

Papers I reviewed

Paper 1

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Generation of Electrical Power using Bicycle Pedal

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Fig.1 Charging batteries using bicycle pedal

In this paper, dynamo or alternator is connected to the bicycle to generate Electromagnetic Energy

However the arrangement of dynamo was not mentioned in this paper. Just matlab simulink was given in this paper.

I found a youtube video where the dynamo placement on bicycle is mentioned.



The dynamo is placed like this. So when the wheels rotate , the dynamo rotates about an axis perpendicular to the axis of rotation of the wheel.

Paper 2

Energy Harvesting Bicycle

By

Michael Hui

A Senior Project

presented to

ELECTRICAL ENGINEERING DEPARTMENT

California Polytechnic State University, San Luis Obispo



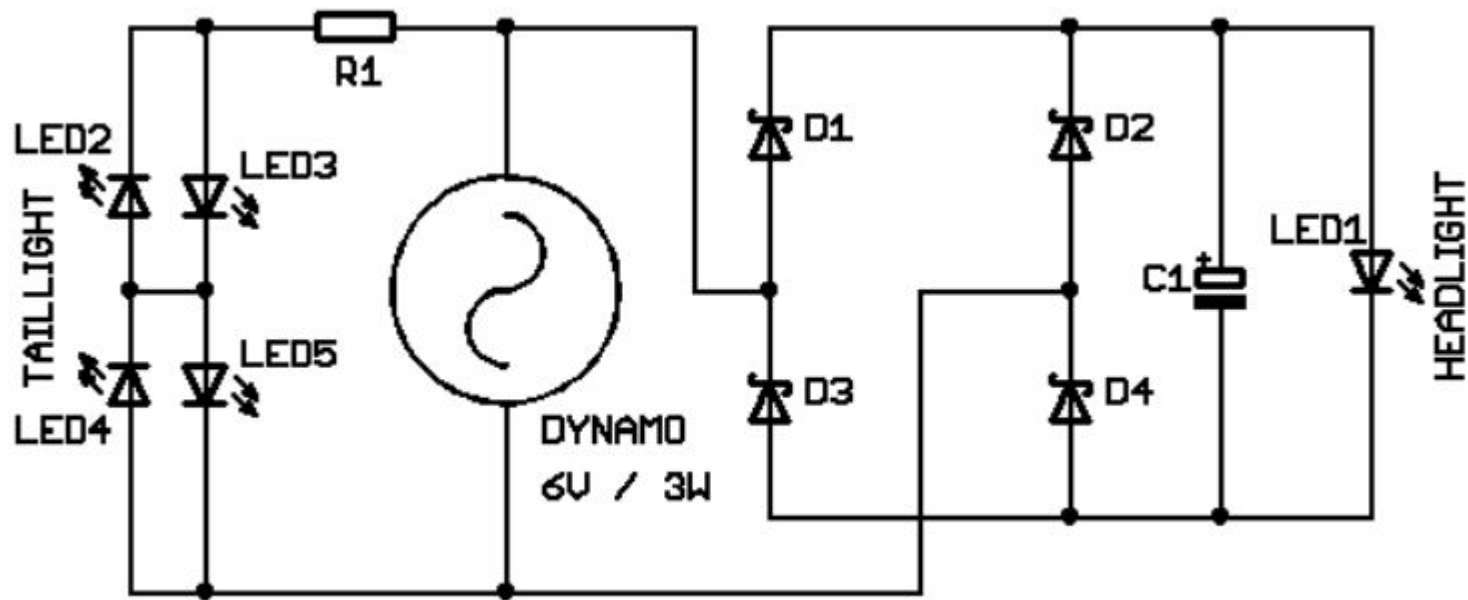
Figure 5: Dynamo mounted to bicycle frame.

This paper is using same dynamo config as the commercially available one discussed previously that I saw in a youtube video



Figure 10: Testing circuit with LEDs off (left) and LEDs on (right).

Here we can see they are lighting leds using the dynamo



This is the complete design they made for lighting tail and headlights using the dynamo

Paper 3



Special Issue Article

Advances in
Mechanical
Engineering

Study of piezoelectric materials combined with electromagnetic design for bicycle harvesting system

Dyi-Cheng Chen¹, Shih-Hung Kao² and Chen-Kun Huang¹

Advances in Mechanical Engineering

2016, Vol. 8(4) 1–11

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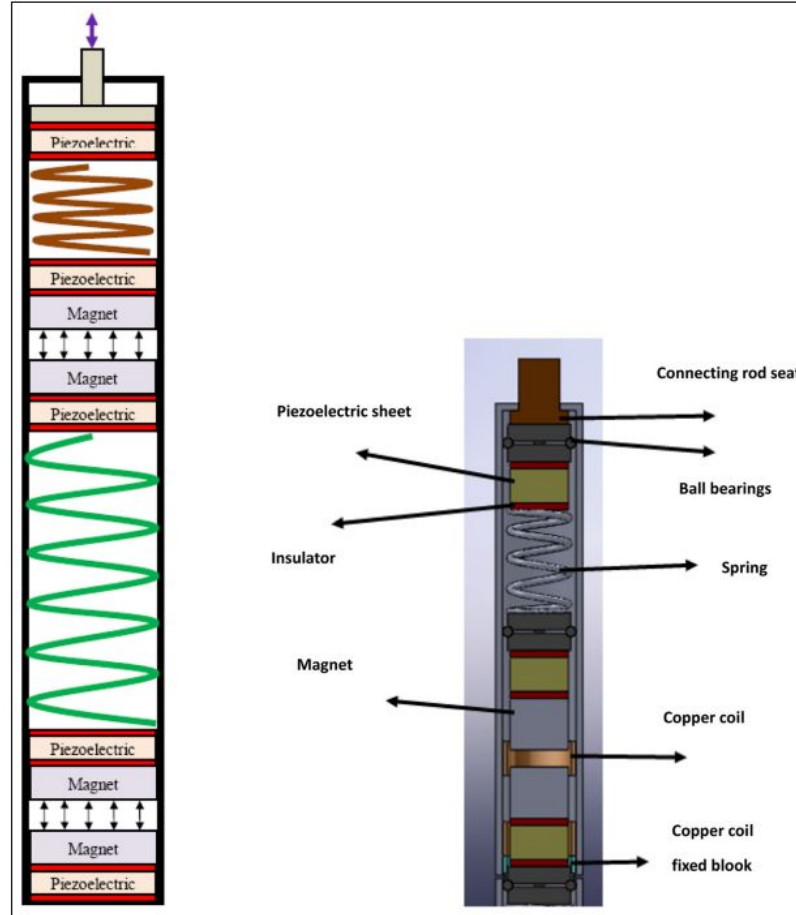


Figure 1. Shock absorbers with energy harvesting design for a bicycle.

The proposed model comprises of nonlinear magnetic springs for absorbing sudden impact energy.

These magnets are also rapped with coil to generate electromagnetic energy

The main power generator in this model is the piezo-electric sheet and the electromagnetic energy generated by the flux lines cutting the coil.

Paper 4

Article

Voltage Improvement of a Swing-Magnet-Type Generator for Harvesting Bicycle Vibrations

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Abstract: This paper proposes a swing-magnet-type generator that utilizes environment vibration for energy harvesting applications. This device consisted of a liquid, a swing magnet with a float, and a coil, and it was expected to generate electricity using the minute vibration of a bicycle. The vibration of the wide frequency band of the bicycle was converted into a vibration of a low-frequency mover. The yoke size of the permanent magnet affected the linkage flux and swing characteristics. Therefore, we verified the effect of the mover characteristics on the swing moment by structural simulations and vibration experiments using a linear motor. The yoke size changed the torque, which affected the resonant frequency of the swing. The magnetic-field analysis revealed the effect on the flux linkage in the yoke. The output voltage of the generator in the bicycle was 2.1 V, which could power a light-emitting diode.

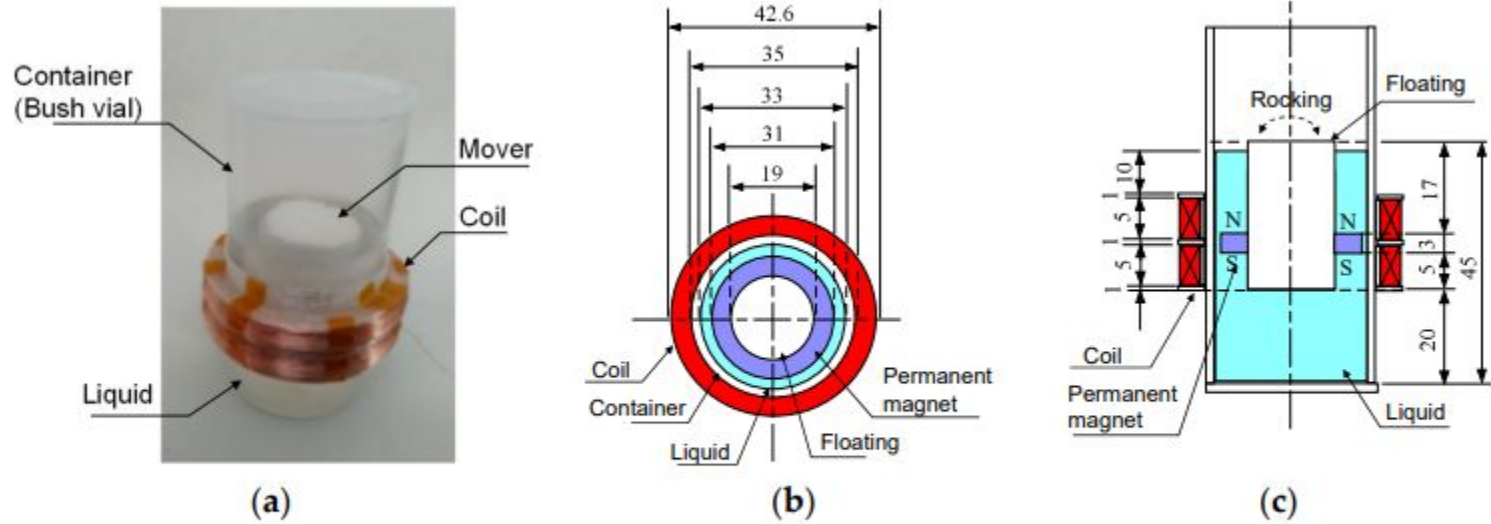
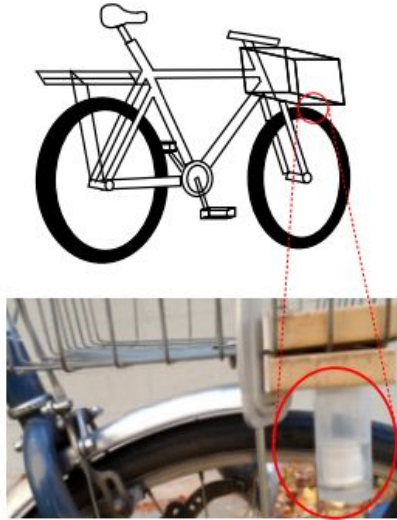
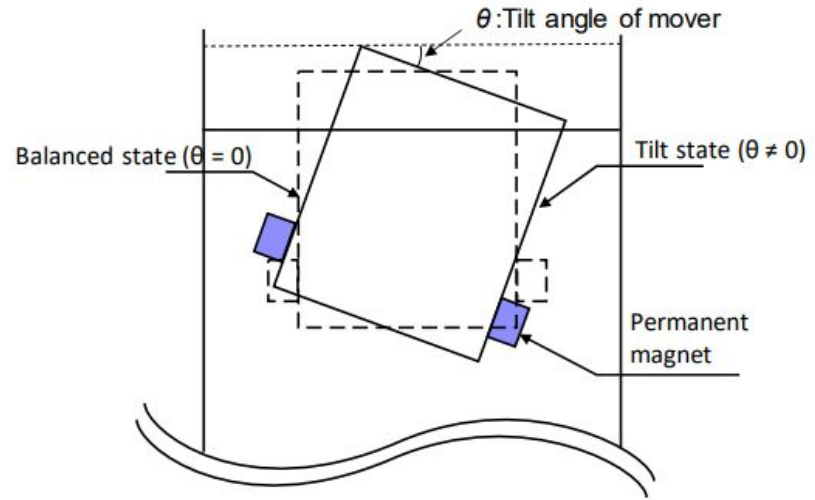


Figure 3. Swing-magnet-type generator. (a) External view; (b) Plan view; (c) Front view.

The arrangement has a magnet floating in water in a container. The container is wrapped using coil. Due to bicycle vibration, the magnet arrangement will swing sideways and this moving flux lines will generate Electromagnetic Energy.



(a)



(b)

The entire design is fitted on the front basket of the bicycle. Maximum angle of tilt experimentally found is 15 degrees.

Paper 5

Piezoelectric Generator Harvesting Bike Vibrations Energy to Supply Portable Devices

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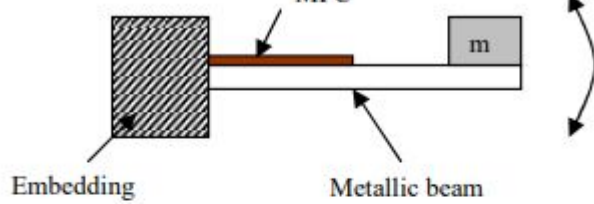


Fig. 9. Metallic beam with piezoelectric element.

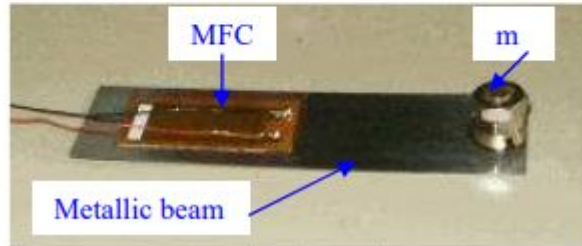
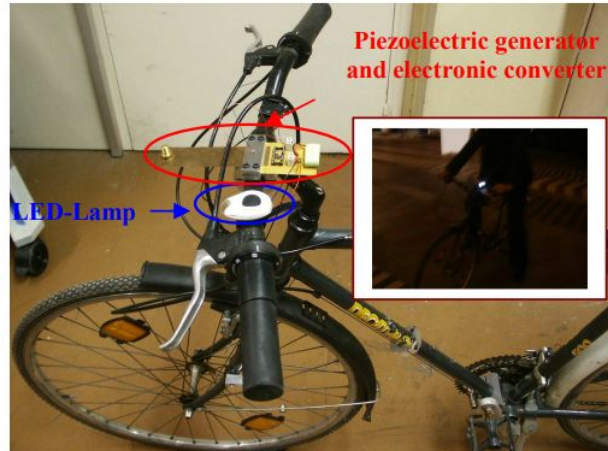


Fig. 10. Beam piezoelectric transducer using a MFC.



This paper proposes a beam type piezoelectric transducer. The vibrational energy is converted into electrical power.

The generator system is fixed on the top of the handlebar of the bicycle

Paper 6

Article

Harvesting Energy from the Counterbalancing (Weaving) Movement in Bicycle Riding

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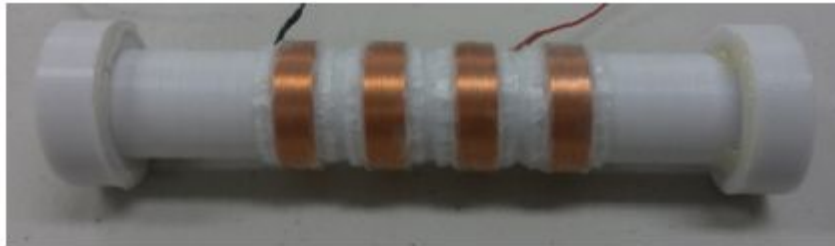
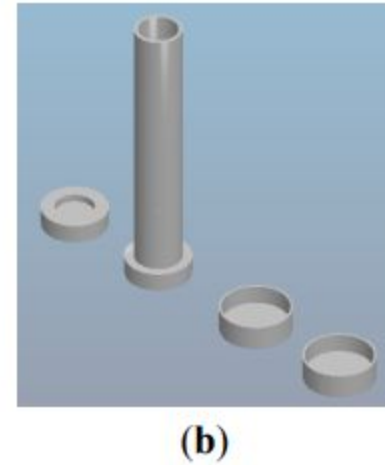
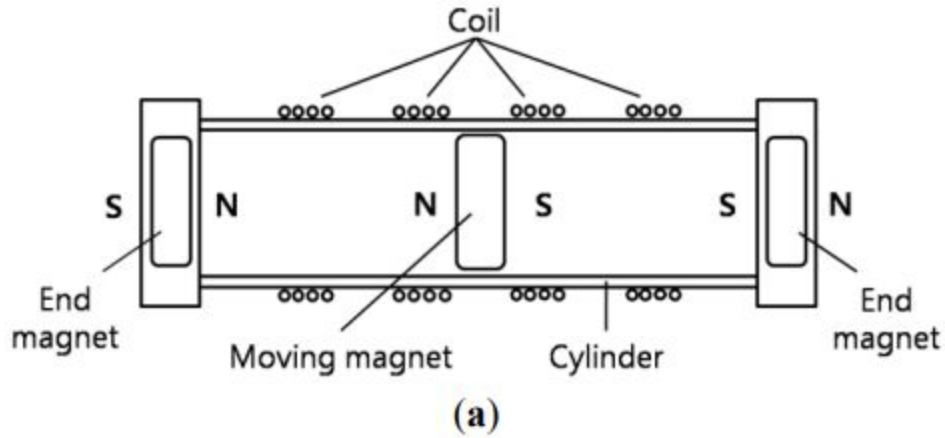
Received: 25 May 2012; in revised form: 12 July 2012 / Accepted: 17 July 2012 /

Published: 30 July 2012

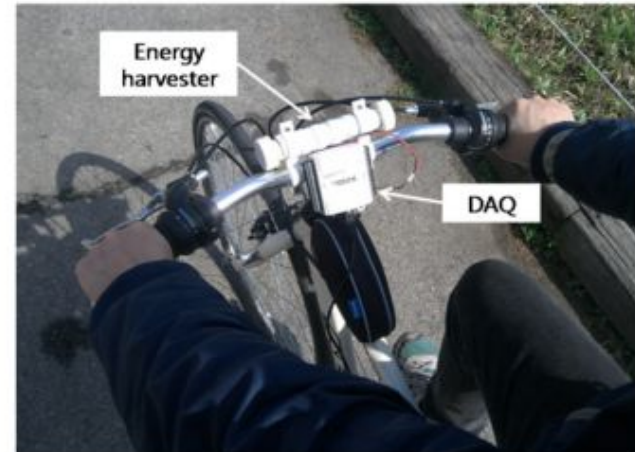


These sideways swaying of the bicycle is called weaving motion of the bicycle. This paper converted this weaving motion into Electromagnetic energy.

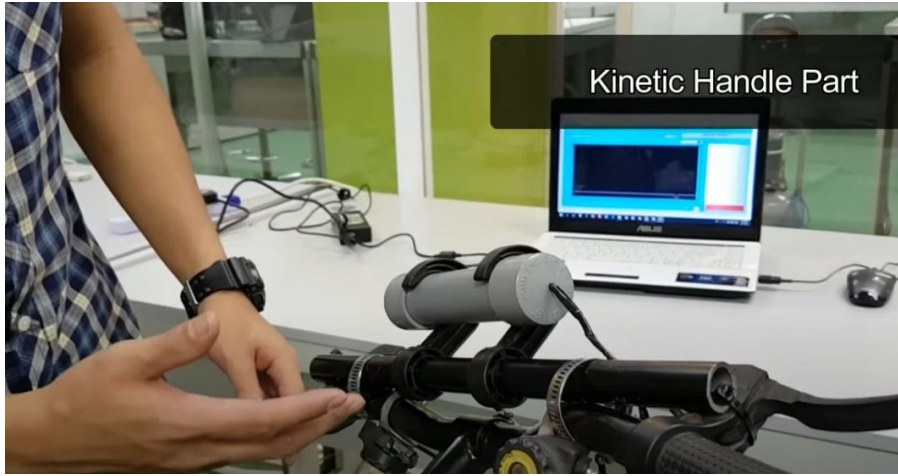
They did this by using a moving magnet in an enclosure. The moving magnet sways as the bike swings side to side. There is coils around the entire enclosure, so the motion is converted into Electromagnetic Energy



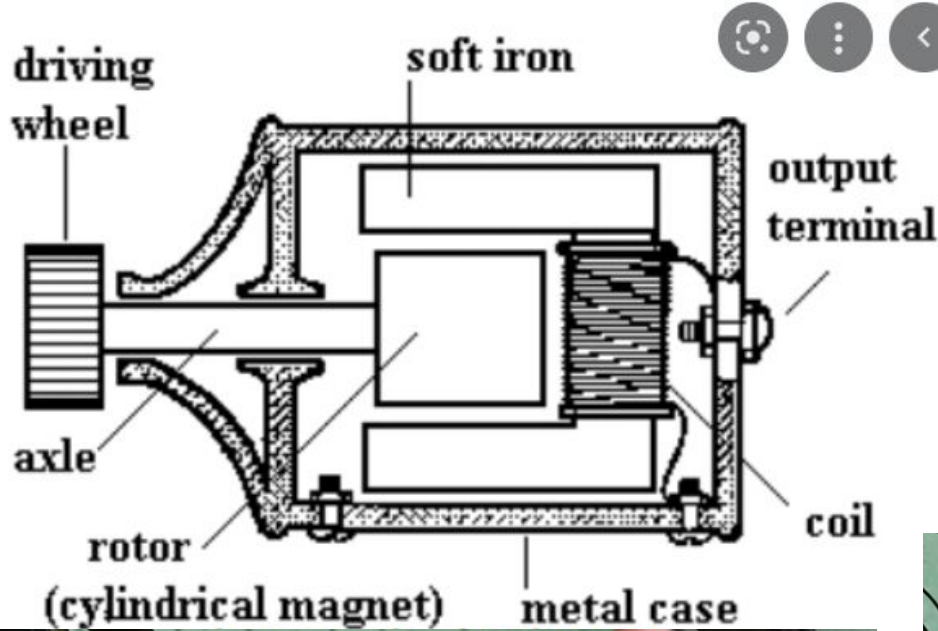
Here we can see how the moving magnet is placed and how the coils wrap around the entire enclosure



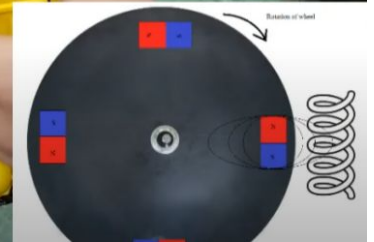
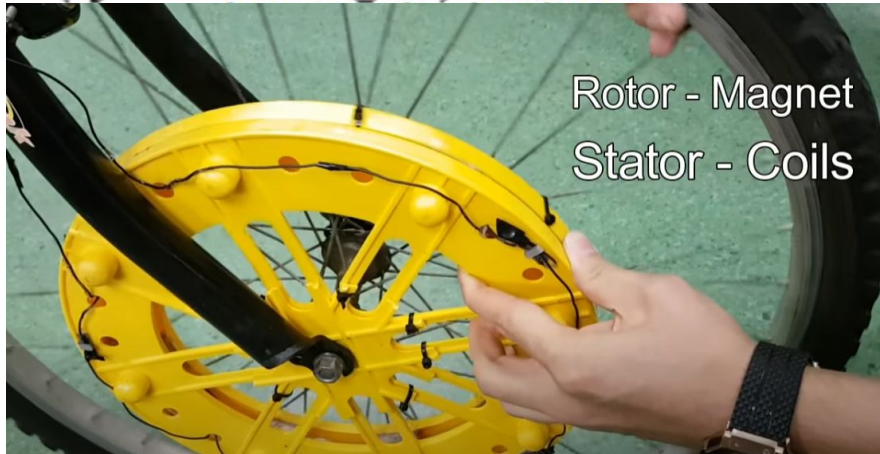
Energy Harvester I found on Youtube



I found a youtube video where they were using both the weaving generator mentioned before as well as a dynamo based generator they termed as the wheel hub part



The wheel hub has two yellow casings. The inner one is the rotor and it rotates, whereas the stator is fixed



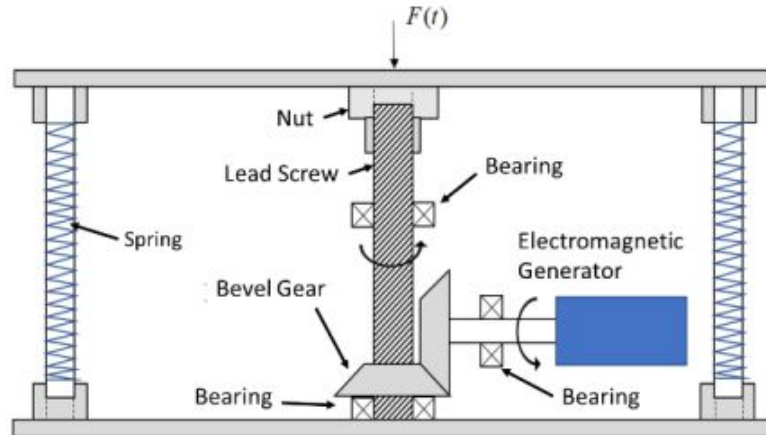
Ideas I propose

First Idea

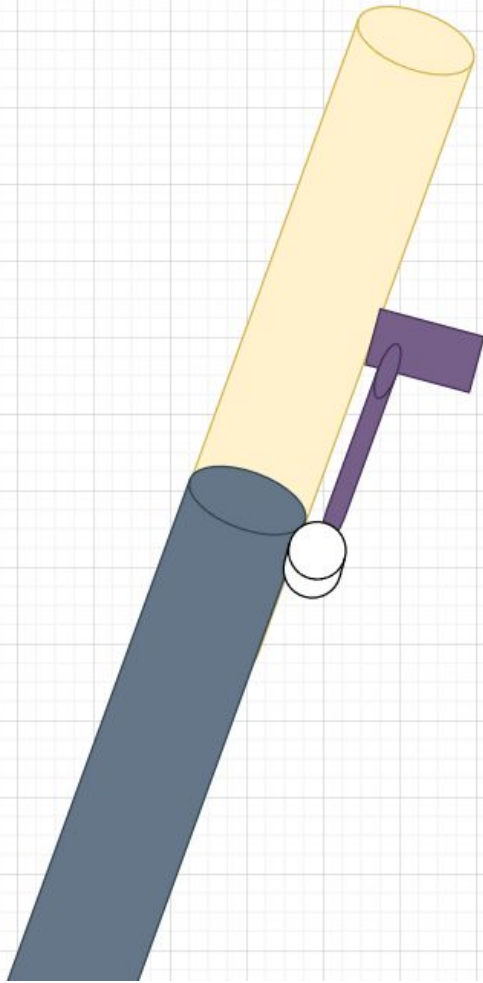
**Lead Screw Based Suspension Rod Electromagnetic
Energy Harvesting**



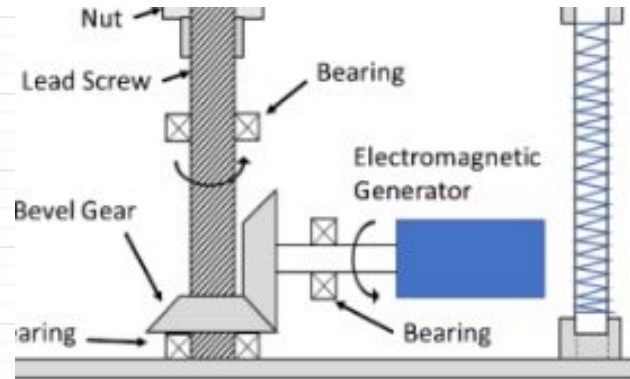
We can see the yellow suspension rod . We will implement a lead screw design to harvest energy. We will attach a small fixed platform given on the suspension rod which will generate electromagnetic energy exactly as given below. This design is taken from the following paper :



(b) Lead-Screw Design



The yellow is the moving suspension rod, the black is the fixed enclosure. The lead screw is fixed on the suspension rod and when the suspension is moving down or up it is piercing the translationally static screw fixed on a casing in the fixed enclosure which is then rotating the dynamo to produce power.



b) Lead-Screw Design

This is kind of like the bevel gear model I proposed in the previous presentation

Idea 2

EMEH based on magnetic plucking on Bicycle wheel



We will place small enclosures with magnet along the inner side of both the forks of the bicycle.

Enclosure having magnet





Magnets will
be placed in
this format

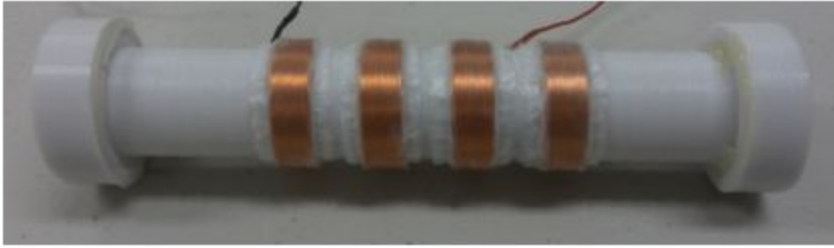
Then we will place magnets with alternate north and south pole equally spaced on the wheel rods.

So as the wheel is rotating the magnets in the enclosure will be periodically pulled out and pushed in due to the attraction and repulsion forces of the magnets.

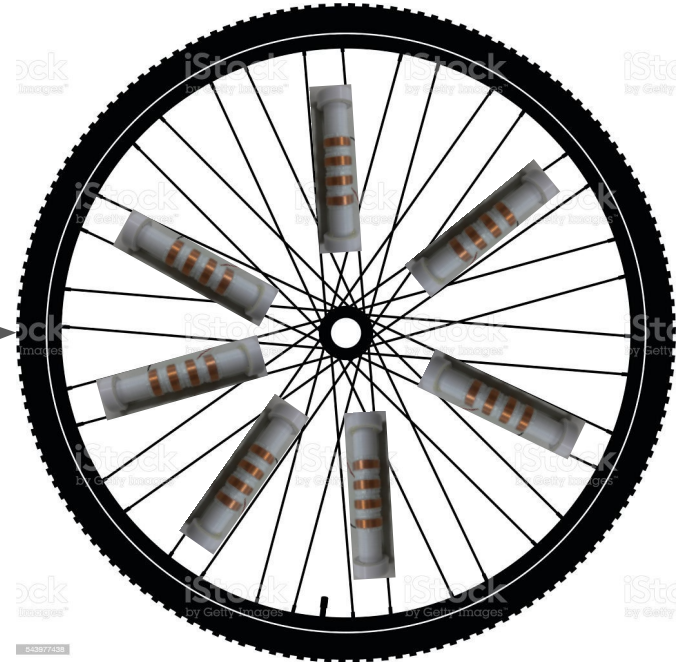
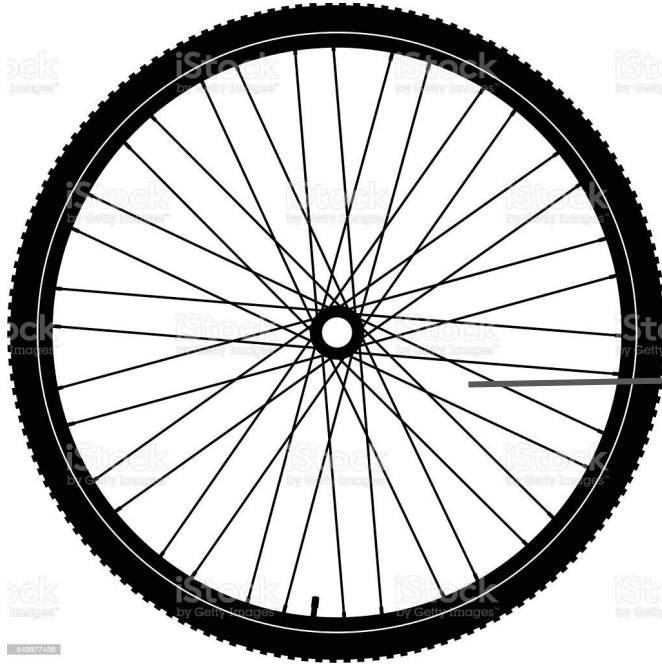
Coils are placed around the enclosure and Electromagnetic energy is generated.

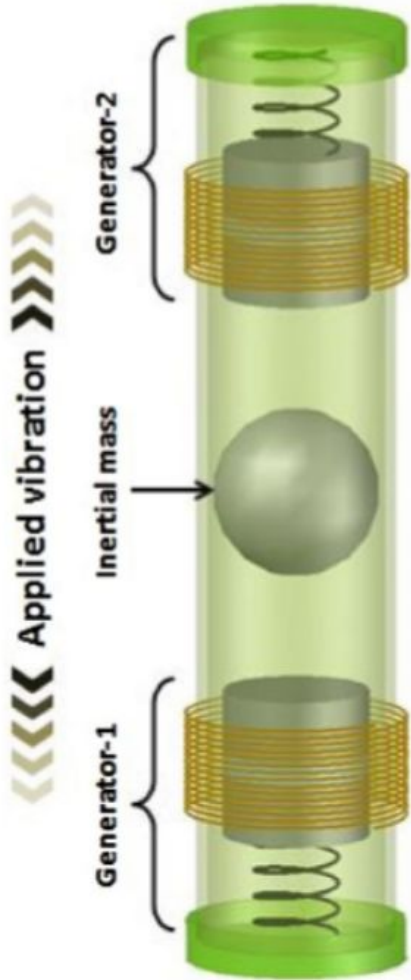
Idea 3

Weaving Non-linear Energy Harvester attached to wheel spikes of bicycle



We discussed about the weaving kinetic energy generator before. What we can do is line up many such small harvesters along the bicycle wheel. As the wheel rotates the magnet inside the coils will perform a vibrational motion inside the coils and voltage will be generated.



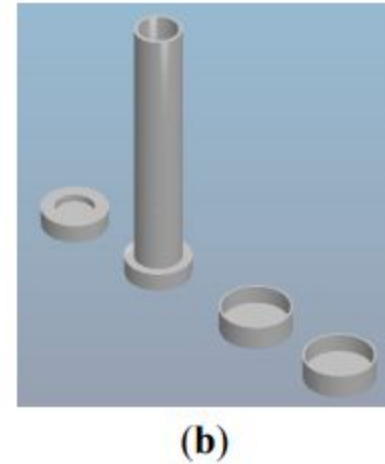
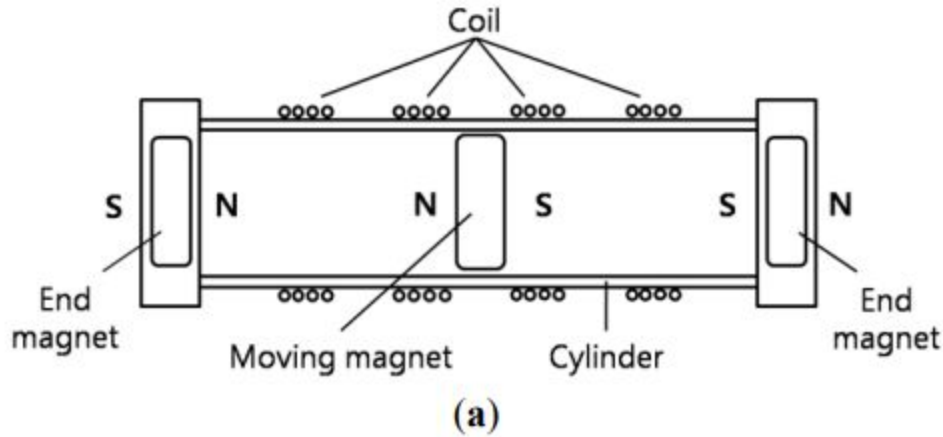


I also found a design like this on reddit. We can use this design too in place of the previous one in our bicycle wheel.

Here the ball is non magnetic and as vibration is applied it hits the magnets and makes them vibrate hence generating Electromagnetic energy.

Idea 4

Non-linear Energy Harvester utilising three magnet vibration



We saw that in a paper discussed earlier that the end magnets were fixed. But that will be extremely wasteful as on impact we can also make those magnets vibrate as well and hence generate energy. That is why I propose that we add springs at the end of the magnets and make them vibrate as well and then wrap the entire system with coils.

Model I propose

Here we can see that all three magnets will vibrate on impact and voltages will be generated in all the three coils. Then we will connect these coils in series and get our output voltage

Magnets

Coils

