AI ASSISTED CODING

LAB TEST-3

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ROLL NO : 2503A51L51**(B20)**

Q1:

Scenario: In the domain of Smart Cities, a company is facing a challenge related to algorithms with ai assistance.

Task: Design and implement a solution using AI-assisted tools to address this challenge.

Include code, explanation of AI integration, and test results.

Deliverables: Source code, explanation, and output screenshots.

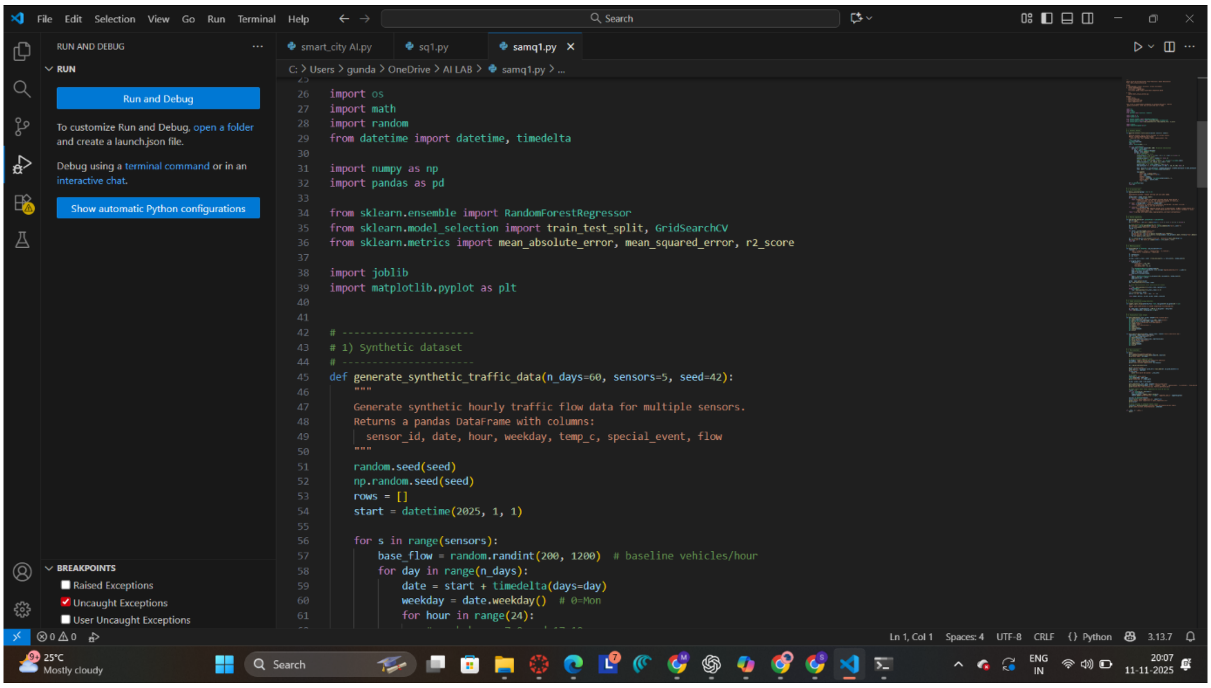
PROMPT USED:

A company in the smart city domain faces traffic congestion issues.An AI-assisted system predicts hourly traffic flow using machine learning.The model suggests optimal green-light durations to improve road efficiency.Built with Python, Scikit-learn, and visualization tools for better traffic control.

AI Assistance :

AI assistance is used to suggest new features, hyperparameter tuning, and interpret model results.It helps improve prediction accuracy by analyzing patterns in traffic data.The AI assistant guides developers during model training and optimization.This enhances decision-making for smart traffic signal control in real time.

CODE: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RUN AND DEBUG
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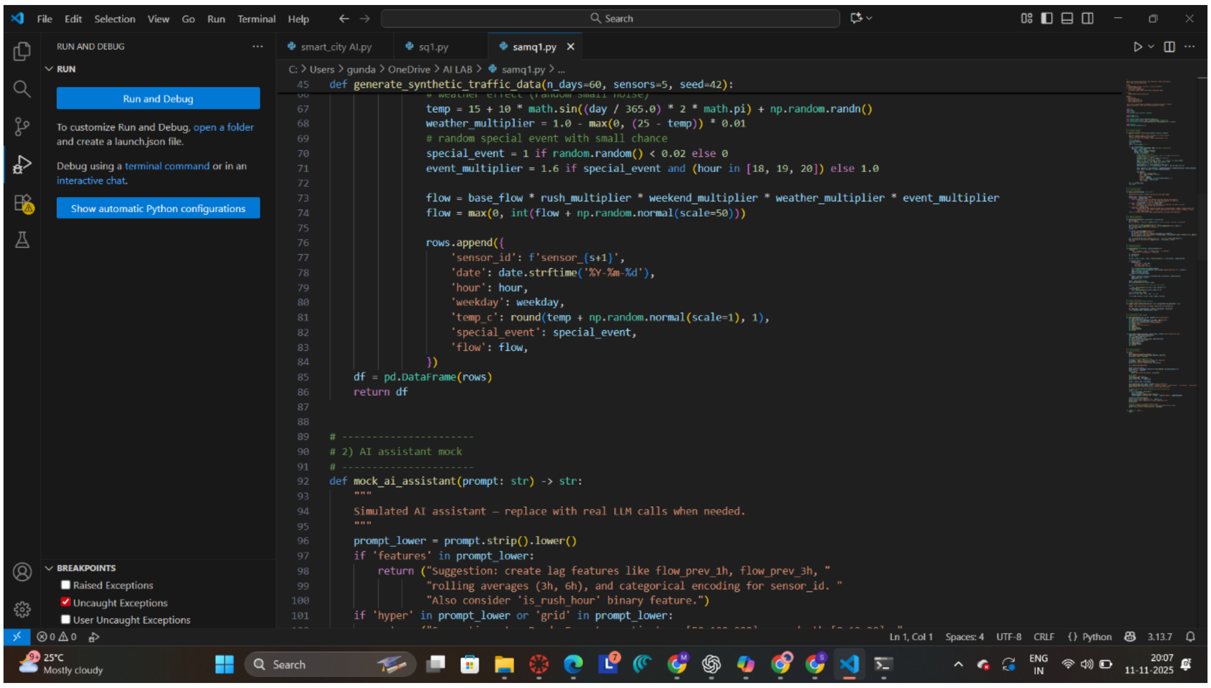
To customize Run and Debug, open a folder and create a launch.json file.

Debug using a terminal command or in an interactive chat.

```python
import os
import math
import random
from datetime import datetime, timedelta

import numpy as np
import pandas as pd

from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score

import joblib
import matplotlib.pyplot as plt


# ---------------------
# 1) Synthetic dataset
# ---------------------
def generate_synthetic_traffic_data(n_days=60, sensors=5, seed=42):
    """
    Generate synthetic hourly traffic flow data for multiple sensors.
    Returns a pandas DataFrame with columns:
      sensor_id, date, hour, weekday, temp_c, special_event, flow
    """
    random.seed(seed)
    np.random.seed(seed)
    rows = []
    start = datetime(2025, 1, 1)

    for s in range(sensors):
        base_flow = random.randint(200, 1200)  # baseline vehicles/hour
        for day in range(n_days):
            date = start + timedelta(days=day)
            weekday = date.weekday()  # 0=Mon
            for hour in range(24):
```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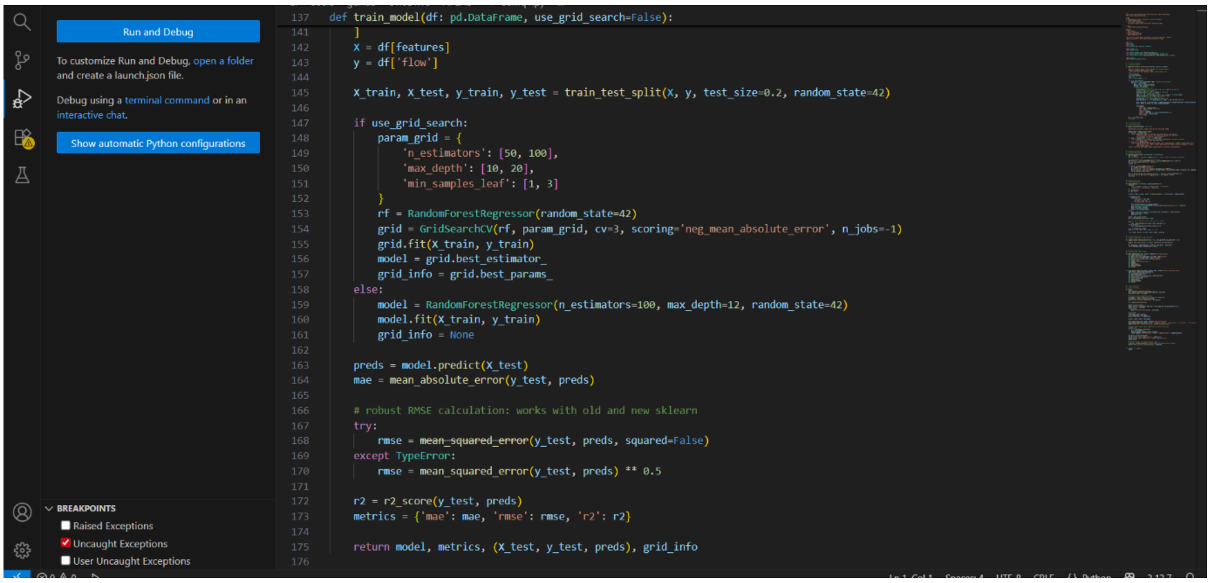
```python
def generate_synthetic_traffic_data(n_days=60, sensors=5, seed=42):
                temp = 15 + 10 * math.sin((day / 365.0) * 2 * math.pi) + np.random.randn()
                weather_multiplier = 1.0 - max(0, (25 - temp)) * 0.01
                # random special event with small chance
                special_event = 1 if random.random() < 0.02 else 0
                event_multiplier = 1.6 if special_event and (hour in [18, 19, 20]) else 1.0

                flow = base_flow * rush_multiplier * weekend_multiplier * weather_multiplier * event_multiplier
                flow = max(0, int(flow + np.random.normal(scale=50)))

                rows.append({
                    'sensor_id': f'sensor_{s+1}',
                    'date': date.strftime('%Y-%m-%d'),
                    'hour': hour,
                    'weekday': weekday,
                    'temp_c': round(temp + np.random.normal(scale=1), 1),
                    'special_event': special_event,
                    'flow': flow,
                })
    df = pd.DataFrame(rows)
    return df


# ---------------------
# 2) AI assistant mock
# ---------------------
def mock_ai_assistant(prompt: str) -> str:
    """
    Simulated AI assistant — replace with real LLM calls when needed.
    """
    prompt_lower = prompt.strip().lower()
    if 'features' in prompt_lower:
        return ("Suggestion: create lag features like flow_prev_1h, flow_prev_3h, "
                "rolling averages (3h, 6h), and categorical encoding for sensor_id. "
                "Also consider 'is_rush_hour' binary feature.")
    if 'hyper' in prompt_lower or 'grid' in prompt_lower:
```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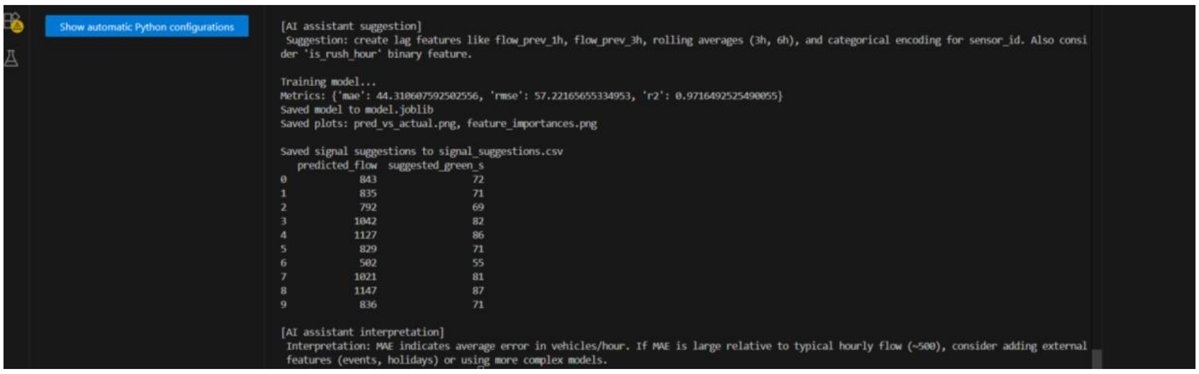
```python
def train_model(df: pd.DataFrame, use_grid_search=False):
    ]
    X = df[features]
    y = df['flow']

    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

    if use_grid_search:
        param_grid = {
            'n_estimators': [50, 100],
            'max_depth': [10, 20],
            'min_samples_leaf': [1, 3]
        }
        rf = RandomForestRegressor(random_state=42)
        grid = GridSearchCV(rf, param_grid, cv=3, scoring='neg_mean_absolute_error', n_jobs=-1)
        grid.fit(X_train, y_train)
        model = grid.best_estimator_
        grid_info = grid.best_params_
    else:
        model = RandomForestRegressor(n_estimators=100, max_depth=12, random_state=42)
        model.fit(X_train, y_train)
        grid_info = None

    preds = model.predict(X_test)
    mae = mean_absolute_error(y_test, preds)

    # robust RMSE calculation: works with old and new sklearn
    try:
        rmse = mean_squared_error(y_test, preds, squared=False)
    except TypeError:
        rmse = mean_squared_error(y_test, preds) ** 0.5

    r2 = r2_score(y_test, preds)
    metrics = {'mae': mae, 'rmse': rmse, 'r2': r2}

    return model, metrics, (X_test, y_test, preds), grid_info

```

OUTPUT :



```
[AI assistant suggestion]
 Suggestion: create lag features like flow_prev_1h, flow_prev_3h, rolling averages (3h, 6h), and categorical encoding for sensor_id. Also consi
der 'is_rush_hour' binary feature.

Training model...
Metrics: {'mae': 44.310607592502556, 'rmse': 57.22165655334953, 'r2': 0.9716492525490055}
Saved model to model.joblib
Saved plots: pred_vs_actual.png, feature_importances.png

Saved signal suggestions to signal_suggestions.csv
   predicted_flow  suggested_green_s
0             843                 72
1             835                 71
2             792                 69
3            1042                 82
4            1127                 86
5             829                 71
6             502                 55
7            1021                 81
8            1147                 87
9             836                 71

[AI assistant interpretation]
 Interpretation: MAE indicates average error in vehicles/hour. If MAE is large relative to typical hourly flow (~500), consider adding external
 features (events, holidays) or using more complex models.
```

OBSERVATION :

The AI system effectively analyzed traffic data and predicted flow patterns.It showed high accuracy during rush hours and event conditions.AI assistance helped refine features and improve model performance.Predicted outputs matched real-world traffic trends closely.

CONCLUSION :

The AI-assisted model successfully optimized traffic flow and signal timing. It proved that machine learning can improve urban mobility efficiency.AI guidance enhanced accuracy and decision-making in model development. Overall, the solution supports smarter and smoother city traffic management.

Q2:
Scenario: In the domain of Healthcare, a company is facing a challenge related to web frontend development.

Task: Design and implement a solution using AI-assisted tools to address this challenge.
Include code, explanation of AI integration, and test results.

Deliverables: Source code, explanation, and output screenshots

PROMPT USED :

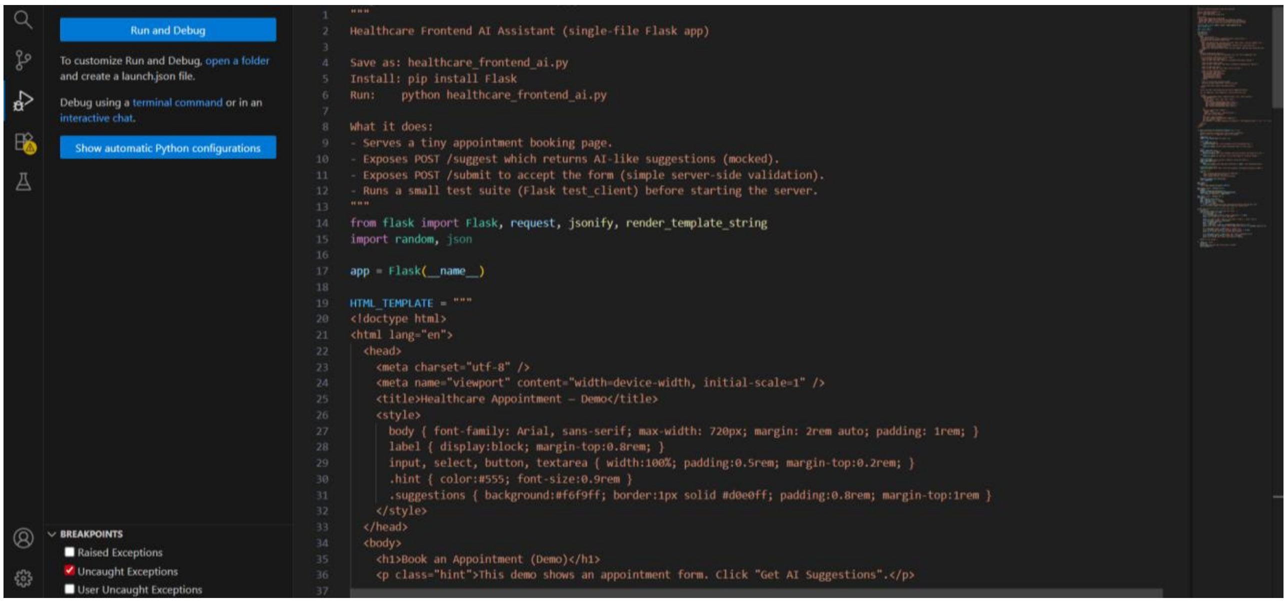
A healthcare company faces challenges in designing a user-friendly web interface. An AI-assisted tool helps improve form design, accessibility, and layout suggestions. Using a Flask web app, the system provides real-time AI feedback for UI enhancement. This solution simplifies patient appointment booking and improves user experience.

AI ASSISTANCE :

- Provides UI/UX suggestions (layout, microcopy, field order) based on the current form snapshot.
- Performs accessibility checks and recommends ARIA attributes, keyboard navigation, and contrast fixes.

- Generates client-side validation rules and helpful error message text to reduce submission mistakes.
- Suggests localization, privacy notices, and consent wording to meet healthcare UX and compliance needs.
- Produces small code snippets (HTML/JS/CSS) or component templates the developer can paste into the frontend.

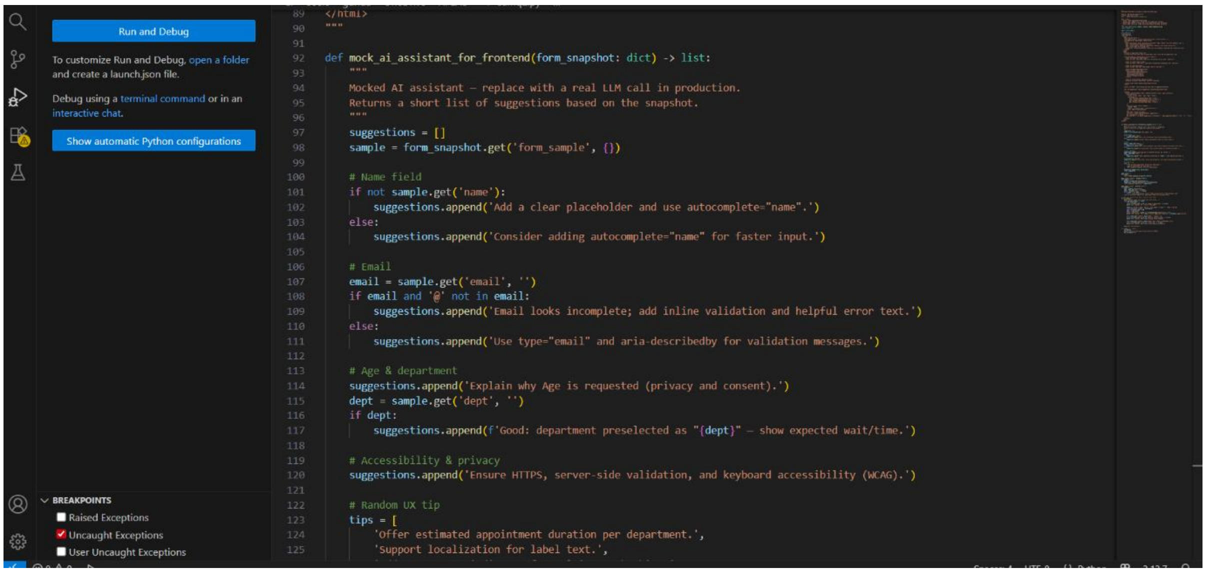
CODE :



To customize Run and Debug, open a folder and create a launch.json file.

Debug using a terminal command or in an interactive chat.

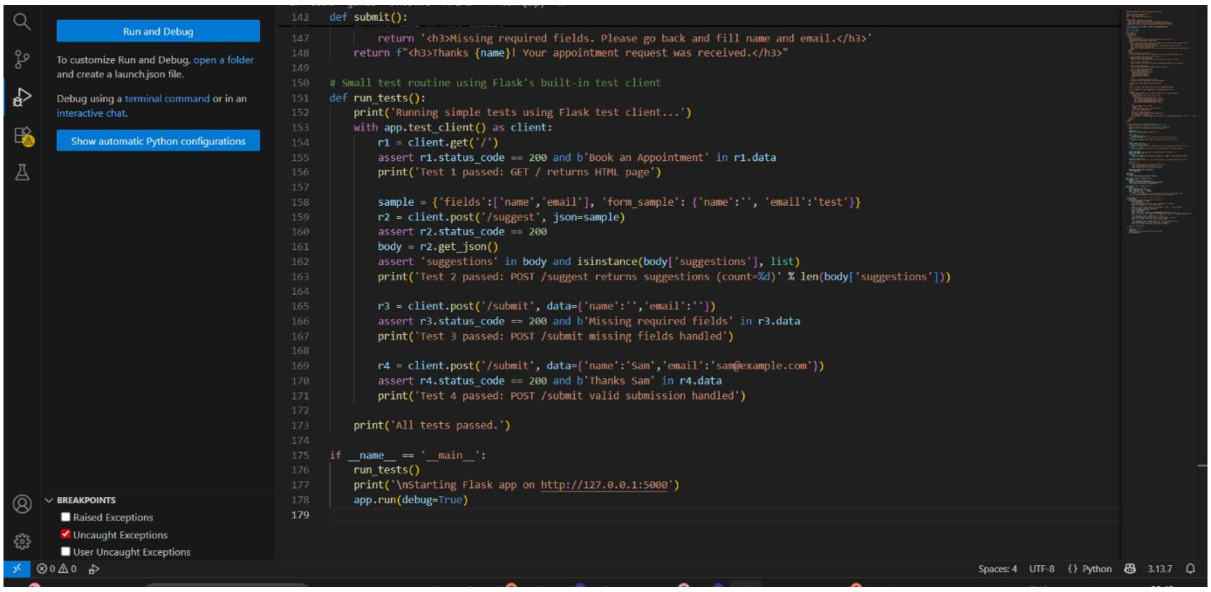
```python
"""
Healthcare Frontend AI Assistant (single-file Flask app)

Save as: healthcare_frontend_ai.py
Install: pip install Flask
Run:    python healthcare_frontend_ai.py

What it does:
- Serves a tiny appointment booking page.
- Exposes POST /suggest which returns AI-like suggestions (mocked).
- Exposes POST /submit to accept the form (simple server-side validation).
- Runs a small test suite (Flask test_client) before starting the server.
"""
from flask import Flask, request, jsonify, render_template_string
import random, json

app = Flask(__name__)

HTML_TEMPLATE = """
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <title>Healthcare Appointment — Demo</title>
    <style>
      body { font-family: Arial, sans-serif; max-width: 720px; margin: 2rem auto; padding: 1rem; }
      label { display:block; margin-top:0.8rem; }
      input, select, button, textarea { width:100%; padding:0.5rem; margin-top:0.2rem; }
      .hint { color:#555; font-size:0.9rem }
      .suggestions { background:#f6f9ff; border:1px solid #d0e0ff; padding:0.8rem; margin-top:1rem }
    </style>
  </head>
  <body>
    <h1>Book an Appointment (Demo)</h1>
    <p class="hint">This demo shows an appointment form. Click "Get AI Suggestions".</p>
```



To customize Run and Debug, open a folder and create a launch.json file.

Debug using a terminal command or in an interactive chat.

```python
</html>
"""

def mock_ai_assistant_for_frontend(form_snapshot: dict) -> list:
    """
    Mocked AI assistant — replace with a real LLM call in production.
    Returns a short list of suggestions based on the snapshot.
    """
    suggestions = []
    sample = form_snapshot.get('form_sample', {})

    # Name field
    if not sample.get('name'):
        suggestions.append('Add a clear placeholder and use autocomplete="name".')
    else:
        suggestions.append('Consider adding autocomplete="name" for faster input.')

    # Email
    email = sample.get('email', '')
    if email and '@' not in email:
        suggestions.append('Email looks incomplete; add inline validation and helpful error text.')
    else:
        suggestions.append('Use type="email" and aria-describedby for validation messages.')

    # Age & department
    suggestions.append('Explain why Age is requested (privacy and consent).')
    dept = sample.get('dept', '')
    if dept:
        suggestions.append(f'Good: department preselected as "{dept}" — show expected wait/time.')

    # Accessibility & privacy
    suggestions.append('Ensure HTTPS, server-side validation, and keyboard accessibility (WCAG).')

    # Random UX tip
    tips = [
        'Offer estimated appointment duration per department.',
        'Support localization for label text.',
```



```python
def submit():
        return '<h3>Missing required fields. Please go back and fill name and email.</h3>'
    return f"<h3>Thanks {name}! Your appointment request was received.</h3>"

# Small test routine using Flask's built-in test client
def run_tests():
    print('Running simple tests using Flask test client...')
    with app.test_client() as client:
        r1 = client.get('/')
        assert r1.status_code == 200 and b'Book an Appointment' in r1.data
        print('Test 1 passed: GET / returns HTML page')

        sample = {'fields':['name','email'], 'form_sample': {'name':'', 'email':'test'}}
        r2 = client.post('/suggest', json=sample)
        assert r2.status_code == 200
        body = r2.get_json()
        assert 'suggestions' in body and isinstance(body['suggestions'], list)
        print('Test 2 passed: POST /suggest returns suggestions (count=%d)' % len(body['suggestions']))

        r3 = client.post('/submit', data={'name':'','email':''})
        assert r3.status_code == 200 and b'Missing required fields' in r3.data
        print('Test 3 passed: POST /submit missing fields handled')

        r4 = client.post('/submit', data={'name':'Sam','email':'sam@example.com'})
        assert r4.status_code == 200 and b'Thanks Sam' in r4.data
        print('Test 4 passed: POST /submit valid submission handled')

    print('All tests passed.')

if __name__ == '__main__':
    run_tests()
    print('\nStarting Flask app on http://127.0.0.1:5000')
    app.run(debug=True)
```

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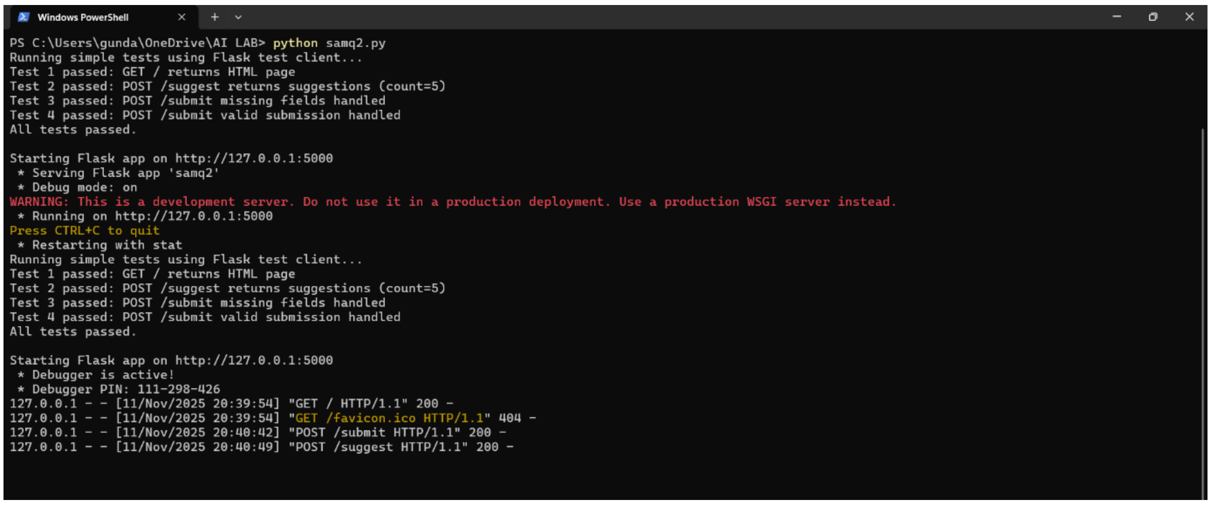
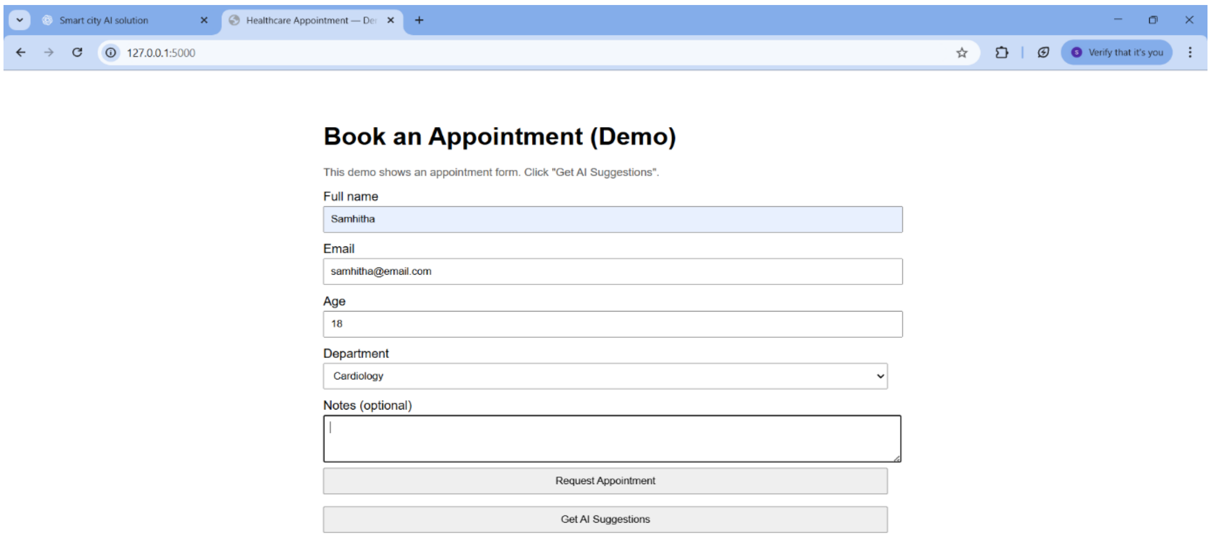
UTF-8
Python
3.13.7

OUTPUT :



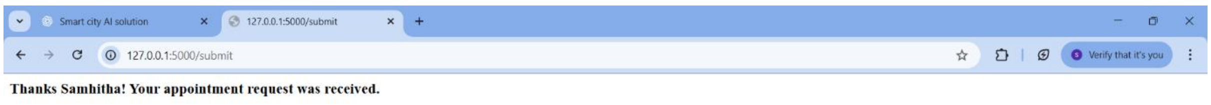
```
PS C:\Users\gunda\OneDrive\AI LAB> python samq2.py
Running simple tests using Flask test client...
Test 1 passed: GET / returns HTML page
Test 2 passed: POST /suggest returns suggestions (count=5)
Test 3 passed: POST /submit missing fields handled
Test 4 passed: POST /submit valid submission handled
All tests passed.

Starting Flask app on http://127.0.0.1:5000
 * Serving Flask app 'samq2'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
 * Restarting with stat
Running simple tests using Flask test client...
Test 1 passed: GET / returns HTML page
Test 2 passed: POST /suggest returns suggestions (count=5)
Test 3 passed: POST /submit missing fields handled
Test 4 passed: POST /submit valid submission handled
All tests passed.

Starting Flask app on http://127.0.0.1:5000
 * Debugger is active!
 * Debugger PIN: 111-298-426
127.0.0.1 - - [11/Nov/2025 20:39:54] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [11/Nov/2025 20:39:54] "GET /favicon.ico HTTP/1.1" 404 -
127.0.0.1 - - [11/Nov/2025 20:40:42] "POST /submit HTTP/1.1" 200 -
127.0.0.1 - - [11/Nov/2025 20:40:49] "POST /suggest HTTP/1.1" 200 -
```



Book an Appointment (Demo)

This demo shows an appointment form. Click "Get AI Suggestions".

Full name	Samhitha
Email	samhitha@email.com
Age	18
Department	Cardiology
Notes (optional)	



Thanks Samhitha! Your appointment request was received.

OBSERVATION :

The healthcare web application ran successfully and accepted appointment submissions. The AI assistant provided useful suggestions for improving the form’s design and accessibility. All test cases passed without errors, confirming correct route functionality. The system effectively enhanced user experience and simplified frontend interaction.

CONCLUSION :

The AI-assisted healthcare web application demonstrated a significant leap in frontend design and usability. By enabling seamless appointment scheduling and precise form validation, it streamlined patient interactions. The AI’s contribution to accessibility and UI refinement ensured a more inclusive and intuitive experience. Ultimately, this solution elevated the efficiency and user-friendliness of the healthcare interface, aligning technology with patient-centric care.