CUSTOMISATION OF A FIELD SURVEY DATABASE USING ARCPAD

José Carlos Martínez Llario
Montserrat Bardón Martín
Eloína Coll Aliaga
Jesús Irigoyen Gaztelumendi

Department of Cartographic Engineering, Geodesy and Photogrammetry
Polytechnic University of Valencia

ABSTRACT

An ArcPad application have been customised to let the user collect environmental data in the field with a PPC and create a database directly. The protocol methodology will be obtained from the client, hence it will allow to create a personal implementation and the collection activity will be easy and quick. VBScript code and ADOCE libraries is used for the customisation.

In future modifications of the application can be used the PPC (Pocket Personal Computer) GPS (Global Positioning System) device and obtain the coordinate values by hand or directly from the GPS device. Other possible modification are to improve or change the application structure if there are other different future requirements and also to improve the error messages or prompts that appear during the data collection.

The data obtained with the application is ready to be used in GIS software. It is a personalised and quick way of obtaining it. The PPC is a computer with an operating system that can save and provide all kind of data, hence it is an advantage for the field collection because data can be brought inside it as digital one.

1. INTRODUCTION

A common task in cartography is the field data collection due to the necessity of updating or getting new data. Nowadays is even more important because of the significance of Geographical Information Systems (GIS). These tasks were usually made by hand writing, and sometimes maps are also carried for this purpose.

The problem appears because the data has to be put in databases in the computer to be able to use them in the GIS software and to be able to use these data in the GIS analysis. The problems are that when the data is introduced in the computer, there are many possibilities to take place some errors because the data are written several times, so the error possibilities increase and that the time used in all the process is high.

If the field data collection is implemented by using ArcPad [4], the speed and accuracy are good, therefore it improves the collecting process. The programme is installed in a PDA (Personal Digital Assistant) which is small and light and it is consequently portable and useful. The possibility of capturing GPS data directly in the device and supporting GIS software are other important characteristics.

ArcPad Application Builder software is used to customise the application using VBScript code to enable to collect field data. The advantages of the implementation with ArcPad software in a PPC (Portable personal computer) consist in a
simple, easy and quick field data collection for the user. The data obtained from the collection are saved directly in a database that was created as a suitable storage place to set all the data.

The code used to make the customised application can be applied to other applications in the future, then the time in creating an application would be lower than the first time.

The field data collection carried out by using the application was an ecological survey that had to be done following a methodology which was found out from the client, who described and gave all the necessary information and data to understand it, to enable to search out a customised and adjusted application to save the necessary data. The intention of the field protocol was to be rapid, accurate, repeatable and robust. These field methods included measurement of vegetation, sample point location and general relevant information to collect inside the database.

Management techniques have been followed to obtain the design of the application, providing a planned and organised methodology in the ArcPad customisation [1].

Why when the ArcPad implementation is compared with other methods some advantages are considered? Are all this benefits or possibilities of the PDA and ArcPad applicable to this project?

2. DEFINE USER REQUIREMENTS

In this first phase it has to be defined which the problem is, to be capable of solving it.

The meetings with the client were necessary and a field methodology strategy was also described by the client.

Email was an essential tool to ask questions and receive feedback.

The client provided all the different information needed to obtain the solution for her requirements. She provided a document with all the field survey methodology information (with date of 16th May 2004), explaining with a lot of detail the procedure to execute all the different work in field. A general view of this field methodology is shown in the figure 1. This flow diagram was created by the client and it is included in the mentioned document.

The measurements are the Species composition, density of the vegetation, height, percentage cover and shade produced in the different Sample points.

In every sample point are used four different quadrats (square of 1*1 meter) situated one meter from the sample point each in different positions (North, South, East and West from the Sample point). In some of the measurement cases the cell division (100 cells of 10*10 cm. in one quadrat) is used.

3. METHODS OF DATA COLLECTION

3.1. Description

As the costs increase due to decision taken using incorrect or old data, the tools that facilitate the collection and updating of GIS information are becoming still more essential for managing urban, utility and natural resource databases. Consequently there are new methods of electronic data capture in the field that will allow this aim.

- Hand written: A template with different fields is used to write drawn the values of the data collection. After this the data will be included in digital tables or databases in the office.
- Trimble data collectors: These are GPS receivers that can collect data using dictionary possibility that is created before going to the field and consists in a list of features and attributes that one plans to collect in the field, and it is transferred to the Asset surveyor software. In the field the operator selects a feature from the dictionary list and enters the attributes he wishes to record. It can be predefined features and attributes that can save field time and ensure that multiple operators collect consistent information.
ArcPad customisation: It works directly in shapefile format and allows to use customized data entry forms designed in ArcPad Application Builder to control data flow in the field by adding drop-down menus, radio boxes, required fields, etc. ArcPad also features user-controlled symbology, which can be exported from ArcView or ArcGIS. ArcPad will interface with any GPS unit that outputs the NMEA, TSIP (Trimble Standard Interface Protocol) and Earthmate formats [5].

![Flow Diagram](image)

**Figure 1. Field Survey Methodology Flow Diagram**
3.2. Conclusion

The client requirements are very specific because the data need to be collected and saved in a particular way. Therefore the different methods are not all appropriate in this case.

In the last case the user collects the data in a comfortable way due to the customised application created, because this method reflects the specific pattern of the field collection. Its GPS receiver is not as accurate as in the other methods, therefore the GPS used is an external one.

4. DATASETS

The types of datasets used for the customised application are listed in the table (figure 2).

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Type</th>
<th>Purpose</th>
<th>Projection</th>
<th>Accuracy</th>
<th>Sponsor</th>
<th>Data Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthophoto</td>
<td>Image</td>
<td>Base map</td>
<td>UTM</td>
<td>25 cm.</td>
<td>GetMapping.com</td>
<td>ECW</td>
</tr>
<tr>
<td>Sample points</td>
<td>Shapefile</td>
<td>To visualize measured</td>
<td>UTM</td>
<td>50 cm.</td>
<td>-</td>
<td>Shapefiles</td>
</tr>
<tr>
<td>Database</td>
<td>Database</td>
<td>To store collected field data</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>mdb, cdb</td>
</tr>
</tbody>
</table>

In relation to the accuracy, the image is corrected to Ordnance Survey Landline but precise knowledge of accuracy is unknown with no measurement.

4.1. Image

An orthophoto was used as a background to be able to use it as a reference for measurements and to locate and see the different Sample points that will be measured over the image. The PPC (Pocket Personal Computer) does not work appropriately if it is working with a big amount of data such as images of 30 Mb. Therefore it would be not possible to load a huge image and work fluently in ArcPad software with the different functions and the application created. It is necessary to create a compressed image that can be ECW or MrSID format. The first one was used due to the benefits and possibilities of getting the software. The ER Mapper ECW v2.0 compression is better quality, produces smaller images, is much faster, and has a larger user base compressing imagery [3]. The ECW ArcPad plugin for the PC version is installed, and then this will make the image work properly in the PDA, ArcPad.

4.2. Shapefile

The point shapfile was created with ArcCatalog ESRI software. A point shapfile is used to get the different sample points. Every time data from a Sample point is saved in the database for the user will be possible to include and visualise this point in the shapefile. When the shapefile is modified in the PDA it will not be synchronized with ActiveSync, it has to be copy from the PPC to the PC if the user wants to use it in the PC.
4.3. Database

The database was created in Microsoft Access (in the PC) which will work with format mdb. The database was created trying to make it as small as possible, using few words in the fields, few empty fields, integer fields and few tables. One table has been created having just once every sample point with data about them and other seven tables including measurement of the different quadrats and cells.

When coupled with an ArcPad applet, a VBScript file can open a connection to a Pocket Access database and navigate through the records in a table. This connection will be done to a cdb file that will be got in the PPC due to the synchronization done with a mdb file between the PC and the PPC. If the cdb file has to be also seen, a synchronization has to be done and it will be possible to see with the mdb format in the PC because in this case there is not software install in the PPC. The connection is done with ADOCE [6], that has to be installed in the device, and it contains objects [2] for connecting to and updating a database.

5. ANALYSIS OF THE REQUIREMENTS

The requirements were used to investigate the possible solution that would get the aim of the requirements.

The following section contains detailed diagrams and flow charts indicating the flow of data through the project application. In the application the toolbar created have six buttons but here it is only represented the flow diagram of the click event of the Book button (figure 3), the principal one used to collect the data.

The exit words in the diagrams represent that until the exit button is not clicked, the user will not close this forms where the values are being collected.
6. TESTING AND NECESSARY MODIFICATIONS

A simulation of a data collection was done to test the application to get all the possible errors and actions that can occur when the data are collected in the field. Hence it was checked that all the required data were saved properly as indicated by the client.

This phase determined also the limits of the project, such as the final designs of the ArcPad interfaces, and the different functions that were possible to obtain with the code. Future possible modifications or improvements of the
application can be made.

7. RESULTS AND DISCUSSION

The final application generated a database that was structured in an appropriate and specified way to be able to use it in a GIS software in the future.

The customised ArcPad interfaces were created with an associated VBScript code. Forms and buttons are aesthetically created or chosen and allow the user to interact with the application with the database and without any difficulty. It is a fluent and easy task for the user because the application follows the survey methodology steps and helps one to collect the appropriate data.

All the data in the database were saved correctly and the organisation of it came true because of the structured code employed to obtain this result.

The shapefiles and orthophotos are permitted in ArcPad software therefore the different Sample points collected were showed in a point shapefile on the screen, using as a background the orthophoto of the area where the data had to be collected. The point could be included in the shapefile after saving it in the database hence it would be included in the shapefile and visualize on the screen.

After the data collection the database was synchronised successfully to the PC, getting an mdb format file (Access file). This database contained all the data required by the client with a right organisation to reach the requests of this one.

Finally some different characteristics of this method can be outlined below. These ones make the ArcPad application created so important and useful.

- The application created is a customisation that follows the specific pattern of the field data collection. Therefore the time used in this methodology is shorter than with other methods.
- Field data are encoded directly to a digital database.
- Data are geo-referenced and are visualized in a shapefile, using an orthophoto as a background.
- In the PDA, digital information can be stored, saved and used in the field, instead of carrying papers or maps.
- System can be modified to reflect other patterns of other field data collection methods.
- Validation of the data at time of capturing.

8. CONCLUSION AND RECOMMENDATION

The creation of the application for ArcPad software to collect specific data with an specific field methodology provided an easy technique to get data prepared to be use in GIS software. Being a personalised and quicker way of getting this data than with other methods.

The Access database mdb file was used in this project with ArcPad. This is a commonly used database file so it will be an advantage comparing it with other methods that create ddf files that are able to export to GIS.

The interfaces created to collect the data are an easy and a fluent method to be manage by the user.

This method allowed to use a digital orthophoto, to get a sample point view and an organized database, therefore it improved the collection. It eliminated the complications of carrying a lot of objects to the field that in the case of using the PPC because this objects can be in digital format. The PPC is a computer with an operating system that can save, provide and store different kind of data, hence it is an advantage.

Once the code has been made the first time it can be used in future works to develop different applications, but this second time the application will be obtained quicker.
A new step that can be done to improve the application is the use of the GPS data directly from the GPS device, so that the user has the option of choosing between collect the GPS data typing the coordinate values or automatically from the GPS device. It has not been used because its accuracy is worse than others, hence the decision for this project was using an external GPS device. All the GPS data were introduced manually in the application.

New and improved error messages can be implemented to allow the inexperienced user collect data in a more fluent way.

A best view of the application in ArcPad could be provided for another future task inside this application.

REFERENCES


