Building a Smart Irrigation System for Effective Turfgrass Irrigation with Recycled Water

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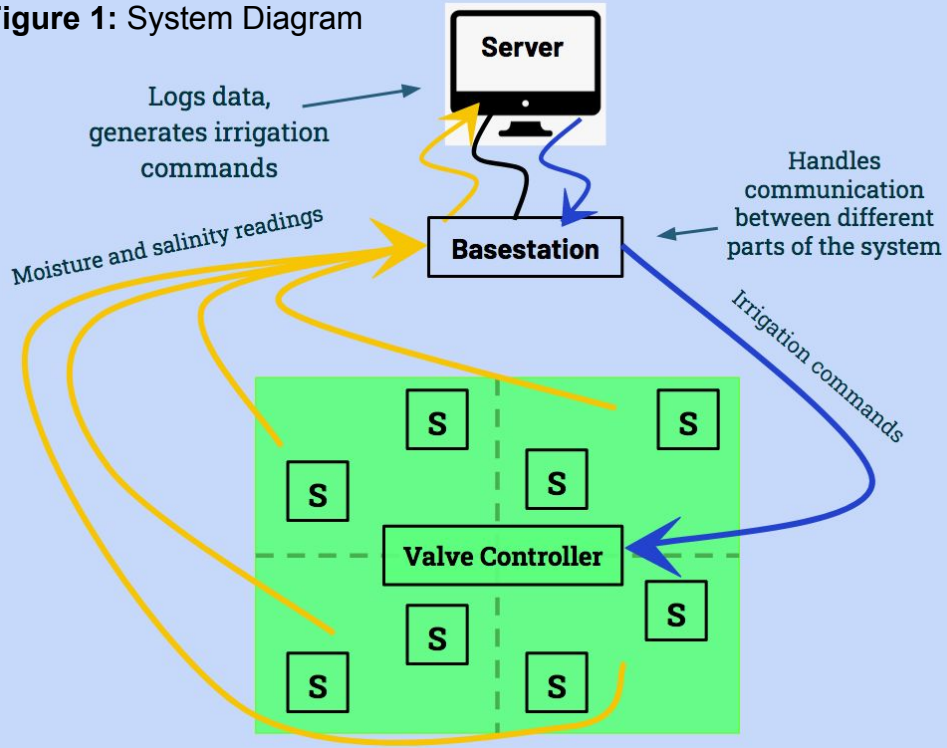
Background

Currently in the United States, substantial amounts of potable water are spent on turfgrass irrigation. However, many turfgrass species have a high saline tolerance, which opens the possibility of using recycled water to irrigate turfgrass. We developed a proof of concept smart irrigation system tailored to turfgrass irrigation with saline water. The smart system uses in-ground sensors to monitor soil moisture and salinity levels, adjusting irrigation accordingly.

Figure 1: System Diagram



System Design

This proof of concept irrigation system is built with Toro soil sensors, Arduino Uno microcontrollers, and XBee radio modules. There is actively running software for each of the sensors (or “nodes”) as well as for the basestation, valve controller, and server . This software enables the different components to function together as a system.

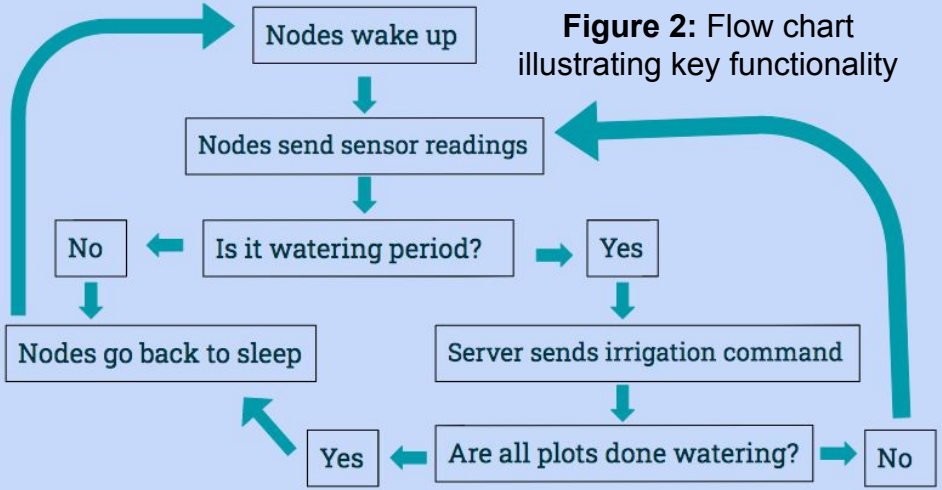


Figure 2: Flow chart illustrating key functionality

The first attempt to deploy the system revealed a serious issue with the nodes’ power consumption. The nodes, powered by 12V 9Ah batteries with 5 Wh solar panels attached, would drain the batteries in less than 2 days. We sought software solutions that would enable each of the nodes’ hardware components to power-down when not being used.

	Awake	Asleep
Sensor	35mA	0mA
XBee	15mA	0mA
Arduino	45mA	30mA
Total	**95mA**	**30mA**

Figure 3: Node Current Draw Measurements by Component

By enabling each part of the nodes to sleep, we can reduce the nodes’ power consumption by 68%.