EDU[**CAD**]TION **STUDY GUIDE**

How to Use Offset Planes and Project Sketches in CAD

Chapter 2, Lesson 3

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Why Use an Offset Plane

• Sometimes parts in CAD need a small amount of clearance between them for physical reasons, such as pins, connectors, or movement.

• In this example, the Arduino has pins that extend below the board, so the bottom of the enclosure must be offset slightly to provide proper clearance. Using an offset plane allows you to sketch and build geometry a fixed distance away from an existing surface.

Creating an Offset Plane

• First, use a pair of calipers to measure the pins. From the measurement, you'll determine that an ⅛-inch clearance is needed.

• Then, to create an offset plane, in the ribbon you'll see select '**Construction**' > '**Offset Plane**' (see Figure 1.1). Select the flat surface you want to offset from, here, the bottom of the Arduino board, and enter the offset distance.

• Once applied, the new '**Construction Plane'** appears both in the model workspace and in the Construction folder within the tree (see Figure 1.2). You can right-click this plane anytime to edit or adjust its value.

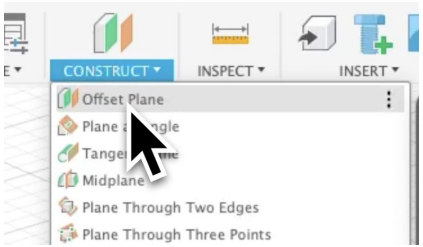

Figure 1.1

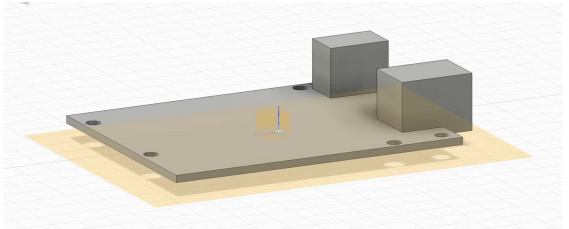

Figure 1.2

Projecting a Sketch

- With the offset plane in place, you can begin sketching directly on it.

- To ensure your new sketch aligns with the existing model, use the '**Project**' tool found under '**Create**' > '**Project**' (see Figure 1.3). This tool allows you to project edges, holes, or profiles from one part onto another surface.

- Here, projecting the Arduino's bottom face transfers its mounting holes and outline onto the offset plane, keeping everything perfectly aligned (see Figure 1.4).

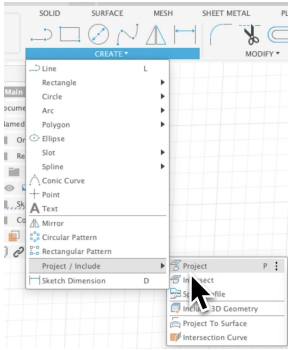

Figure 1.3

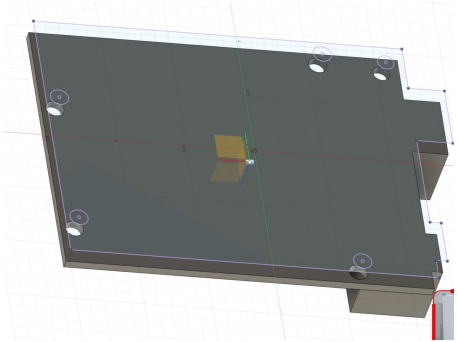

Figure 1.4

Designing the Box Base

• Once projected, draw a '**rectangle**' around the Arduino to represent the base of the box (see Figure 1.5).

• Use an '**Offset**' to expand the boundary by ¼ inch, creating a small shell or wall thickness.

• For the side with the USB and power ports, make sure the edge of your model is flush with the ports to allow proper cable clearance. You can constrain this by connecting the corner of the charge port to the edge of your rectangle.

• Once complete, you'll see all sides turn black, indicating a fully '**defined sketch**' (see Figure 1.6).

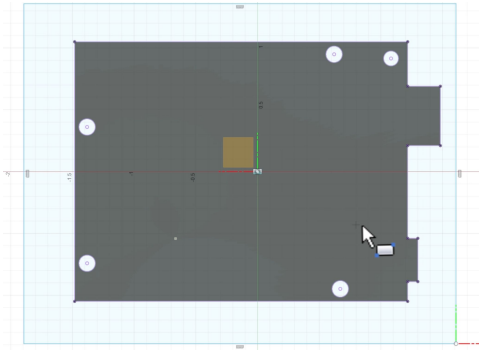

Figure 1.5

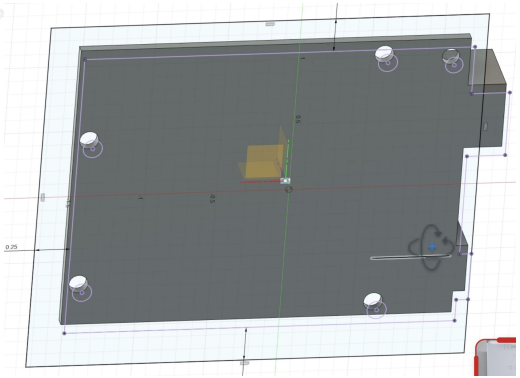

Figure 1.6

Extruding the Base

- Next, use the '**Extrude**' tool to convert the sketch into a 3D component.

- Select all relevant profiles, including the mounting holes for later use.

- In this step, you'll create a multi-directional extrude. In the extrude window, you'll change the Direction setting to '**Two-Sided**' (see Figure 1.7).

- This setting allows two independent arrows to appear, letting you control each direction separately. Pull one side down ⅛ inch and the other side up 1 inch to create thickness and space for the lid. This provides proper clearance and ensures there's room for the lid to fit (see Figure 1.8).

- Set the Operation type to '**New Component**' to maintain an organized workspace.

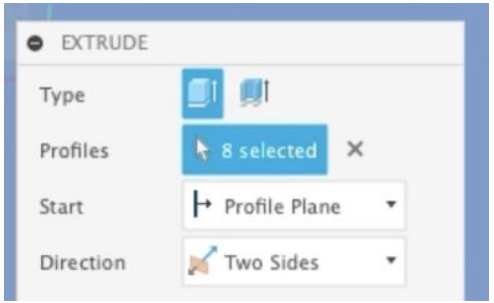

Figure 1.7

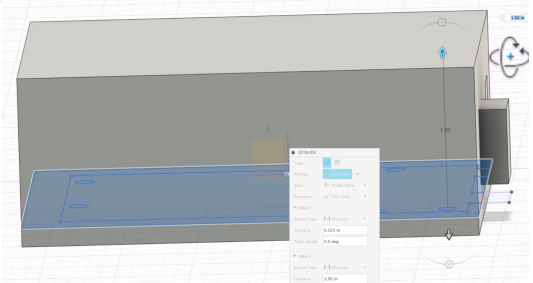

Figure 1.8

Naming Components

- Once extruded, rename your new component in the '**tree**' for clarity.

- In this example, the base was labeled **ARD Bottom Box** (see Figure 1.9). Proper naming ensures your assemblies stay clean and manageable as the number of parts increases.

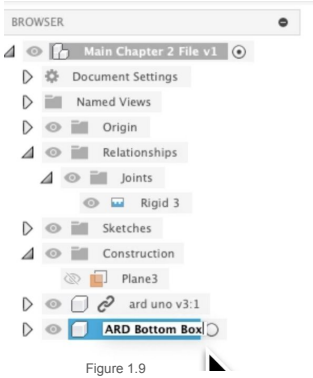

Figure 1.9

Summary

Offset planes give you precise control over the spacing between parts and help ensure everything fits correctly in your design. Projecting sketches onto these planes keeps geometry aligned and easy to reference. Together, these tools help create more realistic, manufacturable assemblies that reflect real-world design needs.

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