

## Context

A PV (Photovoltaic) module, commonly known as a solar panel, is a device that converts sunlight into electrical energy through the photovoltaic effect. The typical components are:

Component	Description
Solar cells	The core component that converts sunlight into electricity, typically made of silicon. They are cut from a cylindrical ingot, so that the cells often have round corners and straight sides (pseudo-square). However, rectangular cells are also available in the market. The thickness of the cells is nowadays less than 200 $\mu\text{m}$ .
Glass Cover	Protects the solar cells from environmental factors and provides support, while allowing sunlight to pass through. The thickness of the glass usually adapts to the type of solar module. Bifacial solar modules often have no frame and thicker glass, for providing mechanical strength to the module. Monofacial modules have a front glass and a plastic backsheet in the rear. The glass used in high-performance modules is more transparent than normal glass, but some applications color the glass by different means. Typical glass thickness is around 2-3 mm.
Backsheet	The rear layer that provides insulation and protection from moisture and mechanical damage. Can be white (for increased reflectivity) or black (for better aesthetics).
Encapsulant	A layer (often made of EVA or POE) that surrounds the solar cells, providing protection and ensuring durability. The lower (rear side) encapsulant normally blocks UV light to either prevent degradation of some module components, while the top (front) encapsulant is UV-transmissive. Thickness 0.5-1 mm.
Frame	Usually made of aluminum, it provides structural support and facilitates mounting.
Junction Box	Houses the electrical connections and protects them from the elements. It often includes bypass diodes to improve performance in partial shading.

These components work together to ensure the efficient conversion of solar energy into usable electrical power.

## Task Description

Your task is to write a Matlab code for a user friendly and intuitive graphical user interface (GUI) which has a sleek look.

## Functionalities

The GUI should receive user inputs and depict an interactive 3D layout of a PV module which updates in real time as the user changes the values in the GUI. The plot should show the basic components of the PV module: front and rear glass, upper and lower plastic encapsulants, as well as rectangular solar cells, and maybe (up to the user) an aluminum frame (cross section of the frame has an “E” shape).

Ideally, the user should be able to select the type of view, so that the composition of the module (i.e. cross section of the frame, cell, glass, encapsulant) can be easily observed.

## Note

Part of the goal of this task is to assess your problem-solving skills, even if your solution is not perfect or complete. Some of the task description is not fully described in detail, since you have access to many sources, even SmartCalc.CTM, generative AI, etc.

If you find the task too simple, feel free to add new aspects to highlight your skills.

Some ideas, for inspiration:

- The user can save/load all the user inputs, such as dimensions, thickness, spacing between rows and columns, etc.
- The color of the solar cells depends on the provided irradiance on the solar cells (as in CFD).
- Include a visualization of the junction box and cables.
- Any additional feature that you might think would not only look good, but also help the user to have a better idea of the module that they are designing.

## Hints

You may use the App Designer to get familiar with the nomenclature. But after a certain point it is recommended to elaborate on the code on your own (without the AppDesigner), for ease of progress.

Assume the only **Toolboxes** available in Matlab are those required for using the AppDesigner and the Optimization Toolbox (if needed).

Good coding practices, user-friendliness, initiative, creativity, proactiveness, additional features, etc. are highly valued.

## Deliverables

The source code of the app should be provided. If more than one file is necessary, please send a zip file instead, indicating which file to run (for testing the functionality).