

**Scanning a Human Face and CNC Machining a 3D Model.**

# Learning objectives

Students will learn how to scan a human face, convert the scan to an STL file, and observe how a CNC router is used to machine the 3D model. This project integrates skills in 3D scanning, computer-aided design (CAD), and CNC machining.

B&T dimensions and types covered

**Dimension**

**2 Confidence in technological progress and 3. Interest in New Tech**nology: By learning how to scan a human face, convert the scan to an STL file, and learning how a CNC router is used.

Types:

* **Explorer:** Through the exercise the student gets to explore exiting new things available with scanning, 3D and CNC.

Grade Level

 middle school / junior high school (grades 5/6/7–8/9) from 11 to 15 years old

High School / College Level / Girls, Women 16 -30 Art, Design, Human tech.

Subjects

 **Technology:** Skills in 3D scanning, computer-aided design (CAD), and CNC machining.

Materials

Materials Needed:

• 3D scanner (e.g., Sense, Structure Sensor, Artec Eva, or similar)

• Computer with 3D scanning software (e.g., Meshmixer, Blender, or similar)

• CAD software (e.g., Fusion 360, Tinkercad, Aspire or similar)

• CNC router

• Material for CNC machining (plywood or Blue styrofoam, machinable wax or something thicker than 40mm )

• Safety equipment (goggles, ear protection, dust mask)

• USB drive or other data transfer methods

Safety rules & tips CNC router!

Duration

Total Time: 4 hours (Can be divided into 4 sessions)

* Session 1: Introduction to 3D Scanning and Face Scanning (1 hour)
* Session 2: Editing and Converting the Scan to an STL File (1 hour)
* Session 3: Preparing the STL File for CNC Machining (1 hour)
* Session 4: CNC Machining a 3D Model (1 hour)

Lesson Plan

Introduction

**Session 1: Introduction to 3D Scanning and Face Scanning (1 hour)**

**Step 1: Introduction (15 minutes)**

* Briefly explain the project and its components.
* Discuss the principles of 3D scanning and its applications.
* Introduce the concept of converting a scanned object into a digital model for CNC machining.

step-by-step development

**Step 2: Setting Up the 3D Scanner (15 minutes)**

* Demonstrate how to set up and calibrate the 3D scanner.
* Explain the importance of proper calibration for accurate scans.

**Step 3: Scanning a Human Face (30 minutes)**

* Choose a volunteer for the face scan.
* Show how to position the scanner and subject for optimal results.
* Guide students through the process of scanning the face, capturing all necessary angles.
* Split the face in half.

**Session 2: Editing and Converting the Scan to an STL File (1 hour)**

**Step 1: Importing the Scan (15 minutes)**

* Demonstrate how to import the scan into 3D editing software.
* Explain the basic interface and tools of the software being used.

**Step 2: Cleaning Up the Scan (20 minutes)**

* Show how to clean up the scan by removing any unwanted parts or noise.
* Teach students how to fill holes and smooth surfaces to improve the quality of the 3D model.
* Split the face in half and lay flat.

**Step 3: Converting to STL (25 minutes)**

* Guide students through the process of converting the cleaned-up scan to an STL file.
* Explain the importance of exporting the file in the correct format for CNC machining.

**Session 3: Preparing the STL File for CNC Machining (1 hour)**

**Step 1: Importing the STL into CAD Software (15 minutes)**

* Demonstrate how to import the STL file into CAD software.
* Explain the basic tools and interface of the CAD software.

**Step 2: Preparing the Model for CNC Machining (30 minutes)**

* Show how to orient the model for optimal machining.
* Lay the (half) face looking up.
* Explain how to set the dimensions, scale, and create supports/bridges\* if necessary. (\*small parts of wood to keep the model in place)
* Teach students how to generate toolpaths for the CNC router.

**Step 3: Exporting the G-code (15 minutes)**

* Guide students through the process of exporting the prepared model as G-code.
* Explain the importance of correct settings for the material and CNC router being used.

**Session 4: CNC Machining a 3D Model (1 hour)**

**Step 1: Setting Up the CNC Router (15 minutes)**

* Demonstrate how to set up the CNC router, including securing the material and loading the G-code.
* Emphasize safety procedures and the use of safety equipment.

**Step 2: Machining the Model (30 minutes)**

* Show how to start the CNC machining process and monitor its progress.
* Allow students to observe the machining process and discuss the steps involved.

Wrap- up & reflection

 **Step 3: Finishing Touches and Evaluation (15 minutes)**

* Demonstrate how to remove the finished model from the CNC router and clean up any rough edges.
* Discuss the outcome of the project and any challenges faced during the process.
* Encourage students to reflect on what they learned and how they could apply these skills in future projects.

Extension activities

* Experiment with scanning different objects and creating STL files for CNC machining.
* Modify the STL file to add personalized features or designs before machining.
* Explore different materials and settings for CNC machining to see how they affect the final product.
* Using plywood to CNC route will give a nice design in layers

**Assessment:**

* Students will be assessed on their ability to scan a face, clean and convert the scan to an STL file, prepare the model for CNC machining, and successfully machine the model.
* Participation in discussions and troubleshooting sessions will also be considered.

Additional Resources

Stl file of a face