

THE IRRIGATION SCHEDULING IGDROID TOOL

DIOGO FRANCISCO BORBA RODRIGUES¹ E CERES DUARTE GUEDES CABRAL DE ALMEIDA²

¹ Doutorando, Programa de Pós-Graduação em Engenharia Agrícola, Universidade Federal Rural de Pernambuco, diogo.borbar@gmail.com

² Engenheira Agrônoma, Prof^a Doutora, Colégio Agrícola Dom Agostinho Ikas, Universidade Federal Rural de Pernambuco, ceres@codai.ufrpe.br

1 ABSTRACT

The speed of information processing of data collected in fields can be a deciding factor in the efficiency of an irrigation system, responding appropriately to crops' water requirements. The objective of this paper was to describe a new tool for irrigation scheduling, called IGdroid. This tool is a mobile phone application for use by farmers who use irrigation and have some climate monitoring equipment, such as rain gauges and evaporation pans, providing irrigation advice in areas based on inputs and outputs data without internet connection. The development process and the main functions of the application are described in this paper. The software is inserted in the farmer's mobile phone to schedule everyday irrigation. Soil properties, irrigation system and crop data must be inserted in the database, so the farmer can insert climatological data in her/his mobile phone on a daily basis. The application can record multiple irrigated areas with different crops, soil types and irrigation systems, and reports irrigation requirements daily. If the farmer needs to irrigate, the app informs her/him of the water depth (mm) and how long to run the system (in hours) in each area. This app also allows simulation of irrigation scenarios in agricultural planning.

Keywords: irrigated agriculture, Android, App Inventor

2 INTRODUCTION

Softwares and models are constantly being developed to assist irrigation (ZAPATA et al., 2012; ESTRADA et al., 2009; BARRADAS et al., 2012), but the growing need for up-to-date information that is always available by phone can help in complex irrigation processes. In the age of wireless communication, mobile phones have become an everyday necessity. Besides their being able to make calls and send messages, the latest developments have transformed mobile phones into small pocket computers (smartphones) capable of processing complex calculations and internet access (DIVYA & MAMAKESWARI, 2013). Common problems in the adoption of these technologies in rural areas are illiteracy, availability of the content in own language, and accessibility as well as awareness of and willingness to test new technologies (MAHANT et al., 2012).

Irrigation is a serious problem for water managers, and to achieve an efficient use of this resource it is necessary to invest in modern irrigation systems as well as develop new technologies for water management (LOZANO et al., 2010; GANJI & SHEKARRIZFARD, 2012). Making a correct decision about irrigation depth implies simultaneous consideration of the phenological and nutritional crop status, weather patterns during the irrigation season and

economic and energy budgets. Addressing all these complexities requires the use of models and softwares (ROCCA & DANUSO, 2011).

The use of the smartphone to support agricultural activity is growing, because it is a tool with a lot of sensors (GPS, camera, accelerometer, light sensor, barometer, wireless), which can be integrated into applications. Several applications have been developed for the agricultural sector to facilitate the daily tasks of farmers (CUNHA et al., 2010; SILVA & BRACHT, 2010). Some tools can be used for smartphone applications. App Inventor is a tool of the visual drag and drop type for the design and build of fully functional mobile applications for Android. App Inventor promotes a new era of personal mobile computing in which people have the power to design, create and use mobile technology solutions every day, in infinitely unique situations. App Inventor's intuitive programming capabilities metaphor and incremental development allow the developer to focus on the programming logic of an application rather than the syntax of the language encoded (POKRESS & VEIGA, 2013).

This paper presents the development and features of an application for smartphones that estimates the depth and duration of irrigation based on information acquired from rain gauges and evaporimeters installed in fields. This application is intended to assist farmers with the control of irrigation, balancing the water in the soil according to meteorological data, and it is different from other applications by virtue of prescribing the depth and duration of irrigation in a simplified way without internet access. It can be viewed and edited anywhere and simulates scenarios for estimating water use during the production cycle.

3 MATERIAL AND METHODS

This mobile phone application enables the farmer to add and remove irrigated areas, changing the characteristics of the registered areas (soil, irrigation system and crop), remove recorded areas, and view, delete and start a new irrigation event (Figure 1).

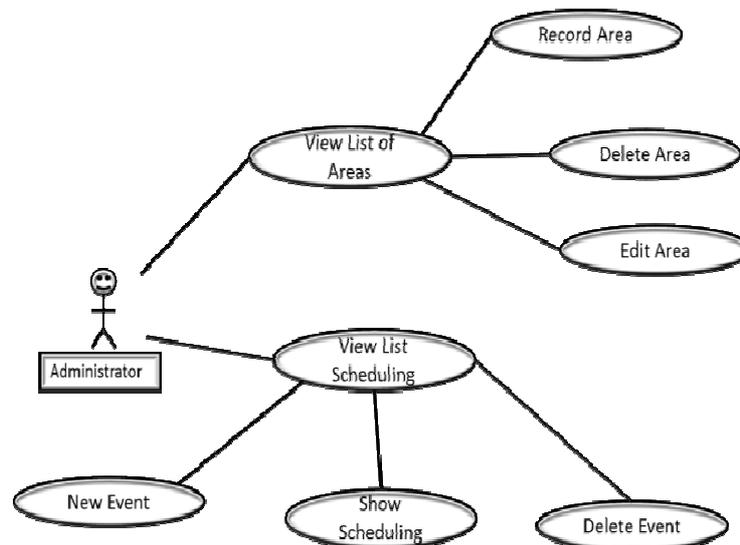


Figure 1. Use case diagram.

The flowchart in Figure 2 schematises the equations and procedures used to determine the required depth and duration of irrigation. The flowchart was adapted to integrate the development of an online system, App Inventor (built by Massachusetts Institute of

Technology), whose main objective is the development of applications for mobile devices using an open source platform for the operating system Android (POKRESS & VEIGA, 2013).

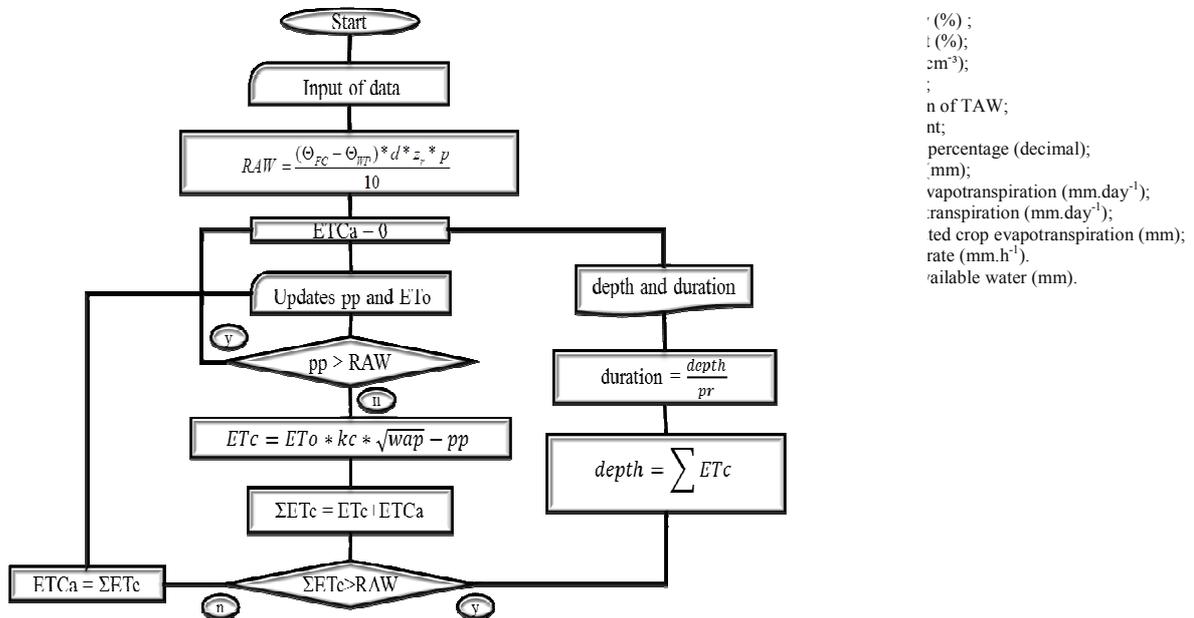


Figure 2. Irrigation decision flowchart.

App Inventor is divided into two parts: a designer (Figure 3) to select application components and a blocks editor (Figure 4) to define their behavior.

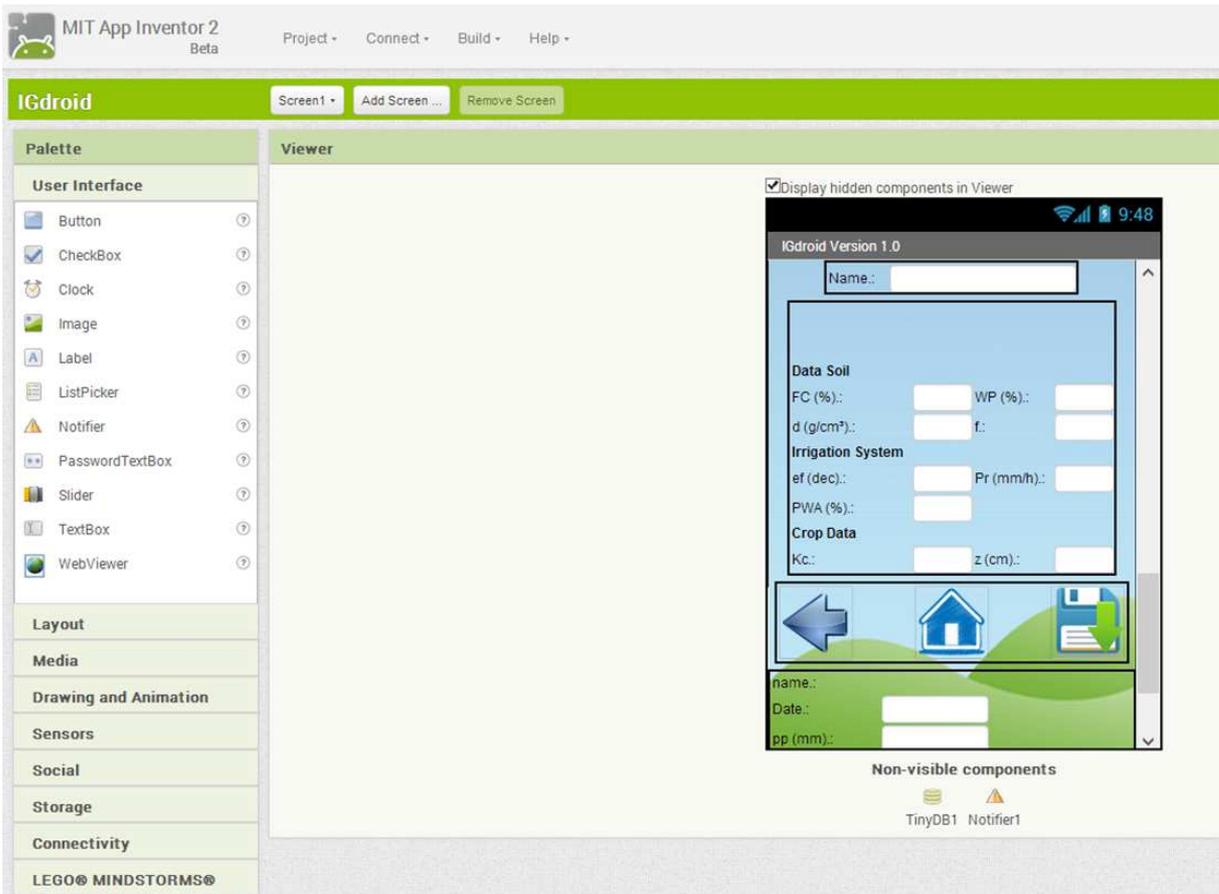


Figure 3. Module design App Inventor.

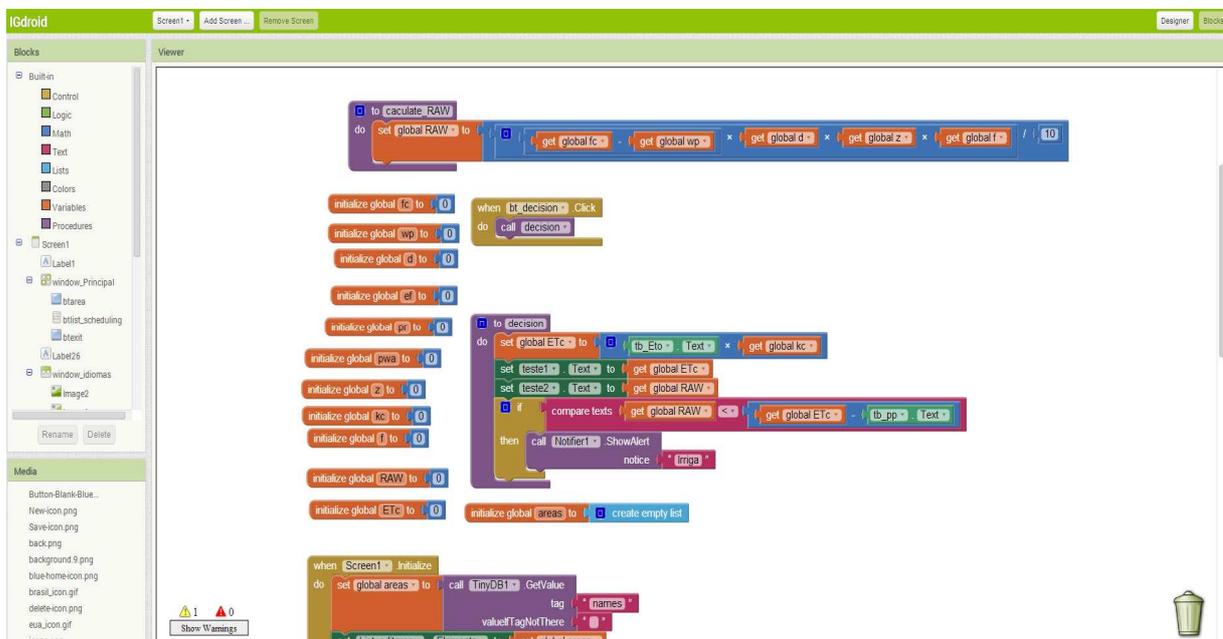


Figure 4. Module block App Inventor.

App Inventor enables developers to see apps while they are being developed (Figure 5), whereby the user inserts a new component to designer module, or creates a new functionality by blocks module, so new features are automatically updated in mobile.

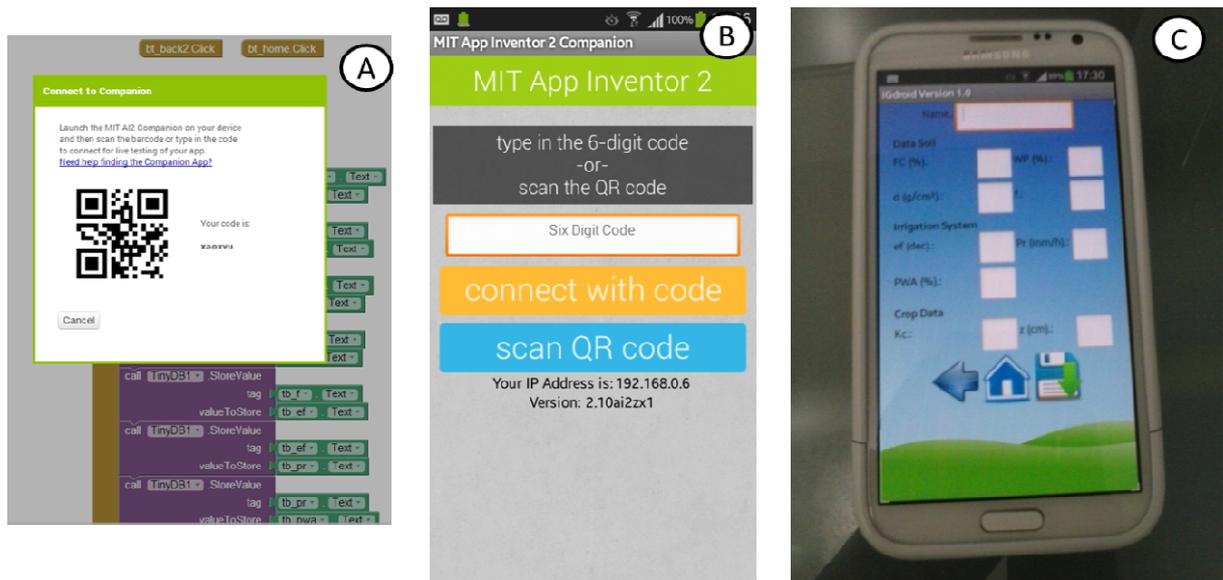


Figure 5. Tag for connection (A); MIT application for reading the tags on a smartphone (B); open application on a smartphone (C).

This has very positive implications not only in terms of quick feedback but also as a way to test and debug applications as they are made. Once the application is complete, it can be downloaded directly to the connected device or exported in apk (Android Package) format for distribution or upload to Google Play.

4 RESULTS AND DISCUSSION

Figure 6 shows the android's main screen with an IG icon and 'Area' button to access management functions of registered areas, a 'Scheduling' button to access the scheduling screen, an 'Exit' button to close the application and a 'Languages' button to select the language.



Figure 6. Screen of IGdroid app.

After selecting the 'Area' button the user is directed to the screen shown in Figure 7a, where by selecting the 'New Area' option the user can register a new area to irrigate, entering all the data required for the registration (Figure 7b). When s/he selects 'Edit Area' a list of registered areas is displayed (Figure 7c). The user can edit any area and change all the data. This option is useful for changes in crop phenological status. The 'Delete' button works to remove a selected area.

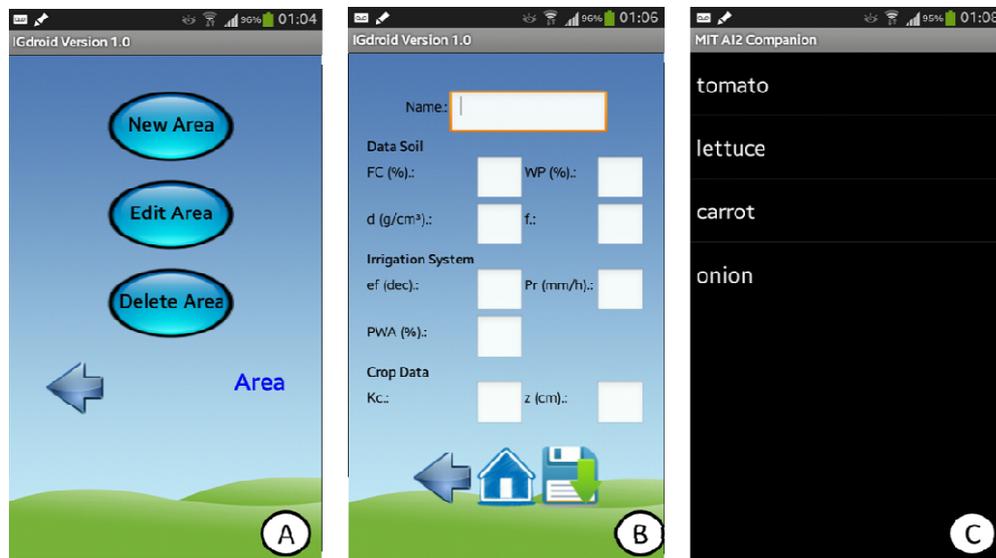


Figure 7. Screen area (a), area register form (b), list of area/crop for edition (c).

The 'Scheduling' button gives a list of areas from which to select and make a decision about irrigation. After selecting the area, the farmer informs evapotranspiration and rainfall daily and press "decision" button (Figure 8a). An alert message will instruct the user to irrigate (depth and duration) (Figure 8b) or not ('No Irrigation') and the data will be stored. The 'New Event' button clean ETc data to start the new climatological water balance.

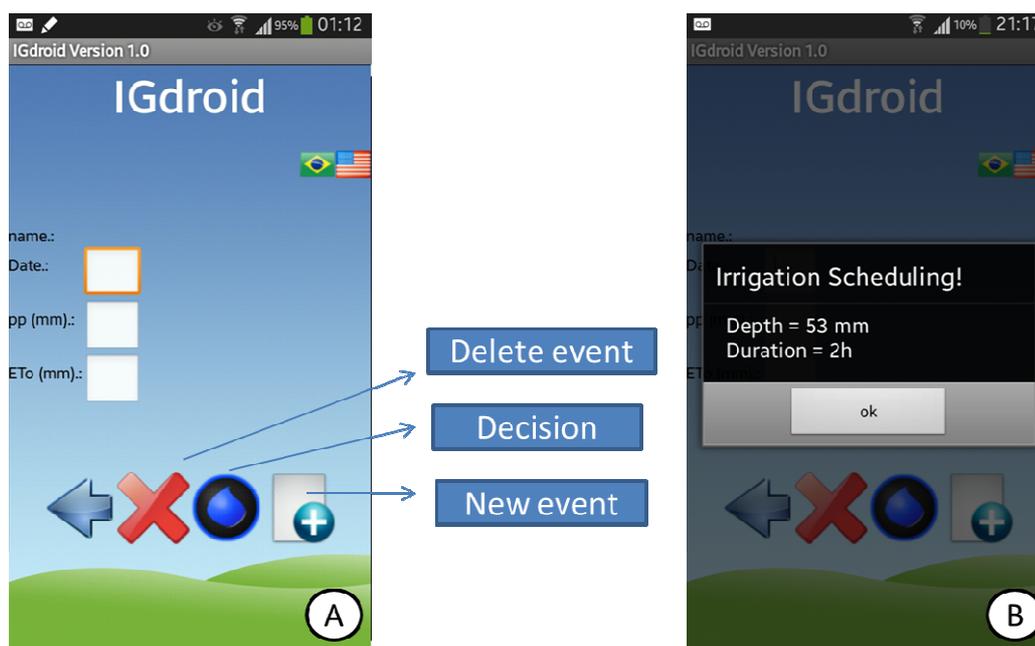


Figure 8. Screen irrigation scheduling.

Functions such as registering coordinates and photos of an area, sharing data via email or exporting them to Excel format will be added later. The program will be available on Google Play for free.

Rodrigues et al. (2013) interviewed irrigators about their irrigation systems and their use of mobile phones. They were then asked about their irrigation scheduling techniques in general and their experience with evapotranspiration tank. This work verified that mobile phone is used daily by small farmers in Pernambuco state, and the use of such devices in order to take accurate and updated information is a possibility to minimize the problems faced in field, particularly with regard to irrigation.

5 CONCLUSIONS

This paper presents a tool for making decisions about irrigation scheduling and is a fast and practical way to find the required depth and duration of irrigation based on soil-water balance by rain gauge and evaporimetric tank, rendering unnecessary the use of spreadsheets, computers and calculators.

This work may also serve as a model for future development of applications with emphasis on irrigation scheduling through the simple insertion of more features, changing the mode of soil-water balance and exploring more of the sensors available on smartphones.

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