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Saving and Storing Data through Mobile-Based Applications Dedicated to Soil Protection

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Authors' contributions

This work was carried out in collaboration between both authors. Author BVC designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Author MC managed the analyses of the study. Both authors read and approved the final manuscript

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ABSTRACT

Mobile applications dedicated to the protection of soil resources are increasingly common among users worldwide. What makes them popular among them is the possibility they offer in the acquisition, respectively saving and storing data from the field. We propose to do an analysis of how to save and store data, to emphasize the malleable nature of applications in relation to what

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software development platforms allow - in this case, the MIT App Inventor® platform. As a result of the research methodology, no less than six possible data saving and storage media were determined (TinyDB®, File®, CloudDB®, Google Sheets®, Firebase®, and DropBox®). The obtained results showed that saving and storing data depends, to the greatest extent, on the specifics of mobile devices (memory and effective storage space). Consequently, for an application made through the MIT App Inventor® platform, several types of configuration of the acquisition, processing, saving, and storage of data are possible, all of which depend both on the specifics of the devices used, as well as on the users' choices regarding the acquisition, processing, saving and storage of data.

Keywords: Soil-related data storage; mobile applications; MIT App Inventor®; soil protection.

1. INTRODUCTION

Nowadays, the majority of mobile devices (with different hardware capabilities, navigation techniques, and physical design) come preloaded with a number of applications [1], including a web browser, an email client, a calendar, a mapping program, a music-buying app, and many more media tools. Some pre-installed applications can be deleted using the standard uninstall procedure, freeing up additional storage for desired applications. Some devices can be rooted to delete undesirable apps even when the firmware doesn't permit it. App Stores are online marketplaces where users may get apps that are not already pre-installed. They could be run by the company that created the mobile operating system for the device, like the App Store® for iOS or the Google Play Store® for Android [2], by the makers of the device, like the Galaxy Store® and Huawei AppGallery®, or by third parties, like the Amazon Appstore® and F-Droid®.

Typically, mobile apps are downloaded from the platform to the intended device, though they can occasionally be downloaded to laptops or desktop computers as well. On Android devices, apps can also be manually installed by launching a specific app package. While some apps are free, some may cost money, either upfront or on a recurring basis. Some apps additionally provide in-app purchases, advertising, or both. In any event, the app store and the app creator often divide the earnings. As a result, the pricing of the same app may vary based on the mobile platform. For general productivity and information retrievals, such as email, calendar, contacts, stock market, and weather data, mobile apps were initially made available. However, there has been a quick extension into other areas, such as those covered by desktop application software packages, as a result of consumer demand and the accessibility of development tools. A wide array of review, suggestion, and curation sources, including blogs, magazines, and specialized online application discovery services, have been developed as a result of the explosion in the quantity and variety of applications, which, like other software, has made discovery difficult.

People are installing more apps on their devices, regardless of the type or utility of the apps, due to the growing number of mobile apps available in app stores and the improving capabilities of smartphones [3]. Native apps, hybrid apps, and web apps are the three categories into which apps are typically divided [4,5]. Apps that are native to a mobile operating system - typically iOS or Android - are made just for that platform [6]. Web applications are typically run through a browser and are created in HTML5 or CSS. Hybrid apps function as web apps cloaked in native containers and are created using web technologies like JavaScript, CSS, and HTML5. Users of mobile phones are increasingly using more and more mobile applications, that have gained wide acceptance in several sectors, including eCommerce and even education [7,8].

According to research, the use of mobile apps is significantly correlated with the user context and is influenced by the user's location and time of day. Professionals are using mobile apps more and more, and when they are properly created and integrated, they can have many advantages. In their work, farmers, ecologists, pedologists, scholars, and students worldwide are increasingly using mobile applications devoted to monitoring and conserving soil resources. They are well-liked by users due to the opportunity they provide for collecting, recording, and storing field data. As such, in continuation of the above mentioned, through the present work we have proposed to identify what are the possibilities of saving/storing the data collected from the field, and if these options are feasible for implementation within a mobile application for monitoring and protection of soil resources.

2. MATERIALS AND METHODS

We set out to conduct research on the potential for saving and storing data specifically for a mobile application for the monitoring and preservation of soil resources through the current effort. We were able to set up no less than six different options for saving and/or storing data from the standpoint of the application we developed using the MIT App Inventor® platform (TinyDB®, File®, CloudDB®, Google Sheets®, Firebase®, and DropBox®). We evaluated each of these variations to see if the data could be saved, what format it could be saved in (text files, images, audio, and video, etc.), what access options there were for later accessing the data for storing and/or saving, and what other options there were. To give you an idea of the possibilities it offers, for saving and/or storing data, the application created by us during Oct. 2020-November 2022, we decided to explain with some work screens for File®, Google Sheets®, and DropBox®. Of course, there are still many aspects that we have not explained, but we consider that these are enough to have an overall idea of what we set out to show.

3. RESULTS AND DISCUSSION

Saving and storing text and images in the device's internal memory can most commonly be done through the TinyDB® storage component, for which the MIT App Inventor® platform has an associated calling function [9,10]. Saving data from the field can, naturally, be done in several formats. Of those considered, configured, tested, and validated, only those related to the suite of programs in the Microsoft Office® package (starting with version 1997 and up to now, version Microsoft Office 365®) are presented.

The second component that by calling in MIT App Inventor® can save and store data in the internal memory of the device is the File® component. This provides an unlimited work option, if the extension of the working files required by the user is known (for example, files that open with the Microsoft Office® suite). Through the File® component, at the application level, it was aimed that the user could save/store the data as Plain Text (*.txt), Word 97-2003 Document (*.doc), Word Document (*.docx), Excel 97 -2003 Workbook (*.xls), Excel Workbook (*.xlsx), CSV-Comma delimited (*.csv) and PDF (*.pdf).

The first variant of what it means to save in the cloud is available through the CloudDB® component. An example in relation to saving the texture of a soil sample is similar to Fig. 1, only the access path to the materials is different.

Next we come up with a very good and important project, which refers to sending data from the created application to Google Sheet®, which can be used both as an online database and as a free MySQL® database. To begin with, a new Google Sheet® type file is created in Google Drive® (Fig. 2), where the values to be sent from the application to the database are configured first.

In terms of saving data in DropBox®, first the user's DropBox® account is accessed (Fig. 3). There are two different types of access: full access to DropBox® (dropbox access type) or only to a specific folder (sandbox access type). For the proposed application we use the sandbox access type, for obvious security reasons (Fig. 4).

After entering the account, a new application "sampling sheet" is created (Fig. 5), accessing the link https://www.dropbox.com/developers/apps, for which different access permissions are set, both for writing as well as for reading data in/from the account (Fig. 6).

In addition to the previously set permissions, other settings can be made, the most important of which is the setting related to the generation of an access code/token (Fig. 7). This token is required at the app level to be able to connect directly between the app and your DropBox® account level storage.

The source code from the application (inspired by a similar project) which has as its purpose the selection of an image from the device gallery, followed by its saving/storage at the level of the new project created in the DropBox® platform is presented in Fig. 8.

As can be seen from the examples above, the scientific knowledge of the world developed gradually, through small steps and giant steps [11,12]. Thus, over time, there have been countless scientific discoveries (with or without rigorous applications) that have contributed to the cultural endowment and the progress of society [13]. Most of the scientific elements are routine observations and records, contained in research reports, reports, and small communications, each having its own importance within the intimate mechanism of the computer act and the development of the community [11].

The approach to reality, through the lens of mobile applications that allow the acquisition and saving/storage of soil data, by sectors and sub-sectors (soil monitoring, protection, and conservation), as branches and sub-branches of reality, was the fruit of the first contact and the first perceptions of the man about the environment through Environmental Information Systems (EISs) [14-16]. Later, it can be observed that due to the avid need for knowledge, the scientific branches (including the development of specific mobile applications) were dismantled into ever more elementary parts, the thin slices of reality being ever deeper. Also, as shown, the MIT App Inventor® platform has obvious features for the development of mobile applications [17-20], which can help the average user in the work they do. In addition, the application created by us is a tangible one that shows that mobile applications can have their place and role both in education and research [21-24].

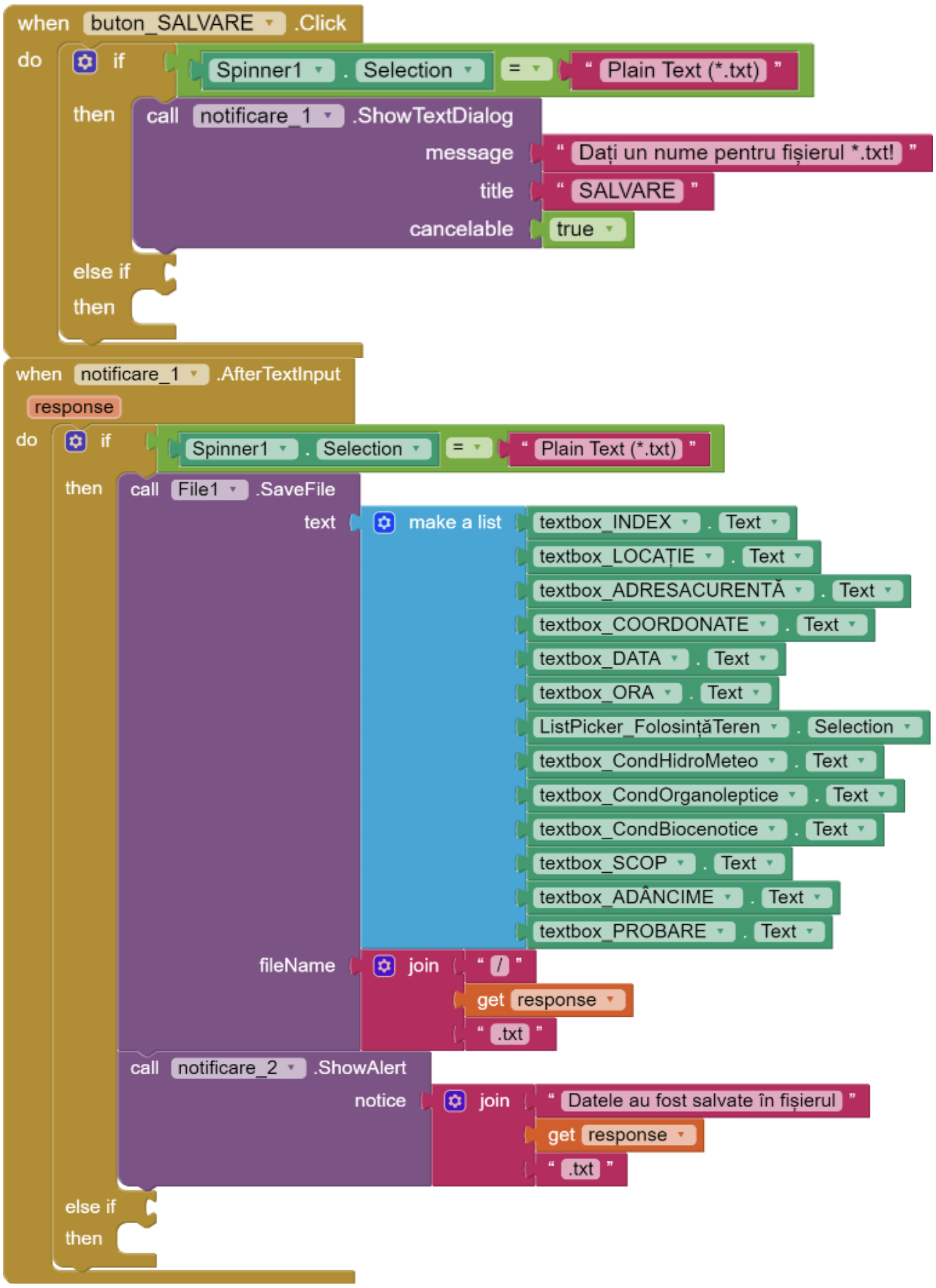

Fig. 1. Configuring the file® component to save data in plain text FORMAT (*.txt)

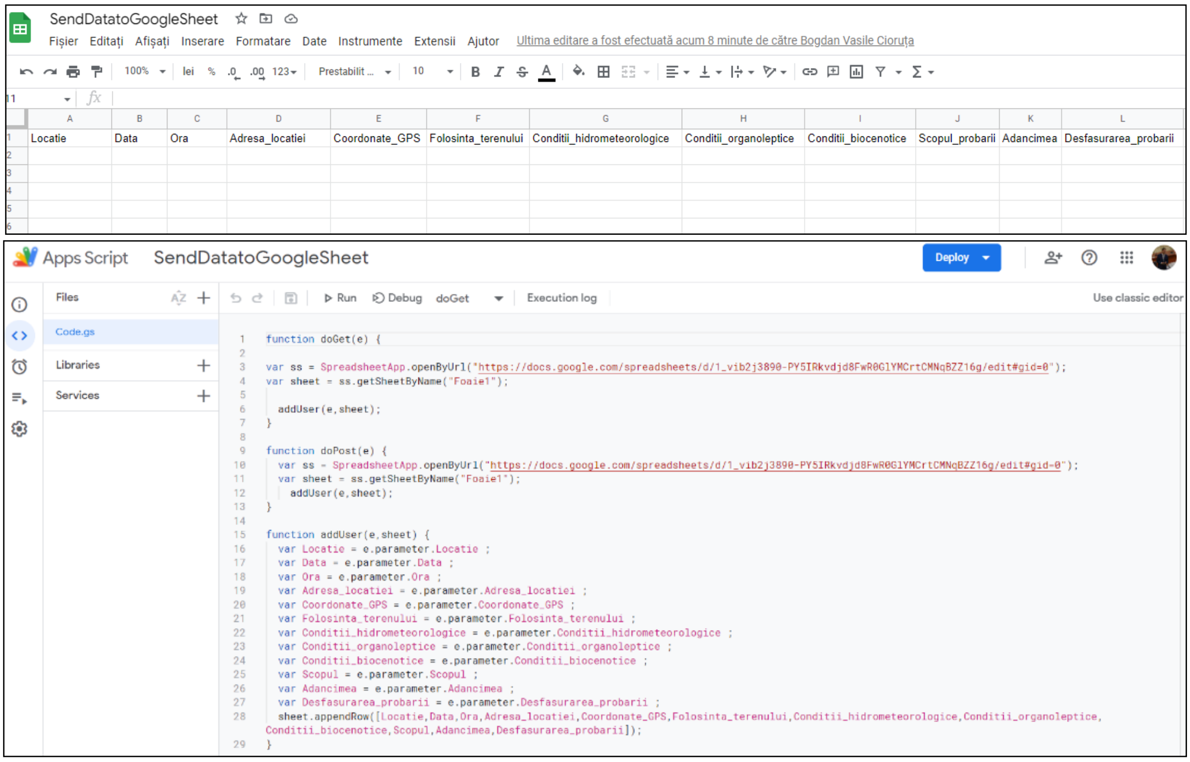

Fig. 2. Configuring Google Sheets® storage to allow data to be saved through the application interface

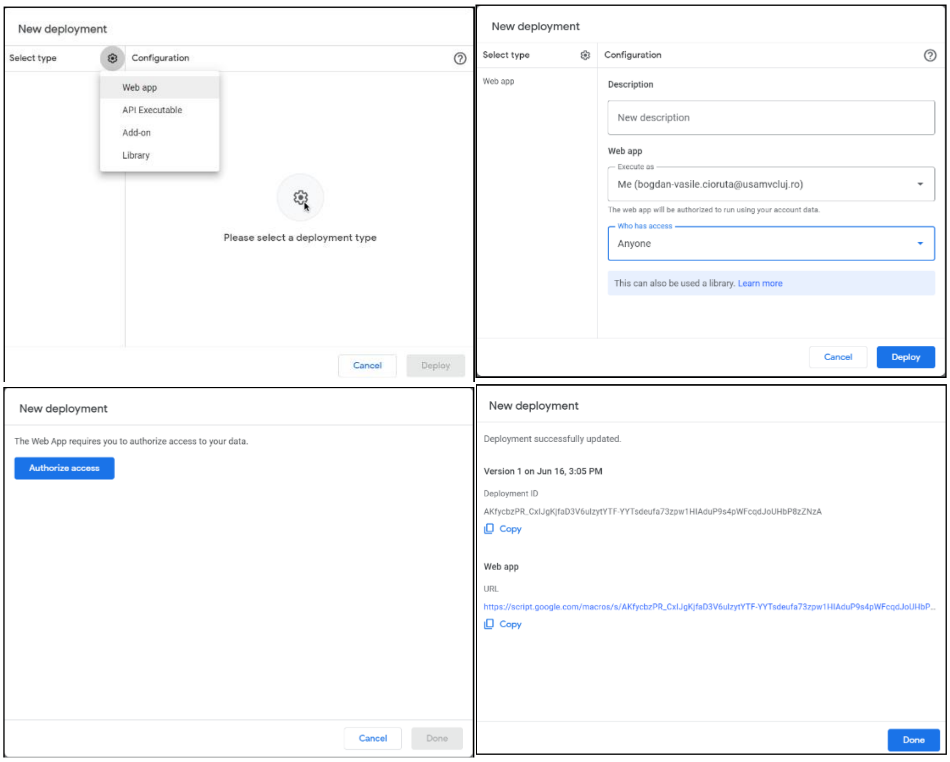

Fig. 3. Setting of the Google Sheets® storage-level access permissions to allow data to be saved, accessed, and viewed through the application interface

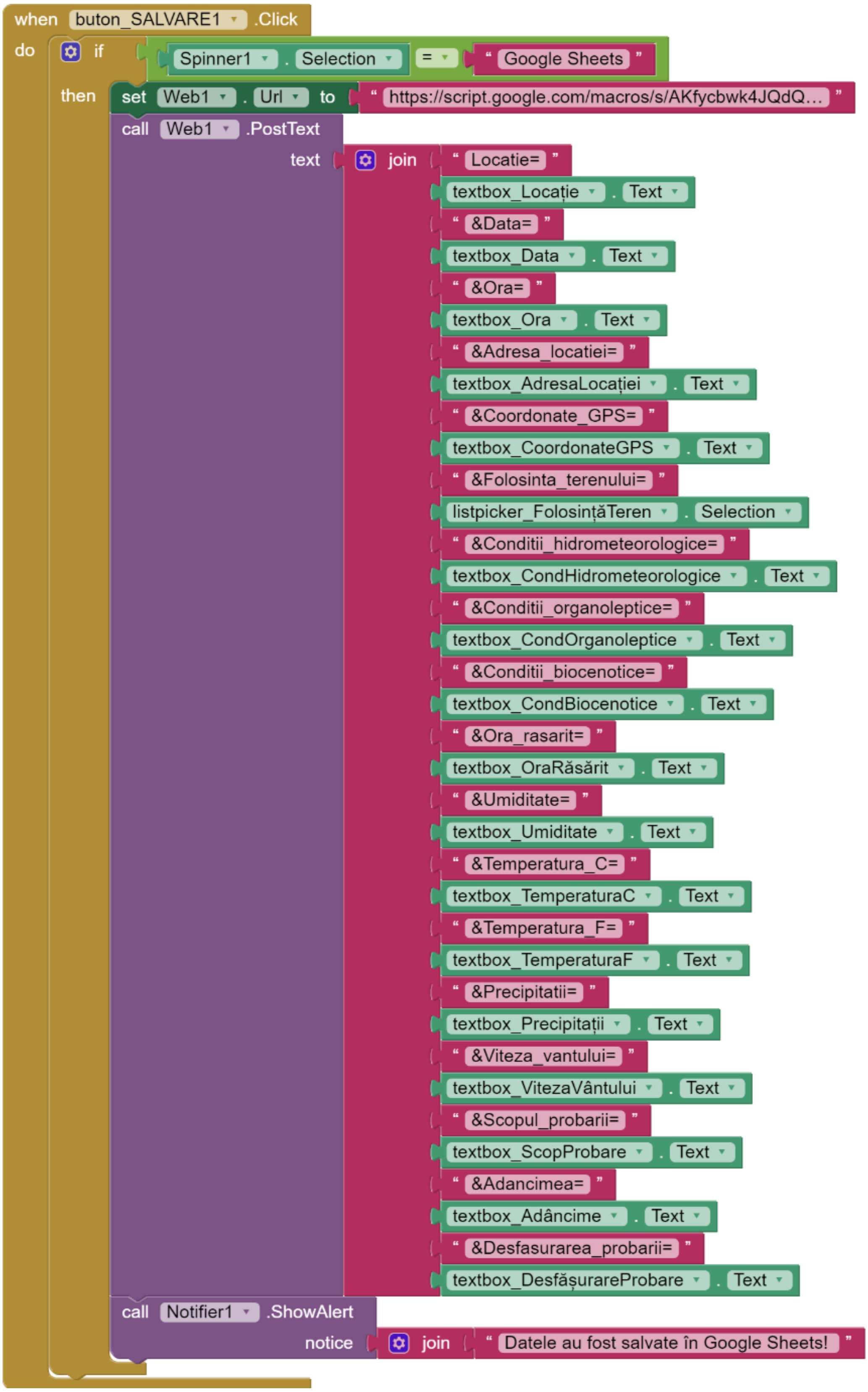

Fig. 4. Source code for saving data in Google Sheets®

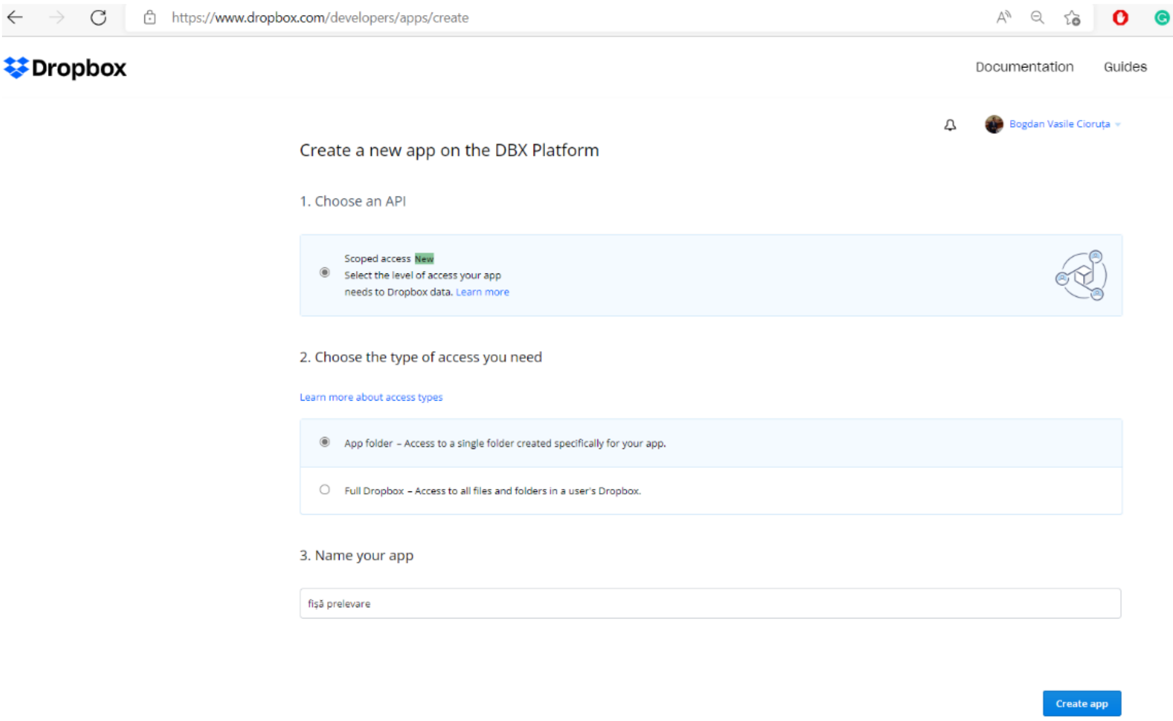

Fig. 5. Step 1 - to set up your DropBox® environment to save data

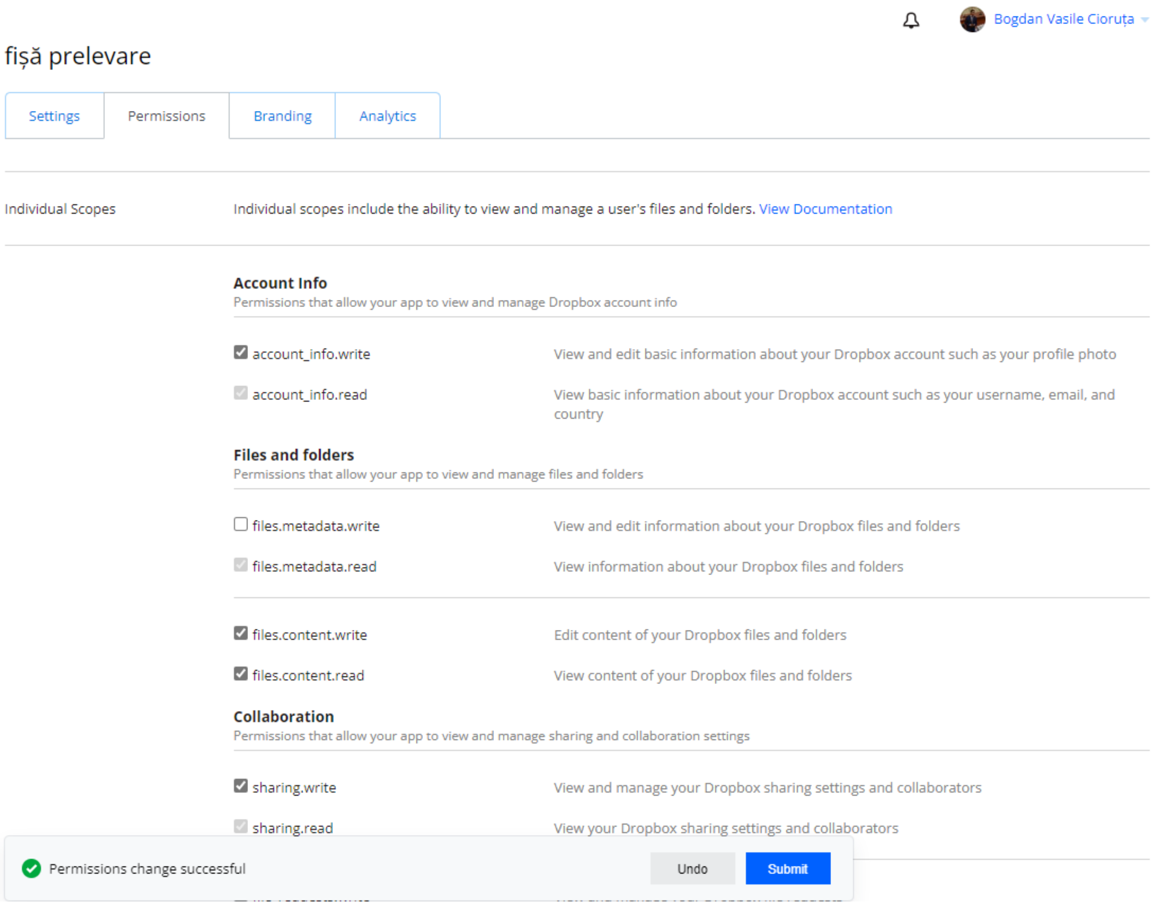

Fig. 6. Step 2 - to set up your DropBox® environment to save data

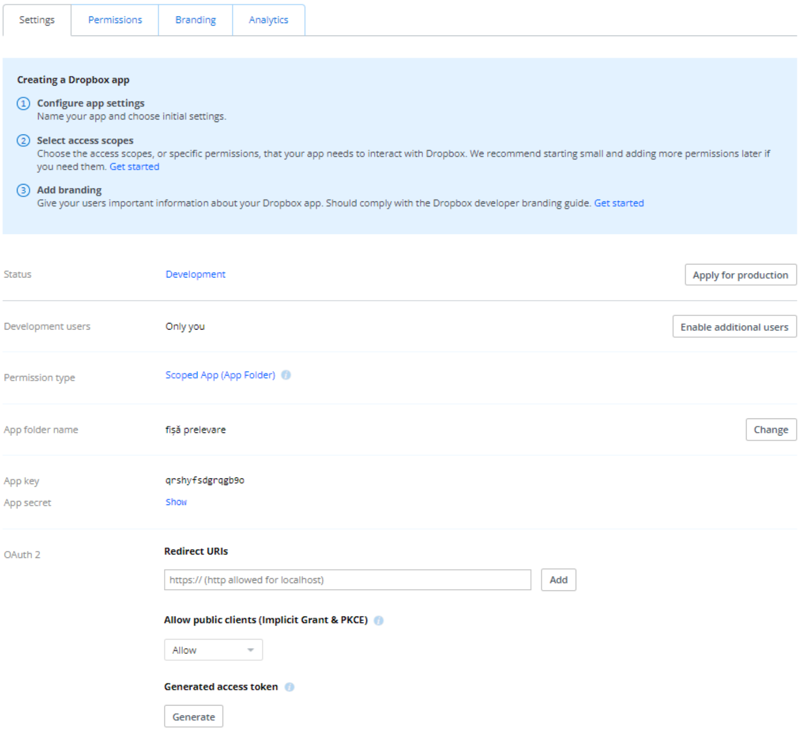

Fig. 7. Step 3 - to set up your DropBox® environment to save data

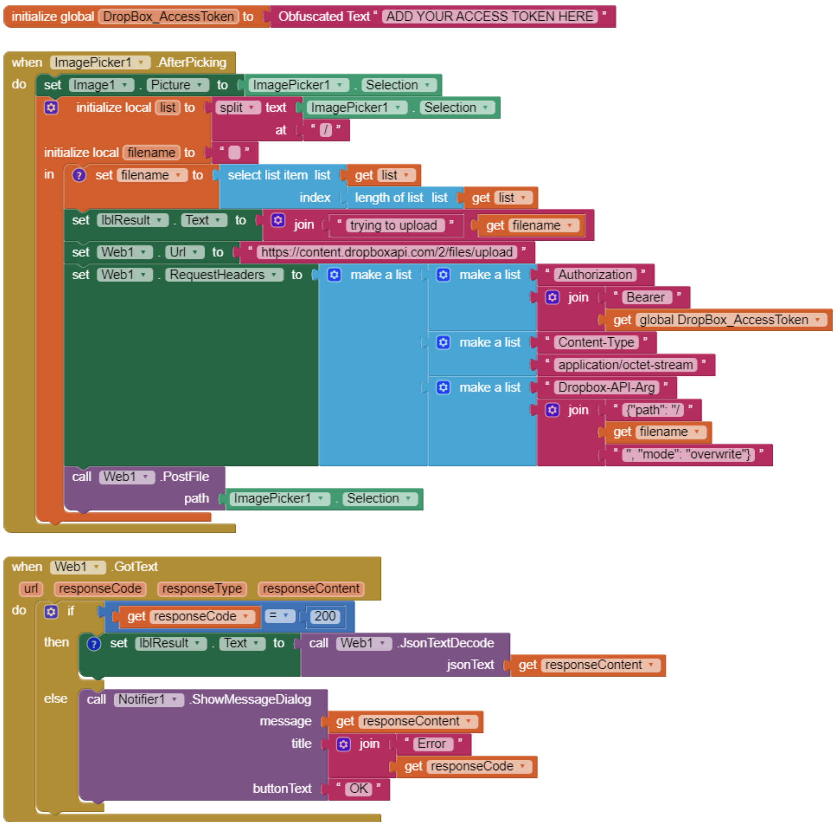

Fig. 8. Accessing the DropBox® environment from within the application to save data

4. CONCLUSION

Saving and/or storing data related to ecopedological indicators - specific to agro-pedological studies, as well as studies related to the monitoring and protection of soil resources - involves several options and work alternatives. From our experience creating an application in MIT App Inventor®, we were able to show that field data (reference for soil monitoring and protection) can be acquired, saved, and/or stored according to the user's needs and the technical specifications configured by the developer of the application. As such, we succeeded in what we set out to do, namely to identify the possibilities of saving/storing the data collected from the field, and we also saw that these options are feasible for implementation within a mobile application for monitoring and protecting resources of soil.

Regarding our application, it currently allows both manual and automatic acquisition of data (via sensors), as well as saving and/or storing them in different formats. Although I presented only part of the possibilities that the ordinary user has for saving/storing data, the application itself includes six work variants, one more efficient than the other (TinyDB®, File®, CloudDB®, Google Sheets®, Firebase®, and DropBox®). From this point of view, we declare ourselves enthusiastic about the possibilities offered by MIT App Inventor® and allow ourselves to recommend others to try to create their own applications for personal use and/or even for research.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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