Using a Filter and Arduino to Increase a Pump's Functionality

by

HJ Hester, Martin L. Tanaka, and Adam Harris

College of Engineering and Technology

The overall research project was to use mechanical and electrical engineering to create an irrigated planter box. The goal of this portion of the project was to develop a pumping sub-system that includes 3D printing a passive pump filter and programming an Arduino to prevent the pump from running dry. A replica of the pump and filter cover were created using CAD software (Onshape, PTC, Boston Massachusetts). The filter cover was designed to be slightly larger to accommodate shrinkage during printing and a layer of filter material. The cover was sliced and printed on a PRUSA Mini+. Design for Manufacturing (DFM) was also applied, which included: rotating the part 180 degrees on the roll axis and using arches to prevent the need for supporting material and post-print touchups. An Arduino UNO, ultrasonic sensor, and relay were used to control the power to the pump. The efficiency of the pump was tested with and without the filter and relay to compare efficiency. The water used in the experiment was previously filtered, so the effectiveness of the filter in removing contaminants was not tested. However, the filter did not prevent the pump from raising the water above 6 feet. The Arduino successfully prevented the pump from running dry by using an ultrasonic sensor to read the height of the water and turning off the pump when the water level dropped to a minimally acceptable value. When the pump was not connected to the Arduino it would run dry. This research demonstrates the increased reliability of a pump that is controlled by a distance sensor. A pump that is connected to a sensor can be left "ON" at all times, without the need for monitoring.