Dataflow programming using Qt framework

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Abstract — **As an alternative to the expensive operating systems and miscellaneous applications there exist open source communities that afford all their products for free. Moreover anyone can contribute to the development of their software. KDE (K Desktop Environment) is an open source community that has a very interesting and fruitful project called KDE-Edu. The goal of the project is to develop Free Educational Software (GPL – General Public License) within the KDE environment. KGeography, an educational application, was chosen in order to study the possibilities of C++ programming language, open source IDE KDevelop and Qt framework, by adding new useful functionality. Integrating new functions and understanding the code represents an additional purpose of this work.**

Index Terms — **KDE, KGeography, open source, Qt, XML parsing.**

I.   INTRODUCTION

KGeography is a geography learning tool, which allows you to learn about the political divisions of some countries (divisions, capitals of those divisions and their associated flags if there are any). KGeography is distributed under the terms of the GNU General Public License (GPL), Version 2. It was developed by Albert Astals Cid, programmer and designer.[1] Among all the features that the application already has, it was implemented additional functionality consisting of one more field: language. Talking explicitly there was added one more field on the information pop up menu and two more quizzes on the topic. The application was developed on Linux based OS Ubuntu.

II.   QT FRAMEWORK

Qt is a cross-platform application framework that is widely used for developing application software with a graphical user interface (GUI) (in which cases Qt is referred to as a widget toolkit), and also used for developing non-GUI programs such as command-line tools and consoles for servers. Qt is produced by Nokia's Qt Development Frameworks division, which came into being after Nokia's acquisition of the Norwegian company Trolltech, the original producer of Qt. Qt uses standard C++ but makes extensive use of a special code generator (called the *Meta Object Compiler*, or *moc*) together with several macros to enrich the language. Qt is free and open source software. All editions support a wide range of compilers, including the GCC C++ compiler and the Visual Studio suite.[2]

III.   PARSING XML ALGORITHM IN C++

Extensible Markup Language (XML) is a set of rules for encoding documents in machine-readable form. An XML parser means an engine that reads an XML file, such that the data from the file becomes available for the application.

In terms of this project XML parsing appears to be very important, because all information is kept in a set of XML files. Qt framework provides several build-in XML parsers. The most convenient is DOM (Document Object Module). DOM is a high-level interface for dealing with XML elements as objects in a navigable tree structure. DOM loads the XML file into memory, so the maximum file size your application can handle is limited by the amount of available RAM. Here is a short example of the hierarchy of an XML file.[3]

```
<map>
<mapFile>europe.png</mapFile>
  <name>Europe</name>

  <division>
<name>Andorra</name>
<flag>andorra.png</flag>
<capital>Andorra la Vella</capital>
<language>Catalan</language>
<color>
   <red>7</red>
   <green>78</green>
   <blue>5</blue>
</color>
  </division>

  </map>
```

IV.   KGEOGRAPHY AND RESULTS

An important aspect nowadays is definitely the graphical user interface of the application. The window of KGeography consists of the title bar, menu items (File, View, Setting, Help), toolbars (Open map, Zoom, Original size, Automatic zoom, Move), buttons to the left with the title about the current map, explore map, and several buttons to test yourself and of course the main part of the

window with the map displayed. All information on the screen is self-explanatory. Each buttons, toolbar or menu item has a special shortcut with a letter underlined (in order to use press Alt + the underlined letter). User can choose any map from the list that appears in the Open map toolbar.

User has the possibility firstly to learn the divisions and their characteristics by clicking on the map. If this is a country then it will display the title, capital, language and flag of the division in the pop up menu, otherwise it can give you information that this particular place is water or a border. Not for all maps all quizzes be performed. The quizzes based on languages are provided only for continents and the world map, because usually divisions of the country don't have their own particular language apart from the official one.
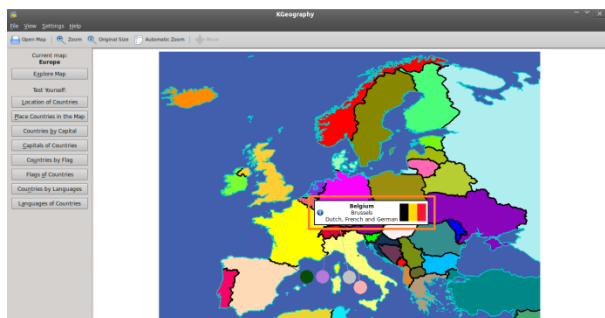

Figure 1. The map of Europe with Belgium selected

All the information described above is presented in the Figure 1. It illustrates the interface of the application with the map of Europe selected.

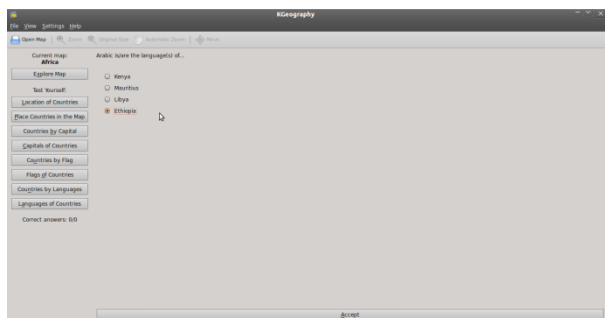The quizzes are called "Countries by languages" and "Languages of countries".

Figure 2. The quiz "Countries by Languages" with the chosen variant Ethiopia

The first quiz is illustrated in Figure 2. In the beginning the user is given the opportunity to choose how many questions he wants. After that the quiz begins. From the list of countries of the continent opened before to explore, a country is given and 4 variants of answers are listed below. Only one variant will be the right answer. User selects one variant and clicks the button below to submit the answer. On the left user can check whether he answered correctly. At the end of the test a menu appears where are written all the questions, user's answers and the correct answers. In that manner user can see the results of his educational process.

The second quiz looks much the same (Figure 3), the only difference is that a language or a set of languages is given and consequently the country where this language is considered official is asked.
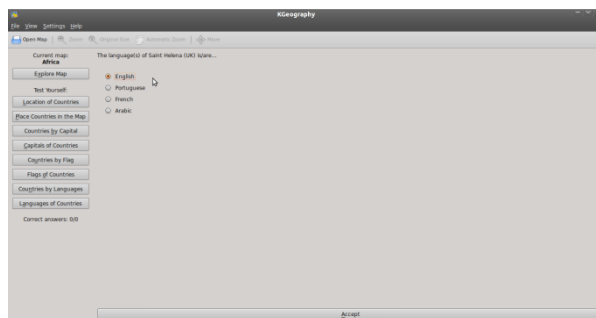

Figure 3. The quiz "Languages of Countries" with the chosen variant English

In case the map of a particular country is opened and the user wants to see its districts, the two buttons for language tests will be unavailable, because there is nothing to learn about official languages of the districts of a country.

V. IMPORTANT REMARKS

While implementing new functionality to an existing open source application one faces several problems. The most relevant appears to be the understanding of the code written by somebody else. KGeography is a big project, it has more than 30 files of code, 148 XML files, 147 maps *.png (world map, continents, districts of countries), 853 flags *.png. The idea is that comments become very helpful. A brief explanation to every file would simplify the team work. Unfortunately this open source project lacks comments. That's why the work on passing through all the files and searching for hierarchy takes a lot of time.

Another issue is the naming of files, classes, objects, variables so that those become self-explanatory. This aspect of developing has a great impact also on understanding the code and makes it simpler and easier to read. Fortunately most times KGeography keeps it clean and simple. Comprehensible code represents an advantage.

VI. CONCLUSION

After all the work is done, we can analyze the results and draw a conclusion. The implementing of new functionality to an existing open source application emphasis the importance of voluntary work and mutual aid. KGeography has a practical purpose, because it promotes education and self-studying. People of different ages have the great opportunity to enlarge their knowledge via interactive learning.

REFERENCES

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