MULTIMEDIA APPLICATION FOR THE CONSERVATION OF ENERGY IN A WORKING ENVIRONMENT THROUGH THE USE OF A RENEWABLE ENERGY SOURCES (RES) HYBRID SYSTEM

Ioannis Karras, **Dimitrios Zevgolis**, *Hellenic Open University, Dept. of Graphical Arts and Multimedia, Patra, Greece*

Harry D. Kambezidis, *National Observatory of Athens, Institute of Environmental Research and Sustainable Development, Atmospheric Research Team, Athens, Greece*

ABSTRACT

This paper focuses on the development and implementation of a Multi Media (MM)) application for the energy saving in a working place through the use of photovoltaic elements, a wind generator and a geothermal heat exchanger. In particular, the mentioned RES, with the MM application having those special features that safeguard its proper function are illustrated and included in the present application.
The study reveals:

- The importance of RES.
- The appropriateness of the MM presentation for informing potential users.
- The appropriateness of the MM application in physics classes related to RES resources and RES exploitation.

1. INTRODUCTION

In the recent years, the energy crisis has become more and more evident in every aspect of our daily life, affecting it in a significant way. The Renewable Energy Sources (RES) seem to solve the problem as gradually expanding more and more in the field of energy. Types of RES are wind energy, solar energy, geothermy, and some others. At the same time the progress of the technology and specifically of the computers have contributed to new inventions such as the electronic design and the visualization of information. Nowadays, the computer has become the "mirror" of human mind and through its multiple applications has conduced to the information and knowledge of its users. (Avouris 2000).

2. CASE STUDY - MM APPLICATION

The creation of a simple or an interactive MM system can improve the presentation of a project and, in the case of the conservation of energy, it can highlight the numerous possibilities of the RES and help non-expert users be acquainted with them. The use of text, graphics, images, animations, video, and sound provides a more impressive and complete way of presentation. (Terzidis 2004, Papakostantinou 2003)

This paper focuses on the development and implementation of an MM application for the conservation of energy in the interior of an office through the use of photovoltaic (PV) panels, a wind generator and a geothermal heat exchanger. In particular, the specific RES system, the MM applications with all the special features that safeguard their proper function are illustrated and then included in the present application. The aim is to highlight the importance and possibilities of the RES in a specific building and also help prospective non-expert users become more acquainted with those.

The analysis for the installation of the specific RES system was made by taking into account all structural and technical features of the office in order to achieve the least expensive and most efficient solution. This was done by considering the incident solar radiation and wind speed and direction in the area of the town of Trikala in Thessaly, central Greece, and also through market research for appropriate PV panels, the wind generators and the geothermal heat exchanger. The data as well as the results that came to light were thoroughly studied and examined, thus, drawing useful conclusions.

The MM application in question is an autonomous utility that can be stored in a Compact Disc, which uses a computer not connected to the internet, with the Flash program installed. It contains three forms of RES; solar energy, wind energy and geothermal heat. Their basic elements and characteristics are all presented. On the ground plan of the office building, however, one can see

all the electrical devices that exist. With this application, each user, irrespective of his knowledge on MM or computer familiarization, will be able to bring the various appliances into operation, check on the power produced from the RES as well as its benefit. One can also be able to choose the source of power either from the wind generator or the PV panels.

THE OFFICE AREA CONSUMPTION		
	No	Wh
Electrical lamp 20W	20	400
Computer 330W	6	1980
Air Conditioning 1.3kW	11	14300
Projector 220 W	1	220
TV 175W	1	175
Laptop 44W	1	44
Coffee-pot 1000 W	1	1000
Hot plate 500W	1	500
Microwave oven 800W	1	800
Sum		19419

Table 1: Electrical devices and consumptions

NOMINAL POWER		
Month	Photovoltaic Daily Power (kWp)	Wind Generator Daily Power (kWh)
J	503,49	145,01
F	421,17	121,29
M	565,73	195,51
A	576,47	215,83
M	531,29	229,51
J	574,72	248,27
J	511,20	220,84
A	540,70	218,01
S	513,76	192,35
O	341,97	108,33
N	308,80	88,93
D	355,49	92,14

Table 2: Photovoltaic and Wind Generator Power

By moving the cursor on each device, the user can get information about it. This interaction can also be traced in the initial page where the contributions of each form of RES in the interior of the building become obvious. (ACM 1992, HCI 2000, Rosson and Carroll 2002)
Geothermal heat is an example where one can see the water motion from the ambient environment into the building and vice versa. Beside the possibility to just click on each item, he can also open or close the windows and doors of the offices. Lastly, each user can adjust the RES energy production manually or by clicking on a preferred month.

Figure 1: The water motion in geothermal heat

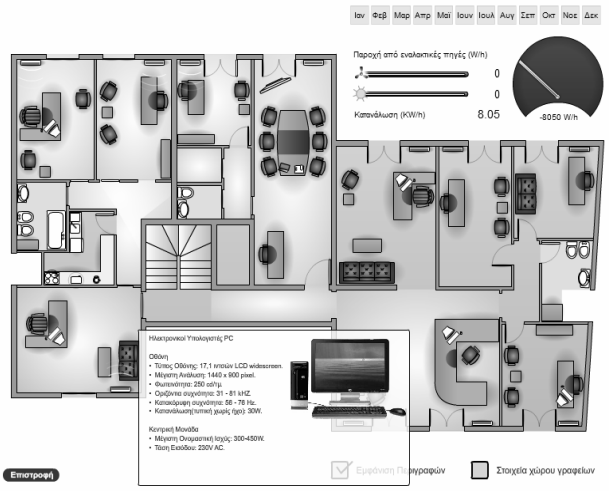

Figure 2: Computer Information

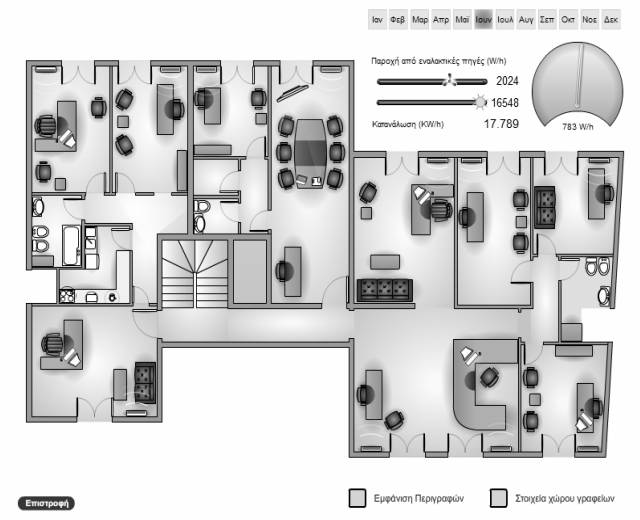

Figure 3: Production of energy from the RES in June

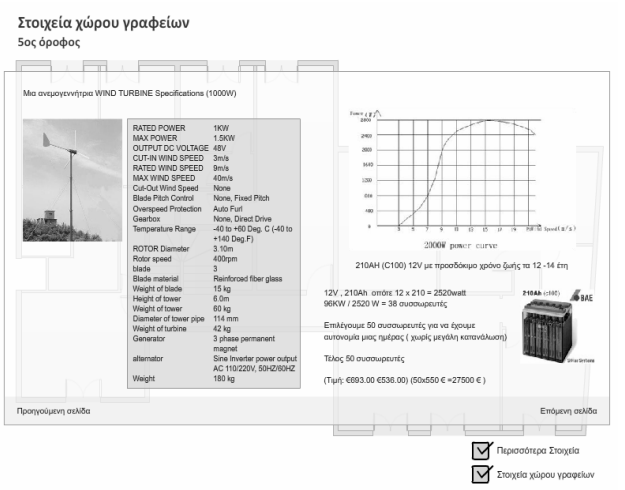

Figure 4: Wind Generator and battery Information

The design and implementation of this MM application was realized through the use of an Adobe Flash CS4 Professional with the help of an Adobe Illustrator CS4 and an Adobe Photoshop CS4. The Adobe Flash CS4 Professional software was the main written context where attractive interactive operations were created. The object-based animation tool, that is part of the software, transferred the project to Flash making it easy to be used by both experienced and non-expert users. The fact that there was a dynamic design kit extending the creative possibilities as an incorporation of the Flash with other Adobe softwares offered a rich ground for productive work. Finally by bringing them all together in the Flash, a more vigorous presentation was achieved, regardless of the operational platform or the device.

In particular, for the implementation of the application new methods of presenting information were used, which do not require the learning of specific modes of projection other than simple mouse clicks on every link or image. The screens connection is hierarchical so that users do not get confused and lose their way or their final goal. (Dimitriadis et al 2004)

3. CONCLUSIONS

According to the specifications set by the users' different demands during the design phase of the interface over-emphasis was placed on simplicity and system effectiveness. (Akoumianakis 2006) Hence, both experienced and inexperienced users can follow an easy course to complete their task and can either move forward or return to the start. This was achieved by the Flash program. The evaluation stage showed that the setup of the application does not allow for a margin of error or false estimations. (Brown 1988)

An issue, however, that came to light as regards the interlink of the application to the internet so that advanced users can be connected to data bases and get updated information for new products for RES. This means that the installation of connections is a prerequisite for the improvement of the application.

Another issue had to do with the predictability of the screens sequence, which despite being judged satisfactory enough, they would better be further investigated. So, in order for the predictability to be improved, information about ''what to do next'' has to be delivered to users. However, the addition of more facts might render the interaction tangly.

There is a concern over the style of interaction; in other words, to examine whether the problems are caused due to many successive steps and if they can be overcome. So perhaps there has to be further investigation and comparative study with other styles in order to discover which one is more suitable for non-expert users.

Other important issues that were brought into discussion were both the enhancement of the interface with more informative elements and terminology. Even though the latter was highly graded, nevertheless, it has to be improved. This is all a matter of careful redesigning.

Everything about the creation of an MM application for the teaching of physics in the RES field is a useful tool because users can have a visual picture of the hybrid system's operation and they can also intervene into it retroactively; in other words, they can change the system's data each time.

REFERENCES

Greek Literature
Avouris, N. (2000). Eisagogi stin Epikoinonia Anthropou - Ypologisti. Athens: Diavlos
Αβούρης Ν. (2000) Εισαγωγή στην Επικοινωνία Ανθρώπου – Υπολογιστή. Αθήνα. Δίαυλος
Akoumianakis, D. (2006) : Sistimata diaxirisis critikis, epixirimaton kai sillogikou mnimonikou. Kefalaio ston tomo ton Avouri, N., Karagiannidi x., Komi B., Eisagogi sti sinergasia ipostirizomeni apo ipologisti – Sistimata kai Montela Sinergasias gia Ergasia, Mathisi, Koinotites Practikis kai Oikodomisi Gnosis, Ekdosis Kleidarithmos.
Ακουμιανάκης Δ. (2006): Συστήματα διάχυτης κριτικής επιχειρημάτων και συλλογικού μνημονικού. Κεφάλαιο στον τόμο του Αβούρη Ν. , Καραγιαννίδη Χ. , Κόμη Β. , Εισαγωγή στη συνεργασία υποστηριζόμενη από υπολογιστή – Συστήματα και Μοντέλα Συνεργασίας για Εργασία, Μάθηση, Κοινότητες Πρακτικής και Οικοδόμησης Γνώσης, Εκδώσεις Κλειδάριθμος.
K. Terzidis, (2004) «Pliroforiki - Polimesa - Hlektronikoi Ypologistes stis Grafikes Texnes », EAP.
Κ. Τερζήδης, (2004) «Πληροφορική-Πολυμέσα-Ηλεκτρονικοί Υπολογιστές στις Γραφικές Τέχνες» , ΕΑΠ
G. Papakostantinou, (2003) «Pliroforiki - Polimesa - Paragogi kai Sxediasmos polimeson», EAP.
Γ. Παπακωσταντίνου, (2003) «Πληροφορική-Πολυμέσα-Παραγωγή και Σχεδιασμός Πολυμέσων» , ΕΑΠ
Dimitriadis S.N., Pomportis A.S., Triantafillou E.G., (2004) «Texnologia Polimeson, theoria kai praxi», Ekdosis Tziola.
Δημητριάδης Σ.Ν., Πομπόρτσης Α.Σ. , Τριανταφύλλου Ε.Γ.,(2004) «Τεχνολογία Πολυμέσων, Θεωρία και Πράξη» , Εκδώσεις Τζιόλα.
Polotis P. (1994). Ypermesa, Yperkeimena kai Polimesa, Ekd. Neon Texnologion Athens
Πολίτης Π. (1994). Υπερμέσα, Υπερκείμενα και Πολυμέσα. Εκδώσεις Νέων Τεχνολογιών, Αθήνα

English Literature
Abowd G. Beale R. (1991) «Users, Systems and Interfaces: A Unifying Framework for Interaction», D. Diaper - N. Hammond, editors, HC/ '91: People and Computers, VI, ρρ. 73-87, Cambridge University Press, Cambridge.
ACM (1992) ACM SIGCHI Curricula for Human-Computer Interaction.
Available on line http://www.acm.org/sigchi/cdg/index.html.
Brown C. M. (1988) Human-Computer Interface Design Guidelines, Ablex, Norwood, NJ.
HCI-Human Computer Interaction, (2000) «Mental Models and Design», available at http://istsvr03.unomaha.edu/hci/mentalmodels.html .
Rosson M. B., Carroll J. M.(2002) Scenario-Based Design. In The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications, pp 1032-1050