

## **BEARING LINKAGE POWERED BICYCLE**

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### **ABSTRACT**

*Considering the depletion of fossil fuel resulting into pollution it is a need of time to minimize conventional power and boost the utilization of mechanical non-conventional power sources.*

*Currently, fuel powered bicycle are available but they are using conventional source. The research entitled "BEARING LINKAGE POWERED BICYCLE" includes concept of renewable energy. Power is generated through alternator mounted at periphery of rear wheel. A chainless bicycle using bearing linkage assembly is provided for pedalling. In addition to this two small rotary fan are mounted upon the front wheel of bicycle generating power by using wind source. This generated power is supplied to mechanical motor through battery which are mounted on carrier of rear wheel. When the rider is pedalling a bicycle, a motion is transmitted from sprocket of extended shaft of motor to rear wheel through chain drive.*

*The outcome of this system is to relief the human efforts by transmitting high speed rotation using non conventional powered motor which is also applicable for long drives. It does not affect the environment (GWW) with no fuel consumption & cost of utilization is zero.*

**Keywords:** *Mechanical powered motor, non conventional power, speed ratio.*

### **I. INTRODUCTION**

India is the second-largest country of the world, undergoing explosive growth. Like many other countries where agriculture is the main activity, biomass and other non – commercial fuels constitute around 40% of energy requirements in India. Around 85.49% of Indian villages are electrified. People use bicycles as the main medium of transportation in villages. In addition in cities, where most of the people are using bicycle for exercise. In India, many of the villages are still without electricity and most of them use bicycle as their medium of transportation. In such places, our system will be of great help.

We are using most of the systems & technologies that consumes our time. And thus life becomes so easier. Now a days we are using non-Renewable Energy source in excessive form but after few year later it will exhaustible. So we are neglecting the amount of the energy that is conventional. Therefore day by day It is being more expensive.

Today's we are facing the problems of load shedding In the villages most of the time load shedding does for 12-15 hours of the day. For the reason we get an idea of our Research paper to generate the electricity using the mechanical energy source, as a mechanical assembly.

We want to use bicycles and pedal for generation of power as a means to help solve part of India's electrical problems. The concept is that Indians are sold or given stationary bikes to generate free electricity using a

battery attached to the bike. That battery is charged as the rider pedals the bike. Pedaling turns a generator, which in turn produces electricity that can be stored in the battery.

According to energy conversion law, energy neither be created nor be destroyed but can be transformed from one form to another. Humans are able to generate approximately 150W of power while riding bicycle. However, this power goes waste without any use. So we must have to recover this energy for effective utilization of energy. An alternator can be used for harvesting the energy generated by a cycle rider while riding.

With reference to the report statistics, "No. of Towns and Villages Electrified in India", Ministry of Statistics and Program Implementation, India, it can be seen that even after 65 year of independence 17.7% of India is still in dark during nights. All of the 5161 towns in India are electrified, i.e. cent percent in the case of towns. However, in India villages are more than towns and development of India is only possible by the development of those villages, out of 593732 village in India only 488439 villages are electrified, i.e. 105293 villages are un electrified. Andhra Pradesh, Goa, Kerala, Punjab, Tamil Nadu, Haryana, and Delhi are the few of the states that are where less than 60% of the villages are electrified, the worst situation is in Jharkhand where only 31.1% villages are electrified. The consumption of electricity in the country is increasing the rate of 10% per year. The energy usage has been increasing through year,

64 but there has been no sufficient increase in the production. In the case of electricity, this leads to load shedding and increase in prices.

As the prices of cured oil are increasing day by day and the consumption are also increasing with time. The amounts of natural resources are decreasing. If the rate of consumption remains same, we will have to face power shortage, all means of power generation will be exhausted. Talking about current position everybody is using electrical appliances just like cell phones and user are increasing day by day. They require electrical power for their operation. What else if power is cut? To save the power and natural resources and to fulfill our daily requirement we are going for friction less generation of power using bicycle. As previous methods for generation of power using bicycle was created by using alternator, wind turbine have various disadvantages just like alternator provide friction which reduces speed and require more efforts to peddle the bicycle, and wind turbine which cannot generate more power it require more wind energy for generation and the appearance was not so good. All the disadvantages of above methods are over come in this technology which is based on the principle of electromagnetic induction. The energy will be generated by peddling which will rotate the wheel and the assembly place in between the spokes. This energy is stored inside the battery and it can be used to drive the motor during driving the bicycle. This technology does not require any external power supply for charging the equipment's it is a man power generator. It requires only human efforts. This method is very useful during large power cuts. It is a clean way of generating energy; it does not contain any combustion of any kind of fuel.

## 1.1. Problem Statement

When the word 'bicycle' comes in the mind. We all know, what is this concept is all about. We all are familiar with bicycle. Our half of the age has already gone by using bicycle.

Let us think about those problem which we have faced while using bicycle. Definitely it will make a long list..!

- 1) When we used those bicycle we have faced chain & sprocket friction problems for its maintainance lubricating oil are using for its better performance.

- 2) Continuous pedalling will make more tired and also have lots of human power losses. The human can generate 150Watt power by continuous per hour pedalling.
- 3) When we travelling to mountain and hilly areas with the same bicycle it becomes more difficult for the rider to ride his bicycle.
- 4) While traveling by the bicycle when we stop at the signal or somewhere, then we have to start pedalling bicycle with new energy.

## 1.2. Objective

To overcome from above discussed problem, we want to modify our simple or regular based cycle to the next level so it will be helps us to relief human effort.

- 1) We are trying to re-modifying the bicycle in such a way that it will composed of different components such as motor, battery, alternator.
- 2) We are trying to eliminate the total chain & sprocket assembly instead of it we are using bearing linkage assembly assembly.
- 3) By using such gear box, it will be exactly double efficient as compare to simple or regular bicycle.
- 4) It will required less human power for its operation.
- 5) It will also help for easy transportation.

It won't require any new power to ride once it is stopped, the energy produced in the battery itself run the cycle just like bicycle

## II. LITERATURE REVIEW

- ❖ ASM'S International E-journal of ongoing Research in management.

eISSN-2320-0065

We are trying to use most of system & technologies that can consume less time, thus the life become more easier. But we want to neglect the dependence of alternatives fuels & try to use electrical components as more as possible.

For the reason we get an idea from above research paper to generate electricity using non-conventional energy source as a mechanical assembly.

- ❖ 4th International Conference on Advances in Energy Research 2013, ICAER 2013

Experimental Analysis and Feasibility Study of 1400 CC Diesel

Engine Car Converted Into Hybrid Electric Vehicle by Using BLDC

Hub Motors

New generation HEV (hybrid electric vehicles) are targeting for reducing exhaust gas pollution by operating in EV (electricvehicle) mode during the stop and go movement in thick traffic conditions at low engine rpm, but run on ICE (Internal Combustion engine) mode at cruising speed on highways. While new Hybrid car concepts are being developed internationally,existing Gasoline and Diesel powered conventional ICE vehicles will be guzzling unwanted pollutants for rest of their life,adding to the menace of global warming. To address the need for conservation of fuel and reducing production of harmful pollutants by millions of cars driven world over, an experimental research work was carried out in the field of conversion of existing diesel or petrol cars in to HEV. Main objective of the research is to reduce consumption of fossil fuel, for preserving it for future generation.

- ❖ Generation of Electrical Power using Bicycle Pedal

It is known that the supplies of fossil fuels are limited and their utilization as energy source causes environmental degradation due to unfinished ignition when used as energy source, in addition to this as the world population increase the order for energy sources increases, so the issue of a steady replacement of fossil fuels with renewable energy source is of major consideration for most countries. Renewable power generation system is currently preferred for clean power generation. With ongoing revolution in the generation, electricity is generated at small level by using bicycle pedal. Bicycle is the main mode of transportation for many Indian villagers. Most of these villages are un electrified. Power generated by pedaling can be converted from mechanical to electrical energy by using either alternator or alternator

## ❖ FRICTIONLESS POWER GENERATION USING BICYCLE

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The intention of this project is to build a straight forward human powered generator from a used bicycle and to use it to power light bulbs, cell phones, laptops, and other small appliances. This project will help to develop engineering skills while learning about a clean way of generating electricity and satisfying our basic requirement. We are going to use the hard drive magnet and inductive coil to generate electricity due to which our mobile phone will be charge and followed by ac to dc converter. This is totally clean way of generating energy. As fuel is not a renewable energy source and the prices are increasing day by day. It will not be affordable by a common man after some period. Here no fuel is required to generate electricity, so everybody can afford this method for power generation also it eliminates the emission of CO<sub>2</sub> which will reduces the pollution. Conventional methods for generating electricity make use of alternator and wind turbine, but they have disadvantage that they produce friction and reduces speed which require more efforts.

## ❖ S. Dunnett: Small Wind Energy Systems for Battery Charging.

Practical Action Technical Information Leaflet.

From above research paper we got idea about wind power, small wind energy generation can helps as the additionally. The motor can be mounted near the front wheel.

## ❖ Development of fuel-cell-powered electric bicycle

J.J. Hwang a,\* , D.Y. Wang a, N.C. Shih a, D.Y. Lai b, C.K. Chenb

The design, fabrication, and testing of a prototype of electric bicycle powered by a proton exchange membrane fuel cell (PEMFC) is reported. The fuel-cell system is composed of a 300-W fuel-cell stack, metal hydride canisters, air pumps, solenoid valves, cooling fans, pressure and temperature sensors, and a microcontroller. To reduce cost, all components are commercially available except for the microcontroller, which has been developed to operate the system effectively. The fuel-cell system is installed on a commercial electric bicycle. Results show that the efficiency of the fuel-cell system can reach up to 35%, and the ratio of travel distance to fuel consumption of the prototype electric bicycle is about 1.35 km g<sup>-1</sup> H<sub>2</sub>.

## ❖ Estimating cycleway capacity and bicycle equivalent unit for electric bicycles

Sheng Jin a,† , Xiaobo Qu b, Dan Zhou a, Cheng Xu c,d, Dongfang Maa,† , Dianhai Wang a

With the rapid increase of electric bicycles (E-bikes) in China, the heterogeneous bicycle traffic flow comprising regular bicycles and E-bikes using shared cycleway creates issues in terms of efficiency as well as

safety. Capacity and bicycle equivalent units (BEUs) for E-bikes are two most important parameters for the planning, design, operation, and management of bicycle facilities. In this paper, eight traffic flow fundamental diagrams are developed for one-way cycleway capacity estimation, and a novel BEU estimation model is also proposed. Eleven datasets from different shared cycleway sections with different cycleway widths were collected in Hangzhou, China for estimation and evaluation purposes. The results indicate that, with around 70% share of E-bikes, the mean estimated capacity is 2348 bicycle/h/m. The effects on the capacity of the proportions of E-bikes, gender of cyclists, age of cyclists, and cyclists carrying things were also analyzed. The results implied that the estimated capacity is independent of a cyclist's gender and age, but increases with the proportion of E-bikes. According to this study, the mean BEU for the E-bike is 0.66, and the converted capacities of pure regular bicycles and pure E-bikes are 1800 and 2727 bicycle/h/m, respectively. These findings can be used to propose practical countermeasures to improve the capacity of heterogeneous bicycle traffic flow on shared cycleway.

❖ Identifying dynamic model parameters of a BLDC motor

A. Kapun \*, M. Čurković, A. Hacı, K. Jezernik

An off-line identification method founded on the least-squares approximation technique and a closed-loop disturbance observer is applied for identifying the parameters of a BLDC motor model. No special configuration of the motor is required besides the availability of experimental data for back-EMF, phase currents, rotor position, and rotor speed. This method is used to identify the back-EMF harmonics and mechanical parameters, where the mechanical parameters refer to cogging-torque, viscous friction coefficient, and Coulomb friction coefficient. The proposed identification method is theoretically investigated, and the method's effectiveness is proved by experimental results performed on a low-power BLDC motor.

❖ Introducing specific power to bicycles and motorcycles:

Application to electric mobility

Magno Mendes, Gonçalo Duarte, Patricia Baptista

Electric bicycles and motorcycles have emerged as a possible way of improving the transportation system sustainability. This work's aim was to quantify the energy consumption, the trip travel and the driving dynamics on specific routes in Lisbon, Portugal. Six electric and conventional bicycles and motorcycles were monitored, and a methodology to quantify the power required in each driving second was developed: Motorcycle and Bicycle Specific Power (MSP and BSP respectively). MSP and BSP allows characterizing energy consumption rates based on on-road data and to define real-world operation patterns (driving power distribution), as well as to benchmark the different propulsion technologies under the same baseline of specific power. For negative MSP and BSP modes, the conventional and the electric motorcycles and bicycles demonstrated a similar pattern. However, their behavior was different for positive modes, since electric technologies allow reaching higher power conditions. The methodology developed estimates accurately the energy consumption (average deviation of  $\pm 0.19 \pm 6.76\%$  for motorcycles and of  $\pm 1.41 \pm 8.91\%$  for bicycles). The MSP and BSP methodologies were tested in 2 Lisbon routes. For the electric motorcycle an increase in trip time (+36%) was observed when compared to the conventional one, while for the electric bicycle a 9.5% decrease was verified when compared to the conventional one. The Tank-to-Wheel (TTW) energy consumption for motorcycles was reduced by 61% when shifting to electric mobility, while a 30% Well-to-Wheel (WTW) reduction is

obtained. For the electric bicycles, an additional energy use is quantified due to the battery electricity consumption.

❖ A genetic algorithm for bearing linkage assemblies

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Generation of bearing linkage assemblies with up to eight-links has been reported recently. Almost all the works reported so far deals with the generation of distinct graphs and then go for reverse transformation. It is desirable to know the characteristics inherent to the structure so that best chain can be selected from the numerous distinct chains (gear trains) with the same number of links and degree-of-freedom. In order to accomplish this, quantitative measures are developed in a very simple way, using some of the principles of the genetic process. These measures are used to test isomorphism and to know relatively the characteristics like speed ratios and transmission efficiency

❖ Fuel cell-battery hybrid powered light electric

vehicle (golf cart): Influence of fuel cell on the driving performance

Ivan Tolj, Mykhaylo V. Lototsky\*, Moegamat Wafeeq Davids,

Sivakumar Pasupathi, Gerhard Swart, Bruno G. Pollet

light electric vehicle (golf cart, 5 kW nominal motor power) was integrated with a commercial 1.2 kW PEM fuel cell system, and fuelled by compressed hydrogen (two composite cylinders, 6.8 L/300 bar each). Comparative driving tests in the battery and hybrid (battery þ fuel cell) powering modes were performed. The introduction of the fuel cell was shown to result in extending the driving range by 63e110%, when the amount of the stored H<sub>2</sub> fuel varied within 55e100% of the maximum capacity. The operation in the hybrid mode resulted in more stable driving performances, as well as in the increase of the total energy both withdrawn by the vehicle and returned to the vehicle battery during the driving. Statistical analysis of the power patterns taken during the driving in the battery and hybrid-powering modes showed that the latter provided stable operation in a wider power range, including higher frequency and higher average values of the peak power.

### III. OBJECTIVE

The main objective of this project is to reduce the manual efforts. Combing various components to the simple bicycle to create a hybrid bicycle which will help to ride for its better and efficient working.

Eliminating sprocket & chain will helps to reduce the use of lubricating oils. The main aim of this project that we wanted to create a bicycle free from conventional energy like fossil fuels. Which will environmental healthy. So that it won't make any problem in future.

### IV. CONSIDERATION

When the whole idea is discussed about the concept epicyclic powered bicycle, there were some difficulties which would have to be faced with the members.

-Discussed below,

1) What kind of battery should be selected.

- 2) Which alternator should be considered for the working.
- 3) How much power of motor should be used for the better convenience of bicycle working.
- 4) What kind of gear is selected, bearing linkage assembly consideration.
- 5) Rotary fan (Board fans are selected)

When the consideration was carrying out, 1st of all the motor was the main part which was the most important component which has to be selected,

When we attached the motor to the bicycle following consideration are taken out,

- 1) Average weight of natural human will be considered as 75kg.
- 2) Average weight of the bicycle is considered as 15kg.
- 3) Combining it will be 90kg.

Now, neglecting plane surface let us consider hilly & rough area where the bicycle is to drive. Average human can travel with a speed of 20km/hr & can produce approx. 150 watt of energy.

Selecting the motor could having enough power to run i.e. 24volt, 250watt the remaining component such as alternator. Due to this we select the battery which is used in commonly bikes of 12V. Which was having enough power to run the motor.

## V. WORKING PRINCIPLE

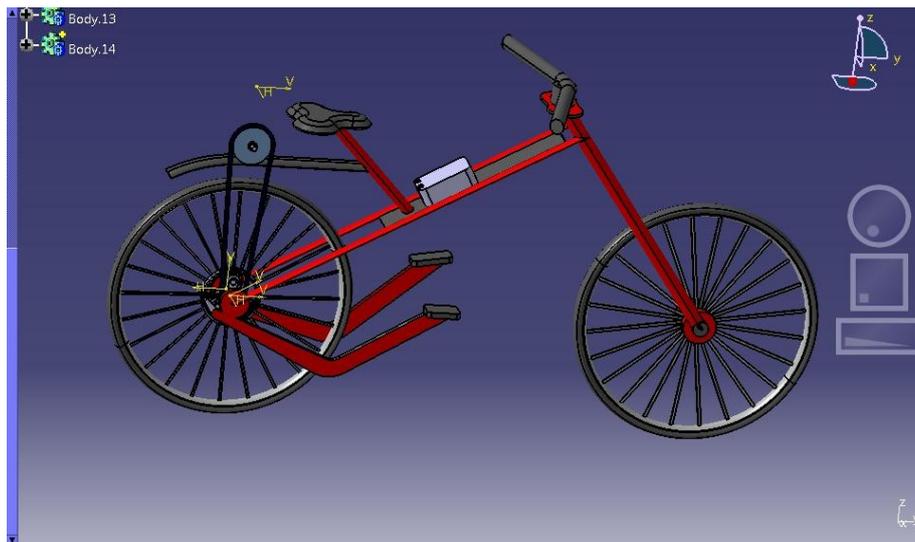
An Hybrid bicycle works on chainless drive which is based on bearing linkage assembly. As usual, first of all the bicycle is driven by the pedal operated chainless drive. The alternator which is mounted near the rear wheel will starts rotating along the wheel. So that the alternator will starts generating energy and that form of energy will be stored in the battery. Thus the mechanical energy is converted into electrical energy. This energy will provide the input power to motor. And the motor will increase the rpm of the wheel. In addition to this two rotary fans on front wheel will also carried out the same process.

### FIGURE



## VI. COMPONENTS OF HYBRID BICYCLE

- Bicycle
- Epicyclic gear box
- Alternator
- Battery
- Motor
- Rotary fan(Windmill)
- Connecting wires



### 1.3. BICYCLE

- As we are familiar with regular bicycle which is composed of chain and sprocket.
- But here we are replacing the chain and sprocket assembly with pedal operated bearing linkage assembly.

Following fig. Will show the brief idea about the bicycle.



Fig. Bicycle

#### 1.4. EPICYCLIC GEAR BOX

- Firstly we discussed for selection of gears and from overall surveying we came to the conclusion that bearing linkage assembly assembly will be the best of all.



Fig. Bearing linkage assembly

#### 1.5. ALTERNATOR

- Alternator is a device which works exactly as same as alternator.
- Just the difference is when we have to generate more power it is impossible to produce required power from alternator.
- So instead of it we are using alternator.



Fig. Alternator

## 1.6. BATTERY

- In this project here battery will play the main role.
- Because it will store the power which is produced by the alternator.
- Further it will supply the input power to the motor.



Fig. Battery

## 1.7. MOTOR

- The motor will run with the help of power provided by the battery.
- As we selected the motor for having maximum torque to bicycle.

### SPECIFICATION

- Electric Bicycle permanent Magnet **DC Motor MY1016**
- **24 volt 250 watt** output electric Bicycle motor.
- rated speed (rpm) : **2650 +/- 5 %**
- rated current : **≤ 13.7A**; current without load : **0.7 - 1.4 A**
- rated torque : **0.87 Nm**
- transmission : chain sprocket (11 teeth, pitch 1/4"=6,35 mm), exchangeable, fixation nut shaft diameter :10 mm (milled groove one-sided 1,5 mm)



Fig. Motor

## 1.8. ROTORY FANS

- The two board fans which are mounted near the front wheel.
- This fans plays a role like as wind energy.
- This will help for additional power generation.



Fig. Rotary fans

## VII. ADVANTAGES

As compare to chain drive bicycle, this bicycle complete 2 rotations of wheel in single stroke of pedal.

- Pollution free.
- It is cheaper than bikes.
- No fuel consumption hence zero fuel costs.
- Negligible maintenance

## VIII. FUTURE SCOPE

There is a lot of scope in the improvisation of this system. We have discovered a system which is visually as well as practically appropriate but lots of corrections and improvements can be carried out if it has to be explored more and to see this concept in the world in the upcoming era. And this all can be discussed as below :-

If this powered bicycle is manufactured in mass or in greater quantity it will definitely help to distinguish its parts and components to the next level.

Thus, excellent and efficient quality of components can be obtained to form the powered bicycle.

More furnished parts can be manufactured so that the margin of errors becomes less and less.

More study can be done on the bicycle and so that it will reduce the human efforts.

We can also use the modified and latest mechanical design softwares to form a design of bicycle for its better understanding.

Fabrications of manufacturing of this system can done in way that more furnished parts can be made having less clearance.

More power transmission can be obtained if the components used in system are of excellent type.

## IX. CONCLUSION

In conclusion human power there is a vast scope in economical use of hybrid bicycle mechanism as an alternative energy source thereby renewable energy generation as well as exercising for good health cause. To overcome from such fossil fuel problem this hybrid bicycle will definitely help the user so that it will be beneficial for the user as well as environment without affecting it.

In this mechanism we have combined the independent component and are getting energy consumed while exercising is presented.

## X. ACKNOWLEDGEMENT

I would like to express my sincere thanks with a great deal of pleasure towards my guide Prof. S. V. DESHPANDE for helping and guide me through this sea of hard work and for taking a lot of interest in my project. He helped me in selecting right project with good feasibility and application . I would like to thanks for his never ending support and motivation

. I wish to thank Dr. A.A. KARYAKARTE (HOD Mech. Dept ) . she was constant source of guidance and inspiration during all stages of work.

Last but not least , I wish to express my deep gratitude to all those who extended their helping hands towards me in various ways during completion of this report and all the professors of mechanical engineering who helped me directly or indirectly during this course of work .