AGDATABOX – API
(APPLICATION PROGRAMMING INTERFACE)

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Abstract.E-agricultural is an emerging field focusing in the enhancement of agriculture and rural development through improve in information and data processing. The data-intensive characteristic of these domains is evidenced by the great variety of data to be processed and analyzed. Countrywide estimates rely on maps, spectral images from satellites, and tables with rows for states, regions, municipalities, or farmers. Precision agriculture (PA) relies on maps of within field variability of soil and plant attributes, with one experiment using various technologies to measure soil and plant attributes. Despite the difficulty in obtaining data in the field and the interaction between the collection stage and the data processing, storage, and interpretation environments has been a bottleneck for producers seeking to make use of the technology. An existing problem is the organization and administration of this data to obtain the information that can be used for the correct management of the field. The objective of this work is to present a computational solution to this problem. AgDataBox-API is a platform that was developed to store and integrates traditional agricultural data, data samples, maps, and management zones. This platform was developed using cloud framework and is for other developers to easily integrate their systems into the cloud, without having to knowhow the internal integration is done. Communication between a system and AgDataBox-API is done using HTTP protocol. As example, a free mobile application was developed using Android and Apple operational systems and allow insertingprecision

agriculture data using the smartphone. To demonstrate the potentiality of the software an experimental data from two sugarcane fields located at São JoãoMill (Araras - SP), each area with approximately 200 hectares characterized by production environment (texture and climate) was used. The results demonstrate how data can be easily handled and information can be extracted from it. This software is free of charge.

Keywords.*software, cloud data, integration data*

Introduction

Precision agriculture (AP) is seen as an optimized practice of site-management and aims to increased profitability of crop production, reduced production costs and reduced environmental impacts caused by agricultural practice (Adamchuk et al., 2005). Linked to this form of production is the use of electronic and information technologies, such as the use of GNSS localization systems, Geographic Information Systems (GIS), remote sensing techniques, mobile computing among others (Lee et al., 2010), which allow the producer to know in detail his producing areas with data about soil type, fertility, relief and vegetation, among other characteristics, so he can make better decisions about the management process.

Due to the acceptance of the use of technologies in the field, many technologies have emerged for obtaining and monitoring crops, resulting in an excessive volume of different types of data (Fountas et al., 2005), which makes it difficult to manage, interpret and use. Authors such as Steinberger et al., (2009) and Nash et al., (2009) comment that effective use of data requires that both internally generated data (devices and equipment and software at particular site) and externally generated data (eg meteorological data) are easily integrated and shared between different hardware, software and information systems. The difficulty in managing and integrating data obtained in the PA context can be understood by the complexity and diversity of formats in which data are presented (maps, images, field operations, costs, meteorological data) and obtained (software's, equipment, laboratories, and sample collections). In addition, they are often presented in proprietary formats and cannot be inserted into other software.

In this context, the present work seeks to present the development and viability of the construction of a centralized (but modular) and standardized environment (called AgDataBox - API), both from the point of view of data format and communication with different applications, allowing integration of data and software used in the context of Precision Agriculture. The web environment was developed using free and open-source technologies and has the functionality of an Application Programming Interface (API), containing resources of storage, integration,

management and availability of agricultural data that can be used to develop PA-oriented applications. The system allows developers in this segment to produce applications that work seamlessly and share data in simple and flexible formats.

Methodology

The API - AgDataBox, was developed from an environment that allows integrating different applications in a single location in a centralized (but modular) way, helping and facilitating the work of software developers who can take advantage of complex resources implemented in the API, Figure 1. In the API, access restrictions were implemented, aiming to incorporate security aspects, as well as routines and business rules that must be followed for the correct operation, following communication patterns and data format.

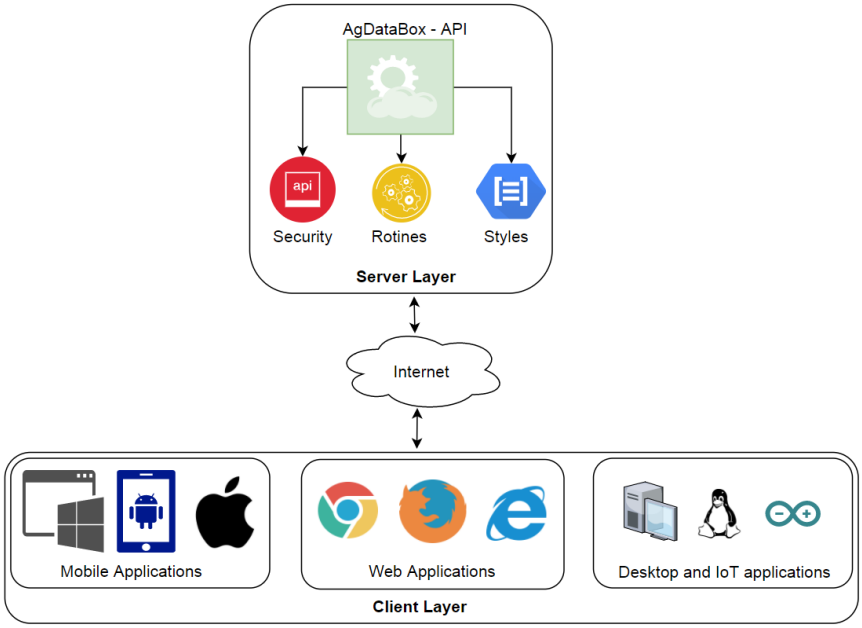

Fig. 1 – Basic operating structure of the platform AgDataBox - API, with different types of applications connected

The created structure allows, in addition to other characteristics:

- Data integration;
- Centralization of management and maintenance;
- Maintenance and management of resources;
- Agility in the process of developing the client applications;
- Scalability;
- Multiplatform;
- Modularity.

The software uses free and open source tools and resources that contemplated the proposed requirements, so the Java programming language was selected, Java is object oriented, cross platform, secure, and efficient, which were important considerations in the selection process. For this project, the VRaptor was chosen as codding framework. PostgreSQL was chosen as the database management system. Spatial functionalities were incorporated by adding the PostGIS extension. The JSON format, which is standard for data presentation, was adopted. It acts on the HTTP protocol for the transport and presentation of data between clients (different applications) and the API.

In the management of data in the cloud, to keep data and resources restricted and made accessible only over limited intervals of time, during which information is exchanged, using JSON Web Token (JWT) (Jones et al., 2015) technology, an environment was developed to include authentication and authorization features.

Data from two commercial sugarcane field of 200 ha each, in Araras, São Paulo State, located in the southeast region of Brazil (22º 24' 47,89" S latitude, 47º 17' 14,62 We (22º 24' 33,60" S latitude, 47º 17' 1,33W longitude, 653 m above sea level). The average rainfall was 1,700 mm. The climate is Aw (tropical savannah) according to the Köppen classification (Rolim et al., 2007).

Results and discussion

The data resources that are available for use, considering the characteristics of the PA context, are shown in Figure 2. Some resources, such as the characteristics of management practices, climatic variables and fields, correspond to general information about occurrences within the fields and allow accurate evaluation for monitoring and management. The spatial information features (represented by Maps in Figure 2) include data from the fields that have spatial attributes. These data include sampling grids, soil and plant characteristics, thematic maps of soil and plant attributes, management zones generated from thematic maps, georeferenced images obtained by satellites and occurrences (filling) by the producer based on their historical knowledge of the plot or occurrences in a given year or harvest (weeds, erosion, and nematodes, among others).

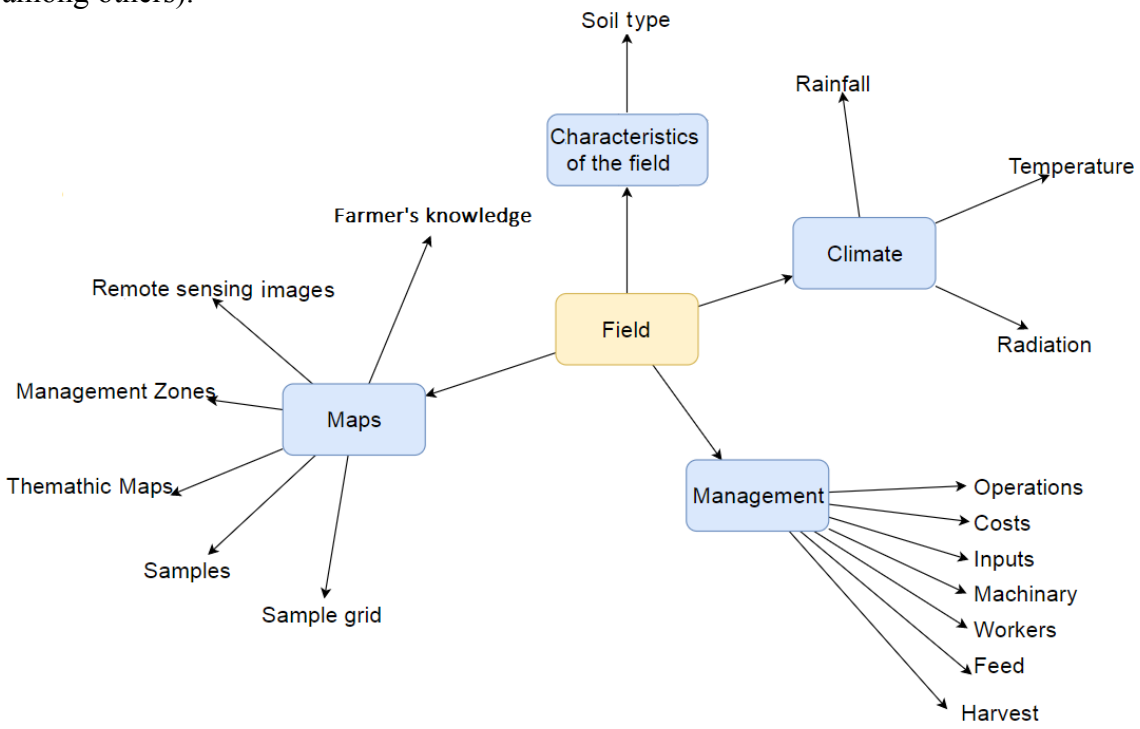

Fig. 2 – Data types for which the API offers management support.

The AgDataBox Mobile tool (Figure 3) was developed for the Android operating system and is available in the Play Store environment. It is fully integrated with the API and was developed to enable growers to store their field data, such as area demarcations, temporary or permanent occurrences, and field operations, among others. Moreover, it serves as a support tool for recording

rainfall and scheduling tasks. AgDataBox Mobile is used as an API testing tool in which requests to the API are made and responses are received, depending on the chosen operation.

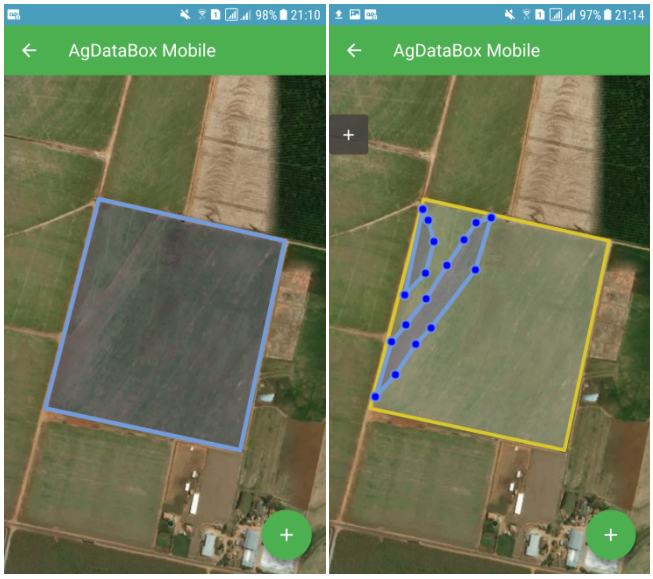

Fig. 3 – AgDataBox Mobile, a client application for the AgDataBox API: Defining field and ocurrences using the app.

Using the PHP programming language, a web module (AgDataBox Web, Figure 4) was developed to integrate all of the functionality of the API. The development of this web module also allows data obtained inthe mobile environment to be viewed, altered, and deleted by this environment and vice versa.

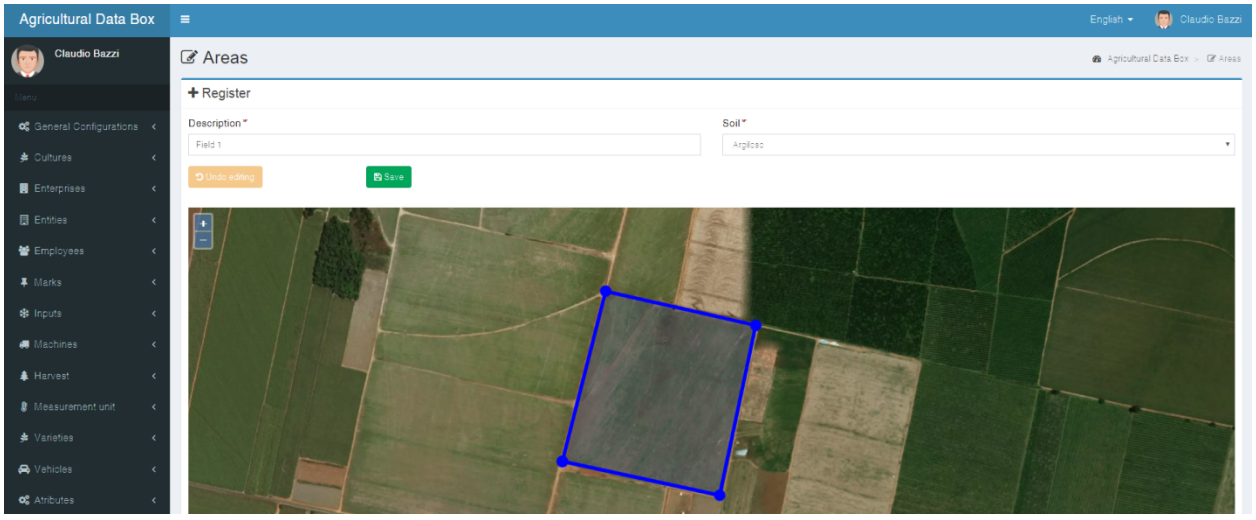

Fig. 4 – AgDataBox-Web, a client application for the AgDataBox API.

The API can be used during the growing period, usually from 12 to 18 months depending on whether it is cane plant or ratoon cane, by the manager to record any occurrence in the field, such as pest infestation, diseases, field gaps, presence of weeds and other important information that may affect the final yield of the crop, Figure 5.

Fig. 5 – Field 1 shape are showed by AgDataBox Admin

Given that the API will enable other applications to make use of the implemented resources, there was a clear need to develop an environment to provide easy visualization and interpretation of each of the resources implemented in the API. In this way, a web site (www.ppat.com.br/api/doc.html) was developed to meet this requirement in a dynamic and functional way. In this environment, all of the features of data storage and retrieval are described clearly and objectively (Figure 6). The documentation web site incorporates an API testing application. Using this application, agricultural software developers can perform tests and become familiar with the API before they start developing their own applications integrated with the API.

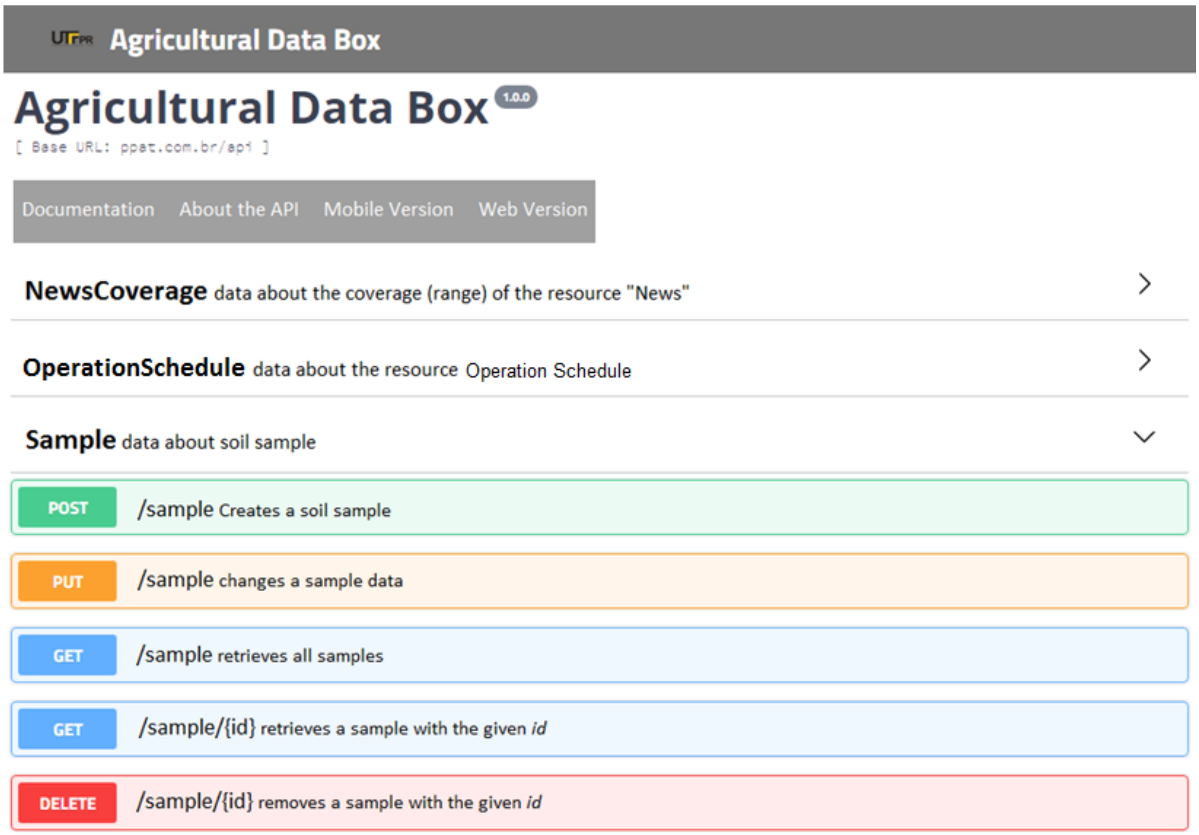

Fig. 6 – Documentation and client application for the AgDataBox API.

To enable its use in both public and private contexts, the API was developed to be modular. Given this feature, the API can be installed for use in private environments, such as service

companies, and configured to serve the client applications of these companies. Hardware resources can then be allocated according to usage needs and the number of users of the system. In this way, each company can make use of the API within its own structure. These instances of the API will be isolated from the others, and they can allocate their hardware resources according to demand. Moreover, such private users can develop their own applications and integrate them in their separate environments.

CONCLUSION

Whether web-based or mobile, most applications developed for the agricultural sector are restricted to local environments. The development of the AgDataBox API shows that it is a viable tool. It is accessible to any other application that allows HTTP communication with aserver. For the developers of "client" environments, the applications developed based on the platform demonstrate the importance of the solution and its correct operation. The API facilitates the integration of agricultural data indiverse formats that areobtained in diverse forms and from various sources. The results described here indicate that the technologies applied in the project areadequate for the development of the application. Moreover, it is found that the development of applications of different types and with different objectives can easily be integrated into the API environment, considering the available documentation. The use of the AgDataBox API as a tool to support developers tends to facilitate and expand the use of information technology resources in the field. The API facilitates the use of these resources by companies in the agricultural sector and growers.

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