INTERACTIVE MULTIMEDIA TOOLS AND APPLICATIONS IN VOCATIONAL EDUCATION IN WIND ENERGY TECHNOLOGIES

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Abstract: The current paper presents a specialized set of internet based interactive tools. The tools are implemented in an e-learning platform developed for the needs of the project TrainWind. The means to accomplish interactivity through the use of different computer design technologies as flash animations, three dimensional visualization software and vector graphics are discussed. The capability of these technologies to provide a wide range of tools and approaches to design specific for the course graphical products with better user acceptance and opportunities for user control and participation are presented. As a concussion a presentation of the contribution to better efficiency of the educational process tough the proposed interactivities is made.
Keywords: Wind energy technologies, interactive tools, internet media

I. INTRODUCTION

Conventional electrical energy generation has in many ways proven to be a leading cause for fuel poverty and ecologic degradation. An alternative on conventional electric generation based on fossil fuels or nuclear fission are the so called renewable energy sources.

Renewable energy sources are based on various power inputs that can be renewed over reasonable amount of time. One of the most popular renewable energy sources include solar and wind energy.

Wind energy is converted into electrical energy by the means of devices called wind energy generators. Wind energy is a popular in the European Union (EU) as well as in Bulgaria.

Currently more than 100GWs of wind energy have been installed across EU and more than 680MWs are installed in Bulgaria. Furthermore future plans consider installation of 150MWs of new power across the EU until 2030 and 800MWs of power across Bulgaria until 2030. [1]

This significant amount of turbines requires numerous work hours in maintenance and installation. Thus wind turbines have to be supported by appropriate workforce. Studies show that 15 workers are required for operation and maintaining each MW of installed wind energy power. Workers involved in wind energy generation are required to have a broad knowledge in electrics, mechanics and hydraulics. At the same time experience in work at highs and safety specifics are needed. This puts high demands on the wind turbine specific expertise that workers should acquire before starting actual work on wind turbines. [2] [3]

As renewable energy sources are quite new concept, presently there are few education programs in high schools that train workers for maintenance and operation of wind turbines. As example up-to date information for Bulgaria shows that currently there are 10 high school programs for training in wind energy technologies and 11 university one. [3] Furthermore the wind turbine technician has to complete a number of training courses in order to obtain the certificates required to work on a wind turbine.

In this scope a specialized vocational education training course has been developed. The TrainWIND course combines the efforts of several European countries including: Bulgaria represented by the Technical University of Varna, ABC Wind Farm and the Association of producers of ecologic energy; Belgium represented by Syntra West; Spain represented by CENIFER; and the UK represented by the Embrace Corporation. The work on the course is funded by the Human Resource Development center - program Leonardo de Vinci (LLP)

The main purpose of the TrainWIND course is to offer an electronic based training platform that can prepare future wind turbine workers. The platform provides basic and specific knowledge on: wind energy fundamentals, wind turbine fundamentals, wind turbine maintenance, wind turbine safety. The educational materials provided aim at people that have experience or education for technicians and seek jobs in the sector but have no prior knowledge on wind turbines. This proves advantages for both employers and employees as the following courses that the worker has to attend, in order to obtain required certificates, will be easy to master due to initial fundamental knowledge.

As an online training course the TrainWIND faces many challenges, since most existing courses, as well as the source material are not developed as online courses. Not prior online resources for education in wind energy were

available when the course was developed. This led the team working on the TrainWIND course to seeking new techniques for representing and visualizing the education material. Many of the multimedia on the source material was replaced by innovative interactive tools.

The current paper aims at presenting those materials and point their advantages in the scope of the above introduced importance of wind energy and consequently education and training in wind energy.

II. MAIN CONSIDERATION ON CONVERTING INTERACTIVE MULTIMEDIA

By analyzing the content of the initial source course material [4] and the specifics of its multimedia content several direction of improvements trough interactive content were considered. Those included:

- *Reducing the window space that each of the multimedia materials takes.*

Since the course is online - best reading and browsing through the materials is obtained by concentrating the education material of one sub-section into one computer screen - scrolling should be avoided since it distracts the reader. This however proves difficult because of the size of and number of formulas, diagrams, pictures and their description - contained in each section.

- *Adding user interaction in order to improve the learning process.*

A major advantage for online education materials is the possibility of adding user interaction. This allows - learning trough visual demonstration and experience. Such materials however are not widely available and should be developed for the specific case.

- *Developing additional interactive tools for visualizing and describing material that is otherwise difficult to explain.*

Wind turbine specifics contain a lot of effects and processes that can be hard to explain and be thought outside the scientific and engineering language. The TrainWIND on the other hand is course aimed at vocational training of people with high education. In order to present those materials special animated movies and user interactions can be developed.

- *Improving the overall quality of the course and developing materials that can be viewed in the selected platform.*

Here conventional materials can be further developed in order to improve their graphical quality and compatibility with online platforms.

III. INTERACTIVE TOOLS DEVELOPED

Following the indentified specific described in the previous section several approaches based on existing and newly developed interactive media concepts were taken. Those included:

1. Interactive equations

The interactive formula content includes a set of wind energy specific equations that presented as an application. In conventional visual representation the different elements of the

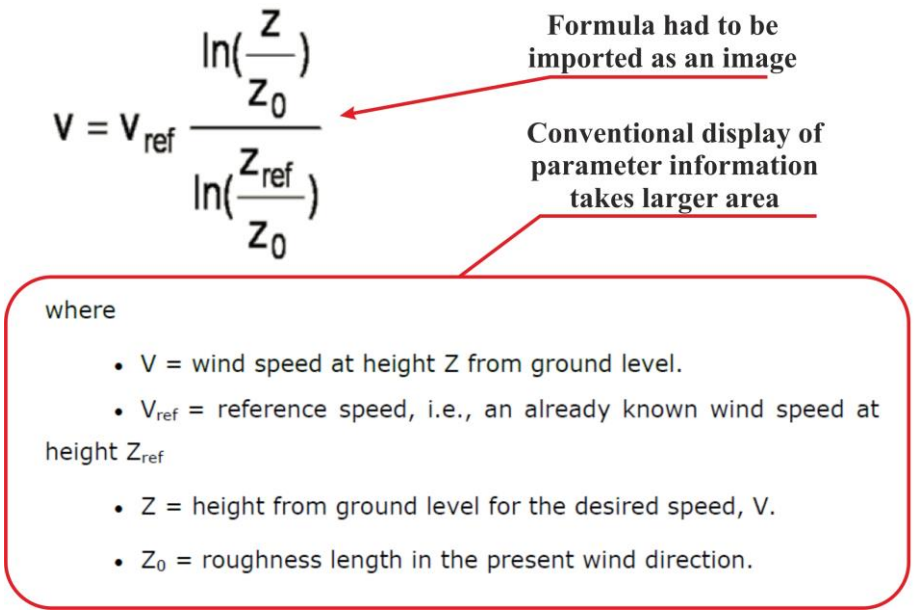

Figure 1. Conventional formula display

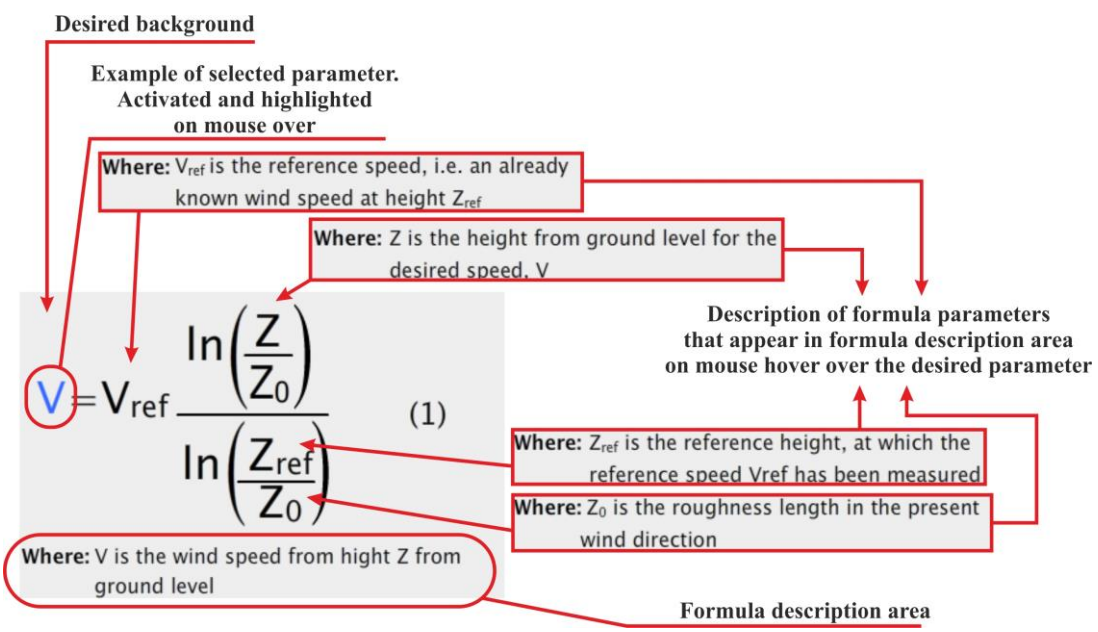

Figure 2. Block diagram of the developed interactive formula

equitation which have not been presented to the reader are described in text bellow the equation - Fiugre 1. This however takes of the screen size - each equation element description takes at least one line of text. In this way presenting equations with several elements could take more screen space. This makes it difficult to fit sections into separate one screen presentations - which as explained before deteriorate the quality of the course.

The developed solution uses a simple interactive media with a minimum of code programming. In this interactive media the elements of the equation are presented to the user by pointing on them - providing description to one element at a time. This saves up screen space, as well as adds exploration to the learning process. It also lets the user pick up the equation components that he doesn't know.

The developed interactive equation is presented and described in detail on figure 2.

2. Interactive visualization of specific in installing wind generators

Visualization in vocational education and training is a predominant factor. Usually when courses are short and present only the essentials visual information plays an important role. A majority of the of the visuals developed for the course are dedicated to installation of wind generators. In order to comply with the set directions in the previous chapter, most of the information is presented in the form of interactive tables. Those tables allow an easy grouping of the information in sections, as well as reduce the overall space taken in one course screen.

The developed interactive media that is used for visualization is presented and explained in figure 3.

3. Interactive representation and visualization of control in wind generators

Those visualizations were used in order to improve the presentability of the course materials and allow the wind turbine specific to be explained without the use of high level engineering on scientific language. Those of materials included two types of representation - three dimensional (3D) animations and two dimensional (2D) animations. An example of the 3D approach is presented at figure 4 and an example of the 2D approach is presented at figure 5.

IV. CONCLUSIONS

The paper had presented three inactive media methods used to improve the quality of online courses in renewable energy and more specifically - wind energy technologies. The discussed methods are based on set of directives developed throughout the course development. Each the interactive media presents possibilities of reducing the content screens and improving quality and interaction.

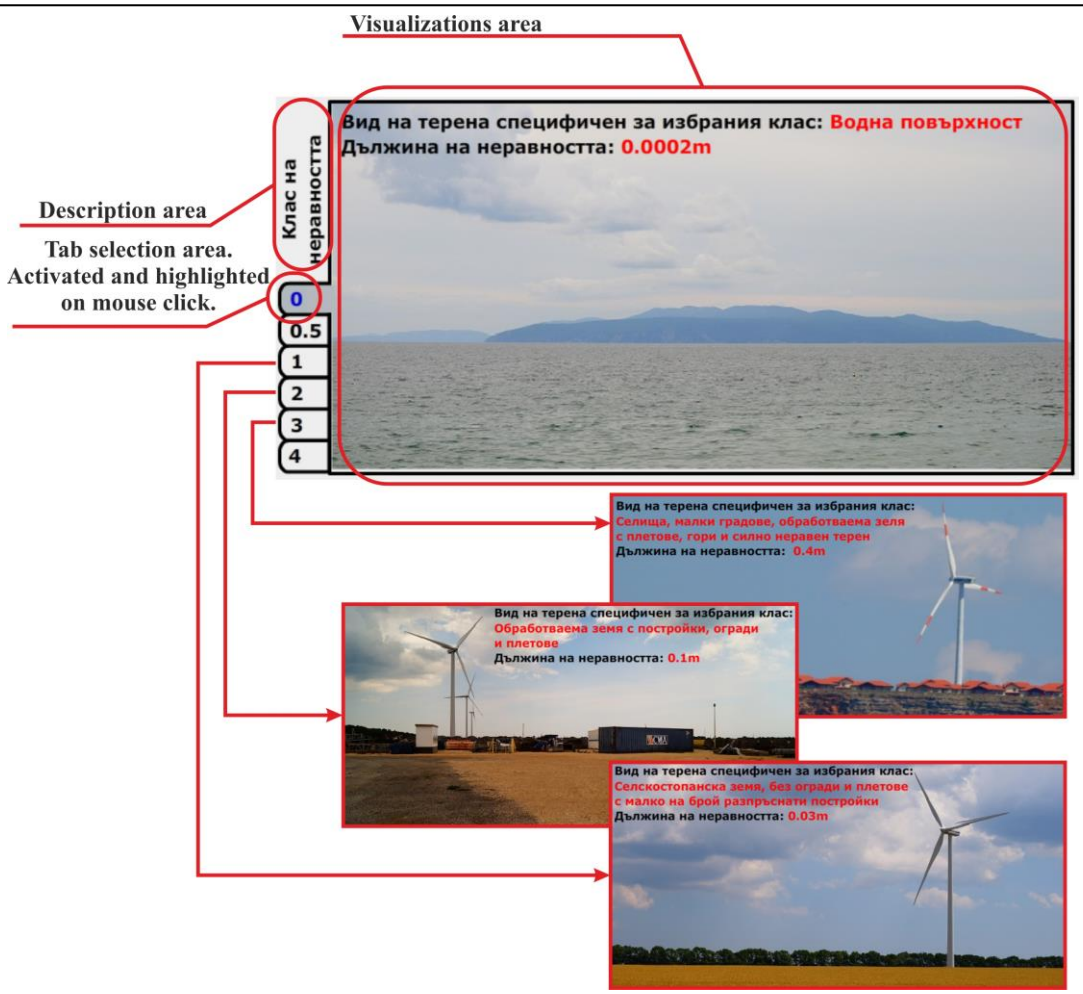

Figure 3. Block diagram of the developed interactive multimedia for specific into installing wind turbines

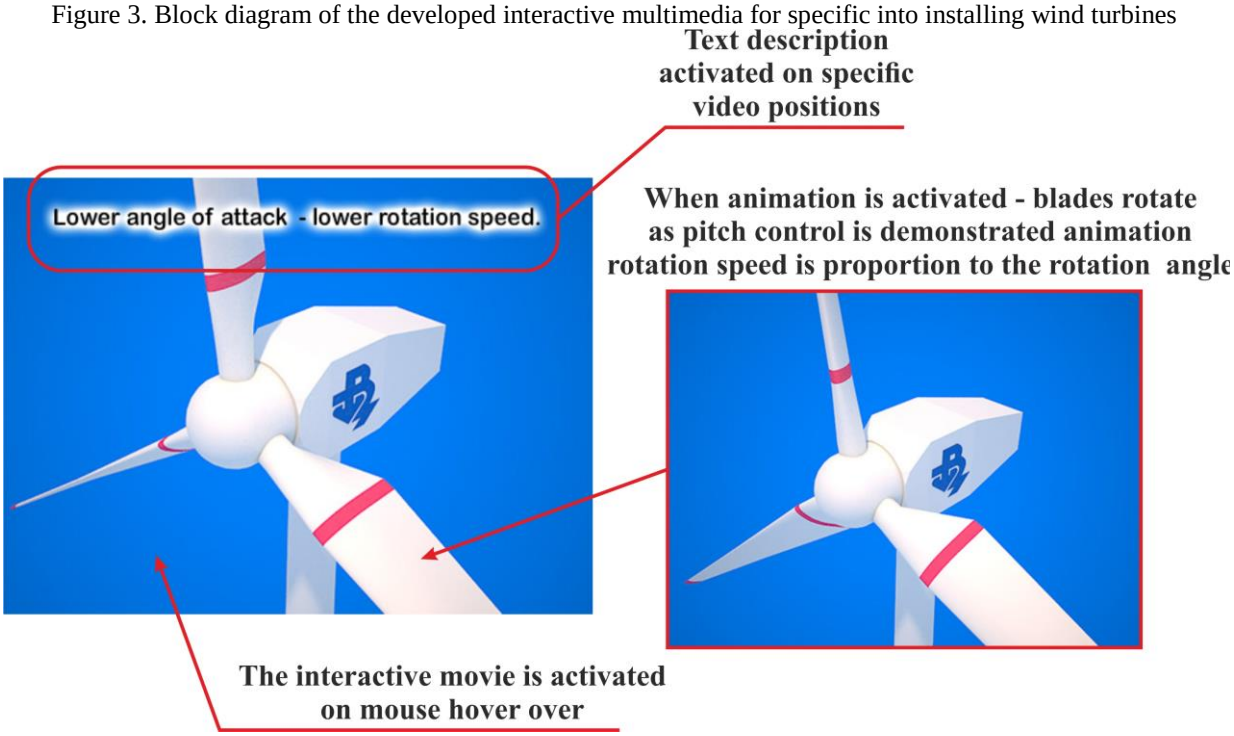

Figure 4. Block diagram of the developed interactive 3D representation and visualization of control in wind generators

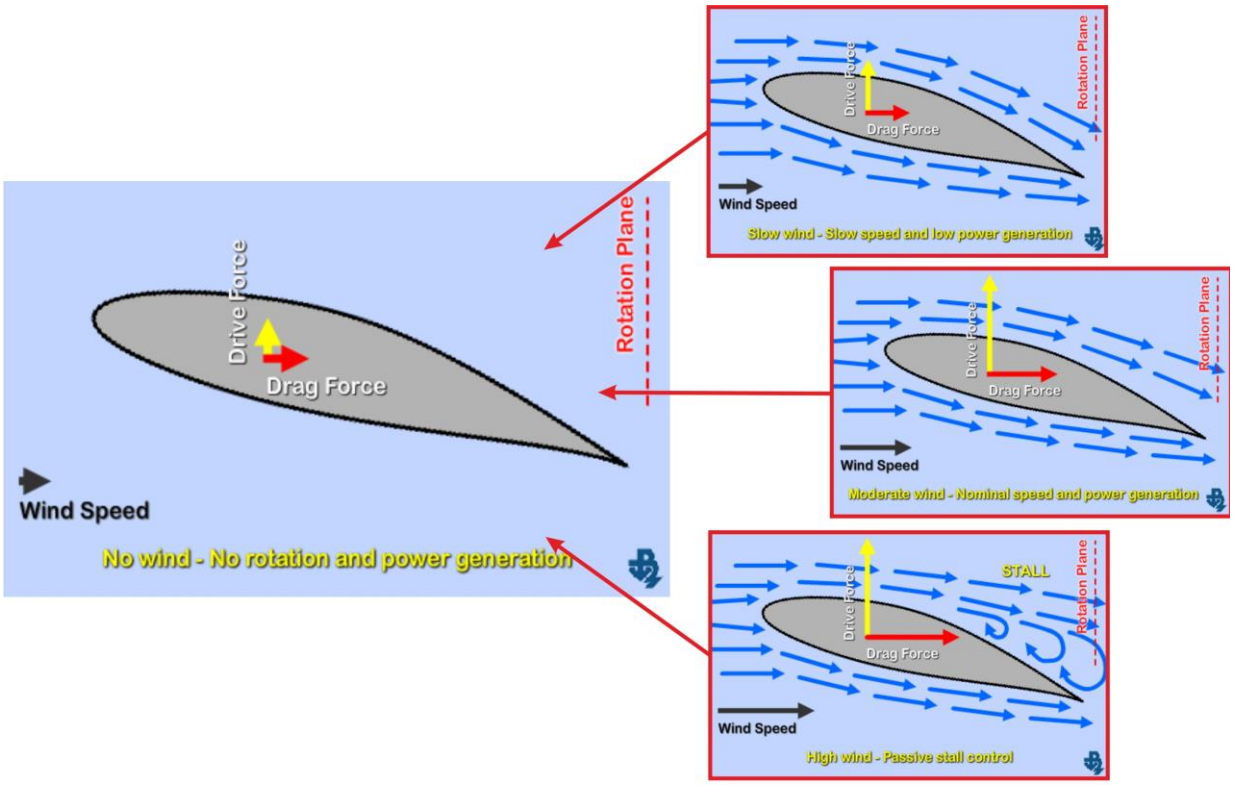

Figure 5. Block diagram of the developed interactive 2D representation and visualization of control in wind generators

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