An Altitude Control System for Long Duration, High Altitude Balloon Flights

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The primary objective of this project is to design, build, and test an altitude control system for high altitude, long duration weather balloon flights. Ordinarily, weather balloons are filled with enough helium so that they rise rapidly to maximum altitude and burst in less than two hours. This makes recovery easier. However, this technique does not allow data to be gathered over long time periods or at specific altitudes. An altitude control system would enable flights of many days over thousands of miles. The secondary objective is to develop an electrical system with solar panels and rechargeable batteries capable of providing power for multi-day operations. Last, the balloon should send telemetry and be trackable anywhere on the planet, over both land and sea. The vertical speed of a balloon can be controlled by venting helium or by releasing ballast. My altitude control module consists of three Arduino Mini Pros (Primary, Secondary, and Reset), a GPS, and an SD card for data storage. The GPS sends time, coordinates, and altitude data to the Primary which then calculates the vertical speed. The Primary sends the altitude and vertical speed to the Secondary which operates the helium and sand valves. To date, one flight has been made to test the altitude control system. The plan was to ascend to 8,000 m and then maintain this altitude for four hours. Unfortunately, the ascent rate was not brought under control before the balloon burst at 25,885 m. Further simulations and ground testing will be conducted to improve my software and equipment. My long term goal is to fly a weather balloon around the world while recording cosmic ray counts, track the balloon during the entire flight, and then recover the equipment at the end of the flight.