INCREASING TEACHING EFFECTIVENESS IN STUDENTS THROUGH THE INSTRUCTION OF SOLAR CELLS USING VIRTUAL LABORATORIES

Mamadaliyev Bunyod Davlatboy ogli
Second-year Master's Student, Namangan State Pedagogical Institute
bunyodbekmamadaliyev748@gmail.com
Moh'd Abu El Sheikh
PhD, Associate Professor, Lecturer at Namangan State Technical University
mhsr70@gmail.com
Inoyatov Shukurillo Turgunboyevich
PhD, Associate Professor, Lecturer at Namangan State Pedagogical Institute
shinoyatov77@gmail.com

Abstract: *At the time when natural resources are running out, the study of solar elements and the use of solar energy are urgent tasks of the present day. Therefore, we are talking about the effectiveness of teaching and learning solar elements with the help of virtual laboratories to students.*

Keywords: *Photoelectric effect, Matlab, Labview, energy conversion, simulation, solar panels, 3D visualization, geothermal*

As natural resources are depleting at an accelerated rate, studying solar cells and harnessing energy from them is becoming an increasingly relevant topic. Through teaching and learning about solar cells, we can develop alternative energy resources and utilize them effectively. Using virtual laboratories in teaching solar cells can be highly effective in enhancing students' learning outcomes. For example, visualization, interactivity, and simulations are particularly beneficial in this regard. [1]

In teaching solar cells, it is advisable to divide the content into the following modules. First, provide fundamental theoretical knowledge and use simulations to help students visualize these concepts. Next, assign simple tasks that involve the practical application of solar energy, such as designing a small solar power station.

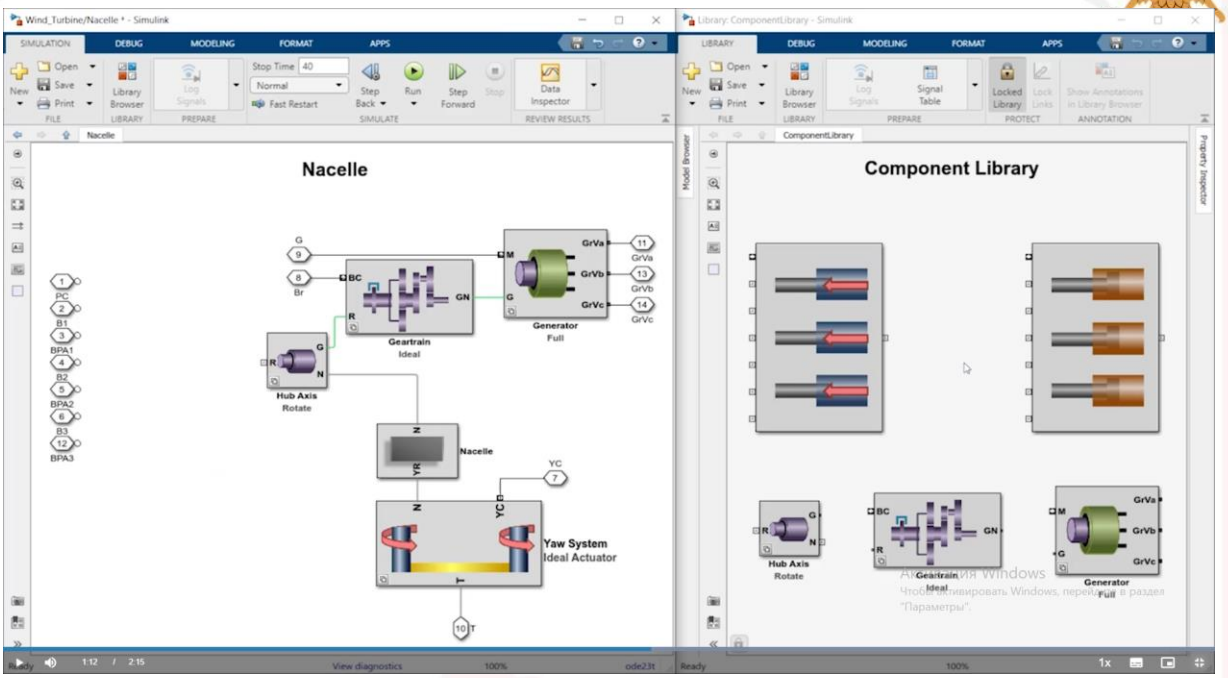

Figure 1. [2]

To reinforce students' theoretical knowledge, we can use the Simulink software shown in Figure 1 to explain solar cells. This figure illustrates some components of solar panels.Renewable energy sources (solar, wind, geothermal, hydro, biomass) are gaining increasing importance against the backdrop of global climate change and rising carbon emissions. [3]

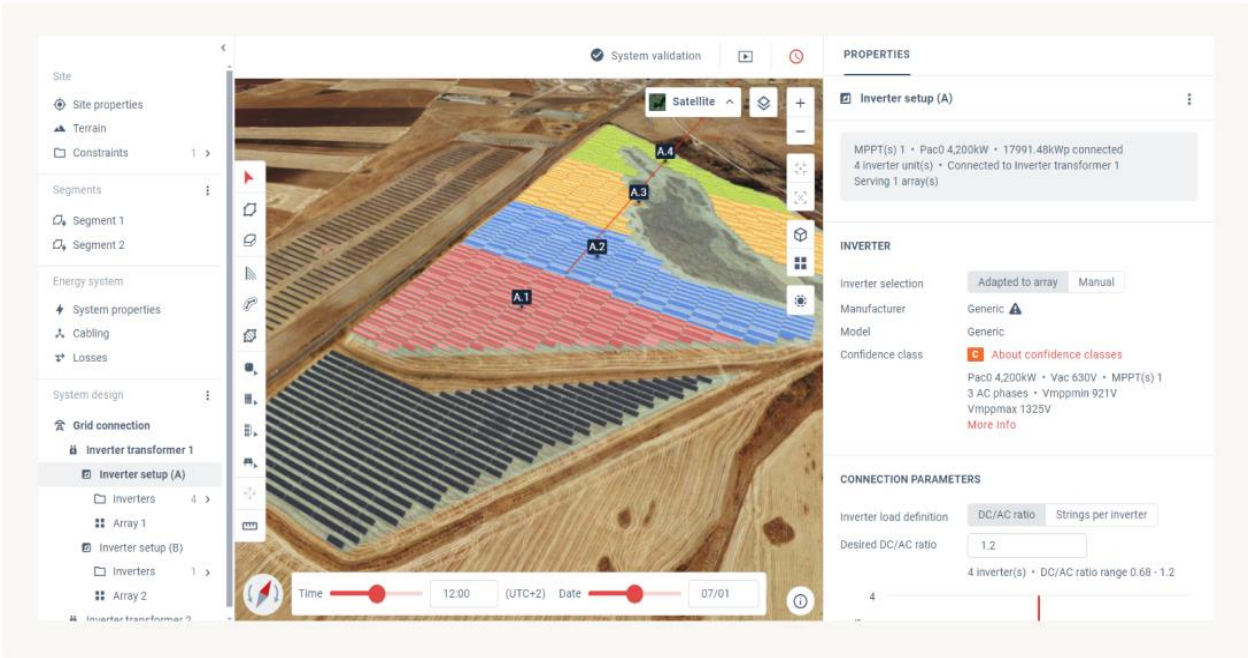

Figure 2. [4]

In Figure 2, some components of a solar cell can be observed. To understand solar panels and the solar system, the Solarlab software has been developed. Using this

software allows students to view solar cells in a virtual environment. In general, programs such as MATLAB, Simulink, Solarlab, LabVIEW, HOMER Energy, OpenModelica, Tinkercad, and PVSyst can be used as virtual laboratories.

Solar power plants, which are composed of solar panels, are environmentally friendly, safe, and economically efficient. The operating principle of a solar power station is as follows: sunlight falls on the solar panels (photovoltaic semiconductors), converts the sunlight—which is direct current (DC) and inconvenient for direct use—into stored energy in batteries. Using an inverter, the DC is converted into alternating current (AC) (commonly 220 V for our use) and supplied to the power grid. Photovoltaic power plants can serve as complete electricity sources for locations far from electrical transmission lines. The surface of solar panels used in these stations is a critical component. These power stations can also operate individual pumps. Installing a dedicated photovoltaic station can provide electricity for households or farms. [5]

If we can demonstrate and teach the above processes to students virtually, we can significantly enhance their learning effectiveness.

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