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Flask Project Structure for Expert Systems

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Expert System

2025 – 2026

Y3 – DCS – NU

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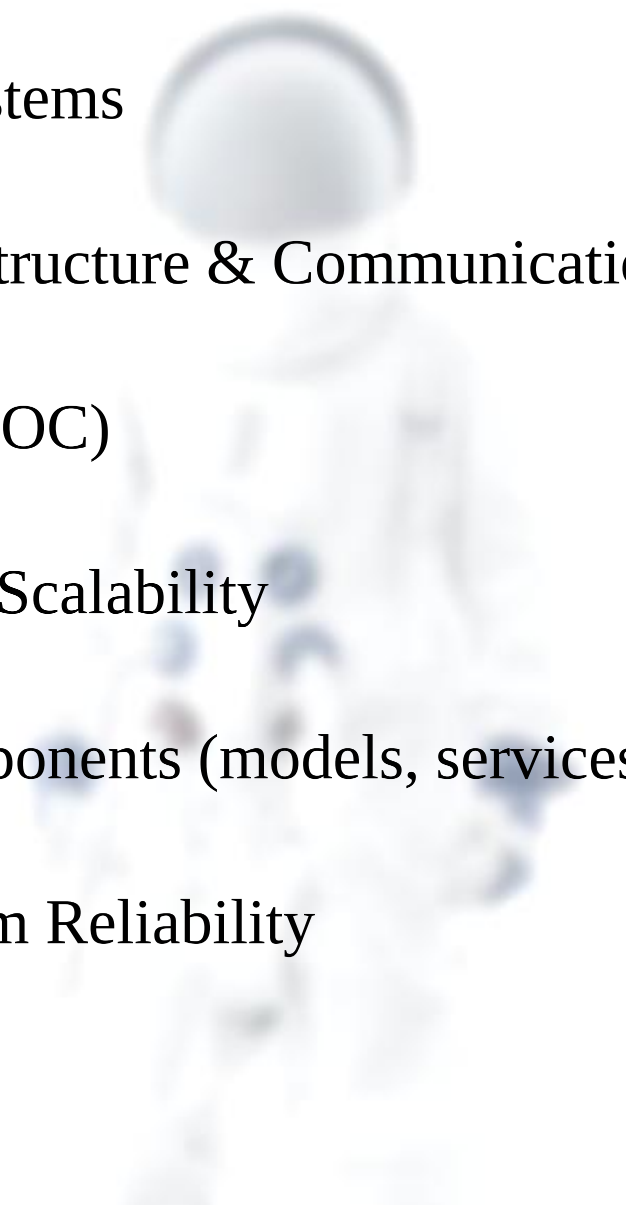

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Learning Outcome:

By the end of this lesson, students will be able to:

1. Explain the purpose of expert systems and how their workflow maps to a structured Flask application.

2. Identify and describe each major folder in the project structure and explain the role it plays in the expert system architecture.

3. Apply the principle of Separation of Concerns (SOC) to keep knowledge, rules, logic, and interface code properly separated.

4. Demonstrate how structured design improves scalability, allowing new rules, facts, and features to be added without breaking the system.

5. Build and organize knowledge models, reasoning logic, and consultation routes into appropriate folders following expert-system best practices.

6. Evaluate system reliability by using tests, migrations, and configuration files to ensure the expert system remains stable as it grows.

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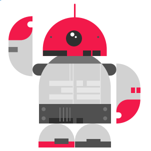

1 — Introduction to Expert Systems

What Is an Expert System?

- AI that mimics human decision-making
- Uses facts + rules
- Needs a clear structure
- ***Example:*** Permissions System

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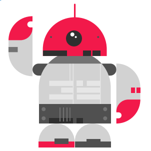

Expert System Workflow

- User Input
- Knowledge Base (facts)
- Inference Engine (rules)
- Output
- Flask project maps to these steps

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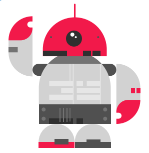
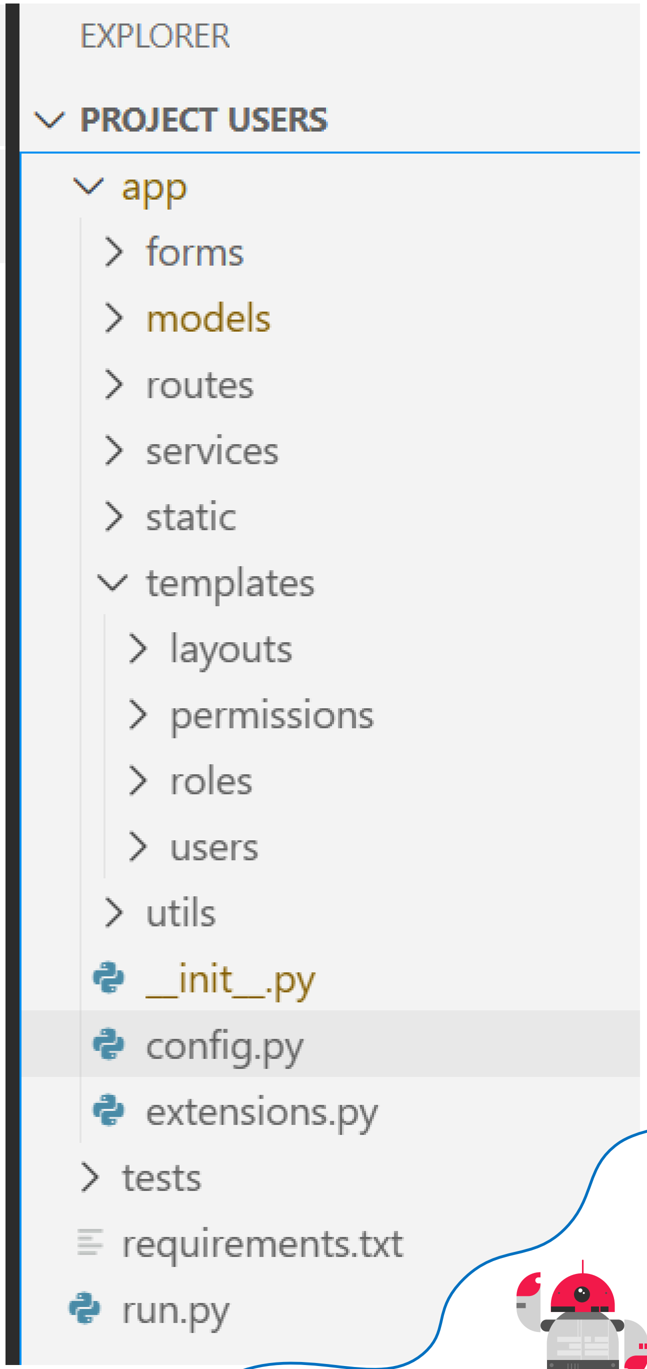


2 — Overview of the Project Structure & Communication

2 — Overview of the Project Structure & Communication

Full Project Structure Overview

- Display folder tree
- "Everything has a place"
- Supports real-world workflow



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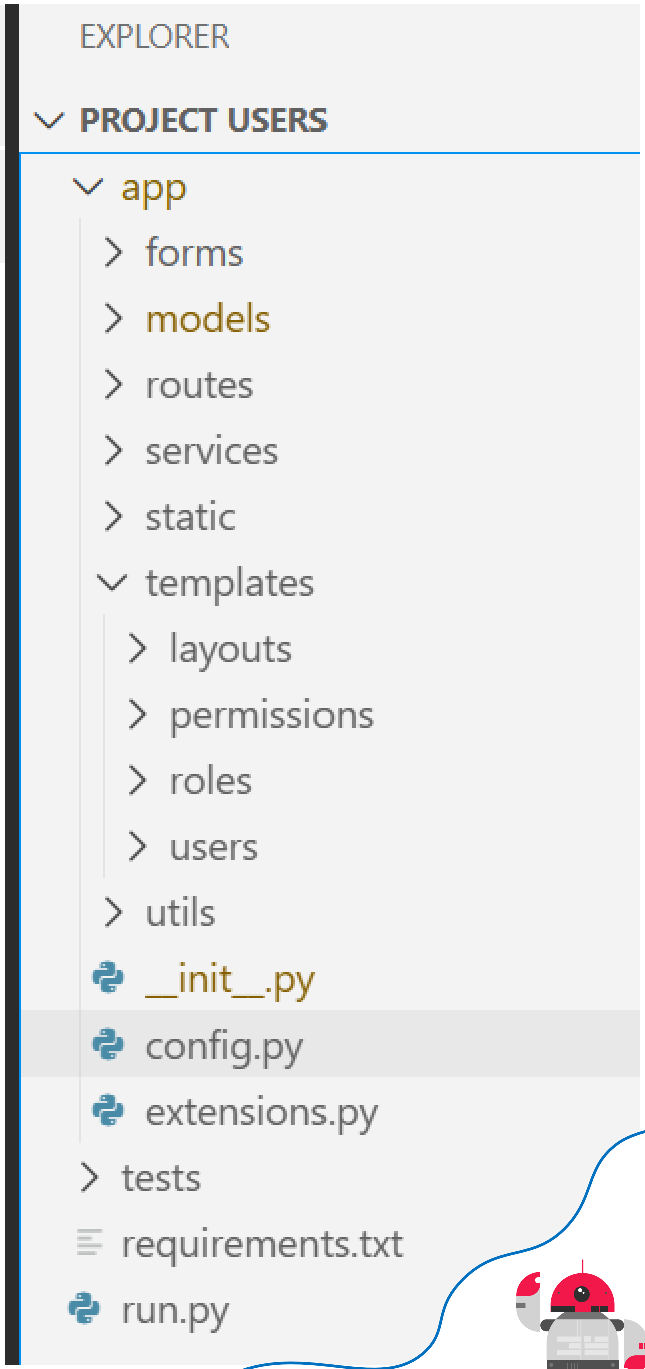
2 — Overview of the Project Structure & Communication

Structure = Communication

- Structure teaches developers
- Reduces confusion
- Makes teamwork easier
- Faster onboarding



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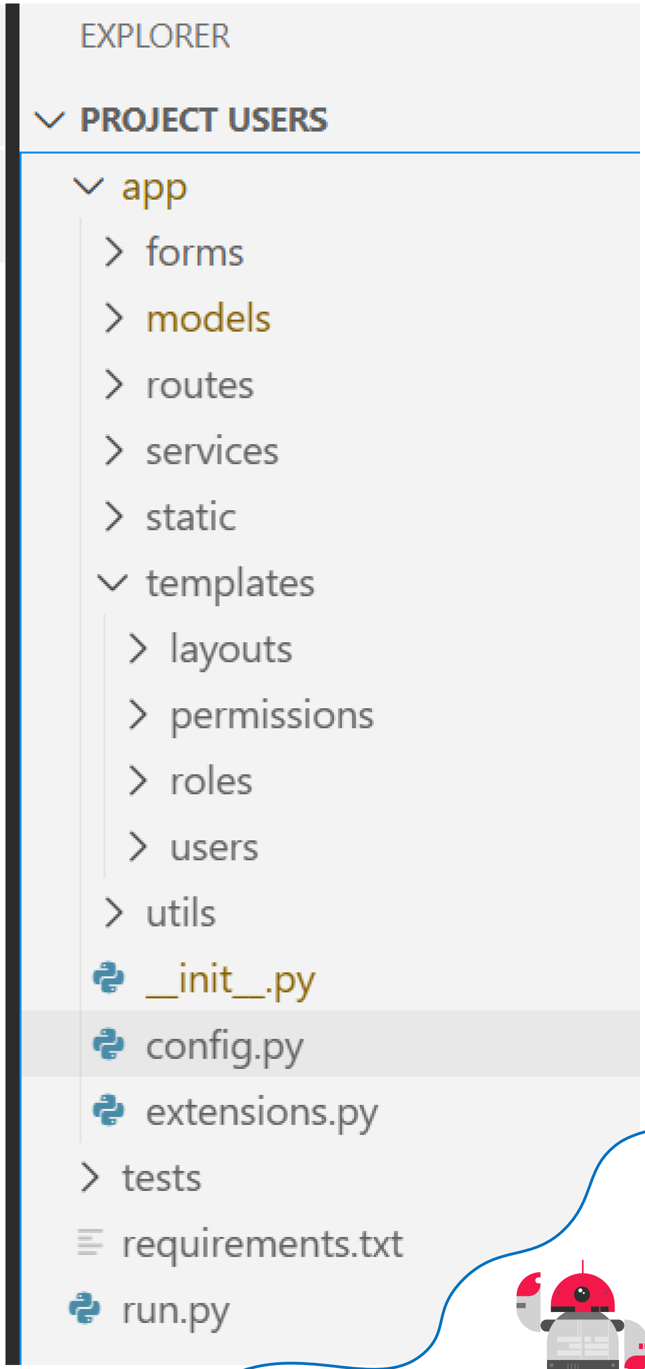
3 — Separation of Concerns (SOC)

3 — Separation of Concerns (SOC)

What is SOC?

SOC is vital in expert systems because mixing rules and interface can lead to incorrect reasoning or unpredictable behavior.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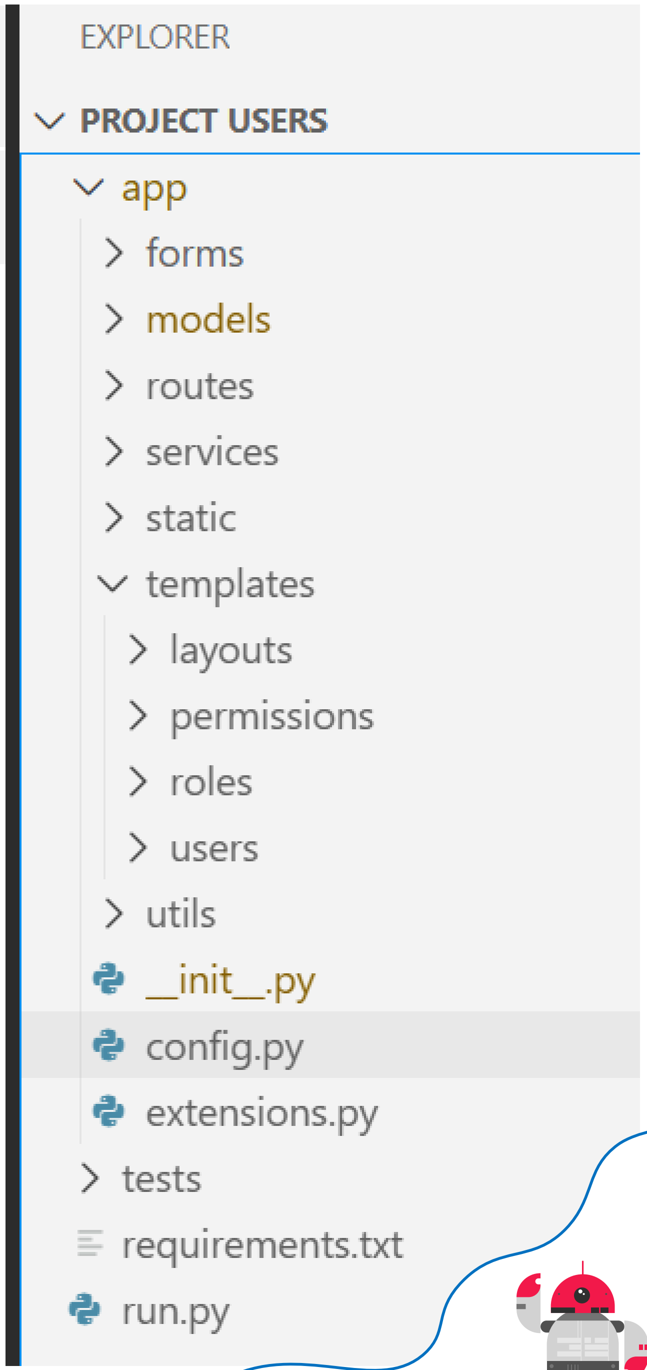
3 — Separation of Concerns (SOC)

Why SOC Matters

- Each folder has one job
- Prevents mixing logic/UI/data
- Cleaner, safer code
- Easy to maintain



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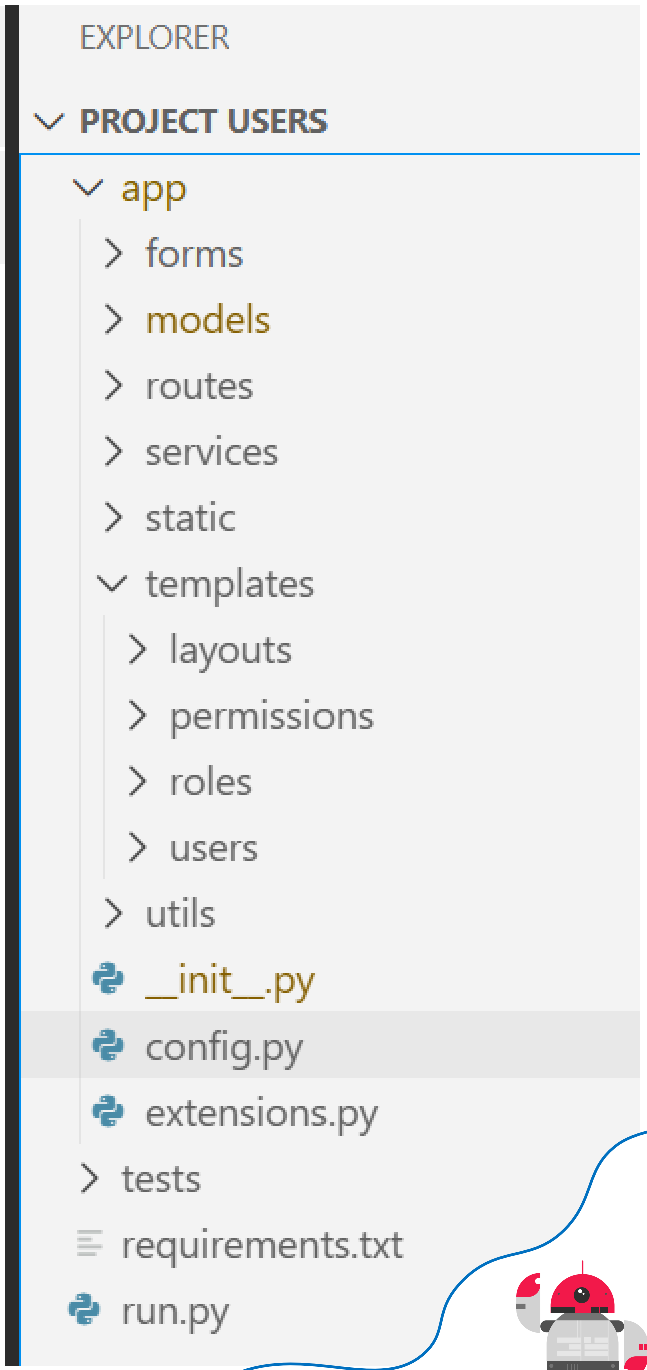
3 — Separation of Concerns (SOC)

Example: Bad Structure

- Everything in app.py
- Hard to read
- Hard to test
- Easily breaks



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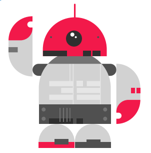
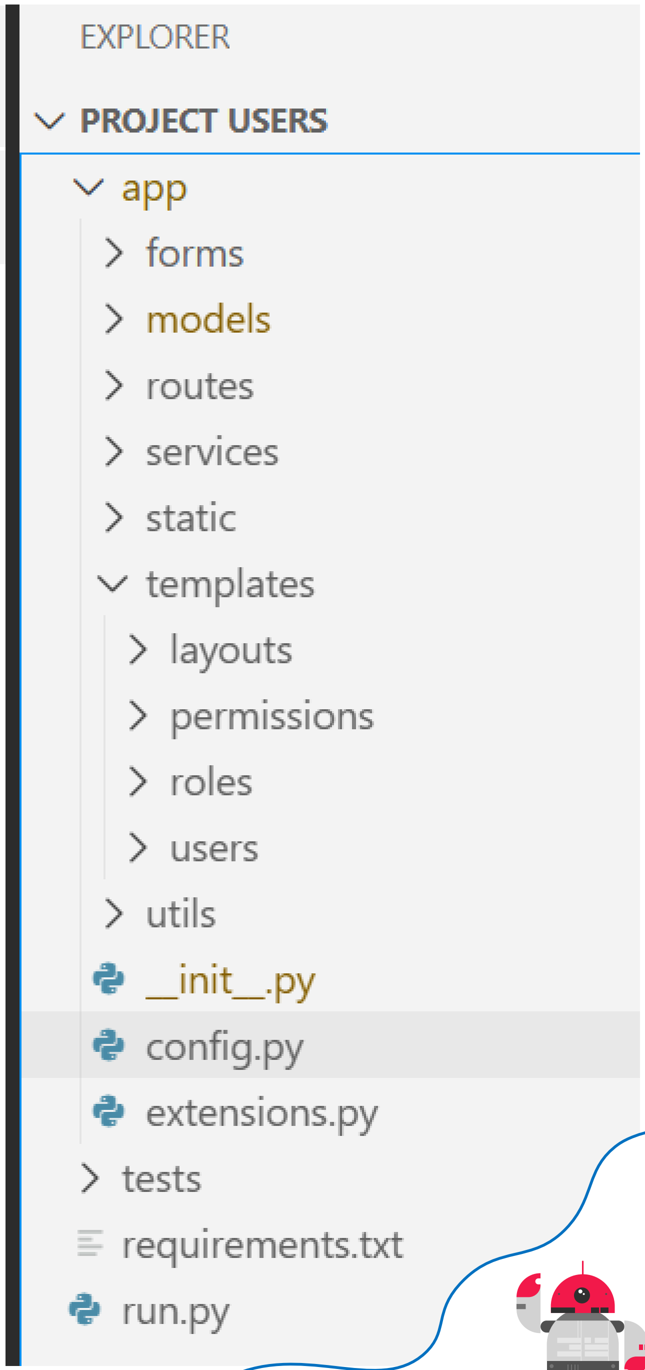


3 — Separation of Concerns (SOC)

Example: Good Structure

- Clear folders
- Easy updates
- Safe changes
- Professional quality



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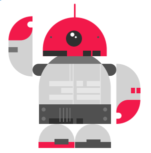


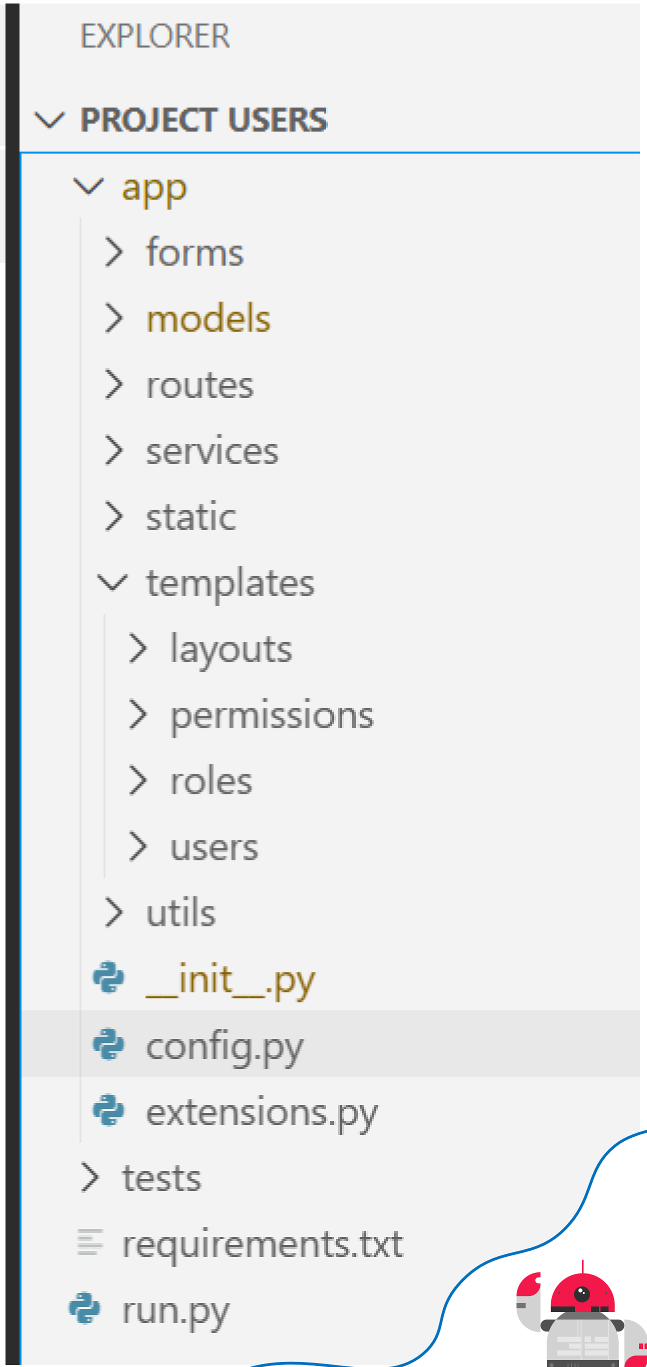
3 — Separation of Concerns (SOC)

Example: Good Structure

Separation of Concerns means each folder has one job.

This prevents mixing:

- Knowledge of UI
- Reasoning with templates
- Database code with business rules



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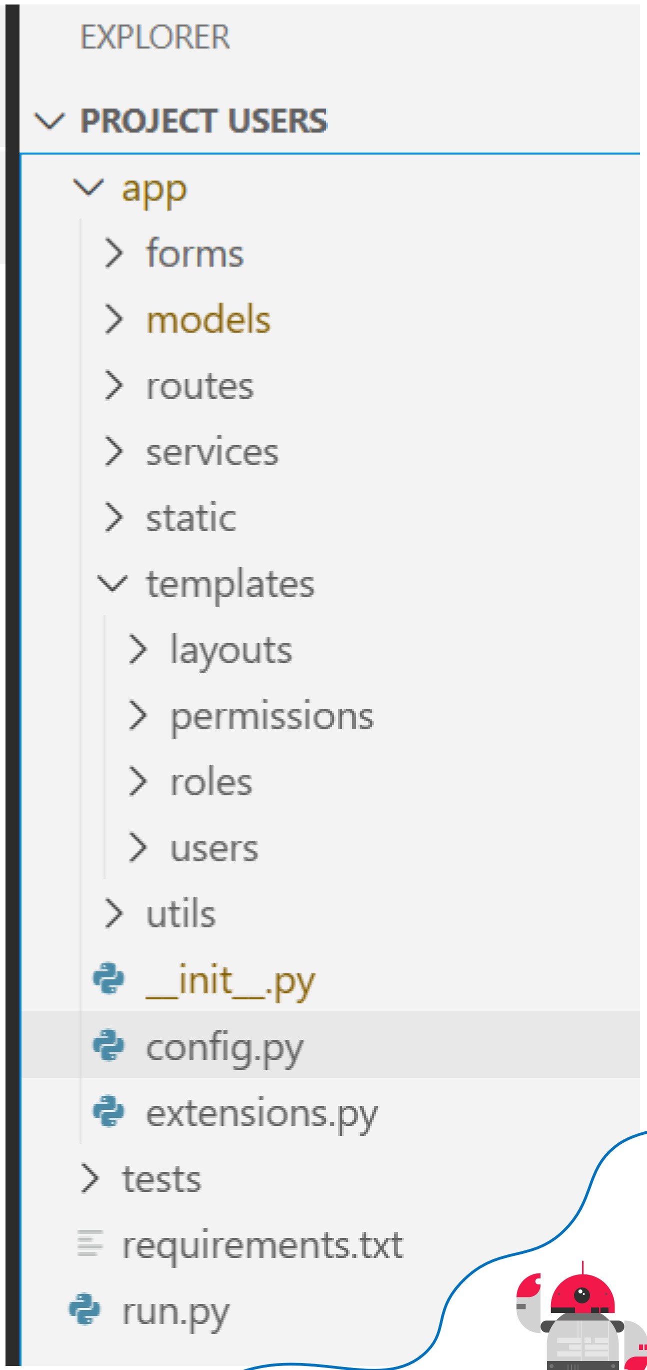
3 — Separation of Concerns (SOC)

Example: Good Structure

Result:

- Safer changes
- Cleaner logic
- Fewer bugs
- Clear flow from user → knowledge → reasoning → output



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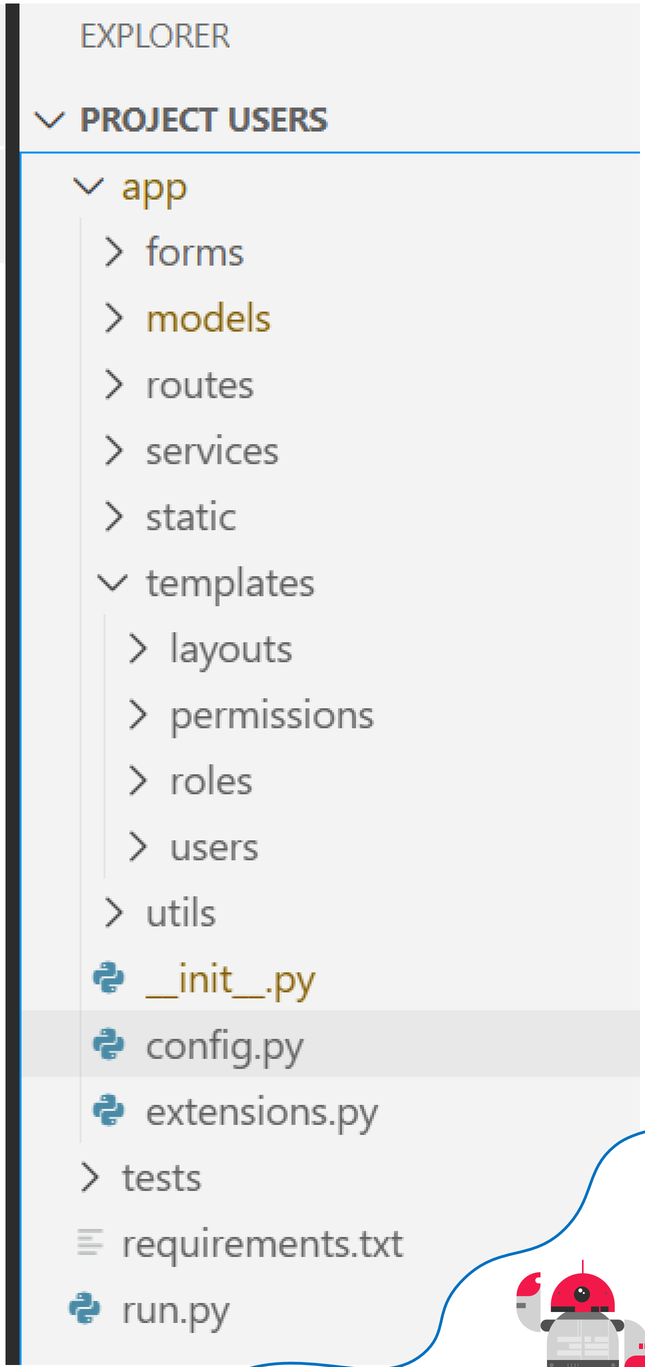
4 — Expert System Growth & Scalability

4 — Expert System Growth & Scalability

Scalability

- Projects grow
- More features
- More rules
- Structure supports expansion



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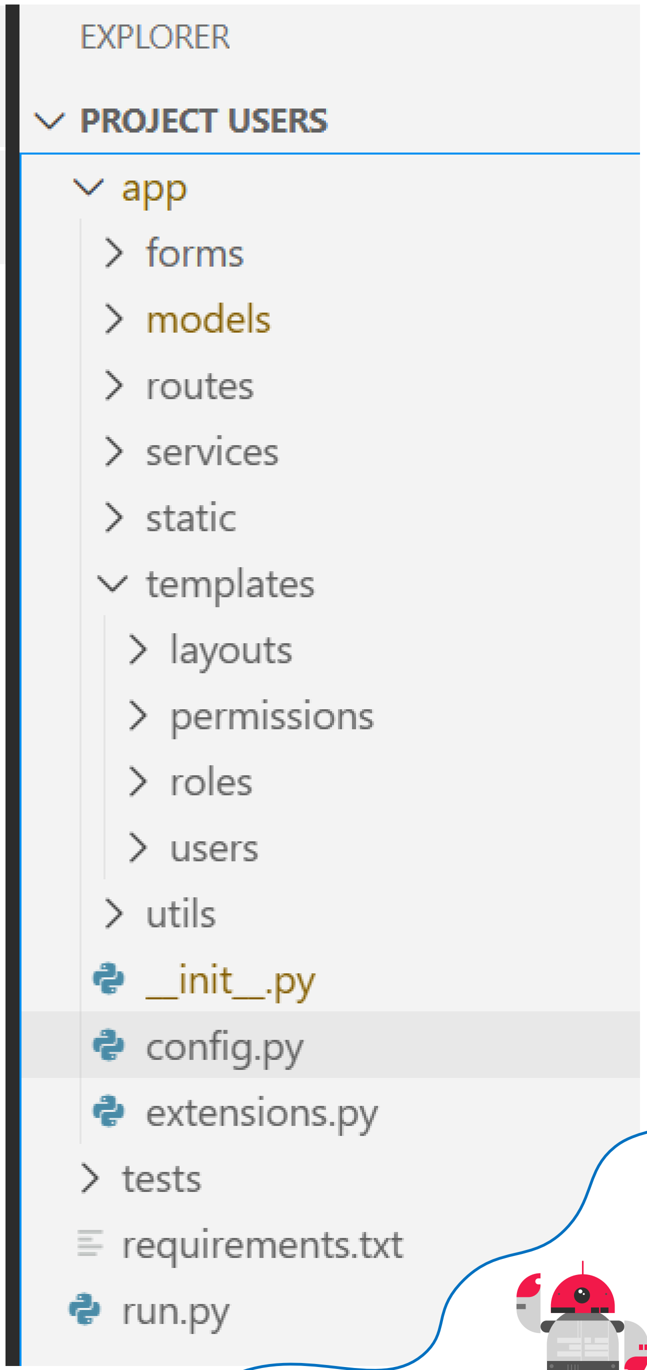
4 — Expert System Growth & Scalability

Expert systems grow quickly:

- More rules
- More facts
- More user roles
- More decisions
- More modules



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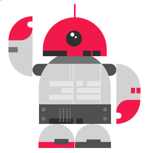
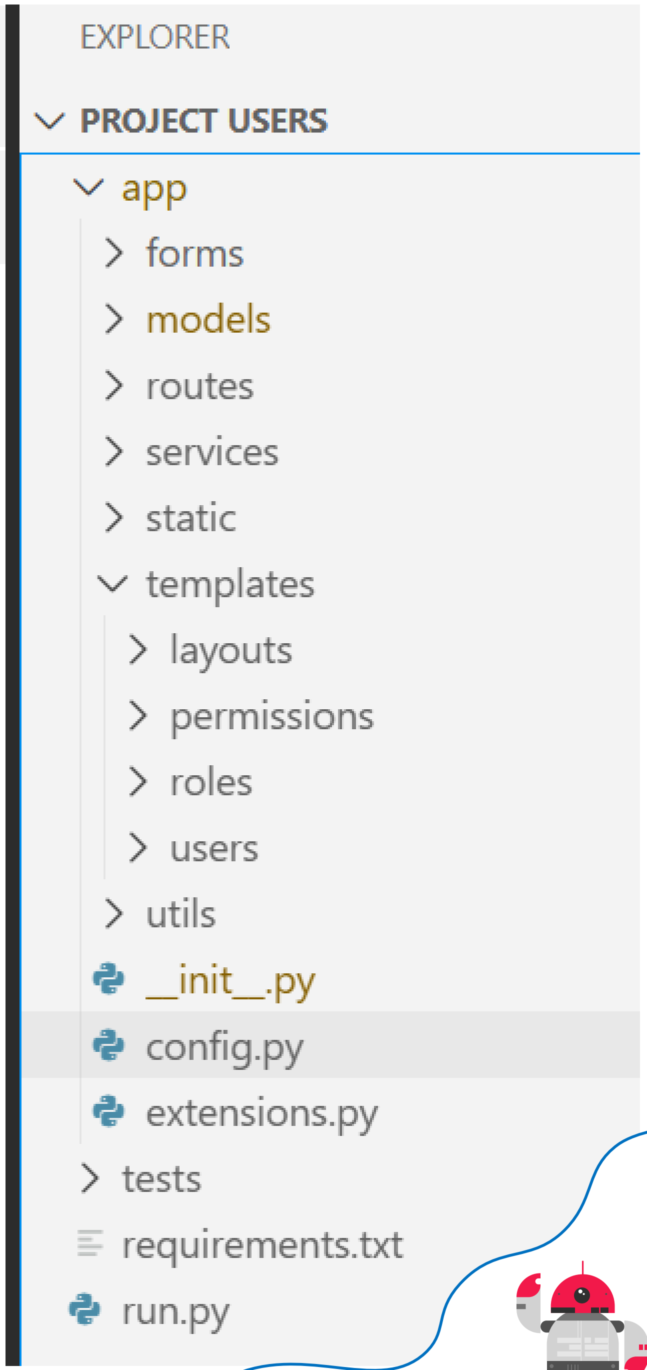


4 — Expert System Growth & Scalability

Without structure:

- Files become huge
- Errors increase
- Updates break things
- Circular imports appear
- Students/developers get lost



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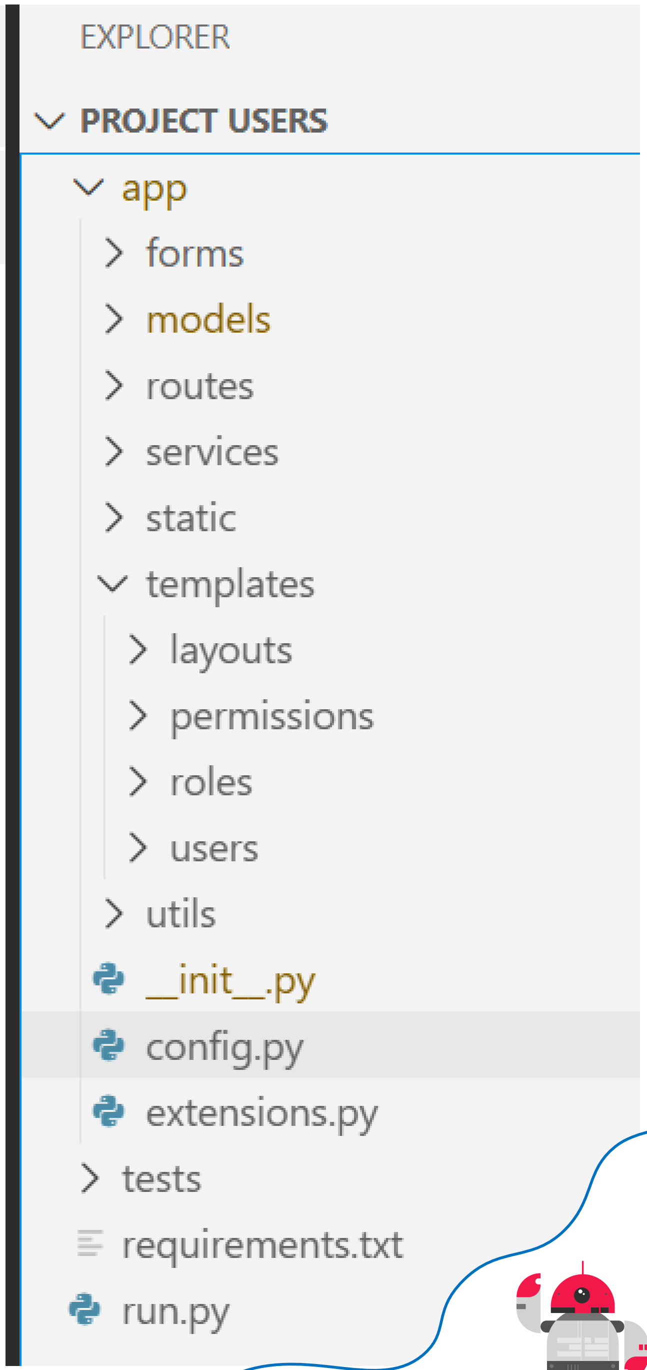
4 — Expert System Growth & Scalability

With structure:

- Adding new rules is easy
- Adding new entities is safe
- UI, logic, and data stay separate
- System can scale without breaking



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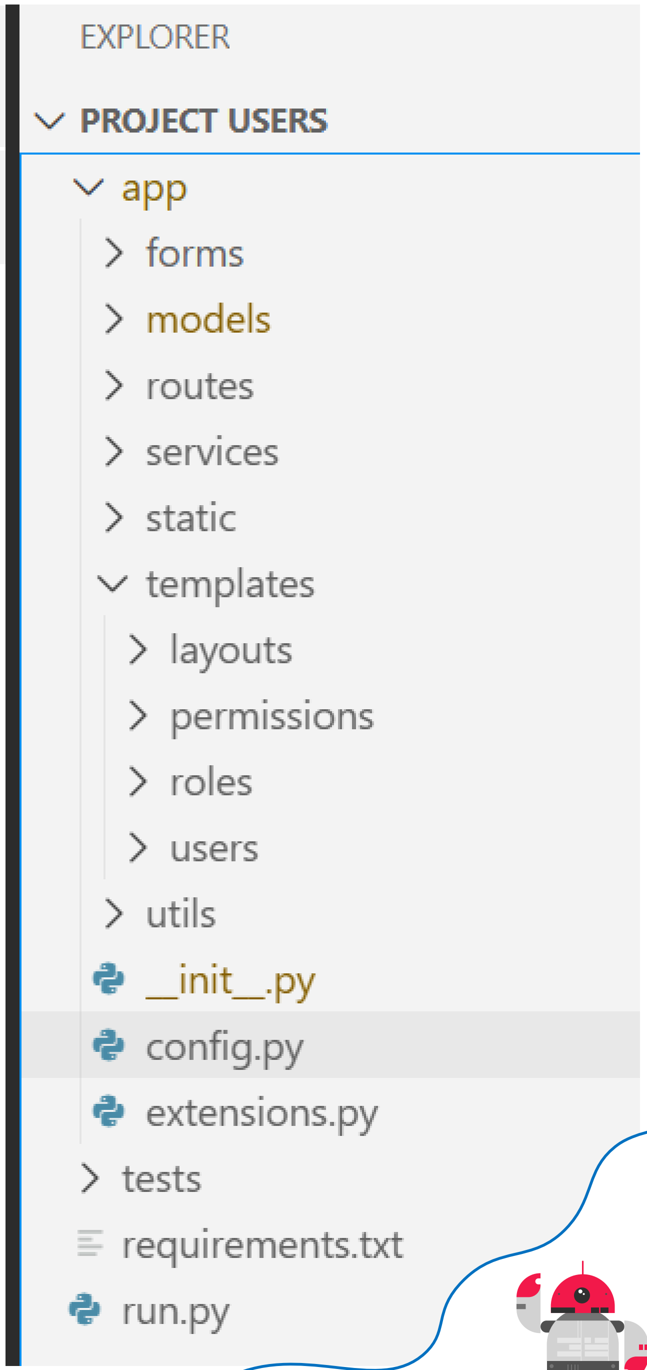
5 — Core Expert System Components (models, services, routes, templates, static)

5 — Core Expert System Components

services/ — Inference Engine

- Business rules
- Decision logic
- Assigning roles
- Permission checks



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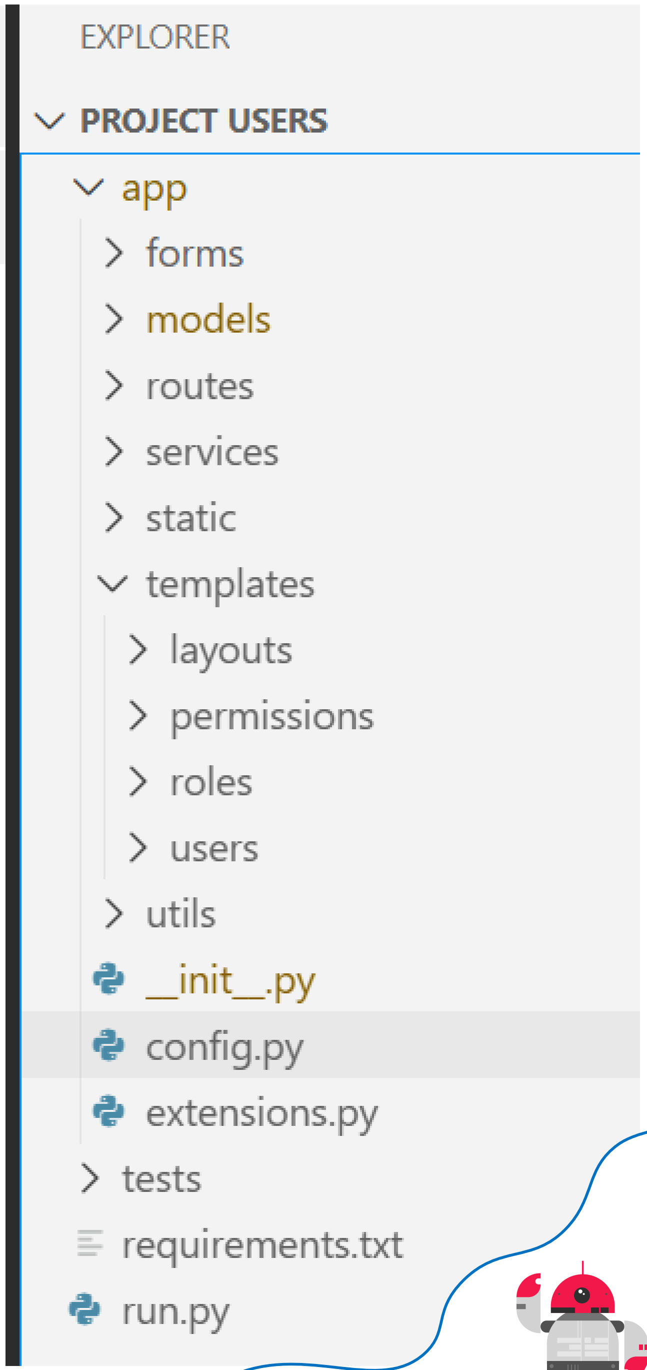
5 — Core Expert System Components

Why Logic Goes in services/

- Templates should not have logic
- Routes should not apply rules
- Clean reasoning layer
- Supports testing



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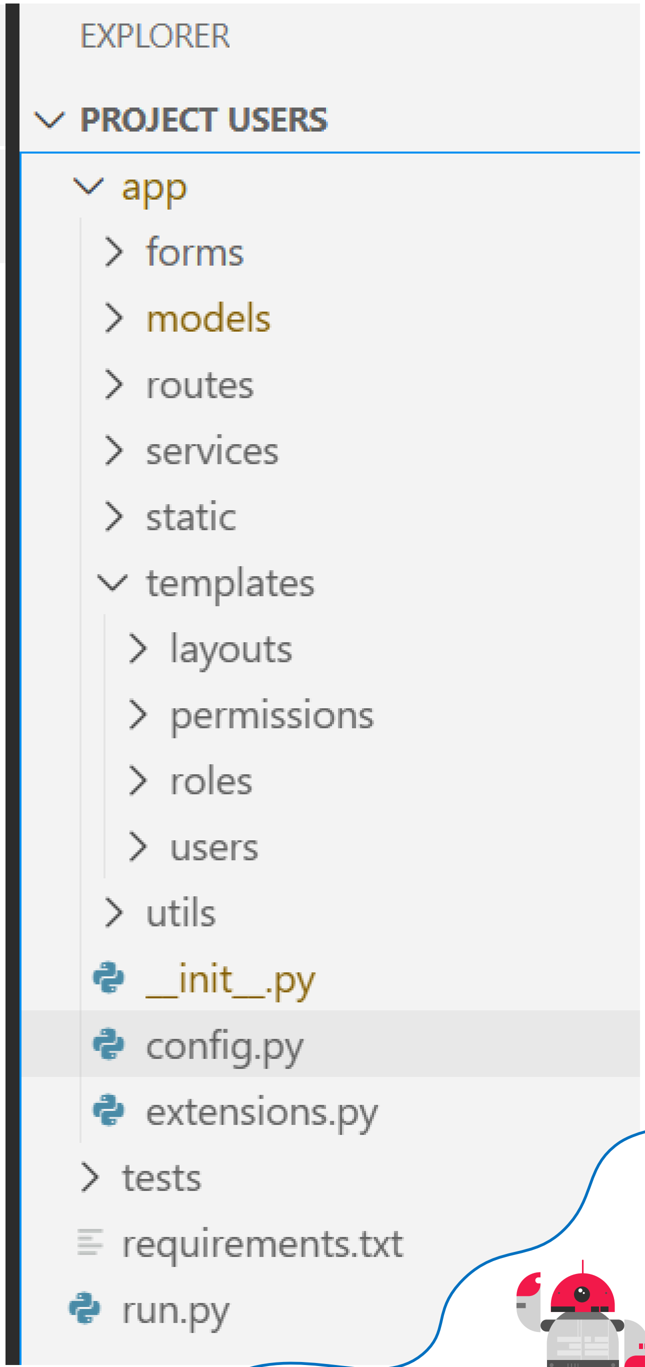
5 — Core Expert System Components

routes/ — Consultation Interface

- User asks questions
- System answers
- Bridges UI + logic
- Routes stay thin



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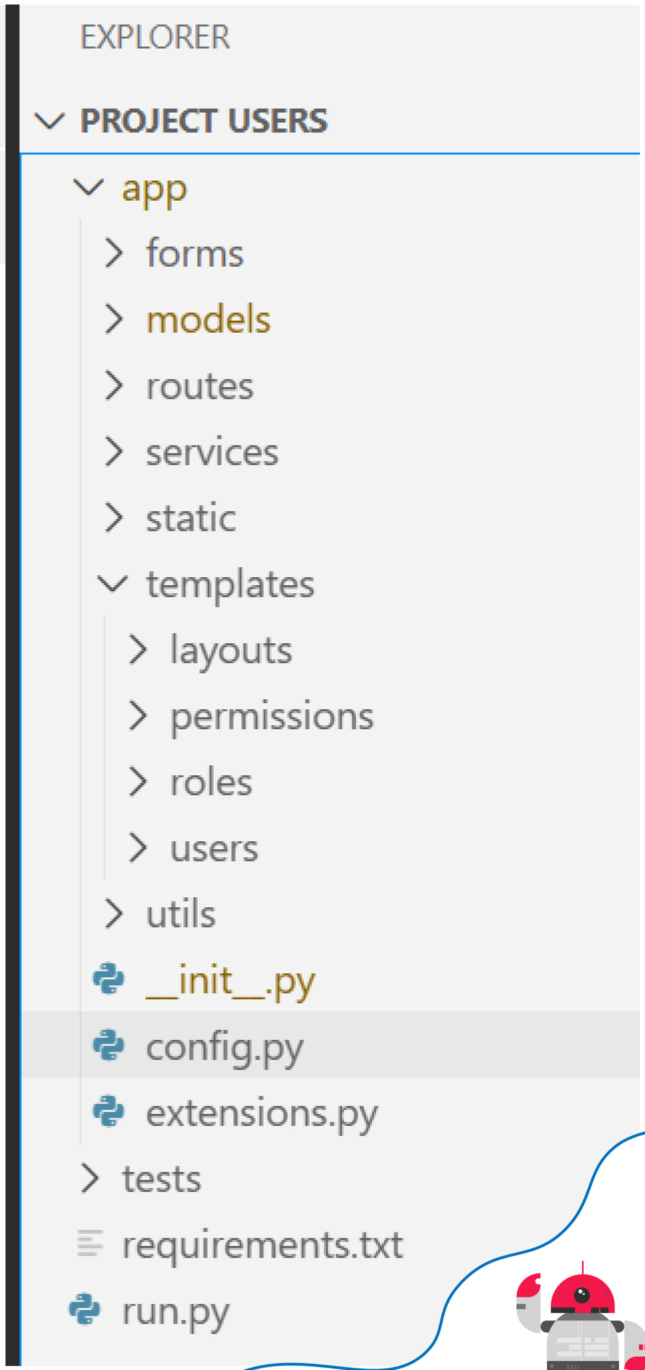
5 — Core Expert System Components

templates_custom/ — Presentation Layer

- HTML views
- Organized by domain
- Custom folder for modularity
- Clear mapping to routes/services



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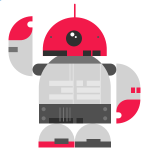
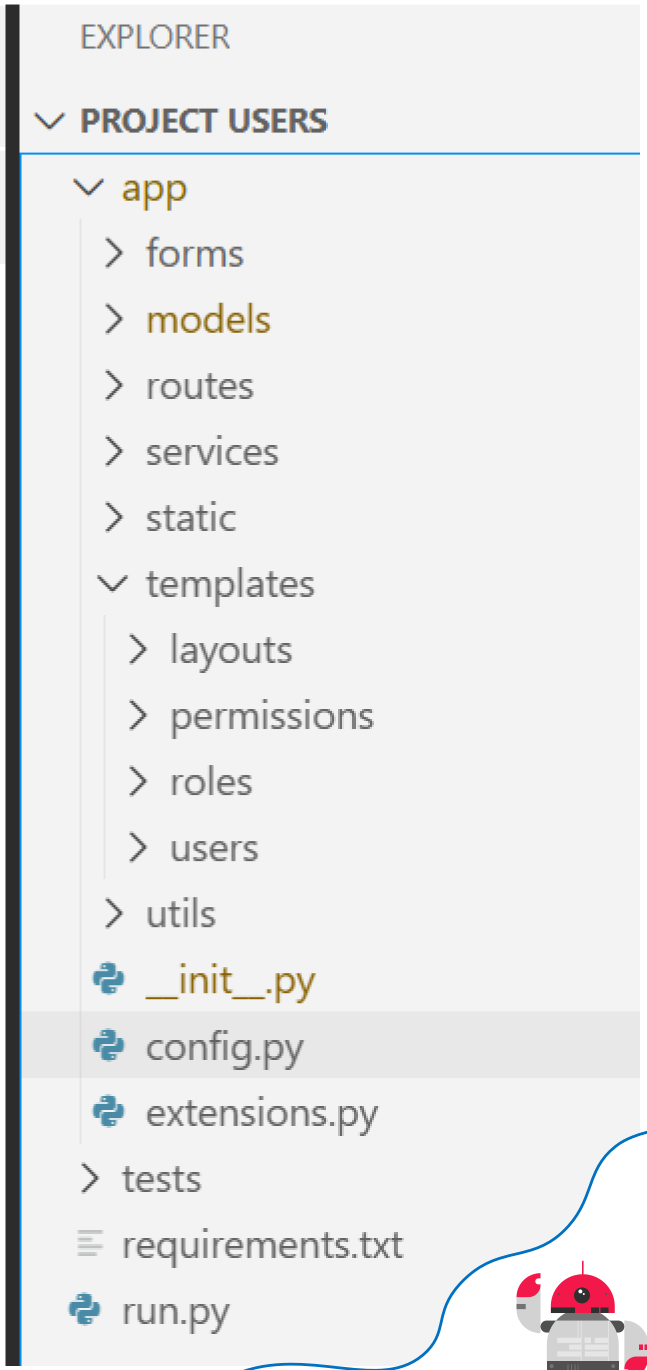


5 — Core Expert System Components

static/ & forms/

- CSS/JS support user interaction
- Forms validate input
- Stops bad facts from entering the system



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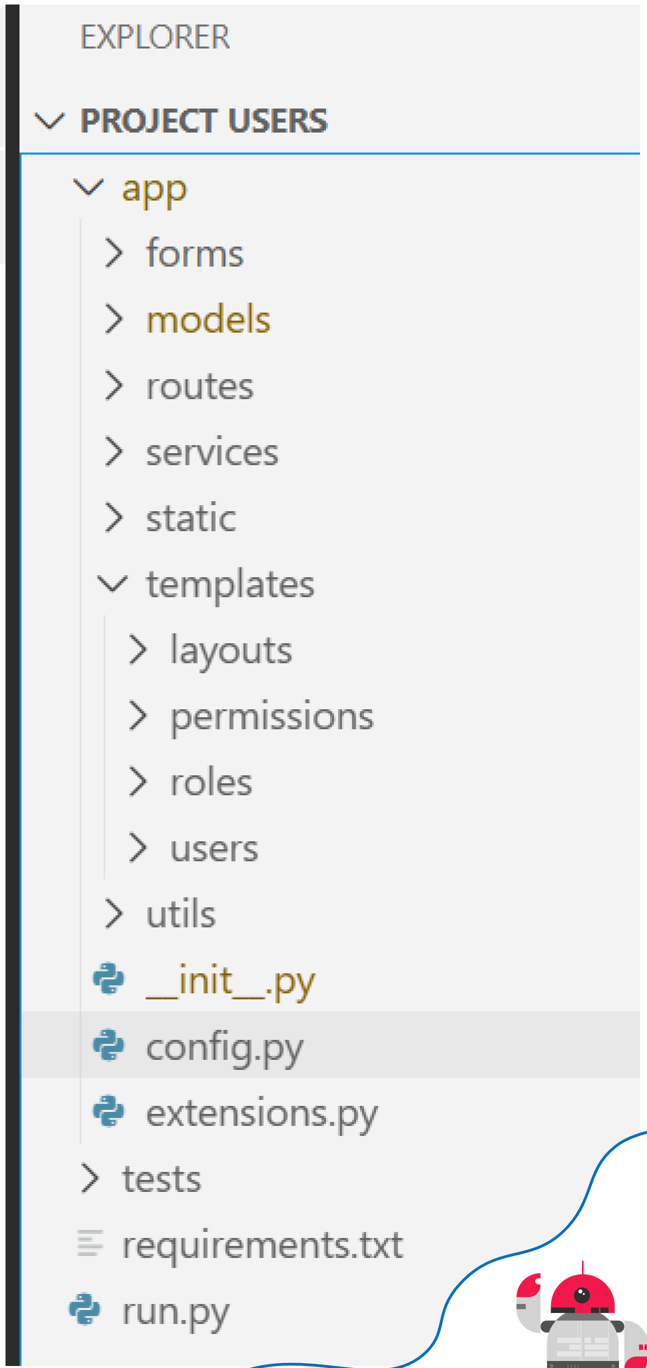
5 — Core Expert System Components

utils/

- Reusable helper functions
- Decorators
- Small reasoning helpers



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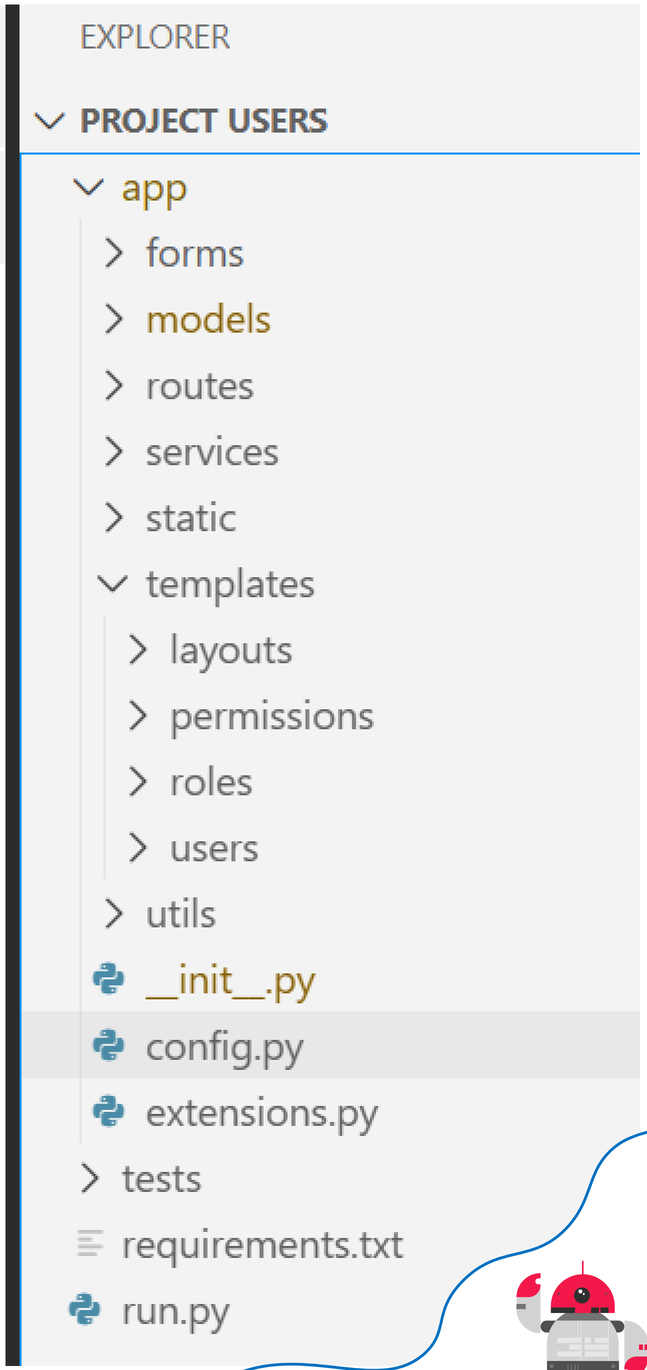
5 — Core Expert System Components

instance/

- Holds database
- Environment specific
- Not in Git
- Protects data



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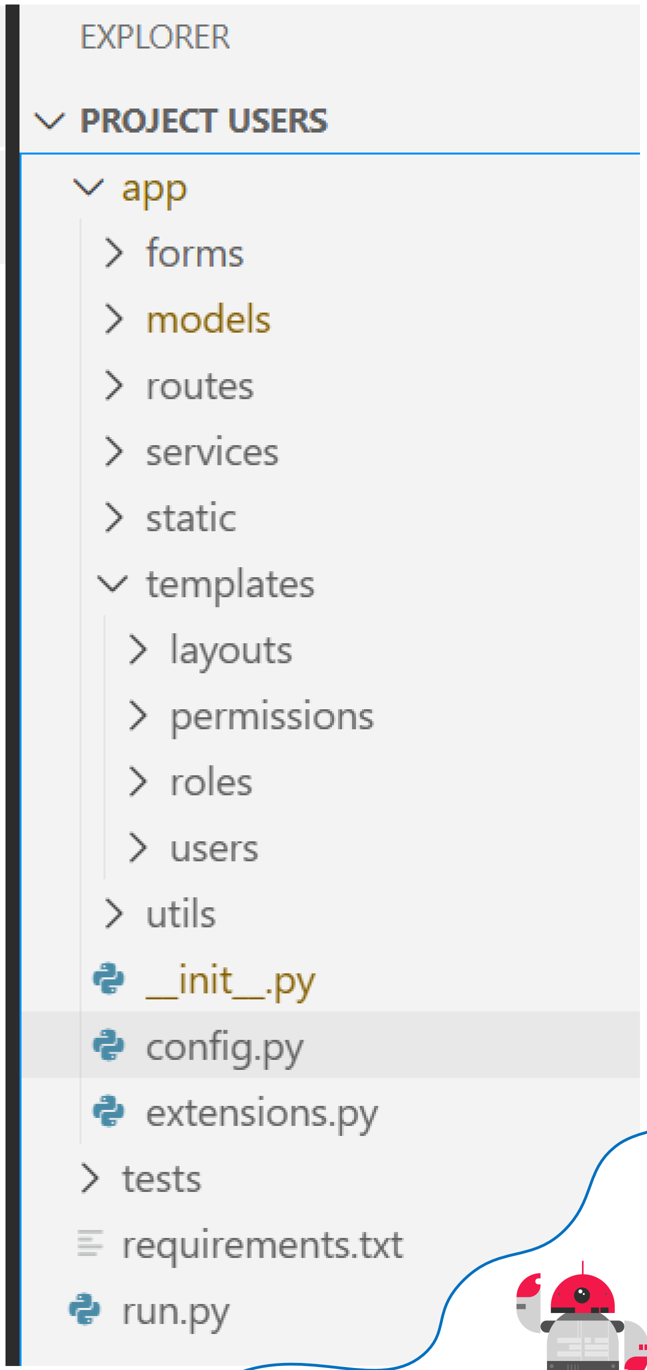
5 — Core Expert System Components

migrations/

- Tracks DB changes
- Supports schema evolution
- Essential for real systems



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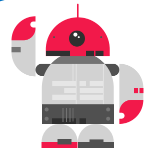
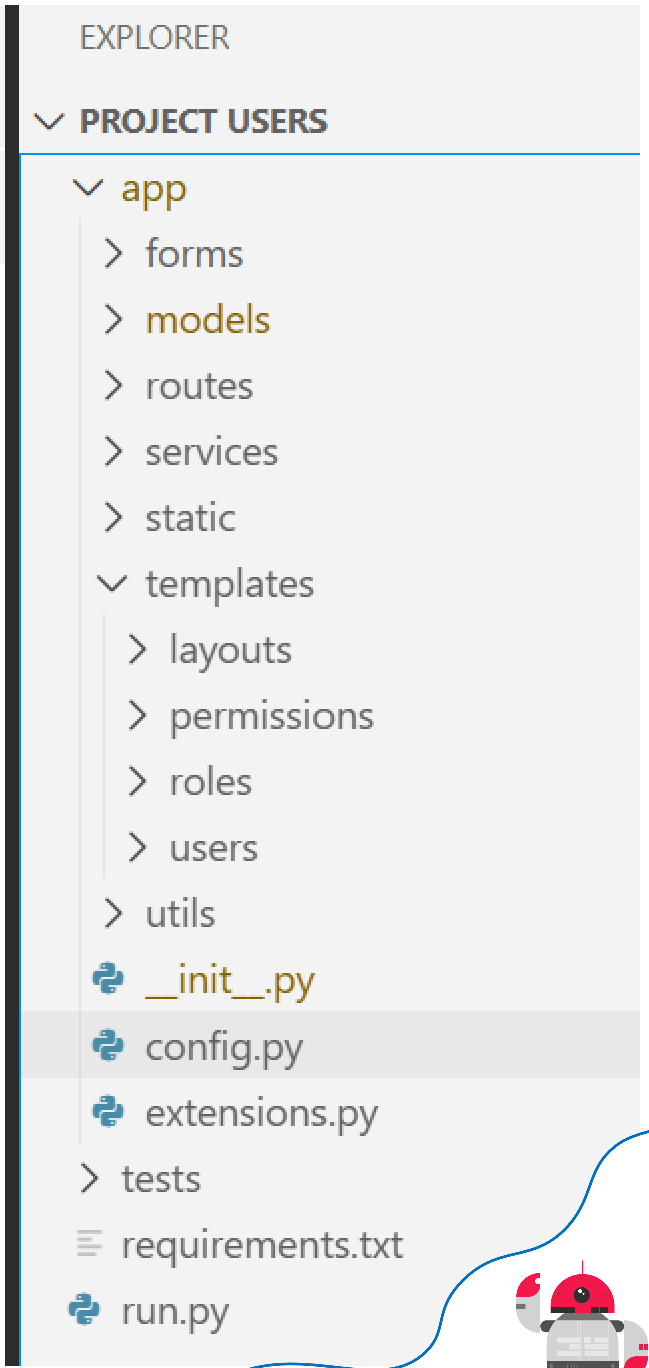


5 — Core Expert System Components

tests/

- Expert systems must be correct
- Test rule logic
- Test knowledge accuracy
- Prevent regressions



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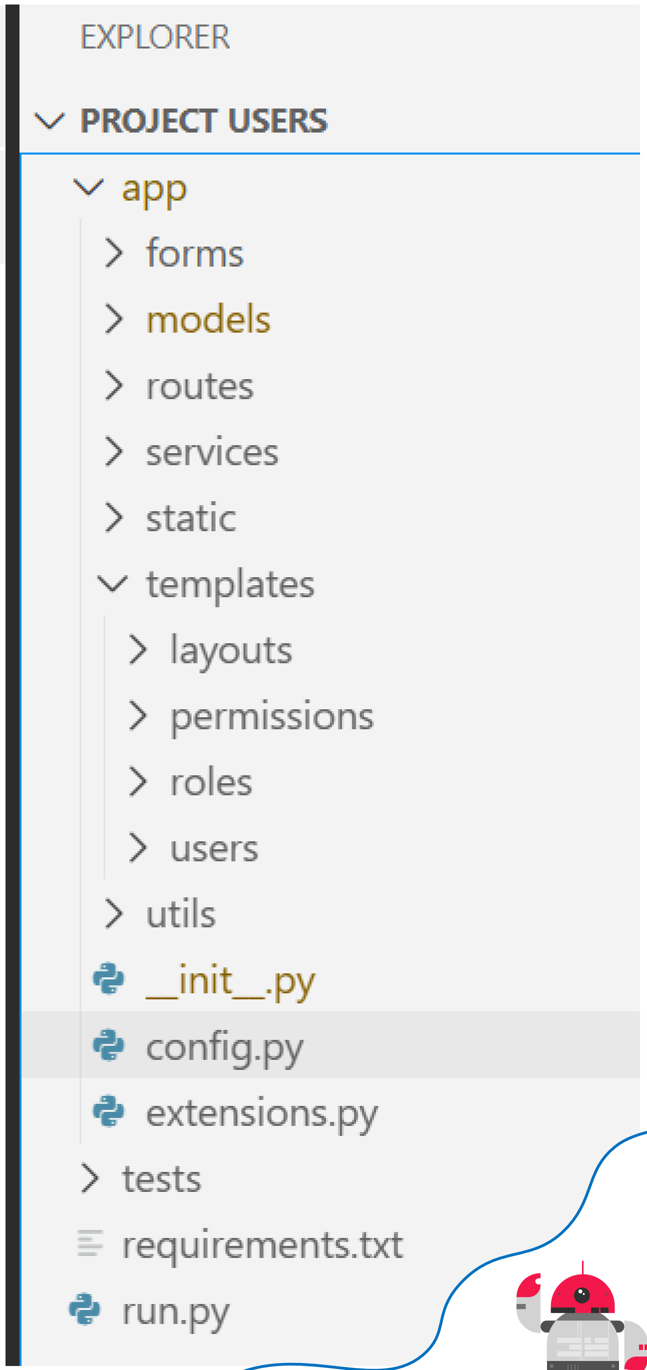
5 — Core Expert System Components

config.py

- Central system settings
- DB URI
- Secret key
- Debug settings



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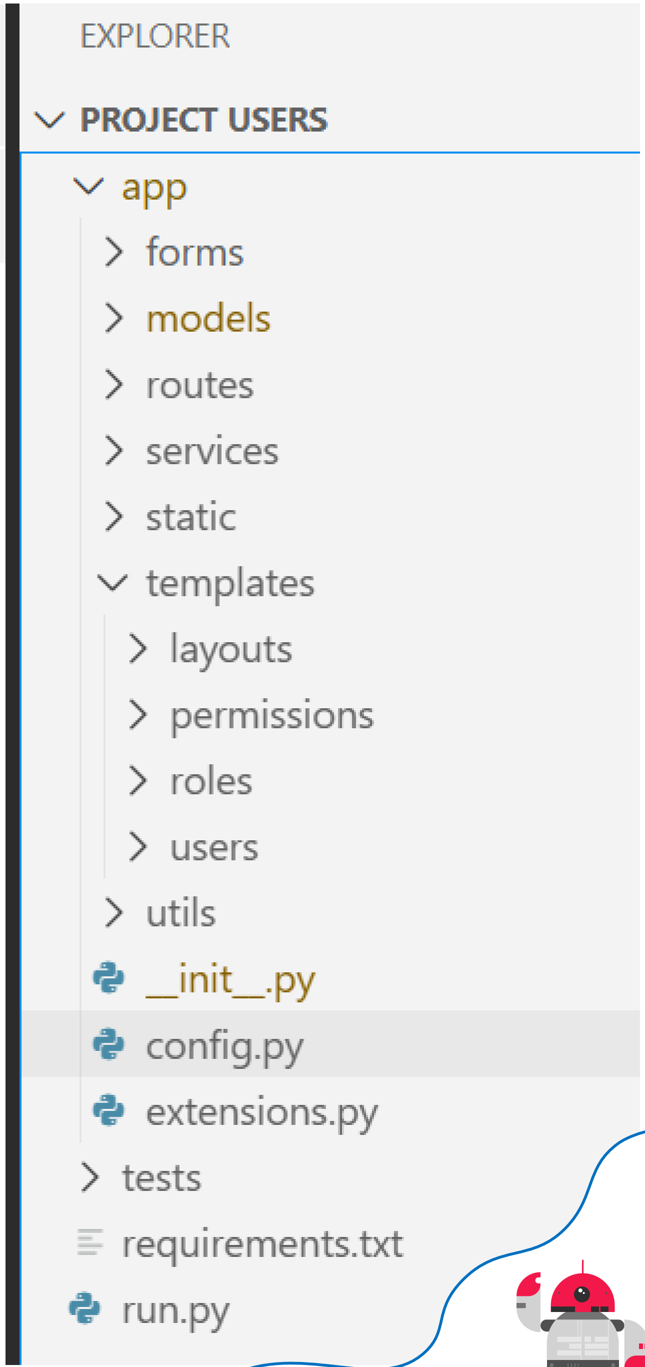
5 — Core Expert System Components

extensions.py

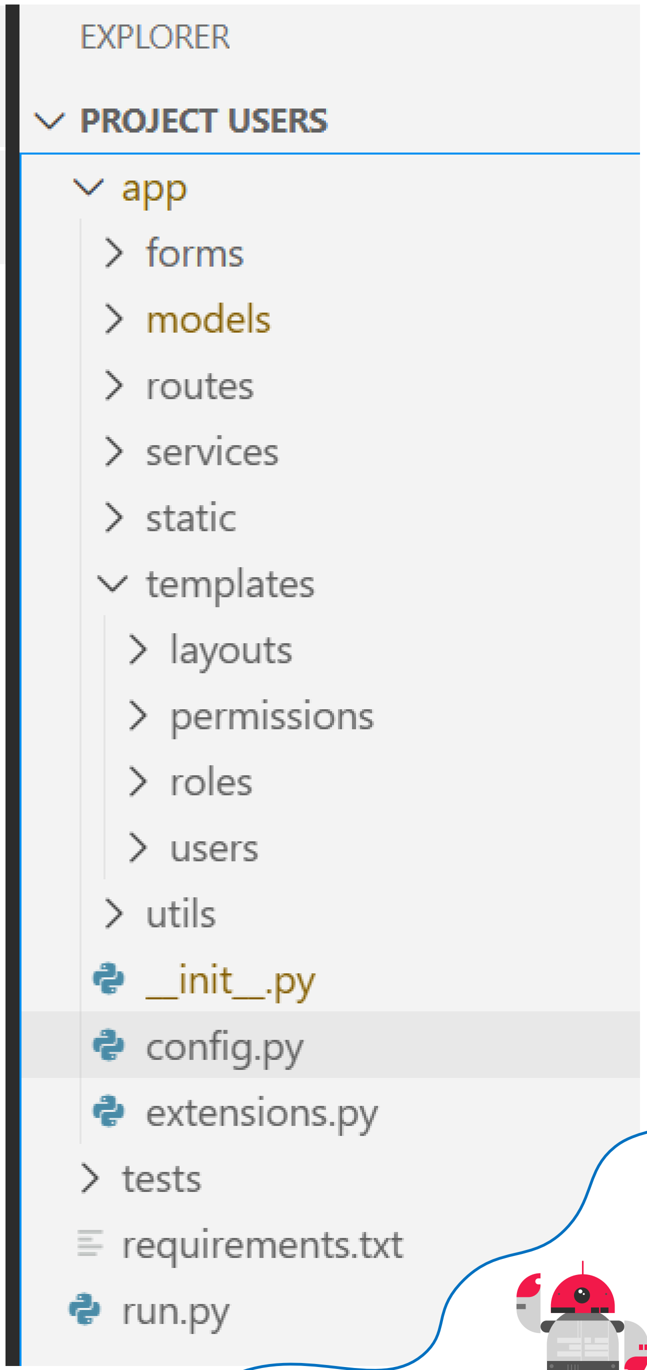
- Initializes SQLAlchemy
- Initializes Migrate
- Avoids circular imports



5 — Core Expert System Components

run.py & Requirements

- run.py starts the system
- requirements.txt = needed libraries
- README = how to use



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  ∨ app
    > forms
    > models
    > routes
    > services
    > static
    ∨ templates
      > layouts
      > permissions
      > roles
      > users
    > utils
    __init__.py
    config.py
    extensions.py
  > tests
  requirements.txt
  run.py
```

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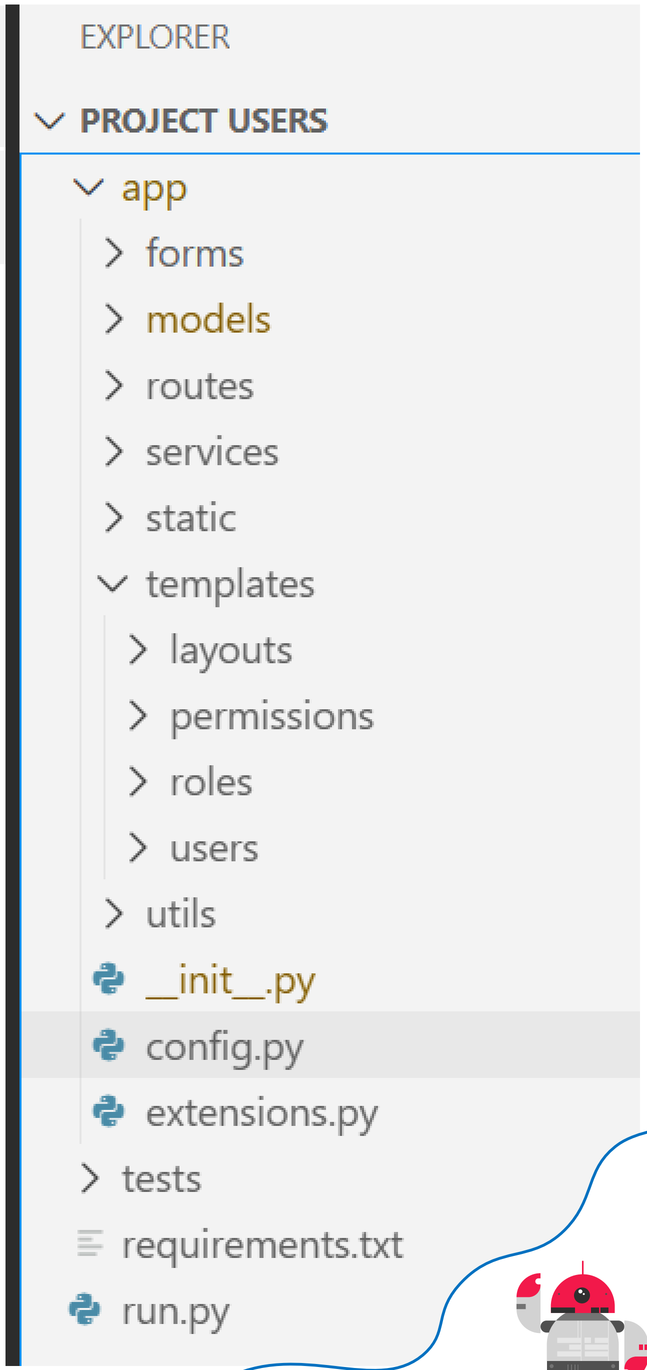
6 — Support Systems & System Reliability

6 — Support Systems & System Reliability

Putting It All Together

- Expert system workflow
- Folder workflow
- Everything maps cleanly
- Easy to upgrade



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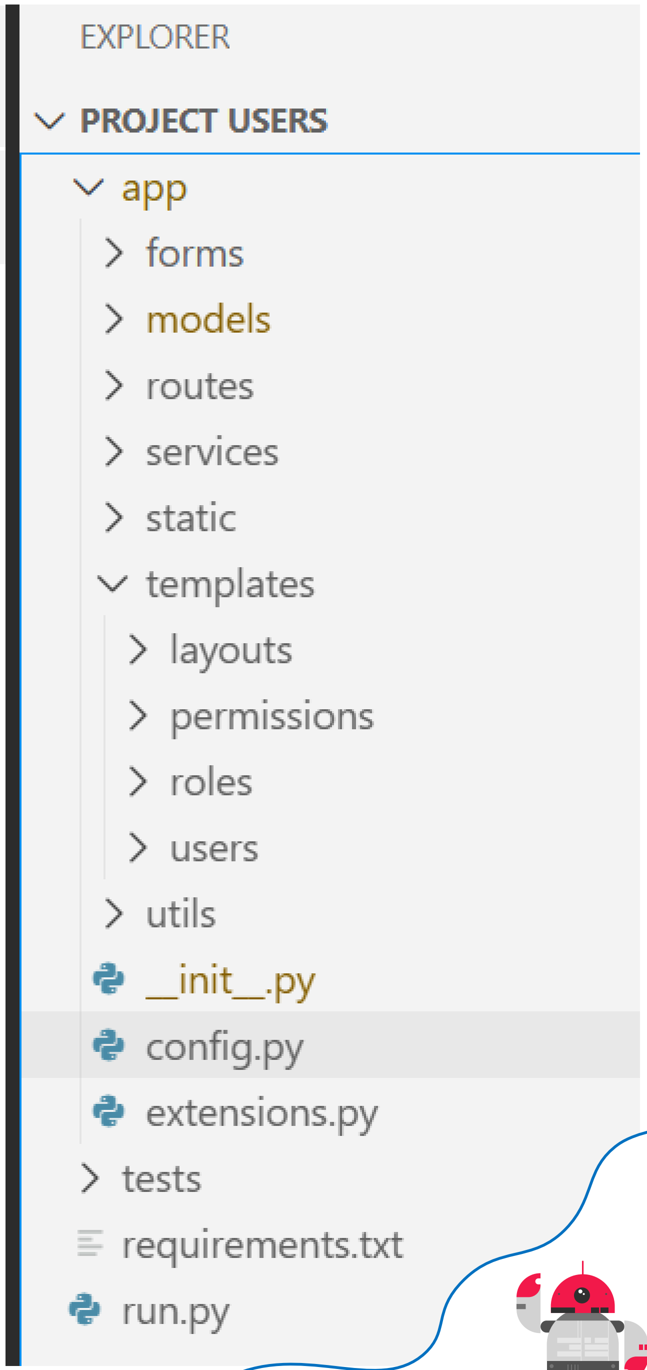
Professional Benefits

- Team-friendly
- Future-proof
- Cleaner development
- Industry standard architecture



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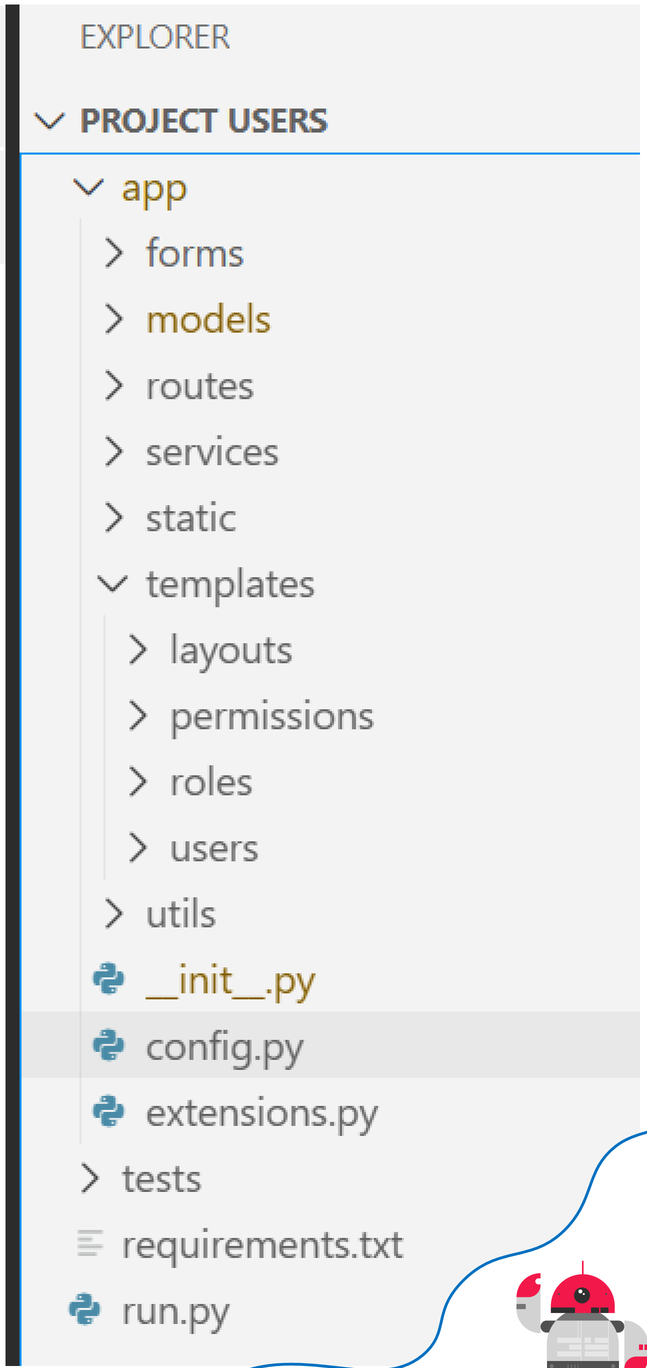
6 — Support Systems & System Reliability

Summary

- Structure is essential, not optional
- Makes expert systems reliable
- Makes development easier
- Builds real-world skills
- Questions & next steps



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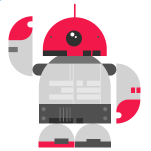

Thank You

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