Energy Harvesting Circuit (KW1-12)

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Introduction
As more and more functions are embedded in portable electronic devices nowadays, its frequent use will deplete the battery quickly. To prolong the duration of usage, energy harvesting of renewable energy sources should be employed in conjunction with the rechargeable battery.

The idea of using solar energy to generate electricity has existed for a long time. It is clean with no pollution, and it is long-lasting and basically maintenance free. Thus, money can be saved in the long run. However, this technology has yet been widely deployed.

In this project, we would like to promote the utilization of solar energy, and build a portable charger powered by solar cells. The charger can be used to charge personal electronic devices such as cellular phones. Two circuits have been designed to manage the charging process of the NiMH battery and to step up the voltage from two to three AA batteries to the output respectively.

Aims and Objectives
The aim of this project is to design and make a portable charger utilizing solar energy. This charger should be convenient to use and easy to carry around. The external charging part should be compatible to charging various kinds of electronic equipment through a USB port.

These are the main objectives:
• Efficient circuit design to achieve minimum size.
• Safety and charging and discharging control through thorough testing.
• Steady, reliable and user friendly in the finished product.

Methodology
Hierarchical diagram for the solar charging circuit

Sunlight → Solar Panel → Charging control IC → Current delivering control → Battery capacity around 80% → Voltage step-up

Power output versus voltage curve

Evaluation
We use SWOT analysis to evaluate the Strengths, Weaknesses, Opportunities and Threats involved in this project. The viability is taken into consideration to see how the SWOT relates to the project aims and objectives.

Strengths | Weaknesses
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• Convenient | • The size is bigger than some of the portable chargers on the market
• Flexible | • For the boost convertor, the efficiency is not very high
• Switches for user to choose to number of batteries | ...
• Supplies a USB standard power output | ...

Opportunities | Threats
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• Substitutes fossil fuel by a green energy source | • Highly dependent on sunlight

Conclusion
This project had successfully met the objectives stated and attains 60.6% efficiency. The circuit can charge one to two NiMH batteries and generates 5V 500mA by 2-3 of any kind of AA size batteries and this is delivered by a USB port.