of manual drive without fatigue

We considered that a person can easily ride this vehicle for 30 min without fatigue or stress on him. After riding the vehicle on a normal city road we found out that a normal person can ride this vehicle for 25-30 Minutes easily.

#### IV. CONCLUSION

The purpose of manufacturing the e-Quadricycle was to provide a

Better personnel transportation vehicle which can serve the user as an exercise bike and will provide a fun ride. It was a great experience to design and manufacture the e-Quadricycle in a complete mechanical environment. Since the e-Quadricycle is having both manual and the powered drives gives an optional driving to the user. The manual transmission of e-Quadricycle is designed with the innovative pedaling system i.e. oscillo-rotational pedaling system which provides easy pedaling than the conventional pedaling system. The maximum speed of manual drive is 10 Kmph. This is quite good for shorter distances and for city ride. The electric drive of the e-Quadricycle provides a leisure and fun ride to the user. The electric drive comes greatly in use when the user is tired. The maximum speed obtained from the electric drive is 12 Kmph. This is quite good for the city ride.

The battery once charged for 3 hours lasts for 10 Km. Hence this is useful for shorter distances as in case of cities. The user can drive this e-Quadricycle for 25-30 minutes without fatigue using the manual transmission. The design of innovative pedaling system provides a better

source for exercise. This vehicle can be used for medical applications like it can be used by the user having knee bending problems. This vehicle can be used in parks, tourist spots as transportation vehicle by all aged groups.

Hence we have successfully designed and manufactured the e-Quadricycle for the users of all aged groups for having a better personnel transportation vehicle and to provide some exercise for the user.

## V. REFERENCE

1. <http://qcycle.webs.com/>
2. Automatic gear shifting mechanism and electric drive in a bicycle, P. D. Kamble, S. P. Untawale and S.B. Sahare; VSRD-MAP, Vol. 2(4), 2012, 125-139
3. [http://en.wikipedia.org/wiki/Treadle\\_bicycle](http://en.wikipedia.org/wiki/Treadle_bicycle)
4. <http://design-site.net/dobbsferry/treadle-linkage>
5. The bicycle story, Vijay gupta, published by vigyan prasar, Noida UP,India
6. The treadle pump, DTU working paper 34, 1991