Smartirrigation Apps: Urban Turf[1]

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Introduction

Mobile smart devices (e.g., smartphones, tablets) have become commonplace today because they are convenient and easy to use. They are ideal for disseminating information on a regular basis using real-time data. Programs developed for mobile smart devices are typically called "apps." There are many apps available to perform a variety of functions, and they can be personalized to the user's needs.

We developed an app called Smartirrigation Turf to provide an easy-to-use mobile tool that delivers information to improve irrigation scheduling for urban turf. Using the app instead of a set time-based schedule for irrigation, homeowners and others can provide irrigation amounts to turf that more closely match water needs. The app is specifically designed for users who irrigate their turf with an automatic irrigation system and typically set it to irrigate a fixed amount on certain days without modifying for weather changes. Using the app to modify the irrigation schedule will reduce irrigation costs, nutrient leaching, and disease, as well as conserve water.

This version of the app is applicable in Florida and Georgia and is compatible with iOS (iPhone, iPad, and iPod Touch) and Android devices. The app is available to download in the Apple App Store and Google Play Store.

App Function

This section provides a step-by-step guide for using the app to obtain information on how to set an automatic timer for irrigated turf. The Smartirrigation Turf app is designed for warm-season turf.

Step 1. User Registration

Once users download the app and install it on their device, they can sign in if they have an account, or register to create an account and start using the app (Figure 1). This allows the app to create an irrigation schedule specific to the site and user. Your registration information is linked to all other input data requested by the app. This information is kept confidential and used solely to administer the app.

Step 2. New Location or System

Next, the irrigation site location must be identified (Figure 2). To do this, a small map with a movable pin is used. The pin is located at your current location by default (using the device's GPS). You can move the pin by dragging it, if you are not located at the irrigation system when you are setting up the app. Identifying the location of the irrigation system correctly is important because this information links the system to the closest weather data source available.

Users may also take a photo of the given system for a quick visual reference. This might be useful if the app is used for multiple irrigation systems or multiple zones. You can enter

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descriptive names for irrigation systems, but these may be easy to forget.

On the same screen where the irrigation location is identified, users must name the new system (Figure 3). The name should be something meaningful to the user, particularly if multiple systems will be added. Example names might include "North Yard," "Pool Area," "Tom's Backyard," etc.

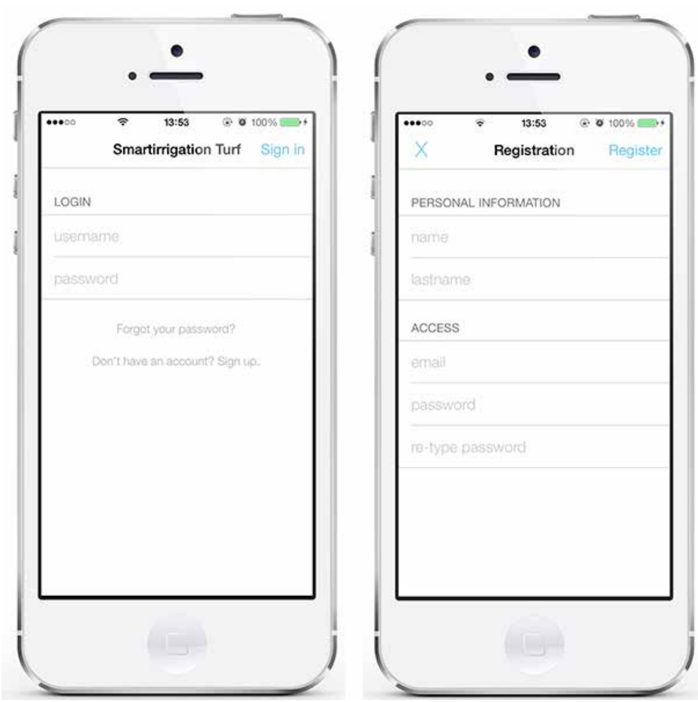

Figure 1. Login and registration screens for the Smartirrigation Turf app.
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Step 3. Soil Information

Next, users select the soil type from a list that includes sand, sandy loam, loam, silt loam, clay loam, and clay. Most soils in Florida are either sand or sandy loam. The most common soils in Georgia are sandy loam or loam.

The user also inputs the root depth. Root depth refers to the depth of the soil where roots are present that are irrigated with the irrigation system. A default value for root depth is provided, but it can be adjusted within a reasonable range based on user knowledge. The soil type and root depth are used to calculate soil water-holding capacity. This helps to ensure that the app-generated schedule does not recommend over-irrigation resulting in leaching or runoff. The soil water-holding capacity is the amount of water the soil can hold without losing it to drainage.

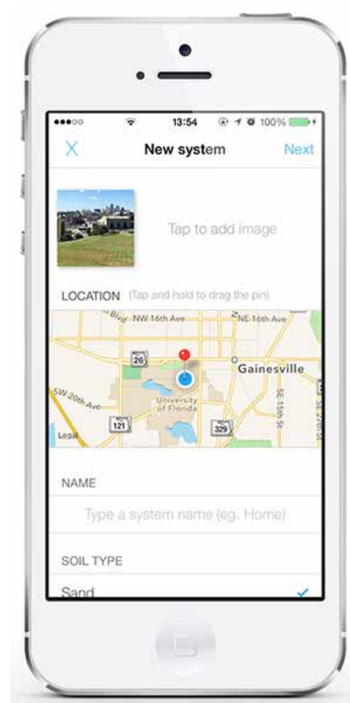

Figure 2. Location selection for new irrigation system using the Smartirrigation Turf app.
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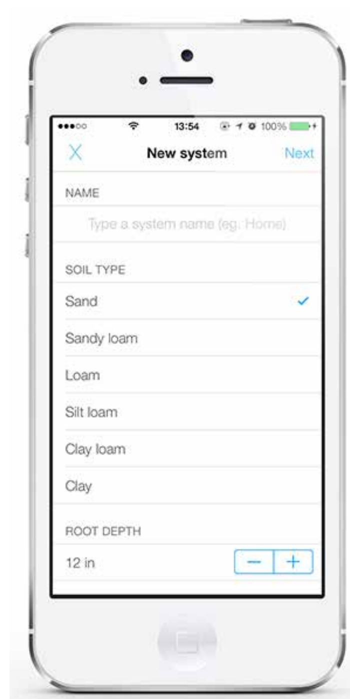

Figure 3. Inputting site soil properties using the Smartirrigation Turf app.
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Step 4. Adding Zones to the System

In this step, users enter the irrigation system zones. Users may input multiple zones and give each zone unique characteristics (Figure 4). For each zone, users will need a name (description), sprinkler type, sprinkler rate, and days when irrigation occurs. This information should match the conditions of the user's irrigation system. The sprinkler type can be micro, spray, multi-stream spray, gear driven rotors, or impact sprinklers. A standard rate is provided for each sprinkler type, but the rate is adjustable if the user has better information about the system. The standard rate for micro, multi-stream, gear driven rotors, and impact sprinkler types is 0.5 in/hr. The standard rate for the spray sprinkler type is 1.5 in/hr. Users select the days of the week when irrigation occurs by touching the day boxes. Blue coloring indicates that irrigation occurs on that day.

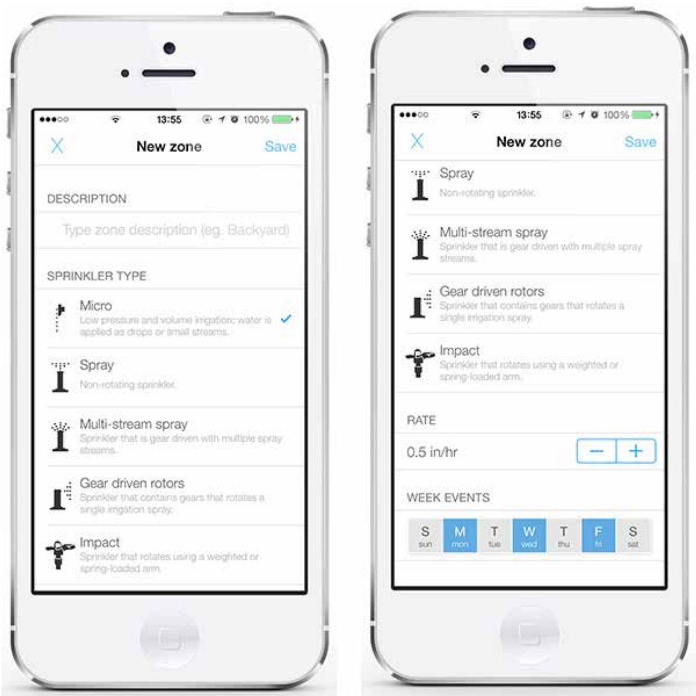

Figure 4. Inputting irrigation system information by zone using the Smartirrigation Turf app.
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Many users may be subject to water restrictions that only allow irrigation on certain days. This should be considered when entering the days of the week to irrigate. If you are unsure of current watering restrictions, check with your county's UF/IFAS Extension office (http://solutionsforyourlife.ufl.edu/map/) or your local water management district.

Step 5. Irrigation Schedule Generated

After finishing the irrigation system and zone input, the user should select "save," and then the user receives an irrigation schedule for each zone of the system (Figure 5). The schedule is in units of time (hours and minutes). This information is designed so that the user can easily take the recommended time schedule and modify his or her automatic irrigation system. Once the system is updated with the new schedule, no further action is needed until the app notifies the user that actions should be taken.

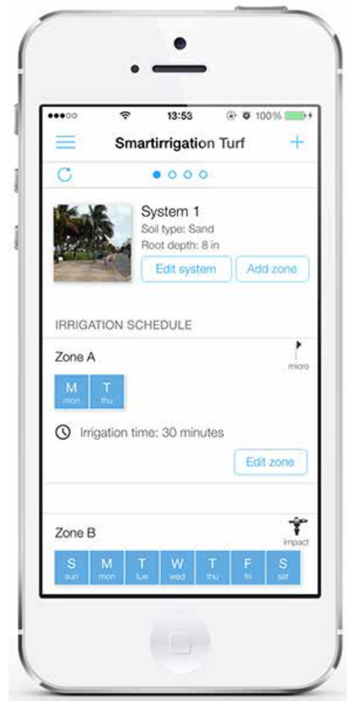

Figure 5. Irrigation schedule from the Smartirrigation Turf app.
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The app also checks to make sure the irrigation amounts recommended do not exceed soil water-holding capacity. If the input data results in this circumstance, the user will receive a message that he or she needs to modify the number of irrigation days and/or the irrigation system.

The irrigation schedule provided by the app is based on user inputs and site-specific weather data. The app uses observed weather data from the Florida Automated Weather Network (FAWN) or Georgia Automated Environmental Monitoring Network (AEMN) weather station that is closest to the irrigation system (For more information about FAWN and AEMN, visit http://fawn.ifas.uf.edu and http://georgiaweather.net). Irrigation is calculated using the FAO Penman-Monteith method to estimate reference evapotranspiration (ET_o) with region-specific crop coefficients (K_c) (Zotarelli et al. 2010). Crop coefficients used are provided in Table 1. This version of the tool considers irrigation to be equal to ET_c where: $ET_c = K_c * ET_o$.

Irrigation schedules are determined by averaging the last five days of reference evapotranspiration (ET_o) and multiplying by the appropriate crop coefficient. Every 15 days a new schedule is determined, and users receive a notification that their schedules need to be changed (Figure 6).

Step 6. Forecast Information

In addition to providing a real-time irrigation schedule, the app also provides current conditions, forecasts of temperature and rainfall probability for the next few hours, and estimates of high and low temperature, relative humidity, rainfall probability, and wind speed for the next five days (Figure 7). Forecast information can be found using the menu in the app. Forecast data are provided by the National

Figure 6. Notification received with new irrigation schedule using the Smartirrigation Turf app.
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Weather Service (NWS); for more information about NWS, visit http://weather.gov.

App users receive notifications if more than 0.4 inches of rain occurs 24 hours prior to irrigation. An example notification for such an event is: "A rain event occurred in (your location) area. Please check (your irrigation zone) and skip tomorrow's irrigation if appropriate." Notifications are also sent if the probability of rain is higher than 60% for the next 24 hours. An example would be: "There is over 75% chance of rain for (your system) area in the next 24 hrs. Adjust irrigation as appropriate" (Figure 8). Historical notifications are accessible in the app using the menu (Figure 9). Users receive notifications to further refine their irrigation schedules to minimize the occurrence of irrigation-generated runoff or drainage.

Using the App

Once you install the app and enter information specific to your site, the app is working! Use the app schedule to set the timer on the automatic irrigation system by zone. Next, read app notifications and alter the schedule as needed. No additional changes are needed to the app unless there is a change in the irrigation system.

Figure 7. Forecast information provided by the Smartirrigation Turf app.
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Figure 8. Notification received from the Smartirrigation Turf app alerting the high probability of rain in the next 24 hours.
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Summary

The Smartirrigation Turf app provides an easy way to determine your irrigation schedule for better management of turf. The irrigation schedule it generates is based on real-time ET_o data at a weather station near the system location. Using this app for irrigation is expected to reduce irrigation amounts annually by 25%–30% if the app-suggested schedules are followed. More information can be found on the Smartirrigation Apps website at http://smartirrigationapps.org.

Figure 9. Using the menu, users can look at all recent notifications received from the app.
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Acknowledgment

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Table 1. Monthly crop coefficient (K_c) values used to estimate irrigation schedules in the Smartirrigation Urban Turf app

	K_c values			
Month	**Panhandle/North Florida**[1,2]	**Central/Southwest Florida**[1,3]	**South Florida**[1,4]	**Irrigation Association**[5]
January	0.35	0.45	0.71	0.52
February	0.35	0.45	0.79	0.64
March	0.55	0.65	0.78	0.70
April	0.80	0.80	0.86	0.73
May	0.90	0.90	0.99	0.73
June	0.75	0.75	0.86	0.71
July	0.70	0.70	0.86	0.69
August	0.70	0.70	0.90	0.67
September	0.75	0.75	0.87	0.64
October	0.70	0.70	0.86	0.60
November	0.60	0.60	0.84	0.57
December	0.45	0.45	0.71	0.53

[1]Crop coefficients used in the model based on ZIP code
[2]Jia et al. 2009
[3]Davis and Dukes 2010
[4]Stewart and Mills 1967; Romero and Dukes 2011
[5]Values used for Georgia; Irrigation Association 2008