Irriframe as Italian National Platform for Water Management

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ABSTRACT

Irriframe platform has been developed by Water Boards Italian Association (ANBI) aiming to ensure an efficient use of water resources in the agricultural sector. In the first year and a half of activity 36 water boards all over the country have been involved and 47% of Italian irrigated area has been covered. Daily basis irrigation scheduling has been provided for 3.500 fields through the Web, SMS and Smartphone. Irriframe services in the last year allowed a water saving amount of about 120 million of cubic meters of water in the covered regions. The software has been designed by the Italy based IT company AltaVia srl on the knowledge base provided by the water boards research centre CER. This paper describes the Irriframe services and the main development trends for the near future.

Keywords: Irrigation, Water Management, Support Services, Drought, Water Efficiency, Web Platform, Italy

1. INTRODUCTION

1.1 The Irrigation challenges

In Italy 32% of farms practice irrigation, with higher percentages in the North-West (62%) and lower percentages in the Centre and South. Compared to 2005, irrigated farms increased by roughly 60,000 units. Irrigated surface area increased by around 2% compared to 2005 (53,000 hectares), with significant expansion in the North-East (+11%) and the South (+6%), as against decreases in the North-West (-4%) and the Centre (-6%). The most irrigated surface area is concentrated in the Po river plain: Piedmont, Lombardy and Emilia-Romagna account for 46%, with 1,225 million hectares of irrigated land. In June 2010 the Environment Council of the EU (Council EU, 2010), adopted the conclusions on water scarcity, drought and adaptation to climate change. The document recognizes that water scarcity and droughts are already a serious problem in many European regions and that the situation is expected to worsen as a consequence of climate change. It also underlines the need to promote water efficiency and water demand management through a combination of different tools

1.2 The Irriframe answers

Irriframe software has been developed by the Italy based IT company AltaVia srl on the knowledge base provided by the water boards research centre CER on behalf of Water Boards Italian Association (ANBI) which is the owner of the platform.

Irriframe consists of a set of tools both for final water users (farmers) and for water managers (boards) to provide extended information on the best water allocation and on how saving irrigation water without decreasing the quality of crop production.

Irriframe is defined as an information "hub" because it combines information from different sources (meteo, farm and GIS data), by mean of a sound knowledge base (water balance) and it makes the irrigation scheduling available on different communication channels.

Real time water balances are also clustered to build up maps on water requests along the hydraulic networks.

2. IRRIFRAME HISTORY

Figure 1: Irriframe history from Videotex to Irriframe

Started in 1984 (Giannerini, 1993) with public founding to test telematics in agriculture (Videotex), Irrinet is ported on the WEB in 1999 to be the first interactive agricultural service on the Internet.

In 2003 (Rossi et al., 2004) it is extended with GIS support and SMS interface (IrriSMS).

During 2007 it involves more than 9000 farms, covering almost 22% of the irrigated area in Emilia Romagna region.

In 2010 (Giannerini et al., 2011) it gets as new label "Irriframe" and is extended to the whole country through the Water Boards Italian Association (ANBI).

Up to now Irriframe is the irrigation support service with the larger number of real user in Europe.

3. KNOWLEDGE BASE: WATER BALANCE MODEL

The irrigation model has been developed by CER and has been validated locally over 30 years field trials (Giannerini, 2004). The main structure of the model is described in Figure 2.

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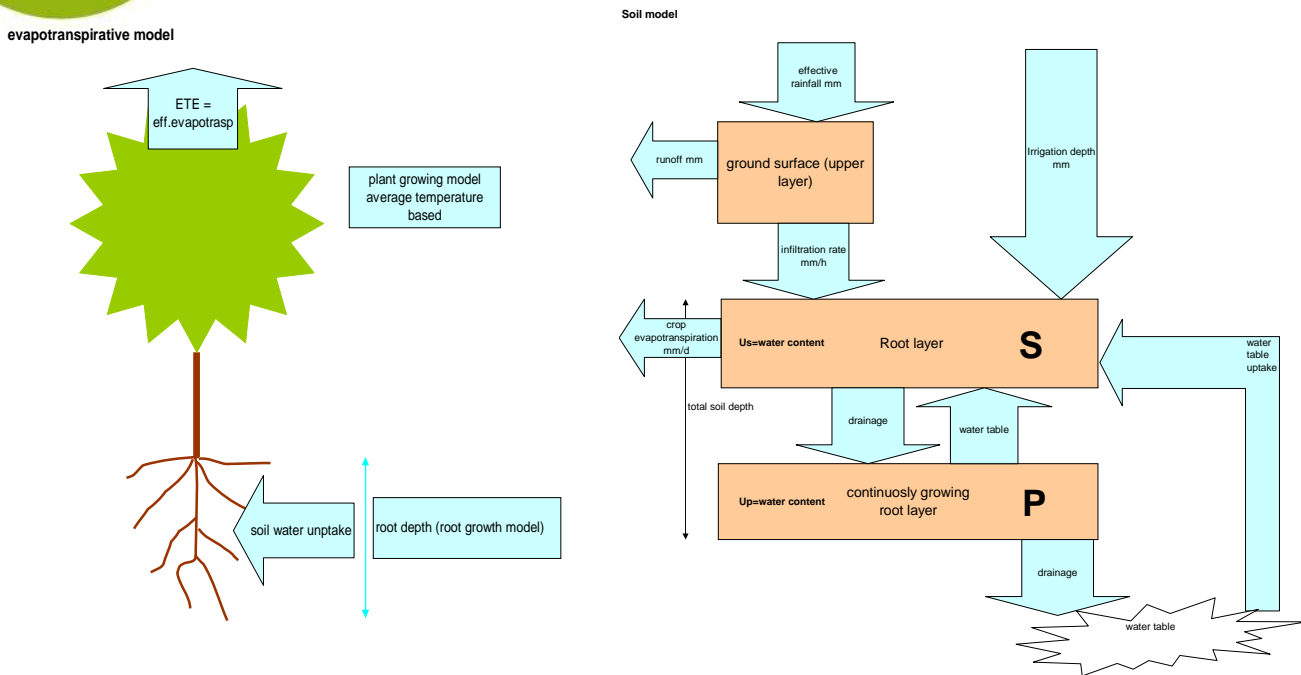## Sustainable Agriculture through ICT innovation

Figure 2. Water balance model

As shown above, the model consider the soil, plant, atmosphere continuum and it is based on water balance, where crop water requirement is calculated from evaporimetric data, corrected for crop coefficients (Kc) (Doorembos et al., 1977, Driessen, 1986) modulated according to local information, accounting for reduced water uptake by the crop due to water stress. Watertable depth data are also taken into account as water supply, in order to reduce crop irrigation needs (Battilani et al., 1992, 1993, 1994 and 1996).

The input date are: type of crop and soil, geographic location, meteorological and soil data and the characteristics of the irrigation system used in the farm. The crop parameters obtained from local trials are from CER databases.

Outputs are given about expected effective crop evapotranspiration, the date of the next irrigation and the relative amount of water to be distributed.

The irrigation schedule takes also into account the actual irrigation water availability. This information is provided in real time by the Water Boards.

4. USER INTERACTION

Irriframe system provides a real-time irrigation scheduling: day-by-day information on how much and when to irrigate farm crops (Figure 3 on the right).

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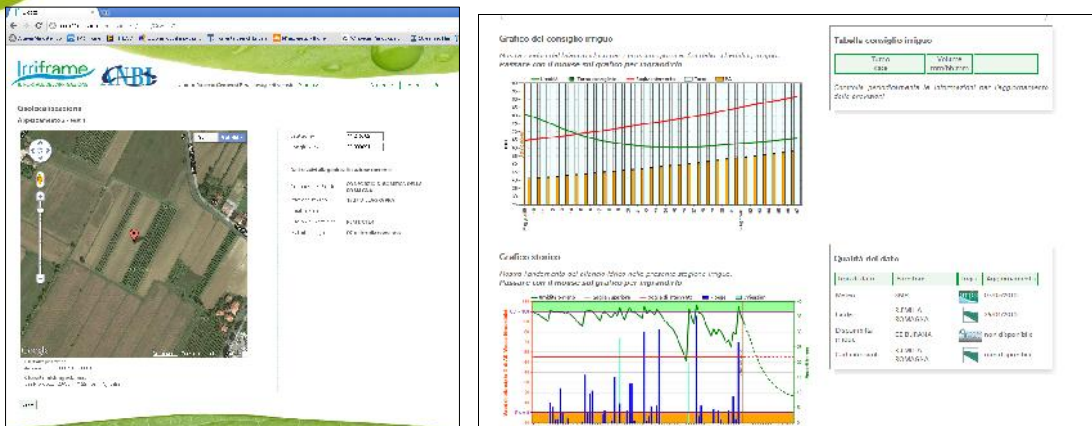Sustainable Agriculture through ICT innovation

Figure 3: Irriframe Web interface

Through the web interface the users can fully interacted with the system:
- register as user and create plots, crops and farms
- store plot geolocation, crop, soil and irrigation system information
- store the actual data on rainfalls, irrigation gifts, crop growing stages
- display the results of irrigation scheduling in text or chart format: predicted evapotranspiration, next irrigation day and water irrigation depth (Figure 4)
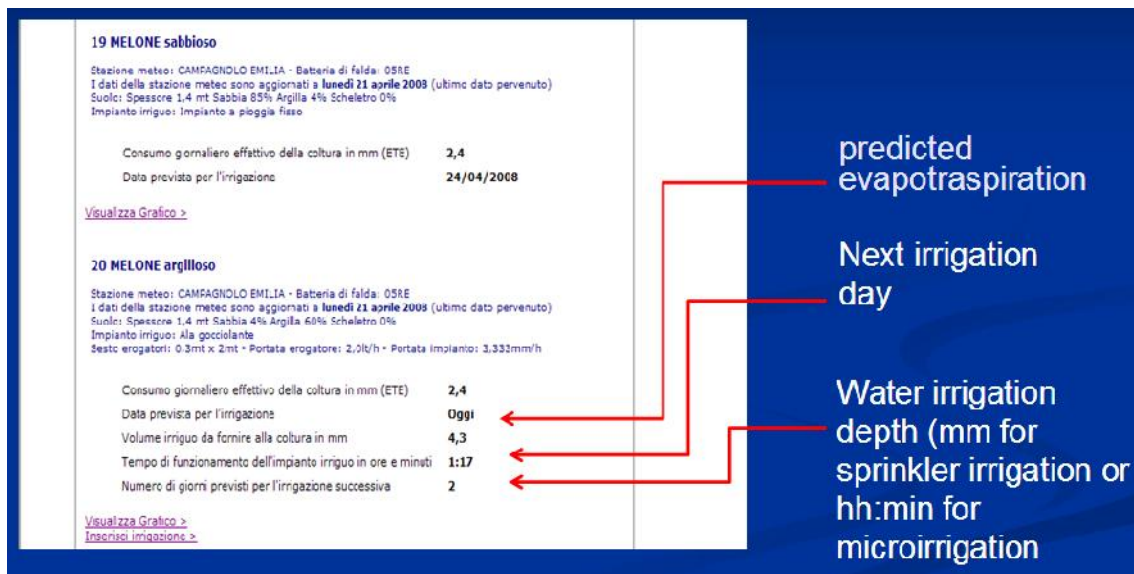

Figure 4: Irriframe irrigation scheduling

To create a new plot (figure 3 on the left) the user clicks on a Google map to mark the plot position and automatically gets the following data:
- Water provider: water board in charge of running the service
- Water district: water availability information

- Meteorology: daily ET, temperature and hourly rainfalls
- Soil: soil texture
- Freatimeter: average water table depth

After that the user fills in the other information required concerning irrigation system and the crop. This user data merged with the data provided by the local networks (meteo, water availability, water table depth..) allows the system to build up the daily irrigation schedule whenever the user need it.

5. IT INFRASTRUCTURE

Irriframe has been developed by AltaVia on .NET 4, ASP MVC and MS SQLServer2008 and is hosted on a virtual cloud servers environment.
The platform full implement the REST methods through ASP MVC architecture.
The Model-View-Controller (MVC, Figure 5) architectural pattern separates an application into three main components: the model, the view, and the controller.
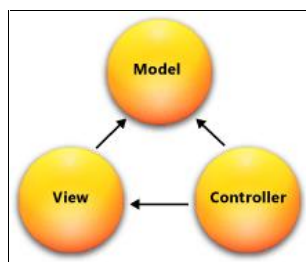

Figure 5: MVC architectural pattern

The MVC framework allows the Test-driven development (TDD) that is a software development process that relies on the repetition of a very short development cycle: first the developer writes an (initially failing) automated test case that defines a desired improvement or new function, then produces the minimum amount of code to pass that test, and finally refactors the new code to acceptable standards.

REST stands for Representational State Transfer and it is a method for retrieving content from an HTTP endpoint. REST's most notable feature is that it is stateless. In other words, each call has all the necessary information for the server to process the request. REST allows to develop applications easy to maintain, flexible and amenable to change.

Actual data are gathered on daily basis in the Web DB server from several sources (meteo agencies, farms, agro-data networks). The irrigation model is run on the Web server every time the user clicks for information so the coolest data are always taken into account. The main architecture of Irriframe is outlined in Figure 6.
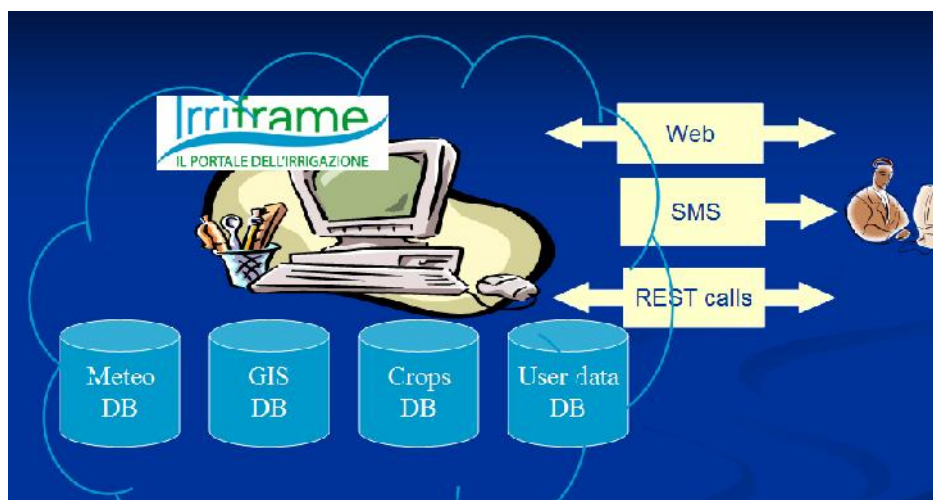
Figure 6: Irriframe architecture

The Irriframe services can be accessed by the different kind of users in many ways as outlined in Figure 6.

The Web pages have a light graphical structure and can be well displayed on a Smartphone. The same information are automatically sent by SMS to much more farmer; most of them are registered into the system by technicians and do not need Internet connection to get the irrigation scheduling.

Water Boards legacy software may be connected with Irriframe by means of REST direct calls to some functionalities.

6. CONCLUSIONS

36 Water Boards were involved in the last irrigation season (Figure 7), 22.400 IrriSMS were sent and 802.500 irrigation scheduling were produced. Approximately 1,8 millions of hectares have been covered by the service that means the 47% of the Italian irrigated area.

Figure 7: Service national coverage

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Irriframe awareness is very high in Italy and all the farms involved with Best Practice Guidelines and/or Quality insurance programmes can use it. Now the challenge is represented by the extension of the service to new areas where is not yet been implemented. As far as the technical point of view is concerned the development group is working on a closer integration with GPS-GIS layer interaction that could be decrease the amount of data the users are requested to interact with the system. An Android APP has been outlined.

7. REFERENCES

Battilani, A. and Mannini, P. 1992. *The influence of water table depth and rootstock on growth habit of peach*. Acta Hort. 315:23-30

Battilani, A. and Mannini, P. 1993. *Effects of water table on potato crop growth and yield*. Acta Hort. 335:405-411

Battilani, A. and Mannini, P. 1994. *Influence of water table depth on the yield and quality of processing tomatoes*. Acta Hort. 376:295-298

Battilani, A. and Ventura, F. 1996. *Influence of water table, irrigation and rootstock on transpirati on rate and fruit growth of peach trees*. Acta Hort. 449:521-528

Council of the European Union. 2010. *Water scarcity, drought and adaptation to climate change*. Draft Council conclusions. Brussels 4 June 2010.

Danuso F., Contin M., Grani M. e Giovanardi R. - *Bidrico Manuale d'uso e di riferimento*

Doorembos J. and Pruitt W.O. 1977. *Guidelines for predicting Crop water requirement*. FAO Irrigation and Drainage Paper n.24

Driessen P.M. 1986. *The water balance on the soil*. In "Modelling of agricoltural production: weather, soil and crops (H. Van Keulen e J. Wolf, eds) PUDOC, Wageningen.

Giannerini, G. 1993. *Renana Model: a model for irrigation scheduling employed on a large scale*. Second Workshop on Crop Water Models :15th Congress on Irrigation and Drainage. The Hague, Netherlands.

Giannerini, G. 2004. *IT services for water management*. The NewAgInternational Conference&Exibition Rome, 19th march.

Giannerini G., Genovesi R. 2011. *Irrinet: IT services for farm water management, a large scale implementation in Italy*. EFITA 2011 Conference Proceedings Prague, Czech Republic 11-14 July 2011.

Rossi F., Nardino, M., Mannini, P., Genovesi, R. 2004. *IRRINET Emilia Romagna: Online decision support on irrigation. Online Agrometeological Applications with Decision Support on the Farm Level*. Cost Action 718. pp. 99-102.