SWE Agent Project - Complete Guide

1) What is SWE Agent Project?

A SWE Agent is an AI-based software engineering assistant that can:

- Read project code

- Understand GitHub repo structure

- Create / fix bugs

- Add features

- Write unit tests

- Run code & debug errors

- Create PR with commit messages

- Explain code changes

2) Real-Life Example

Instruction: Fix login bug where OTP is not verified properly and add tests.

The agent will open repo, find OTP logic, modify code, run tests, fix issues, and create PR.

3) Core Modules of SWE Agent (Architecture)

A) Input Understanding Module: Converts user task to steps using LLMs.

B) Repo Context Loader: Loads repo structure using GitHub API / Git CLI.

C) Code Retrieval System: Uses embeddings + vector DB for relevant code search.

D) Planner: Makes execution plan using ReAct / Tree of Thoughts.

E) Tool Executor: Runs shell, edits files, runs tests, Git integration.

F) Debug Loop: Reads logs, fixes errors automatically.

G) PR Builder: Creates commits and pull requests via GitHub API.

4) End-to-End Workflow

User instruction → Planning → Repo Retrieval → Code Editing → Run Tests → Debug → PR Ready.

5) Complete Tech Stack

Frontend: Next.js, Tailwind, Shadcn UI, Socket.io

Backend: FastAPI / Node.js, REST, WebSocket

LLM: GPT-4o, Claude, Llama, Mixtral

RAG: OpenAI embeddings, FAISS, ChromaDB, Pinecone

Tools: Shell runner, Git tools, Docker sandbox

Storage: PostgreSQL, MongoDB, Redis

Queue: Celery, BullMQ, RabbitMQ

DevOps: Docker, Kubernetes, AWS, GitHub Actions

6) Agent Frameworks

LangChain, LangGraph, CrewAI, AutoGen, Semantic Kernel

Recommended: LangGraph + FastAPI

7) Key Features

Multi-step reasoning, multi-file edits, test execution, auto debugging, PR automation.

8) Final Recommended Stack

Frontend: Next.js + Tailwind

Backend: FastAPI + WebSocket

Agent: LangGraph

LLM: GPT-4o

Vector DB: FAISS / ChromaDB

Storage: PostgreSQL + Redis

Execution: Docker sandbox

Deployment: AWS EC2 + GitHub Actions