Max Power Point Tracking System

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The environment in which a photovoltaic (PV) cells are operated can vary greatly. Other than the amount of sunlight a PV array receives, the temperature, internal resistance, and efficiency can affect the amount of power it will output. Due to the variability of temperature, and amount of sunlight in orbit around Earth, a Maximum Power Point Tracking (MPPT) system would improve the amount of power supplied to the batteries of a cubesat and reduce the probability of pulling too much power from the PV array thus causing the solar cells to brown-out and provide no power.

A cubesat is a small satellite used for short-term space research and is usually placed in Low Earth Orbit (LEO). Many cubesats, including QB-50 Challenger, do not carry a MPPT system onboard. A MPPT system is used to sense the voltage and current outputted by the PV array and regulate the power delivered to the load. This insures that the load does not pull more power than what the PV array can provide and can improve overall system performance.

Using an Arduino, a voltage/current monitor, and a buck converter, we have built a system based on the constant voltage MPPT algorithm as it is the simplest and easiest method to implement. Currently, it is in the prototype phase. The system reads voltage and current using a triple channel voltage/current monitor. The voltage/current monitor transmits data over the Inter-Integrated Circuit ($I^2C$) communication protocol to the Arduino microcontroller. The buck converter controls the amount of power being supplied to the load. Both the voltage/current monitor and buck converter are controlled by the Arduino. Once finalized, it will be used on future cubesats. An overview of the project, details of the current design and initial test results will be presented.