

FREE AND OPEN SOURCE SOFTWARE USED IN AGRICULTURAL EDUCATION FOR SUSTAINABLE ENVIRONMENTAL PROTECTION

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Abstract

Environmental protection sustainability can be achieved only through proper and permanent education. One way to reduce costs in the education of students from agriculture domain, focusing on environmental protection is to replace proprietary hardware and software, used for education, with free or open source hardware and software.

Key words: free software, open source software, sustainable environmental protection.

INTRODUCTION

The concept of sustainability, important in all academic culture is based on environmental protection and social equity for increasing student retention and growing revenue. One of the ways to improve environmental protection sustainability is the use of free or open source hardware and software in students' education. Familiarize themselves with the concepts behind them, they will use after school, in the companies where they work. In the real economy, companies, which are pressed to obtain the best possible financial results, should be helped by specifying tools to comply with these criteria, in favorable economic conditions. Among the tools that fit these conditions are open source.

Open source software (opensource.org, 2015) is computer software that is available in source code form: the source code and certain other rights normally reserved to copyright holders are provided under an open-source license that permits users to study, change, improve and at times also to distribute the software. The top four reasons individuals or organizations choose open-source software are: lower cost, security, no vendor 'lock in', and better quality.

Open source software are distinct from "freeware" or "shareware" where the user does not have access to the original source code. The "free" in "freeware" refers to the price of the software, which is typically proprietary and distributed without source code. Free software differs from proprietary software, which prevents users from studying, changing and sharing the software. Proprietary software use restrictive software licenses or EULAs (End-user license agreement) and usually do not provide access to the source code.

MATERIAL AND METHOD

The first stage consisted of searching on the Internet open source software's and the second phase to test them. If the software had an online version published, that version was tested. Otherwise, the program was installed on a PC with Intel i5 processor on Z97X platform, 8 GB RAM and Win 7 Ultimate on 64 bit operating system.

Educational technology is the effective use of technological tools in learning. One of this technological tools is open source software.

You have to start with an open source software used in 222 countries by 80 million students, whose version 3.0 will be presented in the coming days: MOODLE (modular object-oriented dynamic learning environment). Moodle is a software learning management system, used for blended learning, distance education, flipped classroom and other e-learning projects in schools, universities, workplaces and other sectors (moodle.net/stats/, 2015).

Among the open source software's that can be used in educational domain, remember:

- Website@School is a websites content management system, specially designed to build, manage and maintain the websites of schools, small and big (websiteatschool.eu, 2015);
- Pioneer University / College System is used to automatic learning institutions business processes ranging from admission (manual and online) to enrollment, to registration, to finance, to online payment and student online-registration (sourceforge.net/projects/pums/files/pums, 2015);
- UberStudent is a Linux distribution for learning, doing and teaching academic at the higher education and advanced secondary levels (uberstudent.com, 2015);
- Quandary is an application for creating Web-based Action Mazes (a kind of interactive case-study) (halfbakedsoftware.com/quandary.php, 2015);
- Reload is a project funded under the JISC Exchange for Learning Programme (X4L) (www.reload.ac.uk, 2015). The project focuses on the development of tools that are based on emerging learning technology interoperability specifications.

One of the main elements in the environment protection is concern for water. Among the open source software's that can be used in the water stewardship domain, most important are:

- EPANET models the hydraulic and water quality behavior of water distribution piping systems, which is posted on United States Environmental Protection Agency site (www.epa.gov/nrmrl/wswrd/dw/epanet.html, 2015);
- PCRaster is a collection of tools and software libraries tailored to the

construction of spatio-temporal environmental models. Application domains are amongst others hydrology, ecology or land use change (sourceforge.net/projects/pcraster, 2015);

- HYPE (the hydrological predictions for the environment model) is a dynamic, semi-distributed, process-based, integrated catchment model. It uses well-known hydrological and nutrient transport concepts and can be applied for both small and large scale assessments of water resources and status (sourceforge.net/projects/hype, 2015).

For the material health and material reutilization domain some of the open source software's that can be used are:

- Libre Mechanics it's an Open Knowledge project created to offer a useful platform of information related with the development and research of Mechanical Engineering themes and similar fields (sourceforge.net/projects/libremechanics, 2015);

- Labmansys is a LABoratory information MANagement SYStem designed for biotechnology labs and aimed to globally manage both of the material resources and different manipulation protocols being used (sourceforge.net/projects/labmansys, 2015).

One of the programs for environmental data analysis is ProUCL 5.0. This (www2.epa.gov/land-research/proucl-software, 2015) is a comprehensive statistical software package with statistical methods and graphical tools to address many environmental sampling and statistical issues.

The open source software's that can be used in the renewable energy domain are:

- SimSEE is a tool for optimal dispatch of hydrothermal electrical power systems. Can simulate de operation of petroleum fired plants, wind and solar farms, country interconnections and hydro plants with reservoirs (sourceforge.net/projects/simsee, 2015);

- SolarNetwork is a set of tools to collect and analyses information and also to control and influence behavior of a distributed network of nodes where energy is being generated and / or consumed (sourceforge.net/projects/solarnetwork, 2015);

- EnergyPlus is an energy analysis and thermal load simulation program which is posted on United States Office of Energy Efficiency & Renewable Energy site (apps1.eere.energy.gov/buildings/energyplus, 2015).

- Solar Farm Calculator models the technical and financial details of a photovoltaic farm and calculates the expected output energy at the grid entry point (sourceforge.net/projects/solar-farm-calculator, 2015).

RESULTS AND DISCUSSIONS

Open source software has emerged as the driving force of education

and technology innovation. Real cost of the open source software's can be estimated by Total Cost of Ownership which include training and maintenance costs (Shaikh M, 2011).

A minimum SWOT analysis of open source software identifies:

- Strengths: low cost of acquisition compared with commercial systems, versatility and adaptability, easy and cheap maintenance, good security;
- Weaknesses: not an easy task to install the system, medium engineering knowledge is needed to set-up and debug, indirect costs with customization;
- Opportunities: the adoption of open standards opens doors when new, compatible services become available;
- Threats: the lack of vital documentation may bring unexpected damages,

CONCLUSIONS

European Commission policy makers recognize that open source reduces their ICT costs, makes possible the modernization of government services and will strengthen European ICT service providers. The renewed strategy puts a special emphasis on procurement, contribution to open source software projects and providing more of the software developed within the Commission as open source (ec.europa.eu/dgs/informatics/oss_tech/index_en.htm, 2015).

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