Building a Surveying Rover for Space Exploration

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Space rovers provide an economical and safe means to explore space. Manually controlled wheeled rovers in the past have explored the Moon and Mars. Current rovers are being equipped to be autonomous. We constructed a manually controlled rover with caterpillars around the Arduino Uno and Raspberry Pi Model 4 B. The Raspberry Pi controls the rover's sensory system. The Raspberry Pi camera module v2 lets the user see where the rover is going, and the user can capture 8-megapixel images and 1080p video. The DHT-11 sensor allows the rover to measure the humidity and surface temperature. The photoresistor measures luminosity. Data gathered by the camera and DHT-11 can be viewed on the web or through an app. The Arduino Uno controls the rover's drive system, and another Arduino-based board controls the arm. The user connects with these two systems via Bluetooth. Two Parallax continuous rotation motors drive the caterpillars. An arm powered by five servo motors has its own Arduino board that comes with potentiometer manual controls and allows the user to grab and hold a specimen. Batteries power both systems. We can further modify the number of sensors for future operations and include an object-detection for the camera to detect and name objects and allow for an autonomous drive feature. Enlarging the rover will allow space to collect more than one sample.

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