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SMALL SCALE POWER GENERATION FOR RURAL HOUSEHOLDS

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Abtract: This paper includes details about a project to build a human powered generator with the help of a bicycle. This can be used for upto 120watts DC. This project will help to develop a clean way of generating electricity. It is intended to be both achievable and affordable.

Keywords: portable generator, clean electricity, low cost power generation

I. INTRODUCTION

The purpose of this project is to build a human powered generator with the help of a bicycle which is also portable and can be used to power small appliances such as dc fans, light bulbs etc. This project will help to develop a clean way of generating electricity. It is intended to be both achievable and affordable. By using principles of energy conversation a small amount of power source can be developed which can be used in rural and remote areas. The chemical energy in a person's body is converted into mechanical energy using a bicycle and then further into the electrical energy with the motor. This energy is stored in a battery for further use.

II. LITERATURE REVIEW

[10] A remote village has limited access to electrical power and, as a result, the village homes are lit with candles and kerosene lamps after dark. Narrow mountain paths limit the access to neighbouring villages and limits the supply of diesel for the village's generators. The task is to develop a small and sustainable source of electricity for the village. [7] The intention is to create a system that can be used to generate and store enough energy to light an LED or any other small appliance for about 10

minutes.It is intended to be both achievable and affordable. [1] The chemical energy in a person's body is converted into mechanical energy with the use of bicycle and then further into the electrical energy with the motor. By hand-cranking the bicycle pedal at different speeds we will discover that at higher speeds the lamp will get brighter. We shall also discover that the sound emitted by the speaker gets higher in frequency and amplitude (volume) as the pedaling speed is increased. If the speaker or lamp has weak output, we will connect one at a time. An oscilloscope can also be connected to the dynamo to show the sinusoidal waveform. The loads provided should be appropriately matched to the dynamo's output. This energy can be measured by using a microcontroller and LCD display to display instantaneous power.

III. PROPOSED ARCHITECTURE

The various components which are required to build this project are mentioned below [2] A bicycle which can be of any size, the dynamo will be fixed at the hub of its rear wheel, Dynamo, bridge rectifier, voltage regulator and a LED bulb. [8] Its working can be explained as follows. The AC from the dynamo(present at the hub of the rear wheel) passes through a full-wave rectifier and feeds the LED bulb through the connected circuit elements. The current in the LED is limited by the dynamo to about 0.5Amps - 0.6Amps.LED should be capable of handling this much amount of current without getting fuse. [6] The charge (q) stored in a capacitor is the product of its capacitance (C) value and the voltage (V) applied to it. Capacitors offer infinite reactance to zero frequency so they are used for blocking DC components or bypassing the AC signals. The capacitor undergoes through a recursive cycle of charging and discharging in AC circuits where the voltage and current across it depends on the RC time constant. For this reason, capacitors are used for smoothing power supply variations. The instantaneous voltage produced by pedaling at normal speed is about 14 volts when measured through a multi meter. The light flickers when pedaling is done at low speed. Hence a smoothing capacitor is used to reduce the flicker at low speed and also to increase a little bit of brightness. Capacitor C1 used has a high value so as to reduce the flickering caused at low speed. A small value of capacitor C1will increase the flickering at low speeds. The capacitor should withstand at least 4V.Its value is limited by the size & its cost hence these factors should be kept in mind while choosing a capacitor. LED should be disconnected from the circuit after the capacitor has charged to its full value otherwise it can charge to a higher voltage level. This could be dangerous to the operator as well as for the LED. A sudden very high peak current will most likely destroy the LED or change its color. [9] By revolving the bicycle pedal at different speeds, we will find that at higher speeds the lamp will get brighter. We will also discover that the sound emitted by the speaker will be higher in frequency and amplitude. If the output of the speaker or lamp is weak, we will connect one at a time. An oscilloscope can also be connected to the dynamo to show the output sinusoidal waveform. **7805** is a **voltage regulator** integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The **voltage regulator IC** maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

IV. WORKING METHODOLOGY

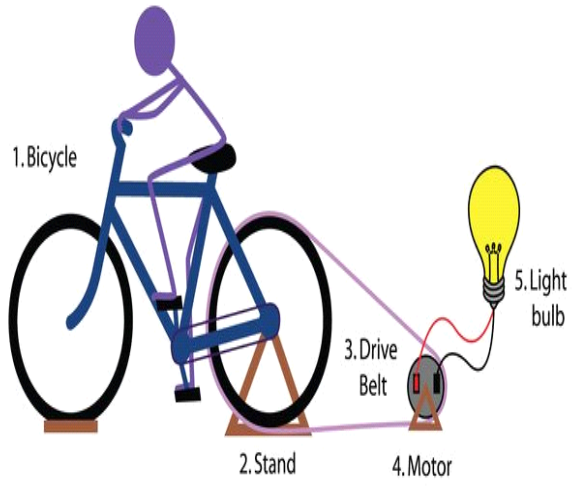

Figure1: Block diagram of small power generation.

A PMDC motor which is used as a generator is fixed at the hub of the rear wheel of the cycle.It is then connected to any dc appliance to which it gives power.[5] The generated electrical power could be used to charge a battery and could be stored or could be used to directly power appliances.The instantaneous voltage developed is around 14 volts which can be checked with the help of a multimeter. We could design an energy storage device that can be hooked up to the bicycle and is portable. It should be easily removable, compact, durable and capable of illuminating the LED via a current limiting resistor for at least 10 minutes.

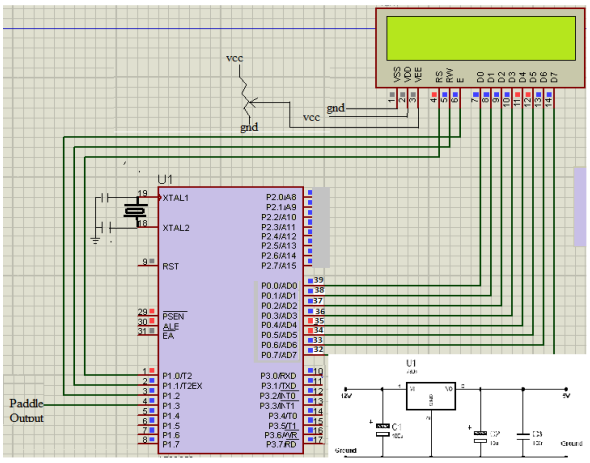

fig: complete circuit connection

This energy can be measured by using a microcontroller and LCD display to display instantaneous power. The chemical energy in a person's body is converted into mechanical energy with the use of bicycle and then further into the electrical energy with the motor. This electrical energy is stored in a battery which can be used to drive LED light and some other small appliances. If we want to use AC power than a inverter can also be used with this apparatus. VCO is used for constant output voltage. In this project we are using 7805 voltage regulator which has an output of 5V.For an average adult cycling at a normal rate it would take around 1 hour to store approximately 150W of power .Several cycle generators can be connected in parallel and connected to a battery which can store power or to an appliance which consumes more amount of power.More the cycling speed more is the instantaneous power developed.But a smoothing capacitor is to connected in the circuit which removes the ripples or the spikes from the voltage or current waveform produced.This can also be used to power AC appliance by connecting an inverter in intermediate stages.The PMDC motor selected should

be according to the needs i.e for high power high rating and more rpm motor should be used.The total energy loss in a cycle generator will be around 42 to 67.5 percent (calculation example for highest loss: 100 watt input = 80 watt after 20% loss in motor/generator = 57.5 watts after 25% energy loss in voltage regulator = 37.5 watts after 35% loss in battery = 32.5 watts after 15% loss in converter = 32.5 watts output = efficiency of 32.5% or energy loss of 67.5%).

V. CONCLUSION

This project will help one develop engineering skills while learning about a clean way of generating electricity. This project is affordable as the total cost is around 1000 /-Rs only. By revolving the flywheel at normal speed the instantaneous power generated is around 80 watts. At high speeds it may go upto 110-120 watts. This setup can be installed on a bicycle. Therefore the user did not need to do extra efforts to charge this battery. As in rural areas and remote areas people mostly use a bicycle to go from one place to the other, so they can charge these batteries during their journies to their fields. This will reduce the efforts. We can light a LED of around 15 watts and a small DC fan around 2 hours with a fully charged battery of 12 volts. Project is easy to understand and develope as it is made basically for rural area purposes.

REFERENCES

[1]Principles of energy conversionLevi.E. Proceedings of the IEEE volume:69, Issue:9DOI: 10.1109/PROC.1981.12151 Publication Year: 1981 , Page(s): 1173 – 1174

[2] An approach in energy harvesting from fitness equipment Sukumaran suresh kumar: Purushothaman M.Science Engineering and Management Research (ICSEMR).2014 International Conferenceon DOI:10.1109/DOI: 10.1109/ICSEMR.2014.7043661 Publication Year: 2014 , Page(s): 1 – 5

[3] A soft-switched full-bridge single-stage AC-to- DC converter with low line current harmonic distortion Bhat,A.K.S. ; Venkatraman,R.power electronics specialists conference.2000.PESC 00.2000 IEEE 31ST Annual volume:2 DOI: Publication Year: 2000 , Page(s): 799 - 804 vol.2 Cited by: Papers (1)

[4]] A Soft-Switched Full-Bridge Single-Stage AC-to-DCConverter With Low-Line-Current Harmonic DistortionBhat,A.K.S. ; Venkatraman,R.Industrial Electronics,IEEETransactionson Volume:52, Issue:4 DOI: 10.1109/TIE.2005.851639 Publication Year: 2005 , Page(s):1109116 Cited by: Papers (32) | Patents (1)

[5] Energy Storage Technologies and Devices
Grbovic,P,Ultra –capacitors in power conversion systems:analysis modeling and design in theory and practice,DOI: 10.1002/9781118693636.ch1
Copyright Year: 2014.

[6] Performance of flicker cancellation scheme for LED-ID systemsIn Hwan Park ; Yoon Hyun Kim ; Yeong Min Jang ; Jin Young Kim ICT Convergence (ICTC), 2011 International Conference on DOI: 10.1109/ICTC.2011.6082550 Publication Year: 2011 , Page(s): 58 – 63

[7]An approach in energy harvesting from fitness equipmentSukumaran,SureshKumar ; Purushothaman, M. Science Engineering and Management Research (ICSEMR), 2014 InternationalConference DOI: 10.1109/ICSEMR.2014.7043661 Publication Year: 2014 , Page(s): 1 – 5

[8]Taekhyun Kim Rylander M ;Powers E,J ;Grady ,W.M;Arapostathis A Instrumentation and measurement technology,conferenceproceedings2008.IMTC,2008.IEEE,DOI:10.1109/IMTC.2008.4547361 Publication Year:2008,Page(s);;1920-1925

[9]Exercise bike powered electric generator for fitness club appliancesStrzelecki,R. ; Jarnut,M. ; Benysek, G. Power Electronics andApplications,2007EuropeanConferenceon DOI: 10.1109/EPE.2007.4417471 Publication Year: 2007 , Page(s): 1 - 8

[10]Electrification in rural areas of IndiaKamalapur, G.D. ; Udaykumar, R.Y. Industrial and information system(ICIIS),2010international conference on DOI:10.1109/ICIINFS.2010.5578635,Publicationyear2010,Page(s): 596-601