USER-FRIENDLY INTERFACE DEVELOPMENT FOR URBAN INFORMATION SYSTEMS USED IN LOCAL GOVERNMENTS

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Local governments in Turkey use different geographical information systems (GIS) and CAD based software. However, most of the software is not designed according to the Turkish law and regulations. Moreover, some degree of expertise is required to use some of these systems. By taking into consideration that these systems will be offered to the use of a wide range of users including experienced and inexperienced, there is a need for user-friendly interfaces to enable the system approachable and manageable by any user. In this study, an easy-to-use and comprehensible interface is developed for ordinary users to enter, update, and retrieve new data, also to produce reports in order to manage an ArcView GIS. The interface is formed using in-house programs developed in ArcView Avenue and Visual Basic. The study area selected for this study is from a part of Tuzla, İstanbul. It is observed that the use of the interface greatly helps the administrators to make sound decisions and thus improve the quality of the services provided. The next step planned in this study is to benefit from the Internet technology by using WapGIS and web tools.

1. INTRODUCTION

In today's complex and dynamic atmosphere municipalities have to increase their financial resources to meet the increasing service demands of urban and rural areas. This forces administrators to find solutions for problems using up-to-date, correct and easily accessible data. According to the data provided by the State Institute of Statistics, there are 3,216 municipalities in Turkey. Population of 2,148 of these municipalities is under 5,000. Compared to whole population, about 78% of the population in Turkey lives in the boundaries of municipalities. Management of such large areas suggests using information technologies.

Currently, there exist few large-scale urban information system application carried out successfully in Turkey. However, it should be noted with the external financial support especially greater city municipalities extended their efforts on this field. Insufficient technological investment, limited support for software, lack of knowledge, lack of specialised personnel, unnecessary bureaucratic procedures, and absence of coordination inside an organisation and among organisations for data sharing and exchange are the factors that negatively affect the transformation to urban information systems. Unfortunately, there are currently no national standards or principals determined for establishment of urban information systems in Turkey.

In this paper two issues are considered as main concerns of the research. The first is to give information about the activities in municipalities and the second is to introduce a new interface built on ArcView GIS software, which is developed in the department of Geodetic and Photogrammetric Engineering in Gebze Institute of Technology.

2. EXISTING ADMINISTRATIVE STATUS IN TURKEY

Administration of municipalities in Turkey is separated into two groups known as “Greater City” and “City” municipalities. Within boundaries of the greater cities, a number of central towns are formed. City and central town municipalities show resemblance in their executive duties, administrative organization and activities. Although administrative organization structure of these municipalities may show minor differences among themselves, they have a formation shown in Figure 1.

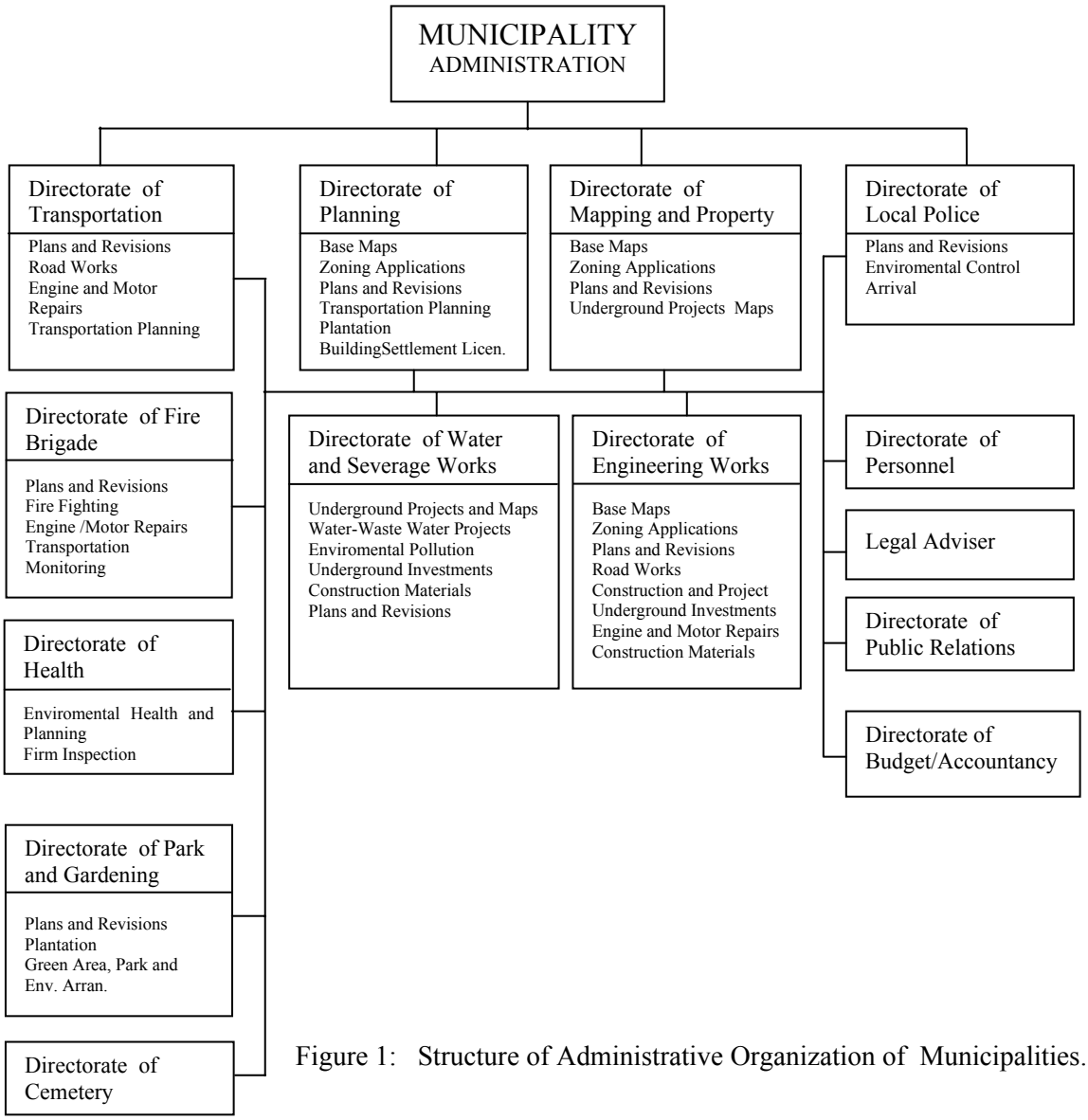


Figure 1: Structure of Administrative Organization of Municipalities.

3. REASONS FOR DEVELOPING INTERFACES

Most of the software used in geographical information system (GIS) studies has foreign origins, as there are not many studies in Turkey using GIS technology. The software is mostly in English and requires high level of expertise. However, it should be pointed out that they are used by a large number of users with different background. Users could be from different age groups and have different education backgrounds. In fact, the firms introducing these software products highlight that

these products are tools or infrastructures to be used to develop new modules and programmes based on the aims and needs of the end users. Therefore, it is very important to develop practical interfaces or programmes in Turkish to apply necessary procedures required by the system for the use of ordinary users, which is very important to develop a successful GIS. In the light of this viewpoint, as one of the most urgent requirements various interfaces have been developed during this study to implement the procedures existing in municipality administration system.

4. CHARACTERISTICS OF ARCVIEW SOFTWARE

ArcView is one of the most popular GIS software used to display and analyse the data as well as making numerous queries as desired by the user. It can be run on both PCs and network computers. ArcView offers many advanced facilities, some of which can be given as follows:

- Database can be viewed in any stage of the process,
- Spatial data can be displayed with different colours and patterns to be selected by the user,
- Any kind of raster images including remotely sensed imagery can be viewed and analysed,
- Vector and raster data can be used together for various analysis purposes,
- Many spatial and logical analyses/queries can be performed,
- Databases can be shown in table format,
- Outputs, analysis results, can be exported in the format of other software,
- Address information can be easily attached to spatial data,

All spatial data are displayed in a window called "*view"*. These windows are highly dynamic in nature. Once a different database is loaded into memory, the view is changed automatically. The view window provides capabilities to edit selected shapes. In a single window graphical information from several layers can be displayed together and every layer has its own legend that can be edited at any time to make the view according to user choices. In addition to a wide range of marks provided with the software, it is also possible to use user-defined marks. In order to add new marks, symbol tables must be formed.

There is a table list showing the attribute table names associated with the layers in view. Any table listed can be called and edited. In these tables every graphical figure is represented in a row and every attribute is shown in a column. Selections made both on the image and on the table are simultaneously displayed; that is, there is an interactive facility for viewing individual shapes or attributes typically in different colours or patterns. Tables can be connected to each other using common fields (i.e. indexing). In such cases, when a record is selected in a table, records in other tables can be highlighted depending on the type of relationship established between the tables. With such a selection that particular figure or attribute on the layers is also displayed in the view.

Logical functions can be formed and the records satisfying these functions can be selected. These logical functions can be formed as scripts in Avenue language, or as using the "Query Builder" facility. The power of ArcView software can be expanded using the programs written in Avenue language, which is object-oriented in nature. New tools can always be added to the menu to conduct new operations. As in all object-oriented programming languages, queries are performed on formed objects. In Avenue instead of calling some ready functions for specific processes, queries are directed to objects and the objects performs the required tasks.

5. INTRODUCTION TO CITYMATIC

CITYMATIC is a package of interface programs, which have been built on top of ArcView, and carries out activities of municipalities given in Table 1. Interface programs in CITYMATIC were

written mostly in Avenue and partially in Visual Basic programming languages. CITYMATIC has been designed in such a way that at no times of the program's run, users are asked to do conventional GIS process or queries. The only thing that users are asked to do is to select one of the GIS processes or query options that appear on the screen while the program is running.

The authors had their inspiration for CITYMATIC from Banking Information Systems running on ATM machines.

Data used for CITYMATIC's design and development belong to a district called "Aydıntepe". Aydıntepe is one of the 10 districts in Tuzla, which is a central district of Istanbul. Data for this project were supplied by Tuzla Municipality at the beginning of this project. Aydıntepe settles over 40ha area in which there are about 1,000 parcels and 950 buildings, some of which are high storey and dockyard buildings. Living population of Aydıntepe is about 12,000.

5.1 The Design of CITYMATIC

CITYMATIC notices the activities of municipalities in ten separate groups. Each group was assigned with particular activities, and almost suits structural organization of municipalities given in Figure 1. In other words, CITYMATIC includes totally 10 modules; each corresponds to one of the 10 groups.

Some features of these modules are summarized as follows.

1. Mapping Works Module: Within this module, mapping activities of Directorate of Mapping and Property are performed. This module consists of 119 interface programs; 26 dialogs and 93 objects created in Avenue. One of them called "Building Application Plan" was created in Visual Basic. Compiled file length of this Visual Basic program is 93,184 bytes. Here and in the rest of this paper the dialogs can be appreciated as sub-modules to each other.
2. Planning Works Module: Within this module, activities of Directorate of Planning are conducted. This module consists of 900 interface programs, including 118 dialogs, and 712 objects.
3. Property and Expropriate Works Module: Within this module, property activities of Directorate of Mapping and Property are done. This module consists of 169 interface programs. 36 of them are dialogs, and 133 of them are objects.
4. Engineering Works Module: Within this module, activities of Directorates of Engineering works and water works are carried out. This module consists of 507 interface programs; 93 dialogs and 414 objects.
5. Public Relations Module: Within this module, public relation activities of municipalities are carried out or organized. This module consists of six sub modules and created in Visual Basic. Compiled file length of this module is 425,984 bytes.
6. Park and Gardening Works Module: Within this module, activities of Directorate of Park and Gardening Works are performed. This module consists of 214 interface programs; 48 dialogs and 166 objects.
7. Accounting Works Module: Not completed yet.
8. Local Police Works Module: Within this module, activities of Directorate of Local Police are conducted. This module consists of 232 interface programs; 49 dialogs and 183 objects.
9. Environment, Scavenging and Health Works Module: Not completed yet.
10. Council Decisions Module: Within this module, council decisions are kept. This module consists of 101 interface programs; 21 dialogs and 80 objects.

As can be seen from these statements, with its current state CITYMATIC consist of 2,242 interface programs. Such a huge number of programmes, of course, bring an additional storage capacity

requirement to ArcView. Before and after CITYMATIC is loaded, 5.7Gb and 8.8Gb file storage capacities of ArcView with the same database are recorded respectively. However, this does not mean that ArcView's run also requires that much storage capacity in RAM and gets slower when CITYMATIC is loaded. On the contrary, ArcView's run requires small space in RAM and is faster when CITYMATIC is loaded. In conventional use of ArcView, all graphical and tabular data together with ArcView as a complete project are stored in RAM. Where as in CITYMATIC, only a number of interface programs and data related to them are stored in RAM.

6. TESTING CITYMATIC ON SAMPLES

When CITYMATIC is started to run, a menu covering 10 modules appears on screen. User should start to process GIS applications by selecting one of the modules. Once a selection is made, a sub-module appears for further process. User should follow instructions or select options to carry on GIS applications. A number of sample screen outputs obtained from selections of menu or module options are given in Figure 6. In this sample, following processing steps are carried out.

- Mapping Works Module is activated from main menu.
- Query option of mapping work module is activated in dialog 1.
- A district name is entered or chosen from the list given in dialog 2.
- Maps or plans to be worked with are chosen from dialog 3.
- Data query option is activated from dialog 4.
- Municipality Parcel Information Query is chosen from dialog 5.
- Screen output option is activated from dialog 6.
- Query results are displayed on screen side by side as graphics and attribute data together with another dialog (Dialog 7). This dialog has info (i) and detailed analysis options additional to screen output options given in Dialog 6.
- For further graphical query, info option that activates cursor is selected. If the cursor is clicked on object appearing on graphics then query results for that object are displayed on screen.
- If a detailed analysis is needed about a geographical object, then detailed analysis option is activated in dialog 8.
- One of the options given in dialog 8 is chosen for detailed analysis.
- Query results are displayed on the screen.

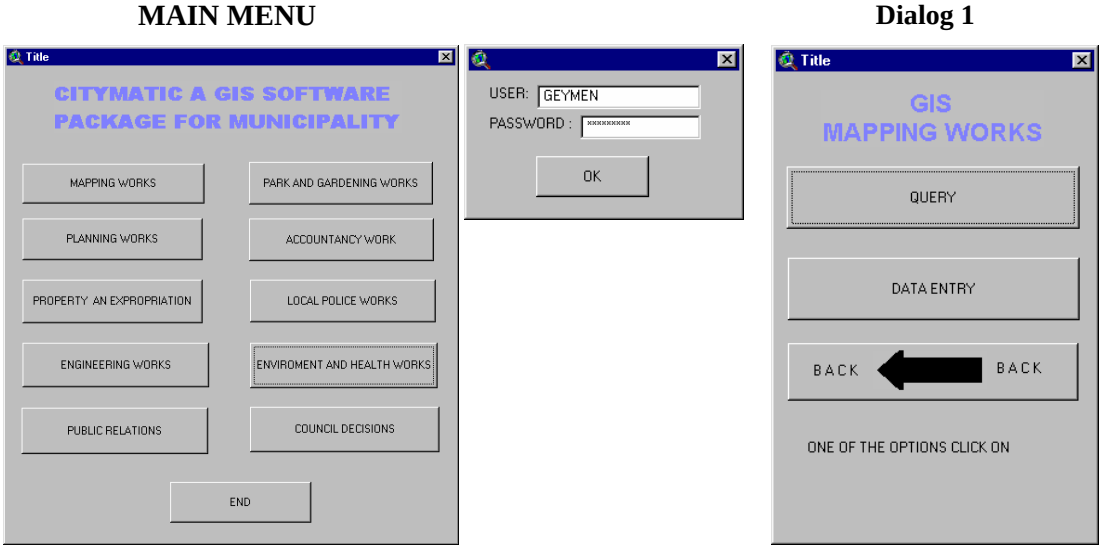
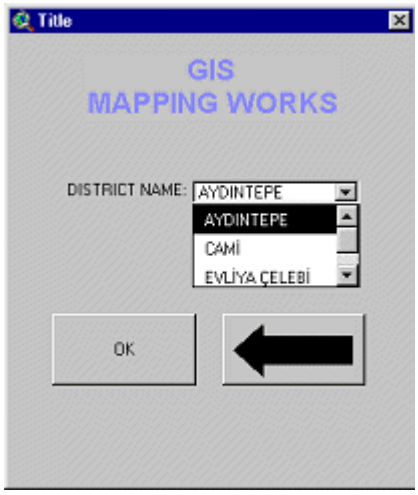
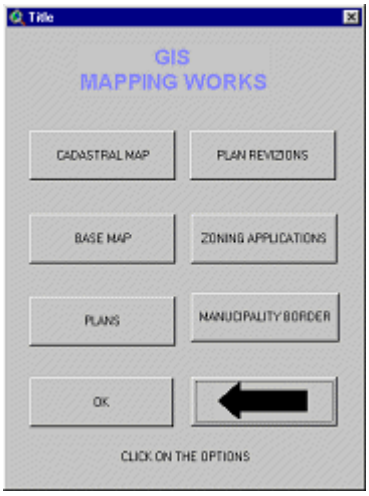


Figure 2: Sample screen outputs of CITYMATIC (continue).

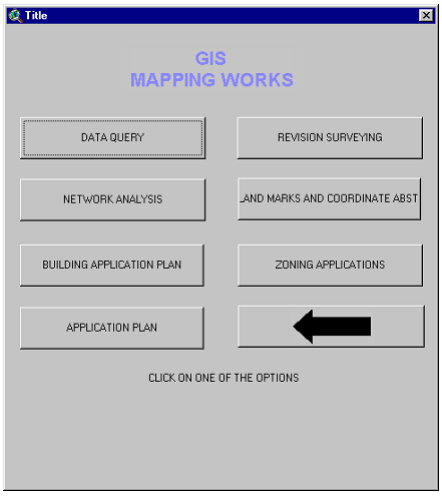
Dialog 2



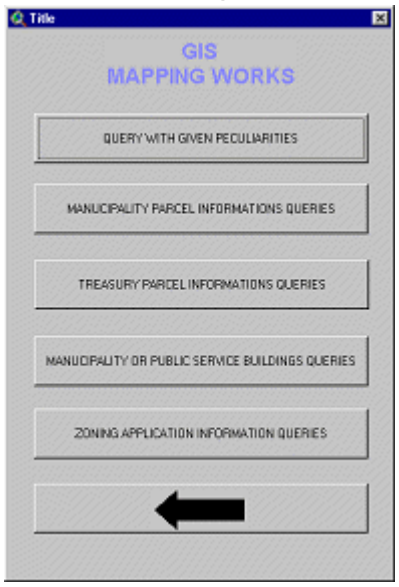
Dialog 3



Dialog 4

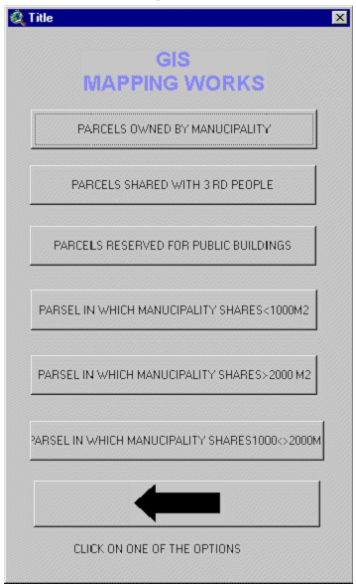


Dialog 5

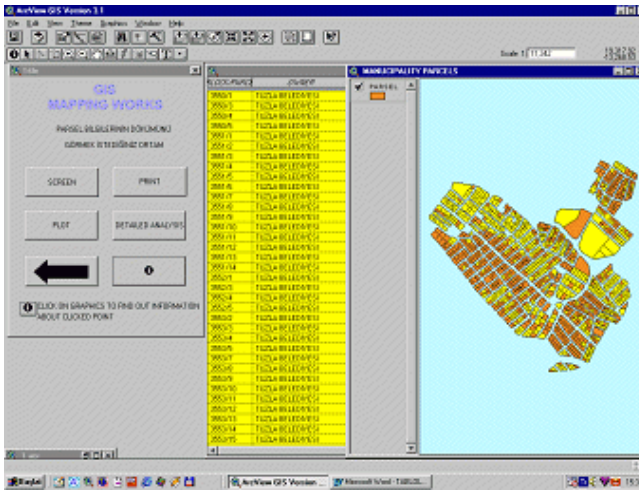


Dialog 6

Dialog 8



Dialog 7.1: View After Screen Option Selected



Dialog 7.2: View After Info Option Selected

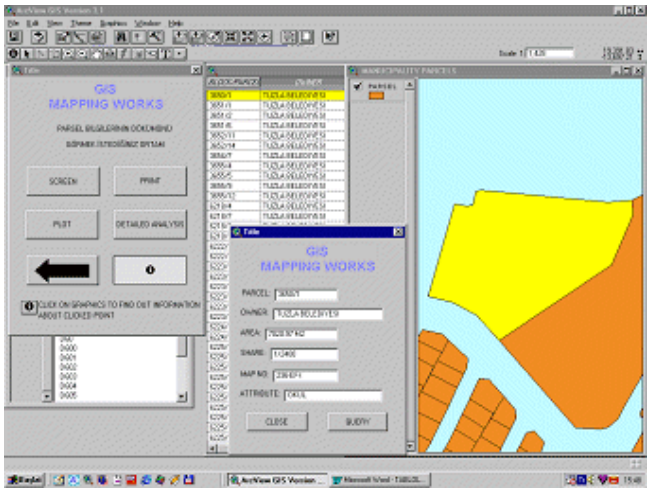


Figure 2: Sample screen outputs of CITYMATIC.

- Many drawing programmes used to create graphical documents are mainly Computer Aided Design (CAD) based. The common feature of these programmes is their interactive nature. Drawings are created by the user controlling the mouse. Editors of the software (e.g. Delphi, Visual Basic and C) provide high level of flexibility and capability to users for designing any kind of graphics on computer screen. It should be drawn attention that there is not any software making drawings with a fully self-controlled way. The main reason for this is the requirements of detailed analysis and query algorithm development and extremely large program codes. As can be seen from Figure 3, the only task that the user must perform with the developed system is to fill in the gaps for parcel and block numbers so as to produce plan application plot.

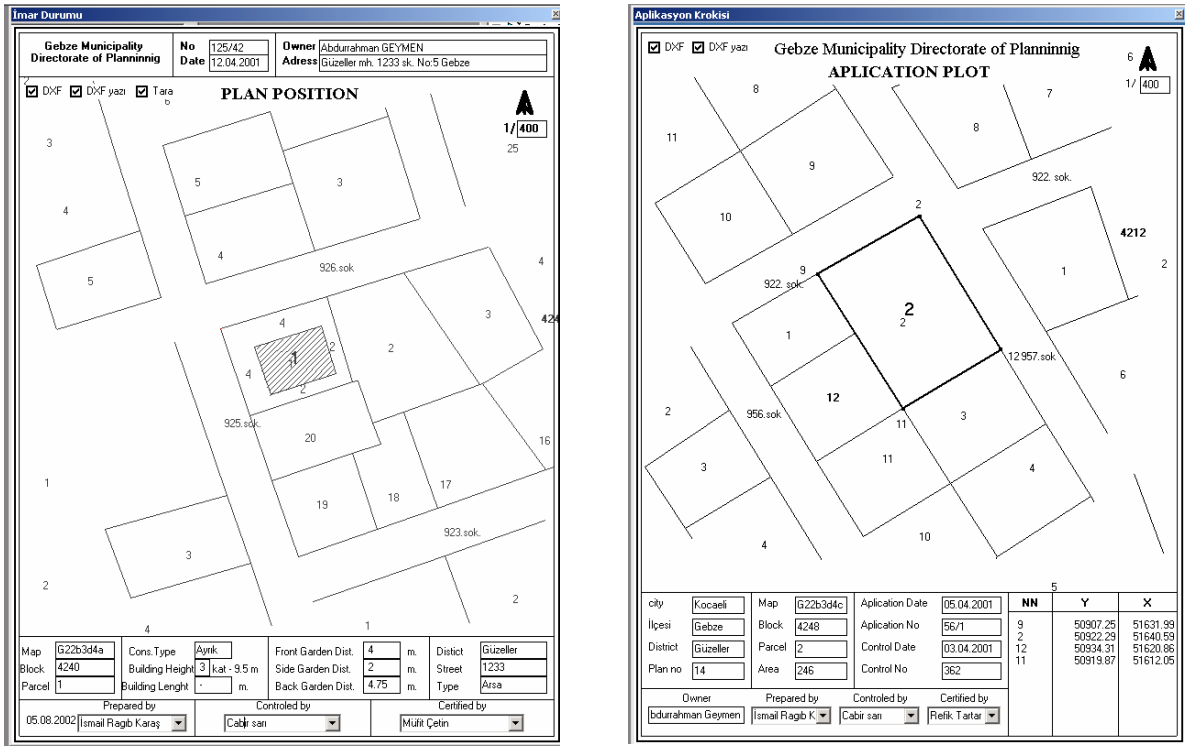


Figure 3: Sample output of the programme for Plan Application Plot.

- In order to produce reliable results after various spatial analysis and queries using a geographical information system, databases must include complete and correct data for that moment of processing, which indicates the importance of data updating. The requirement of data updating usually results from the changes in the location of elements (i.e. point, line and polygon) or in the changes made in the attributes of the elements. As shown in Figure 4, user should only provide some basic information to update spatial data and the attributes attached to them. By making appropriate selections in combo box, all information in tables prepared for the project can be retrieved. Addition of new records or removing an existing record can be also performed without difficulty.

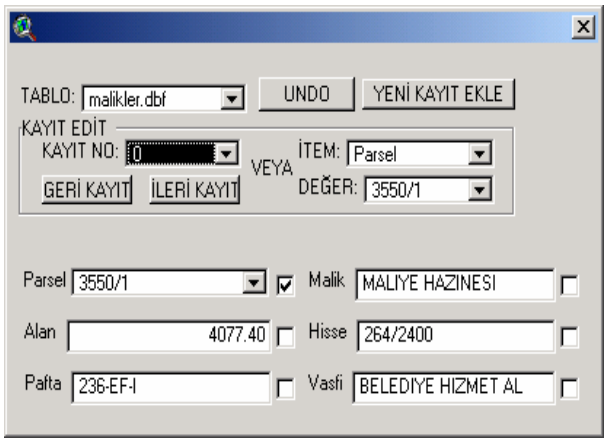


Figure 4: Entering and updating non-graphics data.

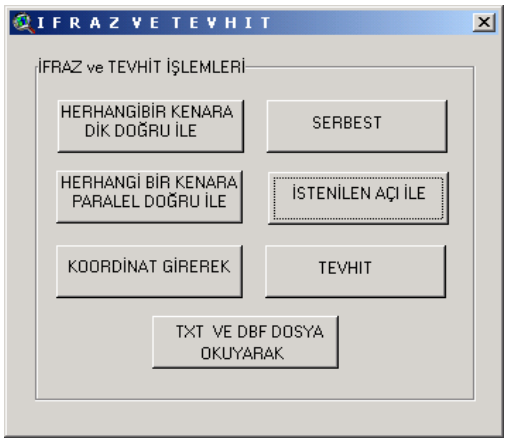


Figure 5: Updating graphical data.

- With the developed interface shown in Figure 5, major processes of purchase, sale, parcel division or separation, parcelisation, combining parcels and extraction for road can be conducted easily and these processes can be also observed on the screen. For instance, the division of the parcel illustrated in Figure 5 under the condition that division line is parallel to one of the edges can be carried out in the exact way shown in Figure 6.

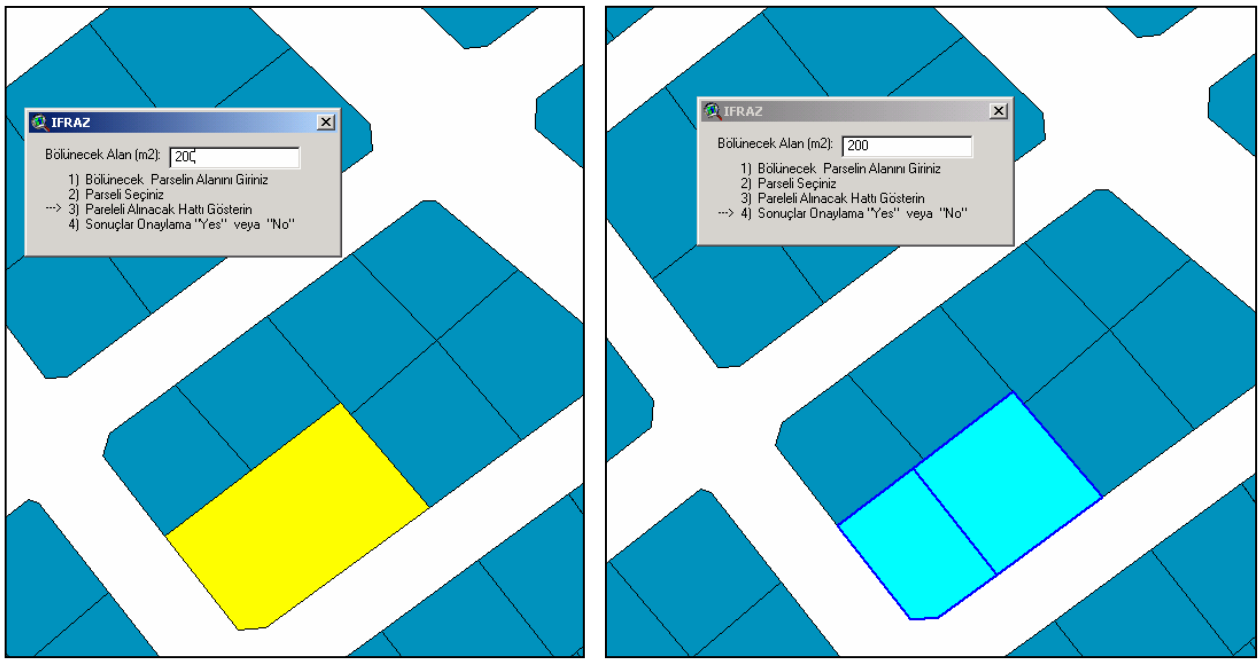


Figure 6: Dividing a parcel into two parts under the condition that the division line is parallel to one of the edges.

7. CONCLUSIONS

In this study, the main objective is to develop application programmes for the benefit of various organisations, specifically municipalities, using spatial information systems. It is thus aimed to make somehow a noteworthy contribution for finding solutions to the transitional problems faced by municipalities in their spatial data processing system. The usage of the developed models and interface will be fully tested when they are employed in several projects.

With the development of similar models and interfaces as performed in this research, governmental organisations will be much more efficient in responding to user needs and applications, the quality of the services will be increased to a greater level, and this will ease the burden of the personnel that do not have to be fully skilled. It is believed that the ill-established system of governmental organisations and the heavy bureaucracy can be overcome using information systems in all departments of these organisations.

8. REFERENCES

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