CONVERSATIONAL 3D CAD MODELING INTERFACE

Documentation By:

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Introduction

This project aims to build an **AI-powered chat interface** that allows users to create and edit 3D CAD models using natural language.

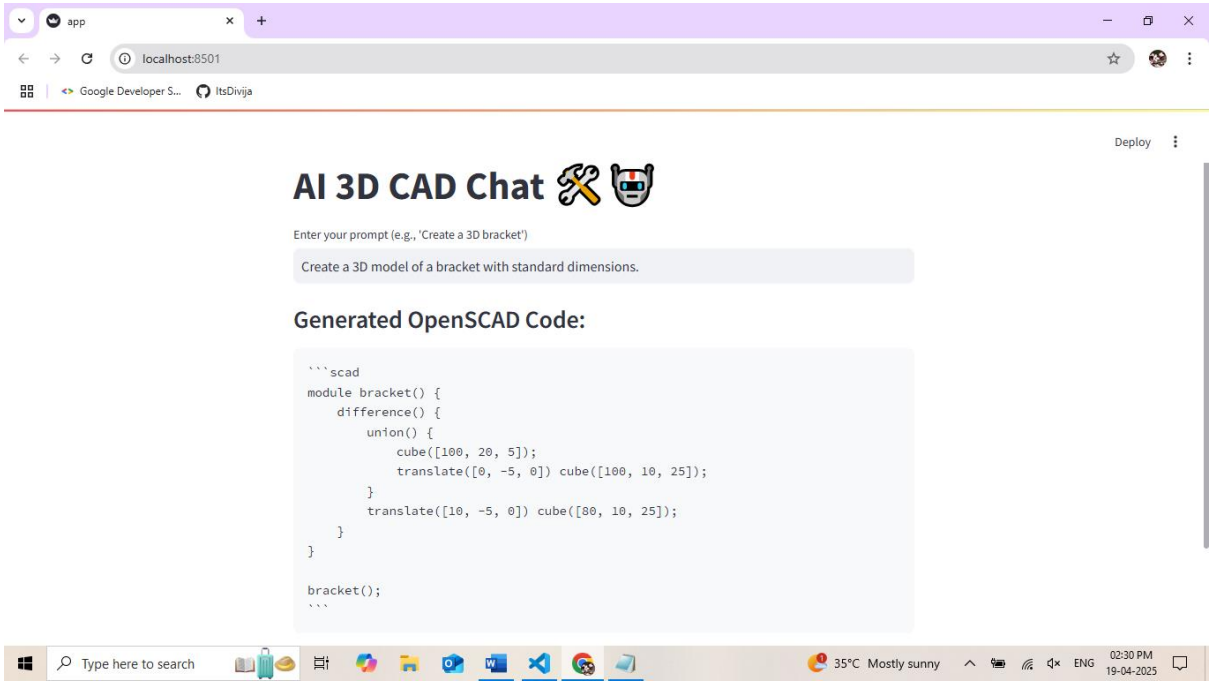
Users can give prompts like:

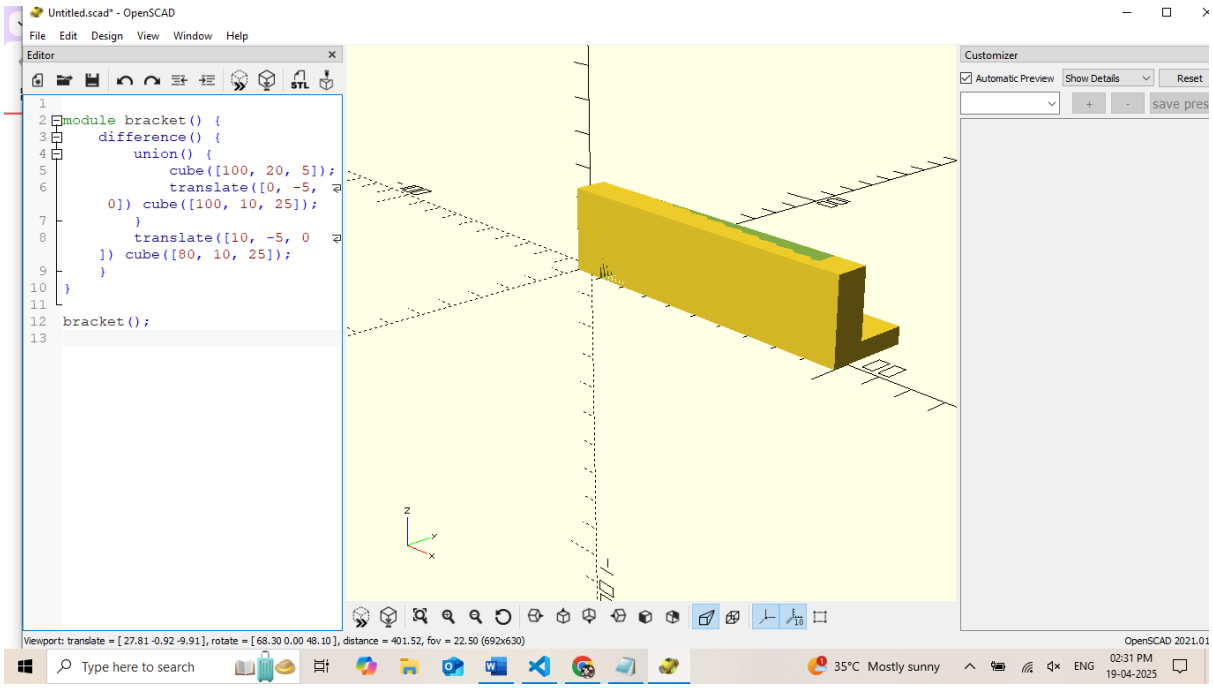
“Create a 3D bracket with standard dimensions.”

And then follow up with instructions like:

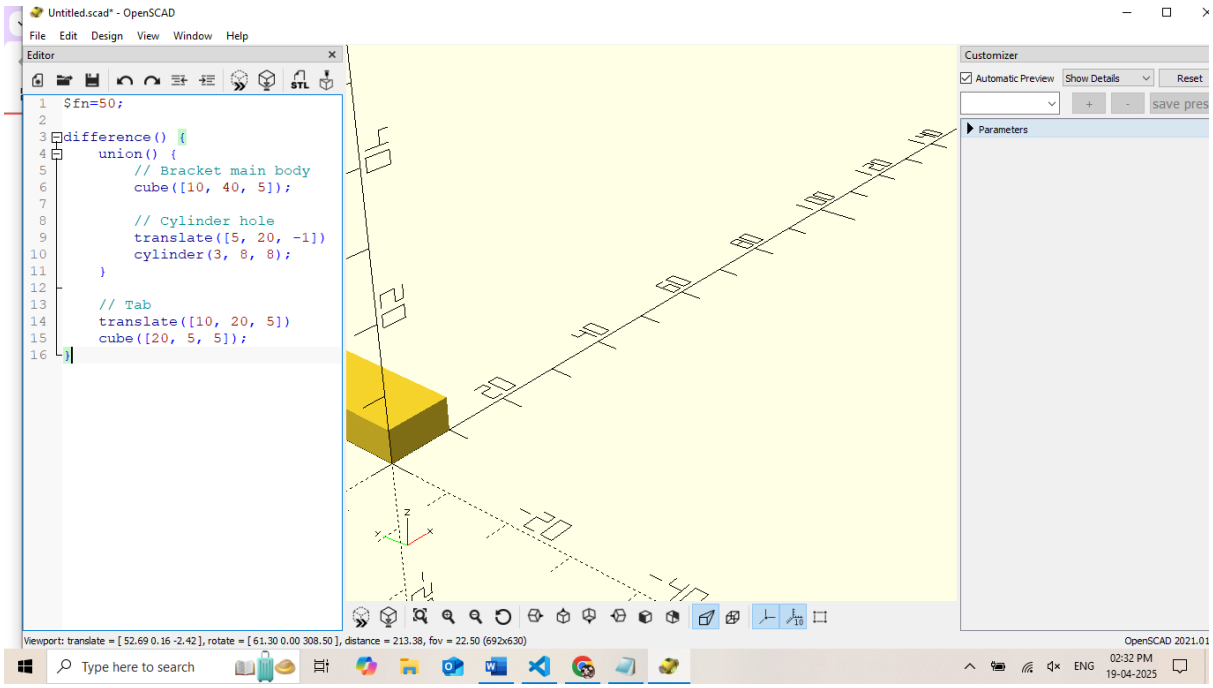
“Increase the left side by 2 mm”
“Make it hollow”
“Reduce the thickness by 1 mm” and many more(shown in screenshots attached below).

The interface generates a **.scad** file that can be opened directly in **OpenSCAD**, and further exported into formats like **.stl,** compatible with **Autodesk** and other CAD tools.




Untitled.scad* - OpenSCAD
File Edit Design View Window Help
Editor
module bracket() {
difference() {
union() {
cube([100, 20, 5]);
translate([0, -5, 0]) cube([100, 10, 25]);
}
translate([10, -5, 0]) cube([80, 10, 25]);
}
}
bracket();
Customizer
Automatic Preview
Show Details
Reset
save pres
Viewport: translate = [27.81 -0.92 -9.91], rotate = [68.30 0.00 48.10], distance = 401.52, fov = 22.50 (692x630)
OpenSCAD 2021.01
Type here to search
35°C Mostly sunny
ENG
02:31 PM
19-04-2025


app
localhost:8501
Google Developer S...
ItsDivija
Deploy
Enter your prompt (e.g., 'Create a 3D bracket')
Increase the length of the bracket by 10mm.
Generated OpenSCAD Code:
$fn=50;
difference() {
union() {
// Bracket main body
cube([10, 40, 5]);
// Cylinder hole
translate([5, 20, -1])
cylinder(3, 8, 8);
}
// Tab
translate([10, 20, 5])
cube([20, 5, 5]);
}
Type here to search
35°C Mostly sunny
ENG
02:31 PM
19-04-2025



Source Code

```
import streamlit as st
from openai import OpenAI

st.title("AI 3D CAD Chat 🛠️🤖")

# User input widget
user_input = st.text_input("Enter your prompt (e.g., 'Create a 3D bracket')")

if user_input:
  # OpenRouter client setup
  client = OpenAI(
    api_key="Insert Your Own API Key ",  # Insert your actual API key.
    base_url="https://openrouter.ai/api/v1"
  )

  # API call with system instruction and user prompt
  response = client.chat.completions.create(
    model="openai/gpt-3.5-turbo",
    messages=[
      # System instruction: only return valid OpenSCAD code.
      {"role": "system", "content": "You are an expert in OpenSCAD. Provide only valid OpenSCAD code, no
explanations."},
      # User prompt (jo bhi tum input karte ho)
      {"role": "user", "content": user_input}
    ]
  )

  # Extract and display the result
  result = response.choices[0].message.content
  st.subheader("Generated OpenSCAD Code:")
  st.code(result, language="scad")
else:
  st.write("Please enter your prompt above and press Enter.")
```

Tech Stack

Technology	Purpose
OpenAI GPT	Convert natural language to 3D code (SCAD)
OpenSCAD	Renders and displays the 3D model
Python	Backend logic and file handling
Streamlit	Simple web UI for chat-based interface

How to Use

1. Install required libraries:

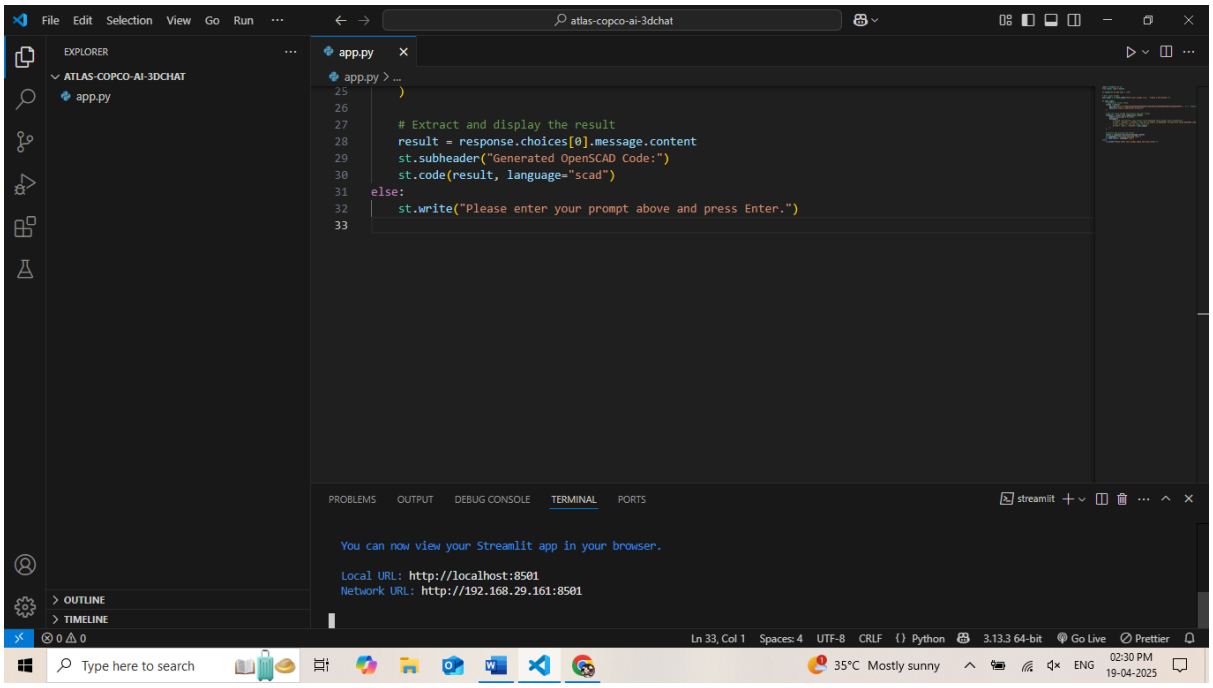
   pip install openai streamlit

2. Set your OpenAI API key.
3. Run the app:

   streamlit run app.py

4. Enter a natural language prompt in the chat interface.
5. The app generates a .scad file based on your input.
6. Open the .scad file using **OpenSCAD** to view the model.
7. To convert to .stl:

   openscad -o model.stl model.scad



Demo Video:

I have created a short screen recording showcasing:

- Initial prompt-based model generation
- Modifying the model using follow-up instructions
- Viewing the model in OpenSCAD

Here's the link to it:

https://drive.google.com/file/d/1U8FO8yZ9ci8oskYiOftj_wTtx-6-P699/view?usp=sharing

Github Link:

https://github.com/Divija-Arora/atlas-copco-ai-3dchat

Innovative Elements

- Modular system: Easy to extend for other CAD file formats (STEP, IGES, etc.)
- Embedding OpenSCAD preview within the chat interface for real-time visual feedback
- Possible integration with **NVIDIA's LLaMA-Mesh** for improved mesh generation so exploring GPU-backed mesh generation models for high-resolution outputs.
