Human Powered Mobile Battery Recharging

Chetan Khemraj, Vishant Kumar, Vishal Deep Gupta and Amit Singhal

Abstract-**The circuit used is basically with less cost and ease in handling. In many rural parts of our country where the problem of power cut and lack of electricity is there, our product will be revolutionary. This charger is a Portable device. This will help as it will motivate the people to start riding cycle which surely improve their health status. So basically our project is very affordable and simple, therefore more and more people can use it easily both in rural and urban areas. Robustness and cost effectiveness are also its features.**

Keywords-Delon circuit, dynamo, charge discharge profile.

Introduction

In today's world when the advancement in technology is at its peak and the impact of these technology over the human health is also point of concern. As the technology is advancing the physical activities are getting reduced. This in turn is not a good sign. In Indian urban areas people use bicycle very rarely and also they had become slave to their electronic gadgets. They are spoiling their health over them. But if they use the portable cycle mob charger it would encourage them to do more physical exercises through cycling. During cycling they can enjoy their gadgets such as phone, tablets, GPS etc.

In rural areas due to unscheduled power cutoff people don't have any mode of Communication so in that case this portable cycle mob charger is the solution. Now, Why pedaling for electricity? The cost of one KWh as your electricity company sells is Rs 5 in my place and earning this through pedal power would take me 5 hours. Not much of an incentive to think about pedal generators. Still the need for pedal power generation seems to exist, as frequent e-mail requests tell me. Ill, pedal power can be made available anywhere, it requires no fuel, is available both day and night, the equipment is inexpensive and needs almost no maintenance.

Addresses three key use cases:

1. Charging batteries for small, portable devices while traveling on a bicycle
2. Generating as much electrical Power as possible on a stationary pedal generator
3. Powering up Electronic devices using the concept of cycle dynamo on stationary mode.

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History

There is one obvious challenge to offering mobile phones in emerging markets: the availability of electricity to charge a mobile phone. You can't expect people to be driving around cars with chargers when most in the market might be riding bicycles.

That's one reason that the biggest mobile manufacturing company has announced the Nokia Bicycle Charger Kit. The kit not only allows a bicycle to charge a phone while they ride it also could create a micro-business for individuals who could offer mobile phone charging services for a fee using a bicycle. For those in non-emerging markets, the solution also introduces a green way to keep your mobile phone charged without having to plug it into the electrical grid.

The kit includes a holder, charger and a small electrical generator which utilizes the movement of the bicycle's wheels to charge the phone through a 2mm charging jack used on most Nokia phones. The Nokia Bicycle Charger Kit is expected to be available before the end of the year and will be available through select retail locations and online.

PRINCIPLES OF WORKING

Principle of Dynamo

An electrical generator is a device that converts mechanical energy to electrical energy, generally using electromagnetic induction. The source of mechanical energy may be a reciprocating or turbine steam engine, water falling through a turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, or any other source of mechanical energy.

The Dynamo was the first electrical generator capable of delivering power for industry. The dynamo uses electromagnetic principles to convert mechanical rotation into an alternating electric current. A dynamo machine consists of a stationary structure which generates a strong magnetic field, and a set of rotating windings which turn within that field. On small machines the magnetic field may be provided by a permanent magnet; larger machines have the magnetic field created by electromagnets.

The energy conversion in generator is based on the principle of the production of dynamically induced emf. Whenever a conductor cuts magnetic flux, dynamically induced emf is produced in it according to Faraday's Laws of Electromagnetic induction. This emf causes a current to flow if the conductor circuit is closed. Hence, two basic essential parts of an electrical generator are (i) a magnetic field and (ii) a conductor or conductors which can so move as to cut the flux.

Principle of Delon circuit

A Delon Circuit is a voltage doubler circuit which is an electronic circuit which charges capacitors from the input voltage and switches these charges in such a way that, in the ideal case, exactly twice the voltage is produced at the output as at its input .The circuit consists of two half-wave peak detectors, functioning in exactly the same way as the peak detector cell. Each of the two peak detector cells operates on opposite half-cycles of the incoming waveform. Since their outputs are in series, the output is twice the peak input voltage produced at the output as at its input.

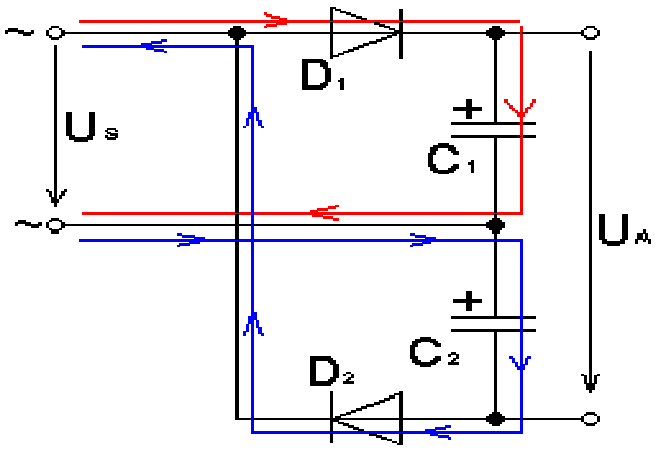

Fig1.Delon Circuit operation

Data Collected after Experiment

There is a table showing the different voltages at different points on the circuit.

VOLTAGE PRODUCED BY DYNAMO	AFTER DELON CIRCUIT	AFTER 7805	OUTPUT BY USB MALE CONNECTOR
6-14V (7kph-35kph)	12-25V (7kph-35kph)	5.06V (7kph-35kph)	5.06V (7kph-35kph)

Table1.ouput comparison

BATTERY THEORY

A cell phone charger is a device used to recharge the battery in a mobile phone unit. Often, a basic cell phone charger comes with the cell phone when it is purchased. In some cases, additional chargers may be purchased that have added features.

There are many different types of cell phone chargers to choose from. Among the most popular are wall chargers, car chargers, travel chargers, rapid chargers and instant chargers. Many mobile phone owners may own one or more of these other types of chargers, depending on situations they may find themselves in.The wall charger is the most common type of cell phone charger. It has a standard plug designed to fit the outlets in the country in which it was sold. In some cases, this cell phone charger may come with some added features, such as a docking station for the phone. However, this may actually decrease the phone's functionality, as it cannot be used while charging. The travel charger is usually very similar to the wall charger but is usually less bulky and may include prongs that fold down for easier travel. In some cases, the travel charger has replaced the wall charger as the standard one included with the phone.

CHARGING SCHEMES

The charger has three key functions

- Getting the charge into the battery (Charging)
- Optimizing the charging rate (Stabilizing)
- Knowing when to stop (Terminating)

The charging scheme is a combination of the charging and termination methods.

CHARGE TERMINATION

Once a battery is fully charged, the charging current has to be dissipated somehow. The result is the generation of heat and gasses both of which are bad for batteries. The essence of good charging is to be able to detect when the reconstitution of the active chemicals is complete and to stop the charging process before any damage is done while at all times maintaining the cell temperature within its safe limits. Detecting this cut off point and terminating the charge is critical in preserving battery life. In the simplest of chargers this is when a predetermined upper voltage limit, often called the termination voltage has been reached. This is particularly important with fast chargers where the danger of overcharging is greater.

SAFE CHARGING

If for any reason there is a risk of overcharging the battery, either from errors in determining the cutoff point or from abuse this will normally be accompanied by a rise in temperature. Internal fault conditions within the battery or high ambient temperatures can also take a battery beyond its safe operating temperature limits. Elevated temperatures hasten the death of batteries and monitoring the cell temperature is a good way of detecting signs of trouble from a variety of causes. The temperature signal, or a resettable fuse, can be used to turn off or disconnect the charger when danger signs appear to avoid damaging the battery. This simple additional safety precaution is particularly important for high power batteries where the consequences of failure can be both serious and expensive.

HYSTERESIS

The time constants and the phenomena mentioned above thus give rise to hysteresis in the battery. During charging the chemical reaction lags behind the application of the charging voltage and similarly, when a load is applied to the battery to discharge it, there is a delay before the full current

can be delivered through the load. As with magnetic hysteresis, energy is lost during the charge discharge cycle due to the chemical hysteresis effect. The diagram below shows the hysteresis effect in a Lithium battery.

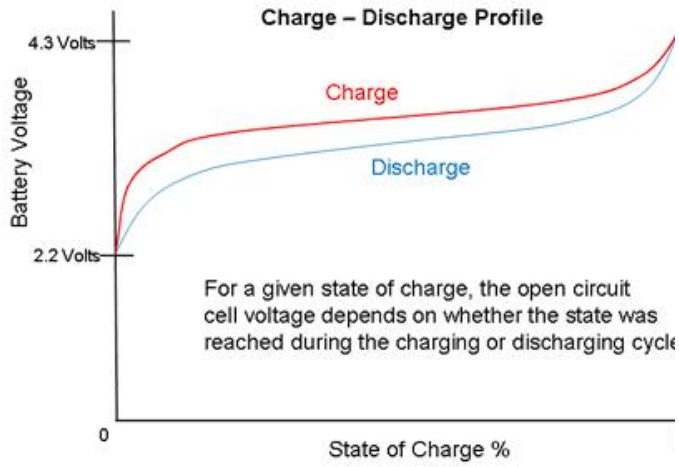

Fig 2.Charge-discharge profile

Allowing short settling or rest periods during the charge discharge processes to accommodate the chemical reaction times will tend to reduce but not eliminate the voltage difference due to hysteresis. Fast charging also causes increased Joule heating of the cell because of the higher currents involved and the higher temperature in turn causes an increase in the rate of the chemical conversion processes.

CHARGE EFFICIENCY

This refers to the properties of the battery itself and does not depend on the charger. It is the ratio (expressed as a percentage) between the energy removed from a battery during discharge compared with the energy used during charging to restore the original capacity. Also called the Columbic Efficiency or Charge Acceptance.Charge acceptance and charge time are considerably influenced by temperature as noted above. Lower temperature increases charge time and reduces charge acceptance.

CHARGER POWER SOURCES

When specifying a charger it is also necessary to specify the source from which the charger derives its power, its availability and its voltage and power range. Efficiency losses in the charger should also be taken into account, particularly for high power chargers where the magnitude of the losses can be significant. Some examples are given below.

AC Mains

Many portable low power chargers for small electrical appliances such as computers and mobile phones are required to operate in international markets. They therefore have auto sensing of the mains voltage and in special cases the mains frequency with automatic switching to the appropriate input circuit.

Higher power applications may need special arrangements. Single phase mains power is typically limited to about 3 KW. Three phase power may be required for charging high capacity batteries (over 20 KWh capacities) such as those used in electric vehicles which may require charging rates of greater than 3 KW to achieve reasonable charging times.

Regulated DC Battery Supply

May be provided by special purpose installations such as mobile generating equipment for custom applications.

- **Special Chargers**

Portable sources such as solar panels

OPPORTUNITY CHARGING

Opportunity charging is charging the battery whenever power is available or between partial discharges rather than waiting for the battery to be completely discharged. It is used with batteries in cycle service, and in applications when energy is available only intermittently .It can be subject to wide variations in energy availability and wide variations in power levels. Special control electronics are needed to protect the battery from overvoltage. By avoiding complete discharge of the battery, cycle life can be increased. Availability affects the battery specification as well as the charger.Typical applications is:-

- **Onboard vehicle chargers** (Alternators, Regenerative braking)
- **Inductive chargers** (on vehicle route stopping points)
- **Solar power**
- **Wind power**

ADVANTAGES & DISADVANTAGES

Portable- it is a portable device which is easily detachable and attachable.

1. No operating cost- it requires only mechanical work so free of any operating cost.
2. Economical- it is free source of electricity, though it require some mechanical work which can be done in any leisure time so it is economical
3. Health improving- Cycling makes one to be fit and healthy.
4. Eco-friendly- Doesn't emit any kind of harmful substances so it is eco friendly.
5. Robust and simple circuit- This circuit requires only five components which are small in size and robust. This makes it simple in design.

6. Very low maintenance-No need of maintenance as devices are very cheap.
7. Better performance on Li-ion battery: In today's time the most of the phones use Li-ion battery in their phones so this is necessary for us to give better performance in those but still it's a disadvantage that it doesn't give optimal performance on other batteries.
8. Frictional losses: The frictional losses occur because of friction between motor wheel & cycle wheel.
9. High speed disadvantage

SCOPE

1. Laptop charging: Laptop also operates on the constant DC voltage but it needs the voltages greater than that of the mobile i.e. 12V to 20V. For this I have to prepare a new circuit with desired specification of the components used in the circuit. These types of technologies are power saving and economical.
2. Using dynamo wheel producing enough amount of power (300w).
3. Use of Ultra Capacitors: I can use the ultra capacitors to store the charge and that can be beneficial if the bicycle is stopped for some time then it would continue to charge the device regularly for some time.

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