Benjamin Mussi
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6.111 Final Project Abstract

Soil-Water Characterization Unit

When a water sprinkler system is installed in a lawn, the lawn must be surveyed in order to ensure that the sprinklers are distributing water evenly. If water is not distributed in a uniform manner, parts of the lawn may dry up while others become swampy. The current method of characterizing the water distribution by sprinklers involves placing cups across the lawn and allowing the sprinkler system to run for some time. After the system finishes its watering cycle, the level of the water collected in each cup is recorded and used in industry standard formulae that give relevant measures of water distribution. While this method of charactering water distribution has been used for some time, error is introduced because of human error in the measurement of water levels in the cups and in the measurement of cup locations. Moreover, because this method measures the water distributed above ground level, it can only be used as an indirect indication of water penetration into the soil. Water penetration into the soil is a better measurement of water distribution in lawns because the goal of watering is to ensure that the roots of the lawn are obtaining proper amounts of water.

My final project for 6.111 will be to develop a device for use by sprinkler system installers that will characterize the penetration of water into soil. The device will be composed of a sensor for detecting water penetration, a color LCD and button inputs for display and user interaction, a GPS for recording position information, as well as a digital controller that will interface with each of the components and perform calculations. The sensor will measure the resistance across twenty pairs of pads along its shaft and convert those signals to digital voltages. The sensor will be driven into the ground at a desired location and the presence of water will detectibly lower the resistance across the pads on the sensor's shaft. The sensor will be four inches long and will take measurements every quarter inch along the shaft. A GPS will be used to record the date, time, latitude, and longitude of each measurement. In addition, the GPS may be useful as a non-volatile memory, however, this has not been verified as of yet. An LCD screen will be used to interact with the user, providing a calibration interface, a display of individual measurement information, as well as the results of formulae computed by the controller that characterize the water penetration and distribution for a set of samples.

If this can be accomplished and time permits further development, the controller will use the sensor inputs to create graphical representations of the measurements and the results of computed water penetration formulae. For example, I'd like to create a graphical representation for the water distribution over the lawn using a blue color for complete soil saturation, a brown color for completely dry soil, and a combination of the two colors for soils between the extreme conditions. I'd also like to develop a 3D-linear interpreter to

estimate the water penetration between measurements. Work for the linear interpreter would commence if the base project were completed with time to spare.