Software for mobile devices to support the environmental radiological monitoring

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Abstract: Project to develop a software for mobile devices where the samples collected for the purpose of environmental radiological monitoring can be cataloged and analyzed by researchers involved in radioprotection and nuclear safety procedures.

Keywords: radiological monitoring, mobile devices, environmental samples.

1. Introduction
The Institute of Radiation Protection and Dosimetry (IRD/CNEN), following a worldwide trend, develops research projects for the preservation, storage and consultation of environmental radiological data. For this purpose, georeferenced databases were built allowing researchers to systematically catalog environmental radioactivity data on soil, water, air and food that contribute to the safe use of ionizing radiation in the country [5].

In general, technologies used by researchers to store their data (software, external hard drive, cloud backup etc.) may become obsolete or subject to data loss. In order to avoid this situation, database systems, focused on environmental radiological monitoring, have been built in order to store these data systematically and with greater security [5].

The main objectives of this mobile device software project to support environmental radiological monitoring are to catalog the distribution of environmental radioactivity in a given geographic space, to link them to a geographic information system (GIS) and to provide access to collected sample data to researchers via mobile devices [1].

2. Mobile application development methodology
In order to use a methodology that is aligned with the developed project, the following premises must be considered:

• Use geospatial data or information that can be associated with an entity or phenomenon in a geographical location on Earth, translated by geodetic reference system at a given time or period of time;
• Model a georeferenced system capable of working with spatial data, having tools that allow the identification of areas from geographic coordinates and being able to visually project the mapped objects of interest with their respective textual indications, quickly obtaining information necessary for a correct analysis [4];
• Adopt a database connection through an Application Programming Interface (API) allowing the database to be isolated in such a way that it can be easily exchanged without any impact to
the application. This ensures database security through a layer that protects the architecture and the data itself.

We should also consider that there are several mobile application development frameworks. These include the Javascript (Cordova™, Phonegap™, Ionic™, React™), C# (Visual Studio™ with Xamarin plugin) and Java (Android Studio™) based frameworks. These frameworks develop applications for the Android™ and Windows Phone™ systems [6].

The first step, regarding the choice of a more suitable development framework will be in the cost-benefit aspect which will take into account the learning time of the features, development time, integration with the various features of mobile devices (be it smartphone be tablets) and easiness of maintenance of the program.

We opted for mobile application technology that can be used to develop a prototype hybrid feature, which uses Javascript, Typescript, Angular, Phonegap, HTML5 and CSS - all open source and with a support base (development community) very broad [3][2].

An important step in the methodology used was the modeling of the sample data to be collected which resulted in the following definitions:

- Sample identification code;
- Date / time of collection;
- Sample type code (sample compartment and category);
- Geographic localization code;
- Radionuclide code under study;
- Radionuclide concentration values after laboratory analysis;
- Geographic coordinates;
- Images of the collection site.

In another phase of the methodology, the main functions to be developed in the mobile application were defined:

- Login function for access control;
- User account data update function;
- Image capture function;
- Geographic coordinate capture function via GPS;
- Descriptive text input function;
- Location map function of the collected sample;
- Storage function of collected sample data for inclusion in a database.

3. Results achieved by mobile application development

Using the proposed methodology it was possible to program a mobile application to collect georeferenced samples. This application is capable of storing environmental sample data enabling its cataloging and it is an important environmental radiological monitoring management tool.

An Android and Windows Phone-based mobile app is available for researchers working with database storage and classification of environmental samples. It therefore allows data collection and storage via the web, analysis and classification of samples and environmental radiological control.

Figures 1, 2, 3 and 4 show the application screens.
Figure 1: Login Screen

Figure 2: Account Screen

Figure 3: Tasks Screen

Figure 4: Maps Screen
Therefore, the following functionalities were programmed in the mobile application:

- Task schedule: screen with description of tasks (collections) to be performed on the day. Each user has access (via login and password) to their assigned collections. After the collection (and data submission) is completed, the task is deleted from the schedule;
- Address Book: screen with contact list of the data collection group, registered on the server. It is possible to send SMS message, make calls and send email (as long as they are registered);
- Task data: Screen with description of tasks (collections) to be performed on the day. Each user can fill in the data (if none exist) or change if necessary. On the server there will be history of modifications and only users with administrator profile can permanently delete previous data;
- Attached photos: screen with description of the tasks (collections) to be performed on the day. Each user can include photos taken at the collection site and record some information about the photo. Photo quality must be at least 5M Pixels. Photos will be stored in the SD Memory Image area (if space is available), otherwise they will be in internal memory. With each submission of data (and server confirmation) the photos will be removed;
- Collected data storage server: screen with description of all data collection tasks performed. You can filter by name, title and period. Generate detailed or summary report. Mark the collections as finished, incomplete or with errors. These will be flagged to the collecting user for later verification and correction.

4. Conclusion
In this project was developed a mobile software, based on Android and Windows Phone, using hybrid technologies capable of supporting environmental radiological monitoring, allowing data collection and storage via the web, georeferenced data location, analysis and classification of collected samples.

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