ENERGY HARVESTING SYSTEM USING DYNAMO

Rohit Barve[1], Dr. R.C. Jaiswal[2]

E&TC Department, Pune Institute of Computer Technology, Pune, Maharashtra, India.

***Abstract*- Ceiling fans are some appliances that are present in almost every house and commercial buildings. A dynamo is an electric generator that will be able to harness the rotary motion of the base of the fan (kinetic energy) and convert it into electrical energy which can be used to power small appliances such as mobile chargers via USB or can be stored in a battery. This paper aims to efficiently present a way to convert an AC input into a regulated and filtered DC output, thereby harvesting the energy and storing it for use as required.**

I. INTRODUCTION

As a sub-tropical country, it is understood that India has high temperature for almost all the days in a year. Due to this hot environment, fan is required throughout the year and each house has at least one fan that runs for almost all day and night. The fan's rotatory motion can be connected to dynamo motor and converted into electrical energy.

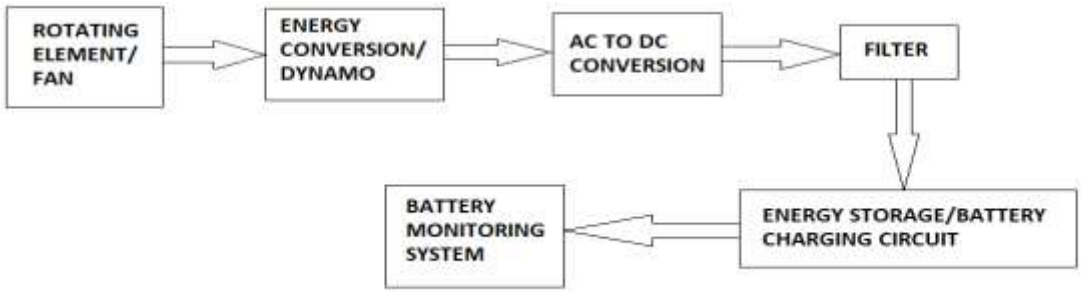
Ceiling fans are present in almost every room in most of the houses, colleges etc. So, these ceiling fans can be used to harvest energy by using the rotary movement of the fan. In accordance to the first law of thermodynamics, energy can only be transformed from one form to another. In case of ceiling fans, the extra energy of the rotating element is wasted and can be reused. This will also enhance the efficiency of fans. Since ceiling fans move in rotatory motion, a dynamo is a suitable device that could convert this rotary motion (kinetic energy) into a form of energy that can be stored. A mechanical arrangement of gears was used to couple the moving fan blades and the shaft of the dynamo. It would be similar to a wind turbine and the stored energy could be used to power a light bulb or charge a mobile phone via a USB.

II. MOTIVATION

The ceiling fan is an appliance in everybody's household that potentially wastes energy and could be used to generate energy. A simple energy conversion and regulatory system can be used to efficiently convert the rotatory movement of the parts into electrical energy. This newly converted energy could be stored in rechargeable battery. This battery could be used to power small household appliances or charge mobile phones via a USB charger.

III. PROPOSED WORK

A. BLOCK DIAGRAM



1 Block schematic of system

1. Rotating element / Fan
   A fan is the device on which the system will be mounted and it will consist of an assembly of gears to couple the rotating element of the fan and the dynamo.

2. Energy conversion / Dynamo
   The fan moves in rotary motion. This motion (kinetic energy) needs to be converted into electrical energy. This is done using a dynamo which is an electrical generator that creates direct current using a commutator.

3. AC to DC Converter and Filter
   Output of a dynamo will be continuously varying and thus will be of pulsating nature. Therefore, we need to convert this signal into smooth, constant DC current. This is done using a rectifier and voltage regulator circuitry. A filter circuit consisting of capacitors follows this so as to remove any remaining ac components.

4. Energy storage / Battery
   The energy now constant and non-pulsating can be stored in a battery. The batteries used are of type Li ion since they are rechargeable.

5. Battery monitoring circuit
   A battery monitoring circuit cuts off the supply of current to battery once the battery is charged fully. It indicates battery status through LED i.e., green for full charge and red of low charge. Once the charge level of battery reaches below 5%, the circuit reconnects the battery to the charging circuit.

B. TECHNICAL APPROACH

An AC dynamo is an electrical device that will be used for converting the energy of the moving fan to rotate the shaft of the dynamo. The dynamo will generate current and the devices will be coupled such that the mean time the voltage is generated is proportional to the number of rotations of the shaft of the dynamo. This voltage generated will be alternating in nature. An AC-to-DC circuit will convert this voltage to DC current. This current will be filtered and regulated, and will be used to charge a 1.2v 2400mah battery. A combination of inverter circuit and a step-down transformer can be implemented so as to utilize this battery voltage for other applications.

IV. CONCLUSION

We are at a point of time where our energy requirements are ever-growing while the energy sources are limited. Conserving energy or recycling it is becoming necessary. In this paper, an alternate way of utilizing wasted energy is presented. The energy that is generated using this method can be used for powering small electronic devices such as mobile phones, power banks, laptops etc.

V. MERITS

1. Low initial cost: This method is much cheaper than using the solar panels which use photovoltaic cells to generate energy.
2. Zero emissions: No particulate matter or hazardous gases are emitted and this method is environmentally conscious.
3. Regular maintenance of this system is not required since once the parts are assembled, they work for a long period of time.
4. Energy generation is localized, so no need of power transmission infrastructure.
5. Simple in Construction.

VI. FUTURE SCOPE

1. The system implemented using dynamo requires more rotational energy to produce the electric energy required. But if the same system is implemented on cycling bikes or cycling machines where input energy is muscular energy this limitation of wastage of input electric energy can be neglected.
2. Same objective of energy harvesting using household energy can be implemented using the following idea of improving fan modelling: Generally, conventional ceiling fan is driven by a single-phase induction motor with 30% efficiency. This value of efficiency is not sufficient enough for the performance of the ceiling fan motor. Many researchers have developed a few methods and came out with a prototype of ceiling fan with better-quality output efficiency and energy saving.
3. The implementation of the idea presented in the paper is easy to implement but the loss of energy is more than that of energy generated. But keeping in mind that when amount of household is being wasted, at places like bus station, this system will harness some of the energy rather than wasting it all.

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REFERENCES

A. Standards/Patents:

[1] C. M. Liu, "Ceiling fan with bi-directional rotation control," ed: Google Patents.
[2] Y. F. Tang, "Ceiling fan with outer-rotor DC brushless motor," ed: Google Patents.

B. Technical Papers:

[1] N. Shah, N. Sathaye, A. Phadke, and V. Letschert, "Efficiency improvement opportunities for ceiling fans," Energy Efficiency, vol. 8, pp. 37-50, Feb 2015.
[2] MD Saquib Gadkari, Khemchand Kolte, Mrunal Jasani, Akash Vichare, Beatrice.S, “Generation of Electricity from Fans”, (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (3), 2014.
[3] Jaiswal R.C. and Vipul Phulphagar, “Arduino Controlled Weight Monitoring With Dashboard Analysis”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887, Volume 5 Issue XI November 2017
[4] Jaiswal R.C. and Sumukh Ballal, "Scalable Healthcare Sensor Network", International Journal of Emerging Technologies and Innovative Research (www.jetir.org | UGC and issn Approved), ISSN:2349-5162, Vol.6, Issue 2, page no. pp350-354, February-2019
[5] Jaiswal R.C. and Nehal Borole, “ Autonomous Vehicle Prototype Development and Navigation using ROS”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Open Access, Peer Reviewed and refereed Journal , ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:7.177, Volume 7 Issue XI, pp. 510-514, Nov 2019.