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Harnessing Power in the Apartment from the Water Supply with Overvoltage Protection

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Abstract:
Conventional energy sources are getting finished day by day and scarcity of energy is gradually rising. Using non-conventional energy sources are rising in parallel with that. Generating Hydro-electrical power was implemented a couple of decades ago. But producing power from supply water is a new idea using the same hydel power methology. India is a developing country, so in India this innovative idea can be implemented broadly. A residential building, common areas, water line roads electricity bills for those areas either have to pay by government or shared equally between the owners. Giving power to those particular areas can be considered as extra cost. Powering those areas by this method can save a lot of electricity bill.

Keywords: Hydropower, hydel, DC, rpm, NO, NC etc.

I. INTRODUCTION

Introduction of hydropower generation has came to our civilization a few decades ago, but typical use of this water power to generate electricity has not changed ever since then. It's still on the primary process like setting up a dam and moving the turbine with water pressure. But what if we use the same concept of hydroelectric power generation to something innovative, that's where it comes harnessing power from supply water. In this paper power is generated by supply water flowing through the pipe inside which a lift based spherical turbine is fixed over which a DC generator is mounted and when water flows it rotates, thus mechanical energy converted into electrical energy. Battery may be used to store the energy and load can be connected by the battery. Protection system for overcharge control of battery, and overvoltage and short circuit protection can also be introduced. Thus by using the supply water of an underground pipe or a residential building power can be generated with a very good efficiency and once installed it can save a lot amount of electricity bill.

Table.1. Materials Required & Cost

SL No.	Material required	Rating	Cost (in Rs)
1.	Motor (1pc)	12V, 500 R.P.M.	60
2.	Rechargeable Battery (1pc)	4V, 1Ah	40
3.	Resistance (5pcs)	1x1KΩ , 4x1Ω	5
4.	Transistor(1pc)	2N222	5
5.	Capacitor(2pcs)	1x 0.01mF , 1x470mF	25
6.	Zener Diode(1pc)	6V, 5W	4
7.	Blocking Diode (1pc)		2
8.	Torroid Core (1pc)		Self-Made
9.	Relay(1pc)	5V	25
10.	LED(10pcs)		20

11.	Switch(2pcs)	1xS.P.S.T. , 2x S.P.D.T.	15
12.	Wires	Multi color wires	40
13.	Turbine		40
14.	Demo Model		30
15.	Miscellaneous		100

Working principle

In the demo project model a plastic turbine used to rotate the DC generator motor shaft. When the turbine rotates by the water pressure power is generated from the DC generator. Here the generated power from the generator is of very low amount near about 1.7V. So it's not enough to recharge our 4V rechargeable battery. Here a booster circuit has been used which boosts that 1.7V to up to 10V. Then that boosted voltage has fed to the battery through an Over Charge Controller with Auto-cut System circuit to charge the battery. The circuit been used so that in case over voltage generation this does not affect the battery. Then load is connected with the battery through a Fuse.

Joule Thief Circuit

A joule thief is a minimalist Armstrong self-oscillating voltage booster that is small, low-cost, and easy to build, typically used for driving small loads. It can use nearly all of the energy in a single-cell electric battery, even far below the voltage where other circuits consider the battery fully discharged; hence the name, which suggests the notion that this circuit is stealing energy or "joules" from the source. The circuit is a variant of the blocking oscillator that forms an unregulated voltage boost converter. The output voltage is increased at the expense of higher current draw on the input, but the integrated current of the output is lowered and brightness of a luminescence decreased. The circuit works by rapidly switching the transistor. Initially, current begins to flow through the resistor, secondary winding, and base-emitter junction (see diagram) which causes the transistor to begin conducting collector current through the primary winding. Since the two windings are connected in opposing directions, this induces a voltage in the secondary winding which is positive (due to the winding polarity, see dot convention) which turns the transistor on with higher bias. This self-stroking/positive-feedback process almost instantly turns the transistor on as hard as possible (putting it in the saturation region), making the collector-emitter path look like essentially a closed switch (since V_{CE} will be only about 0.1 volts, assuming that the base current is high enough). With the primary winding effectively across the battery, the current increases at a rate proportional to the supply voltage divided by the inductance. Transistor switch-off takes place by different mechanisms dependent upon supply voltage. The gain of a transistor is not linear with V_{CE}. At low supply voltages (typically 0.75 V and below) the transistor requires a larger base current to maintain saturation as the collector current increases. Hence, when it reaches a critical collector current, the base drive available becomes insufficient and the transistor starts to pinch off and the previously described positive feedback action occurs turning it hard off. To summarize, once the current in the coils stops increasing for any reason, the transistor goes into the cutoff region (and opens the collector-emitter "switch"). The magnetic field collapses, inducing however much voltage is necessary to make the load conduct, or for the secondary-winding current to find some other path.

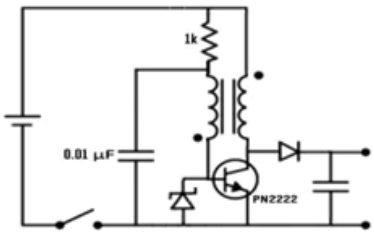

Figure.1. current to find some other path.

When the field is back to zero, the whole sequence repeats; with the battery ramping-up the primary-winding current until the transistor switches on. If the load on the circuit is very small the rate of rise and ultimate voltage at the collector is limited only by stray capacitances, and may rise to more than 100 times the supply voltage. For this reason, it is imperative that a load is always connected so that the transistor is not damaged. Because V_{CE} is mirrored back to the secondary, failure of the transistor due to a small load will occur through the reverse V_{BE} limit for the transistor being exceeded (this occurs at a much lower value than V_{CE} max).The transistor dissipates very little energy, even at high oscillating frequencies, because it spends most of its time in the fully on or fully off state, so either voltage over or current through the transistor is zero, thus minimizing the switching losses. The switching frequency in the example circuit opposite is about 50 kHz. The light-emitting diode will blink at this rate, but the persistence of the human eye means that the blinking will not be noticed.

Over-voltage protection with Auto-cut system

The voltage needed to charge the battery is up to a rated value, depends upon the rating of the battery. It is completely fine to charge the battery until the voltage generated by the generator up to the normal value. But in sudden cases when generated voltage gets higher to protect the battery from extra high voltage overvoltage controller is been used. Generator output is connected with the relay through a resistance in series with the NC contact of the relay. Another wire is taken from the same terminal to the LED which is connected in series and then with the Relay's NO contactor. Another terminal of the generator output is also connected with the battery through the relay.

When output is voltage is low then LED 1 will be on under normal condition. But when the voltage exceeds its rated limit (rating of the relay) the NO contacts becomes NC and NC contacts becomes NO and the LED 2 will be glows which is indicating that output voltage is getting high. And it will trip the circuit and circuit will be open from the battery which saves the battery.

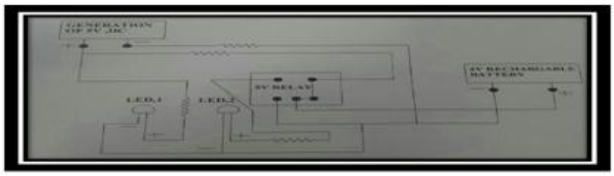

Figure.2. Over-voltage protection with Auto-cut system

II. HARDWARE IMPLEMENTATION

Generator:- In the paper model we have used A DC motor as DC generator for power source. As we know the construction and working principle of DC motor and generator is vice-versa. The 12 Volt 400 r.p.m motor is used as a generator, with permanent magnetic field excitation of two pole machine.

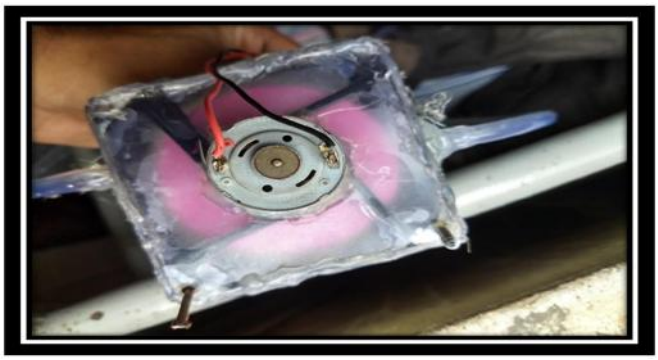

Figure.3. Generator

Turbine:- The laptop cooling fan is been used as a plastic turbine here. Turbine is connected with the shaft of the generator and it rotates as the turbine rotates by the water pressure.

Figure.4. Turbine

Booster Circuit: - A simple modification is done with the previous joule thief circuit by adding a zener diode at the output end to get a regulated voltage of 5-6volt at output end as our battery rating is 4V.

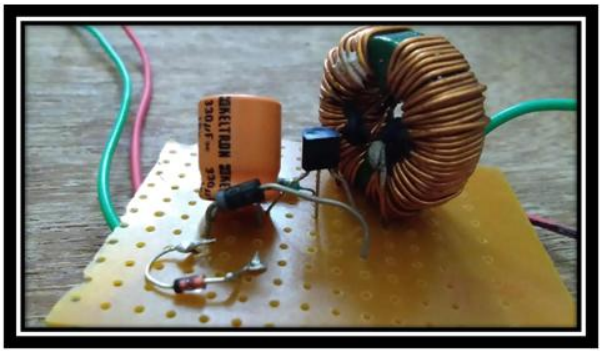

Figure.5. Booster Circuit

Overcharge Controller with Auto Cut System:- For this project we have used 5V, and four 1 Ohm resistors.

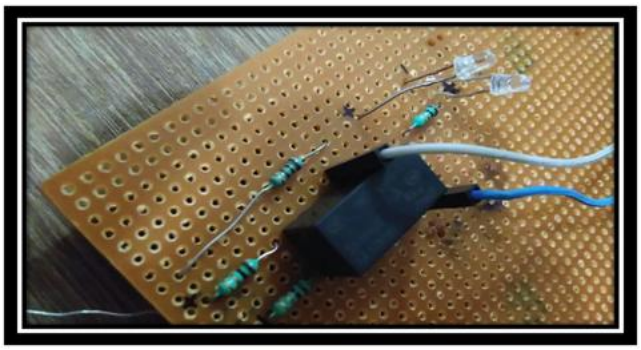

Figure .6. Overcharge Controller with Auto Cut System:-

Battery:- Rechargeable Lead-Acid, 4V, 1.0 Ah battery is been used.

Figure.7. Battery

Demo Model

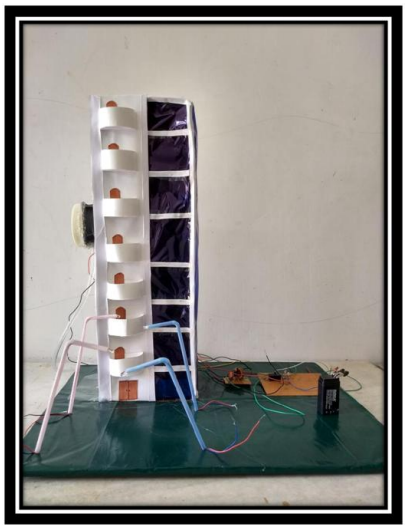

Figure.8. Demo Model

III. CONCLUSION

One of the best advantages is saving in electricity. If the system is implemented properly it can save a very much amount of electricity. Once installed maintenance is low. It can be used in residential building as well as municipality supply pipes. Complete green energy no loss of any natural resources. Using the flow of water to generate power-has long been a small but key source of renewable energy. It can be used in large scale. A startup in Portland has already done it named *Lucid Energy* has developed a system that get's energy from gravity-fed drinking water pipes to produce electricity without any environmental impact. India is a versatile country with huge potential in every aspect so where the supply water is good in that area this system can be installed in underground drinking water supply pipes to generate hydroelectricity. If it works properly it can generate as much as upto 40MW which is sufficient enough to power up a colony. Another implementation can be done in large multistoried residential building where water much or less constantly flowing at the main pipe. Installing the system there can also generate electricity which can be at least to light up common staircase lights as well as building outside lightings.

IV. REFERENCES

[1].Acito, F., & Jain, A. K. (1980). Evaluation of conjoint analysis results: a comparison of methods. Journal of Marketing Research, 17, 106–112.

[2].Bagozzi, P. R., Yi, Y., & Baumgartner, J. (1990). The level of effort required for behaviour as a moderator of the attitude–behaviour relation. European Journal of Social Psychology, 20, 45–59.

[3].Biesiot, W., & Noorman, K. J. (1999). Energy requirements of household consumption: a case study of the Netherlands. Ecological Economics, 28, 367–383.

[4].Black, J. S., Stern, P. C., & Elworth, J. T. (1985). Personal and contextual influences on household energy adaptations. Journal of Applied Social Psychology, 28, 675–697.

[5].Brandon, G., & Lewis, A. (1999). Reducing household energy consumption: a qualitative and quantitative field study. Journal of Environmental Psychology, 19, 75–85.

[6].CBS (1998). De mobiliteit van de Nederlandse bevolking (Travel behaviour of the Dutch population). Voorburg/Heerlen, the Netherlands: Centraal Bureau voor de Statistiek (Statistics Netherlands).

[7].CBS (1999a). Statistisch jaarboek (Statistical yearbook). The Hague: SDU.

[8].CBS (1999b). Statline. Central Electronical Database of Statistics Netherlands. http.//www.cbs.nl.

[9].CBS (2001). Milieucompendium 2001: het milieu in cijfers. Alphen aan de Rijn: Kluwer.