Extending the Life and High Capacity Performance of Lithium-Ion Batteries

## Initial Problem Description:

Lithium-Ion batteries have proven themselves the first choice for anyone working in the electrical field. The uses of the batteries have been increasing ever since Sony introduced the commercial cell in 1991 (Johnson & White, 1998). Now, over 45.5 million people in the United States own Lithium-Ion batteries. They are the fastest growing segment of mobile devices (Pathak, Hu, Bahl, & Wang, 2011). One of the best features about the Lithium-Ion battery its light weight and how fast it can be charged. However, the performance of the Lithium-Ion battery is measured by its capacity, which gets lower and lower after several cycles and after extended exposure to high temperature. Battery cycle is using the device until its battery get low then you recharge it again. During the cycle, electrons are going from the negative terminal to the positive terminal while using the device. Then, it reverses during charging. During the operations, obstacles arise that reduce ion flow, which would reduce its capacity. Although there are different causes, this project will be only focusing on

Overall Objectives and Analysis:

Batteries are devices that convert stored chemical energy into electricity within a closed system. There are three main components in every battery Lithium ions, cathode, and anode. In order for the battery to work, Lithium ions flow from anode to cathode during discharge and it would die if there were no more Lithium ions can flow this way. The Lithium ions flow from cathode to anode in charging. Electrons move in the external circuit into the same direction as Li-ions. The anode (negative electrode) is usually graphite or lithium titanate. The cathode (positive electrode) is typically lithium metal oxide (Väyrynen & Salminen, 2012).

Capacity is measured by the number of ions that can flow. There are two main problems that would reduce the battery’s capacity, elevated temperature and repeating the cycle. This project will be focusing on solving elevated temperature to avoid destroying the capacity by cooling the battery using two methods. The first method is adding small fans on different places around the battery. These fans would circulate the air around the battery, collect the heat, and dissipate it outside the battery while allowing the cooler air that is outside the battery to enter the cooling system and the cycle continues. In addition, there will be an alternative source of energy that helps the fans to work which is kinetic energy that comes from movement. A complex lever system can be used to transfer this kinetic energy to power the fans. By doing that, the battery will maintain a good temperature and at the same time, the fans will not take any power from the battery.

Reference

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