Case Study: AI Tax Return Agent Prototype

GitHub Link: https://github.com/janimiyarj/AI-tax-agent

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1. Project Overview

The AI Tax Agent is an intelligent prototype system developed to assist users in preparing simplified federal tax returns. It integrates secure user authentication, a multi-step data entry flow, intelligent suggestions using LLMs, and downloadable tax summaries. The system is designed with usability, privacy, and extensibility in mind.

Key Objectives:

- Enable users to input tax-related data securely
- Perform a simplified tax calculation
- Provide smart filing suggestions via OpenAI's GPT
- Generate downloadable PDF summaries
- Ensure a smooth, responsive, and secure user experience

2. System Architecture & Design

2.1. Frontend (User Interface):

- Built with Flask templating using Jinja2, Bootstrap 5 for responsive design, and custom CSS for visual polish.
- Multi-step input forms (Step 1 to Step 3) guide the user through entering personal info, income details, and deductions.
- All input forms include inline validation and helpful tooltips to enhance user experience.

2.2. Backend (Flask App):

- Backend is built with Python Flask, ensuring simplicity, readability, and modularity.
- Routes include /register, /login, /step1, /step2, /step3, /summary, and /download.
- User sessions and authentication are managed using Flask-Login, with secure password hashing via bcrypt.

2.3. Tax Calculation Engine:

- Core logic resides in tax_logic.py.
- Calculates estimated tax or refund based on simplified IRS rules using: Filing status, Income components (wages, business income, etc.), Deductions (standard or itemized), Dependent credits.
- Dynamically calculates refund or tax owed and stores results in the session.

2.4. Smart Suggestion Module (LLM Integration):

- Uses OpenAI GPT API to suggest better filing options (e.g., switching from single to head-of-household) based on user profile.
- Enhances the refund outcome if the user accepts the recommendation.

2.5. PDF Generation:

- Generates a filled PDF summary using FPDF and BytesIO for downloadable return preview.
- Output includes key tax details: personal info, income, deductions, filing status, and refund/tax owed.

2.6. Authentication & Session Management:

- User registration and login are handled via secure SQLite-based storage.
- Passwords are encrypted with bcrypt.
- Sessions are refreshed on login to ensure a clean slate for every user.

3. Security & Compliance

3.1. User Data Handling:

- Only essential data (username, email, password hash) is stored in the SQLite database.
- All personal form data is session-based and not persisted on disk or server.

3.2. GDPR Considerations:

- No unnecessary data collection.
- Sessions clear on login/logout, enabling data minimization.
- Passwords are securely encrypted.
- No data is shared with third parties unless explicitly agreed by the user (e.g., OpenAI suggestion opt-in).

3.3. IRS Compliance (Prototype Perspective):

- While the current version **does not** integrate with official IRS APIs, the backend design is modular and prepared for:
  E-filing gateway API integration.
  ID verification (SSN, email validation).
  Expanded W-2 and Schedule support in future versions.
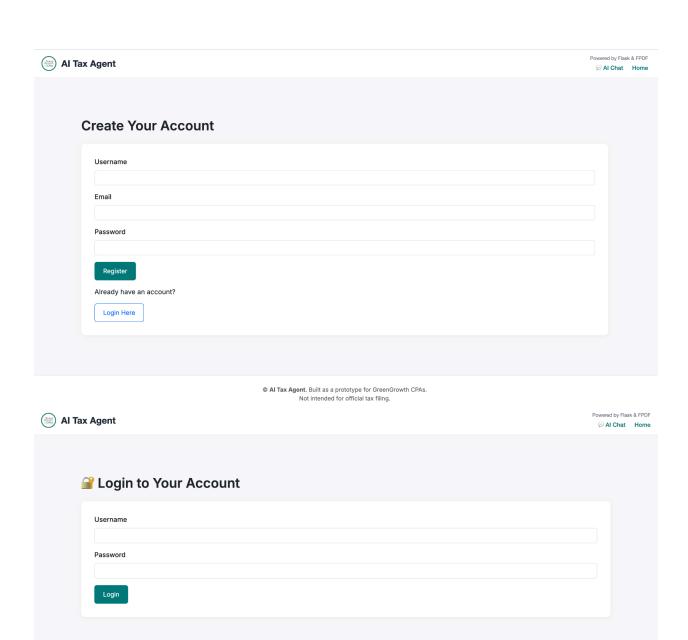
4. User Interface & UX

- Responsive layout (desktop and mobile)
- Intuitive navigation: step-by-step form filling with validations
- Clear navigation: persistent header with links to "Home", "AI Chat", and a universal "Logout" button.
- Personalized welcome message and global logout button
- Auto-dismiss toasts for logout feedback

5. Demo Walkthrough
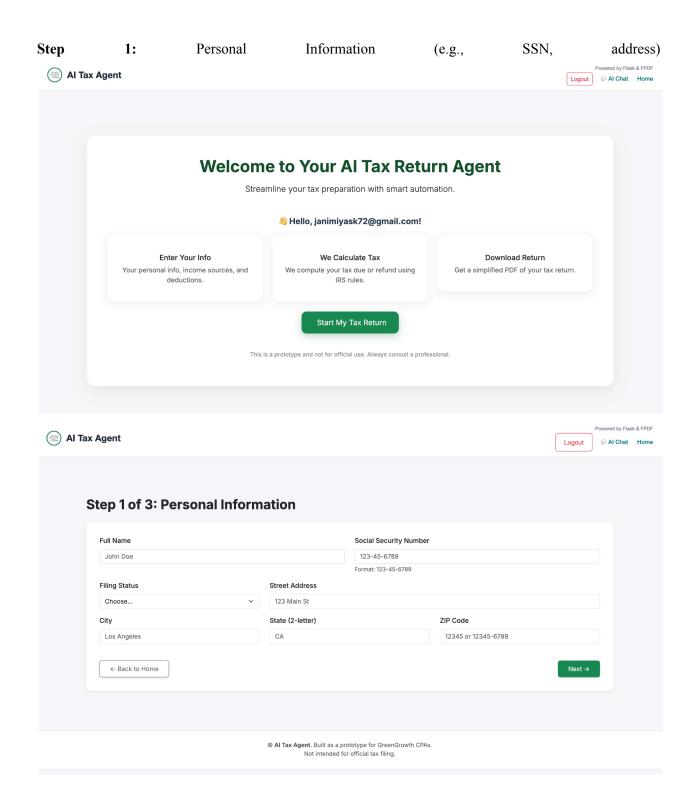
1. **Register/Login** with username, email, and password

Create Your Account

Username

Email

Password

[Register]

Already have an account?

[Login Here]

🔐 Login to Your Account

Username

Password

[Login]

2. Fill in:

Step 1: Personal Information (e.g., SSN, address)

AI Tax Agent

Welcome to Your AI Tax Return Agent

Streamline your tax preparation with smart automation.

👋 **Hello, janimiyask72@gmail.com!**

Enter Your Info
Your personal info, income sources, and deductions.

We Calculate Tax
We compute your tax due or refund using IRS rules.

Download Return
Get a simplified PDF of your tax return.

Start My Tax Return

This is a prototype and not for official use. Always consult a professional.

AI Tax Agent

Step 1 of 3: Personal Information

Full Name
John Doe

Social Security Number
123-45-6789
Format: 123-45-6789

Filing Status
Choose...

Street Address
123 Main St

City
Los Angeles

State (2-letter)
CA

ZIP Code
12345 or 12345-6789

← Back to Home

Next →

Step 2: Income Details (W-2, dividends, business income)

AI Tax Agent

Step 2 of 3: Income Sources

Wages (W-2)

Interest Income

Dividend Income

Business Income

Other Income

e.g., rental, gig work, royalties

Taxes Paid (from W-2 or other)

Enter taxes already paid

← Back

Next →
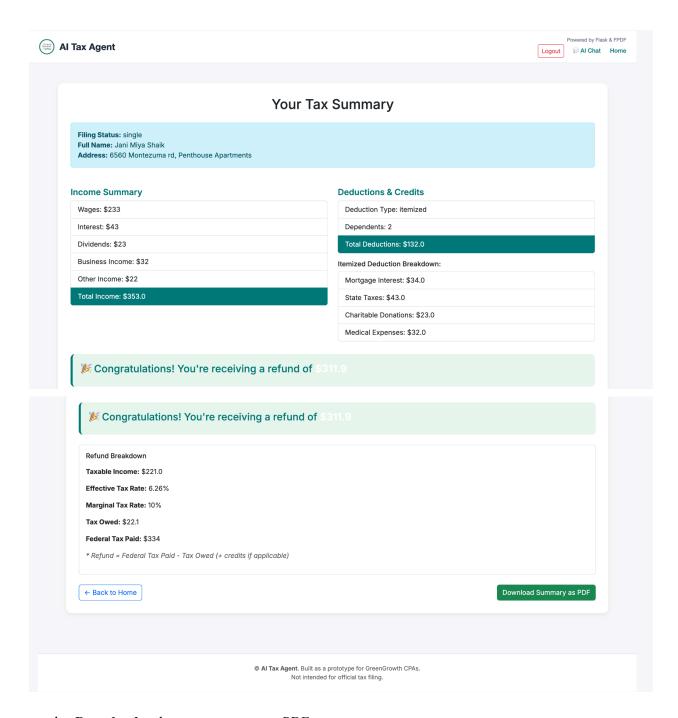
Step 3: Deductions (standard/itemized) and dependents

Step 3 of 3: Deductions & Dependents

Deduction Type *

🔘 Standard Deduction
⚪ Itemized Deductions

Number of Dependents *

[   ]

[← Back]   [Finish →]

Step 3 of 3: Deductions & Dependents

Deduction Type *

⚪ Standard Deduction
🔘 Itemized Deductions

Itemized Deduction Details

Mortgage Interest

[   ]

State Taxes Paid

[   ]

Charitable Contributions

[   ]

Medical Expenses

[   ]

Number of Dependents *

[   ]

[← Back]   [Finish →]

Receive GPT-powered Smart Filing Suggestion

Smart Filing Suggestion

💡 **Here's a suggestion from your AI Financial Advisor:**

The taxpayer has some business income and a good amount of itemized deductions. One smart tax strategy would be to invest more in their business. Business expenses are tax-deductible, and by increasing their business expenses, they can lower their taxable income. This could include things like purchasing new equipment, investing in marketing, or pursuing further education or training in their field.

💰 **This could increase your refund by: $500.0**

Go Back and Apply This Suggestion   Keep My Current Values

3. **View Summary:** Refund/tax owed with prefilled PDF

Your Tax Summary

Filing Status: single
Full Name: Jani Miya Shaik
Address: 6560 Montezuma rd, Penthouse Apartments

Income Summary

Wages: $233
Interest: $43
Dividends: $23
Business Income: $32
Other Income: $22
Total Income: $353.0

Deductions & Credits

Deduction Type: itemized
Dependents: 2
Total Deductions: $132.0

Itemized Deduction Breakdown:

Mortgage Interest: $34.0
State Taxes: $43.0
Charitable Donations: $23.0
Medical Expenses: $32.0

🎉 Congratulations! You're receiving a refund of $311.9

Refund Breakdown

Taxable Income: $221.0

Effective Tax Rate: 6.26%

Marginal Tax Rate: 10%

Tax Owed: $22.1

Federal Tax Paid: $334

* Refund = Federal Tax Paid - Tax Owed (+ credits if applicable)

← Back to Home   Download Summary as PDF

4. **Download** a clean tax summary as PDF

U.S. Individual Income Tax Return Summary

Tax Year 2025 - AI Tax Agent Prototype

Section 1: Personal Information

Name:	Jani Miya Shaik
SSN:	123-45-6784
Filing Status:	Single
Address:	6560 Montezuma rd, Penthouse Apartments, San Di

Section 2: Income Summary

Wages:	$233.00
Interest:	$43.00
Dividends:	$23.00
Business Income:	$32.00
Other Income:	$22.00
Total Income:	$353.00

Section 3: Deductions & Credits

Deduction Type:	Itemized
Dependents:	2
Mortgage Interest:	$34.00
State Taxes Paid:	$43.00
Charitable Contributions:	$23.00
Medical Expenses:	$32.00
Total Deductions:	$132.00

Total Deductions:	$132.00

Section 4: Tax Calculation Result

Taxable Income:	$221.00
Tax Owed:	$0.00
Federal Taxes Paid:	$334.00
Effective Tax Rate:	6.26%
Marginal Tax Rate:	10%

Disclaimer: This summary is generated by an AI Tax Agent Prototype. It is not a substitute for official IRS forms or professional advice.
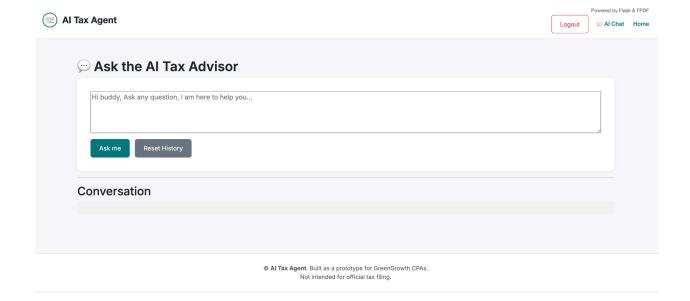
 U.S. Individual Income Tax Return Summary

Tax Year 2025 - AI Tax Agent Prototype

E-Signature:

_____

Signed electronically by Jani Miya Shaik

Date: _____

5. **Use AI Chat Assistant** for additional guidance

6. **Logout** securely with feedback

6. Challenges & Learnings

- **Session Persistence:** Managing fresh state per user login was critical; fixed using session.clear() post-login.
- **Data Validation:** Validating tax-relevant fields like SSNs, wages, dependents, etc., required regex, boundary checks, and error handling.
- **LLM Integration:** Using GPT for tax advice introduced challenges in cost control and hallucination mitigation.
- **PDF Accuracy:** Ensuring PDF output matched input data accurately required debugging layout and dynamic field injection.

Learnings:

- Applied practical knowledge of session-based data handling, user auth, and secure form submissions.
- Gained experience in building intelligent systems combining deterministic logic with LLM-powered reasoning.
- Developed real-world awareness of privacy and compliance needs in tax/finance domains.

7. Limitations & Future Improvements

- Currently uses simplified tax rules (not exhaustive IRS logic)

- Does not yet support real-time W-2 upload or IRS e-filing

Next Steps:

- **IRS & MCPS Integration**: Enable real-time e-filing through IRS-authorized APIs and automate the tax workflow using **Model Context Protocol Server (MCPS)** for secure, modular tax filing.
- **Multi-User Dashboard**: Allow users to manage past filings, resume saved drafts, and download tax return history all from a personalized dashboard.
- **OCR-Based Document Uploads**: Let users upload W-2, 1099, or 1040 forms; extract structured data using **OCR + LLMs**, and auto-fill form steps to save time.
- **Advanced Deduction Logic**: Expand current deduction calculations to support education credits, mortgage interest, retirement contributions, and HSA deductions.
- **AI-Powered Audit Risk Checker**: Use machine learning to flag high-risk anomalies and advise users on corrections before submitting their returns.
- **Enhanced Security & Compliance**: Strengthen data privacy by aligning with **GDPR** standards and IRS security protocols, including encrypted storage and session handling.

8. Deliverables

- Working prototype: AI Tax Agent
- Smart filing suggestion: via OpenAI
- Secure login & session flow
- Downloadable PDF return summary
- AI tax chat assistant
- Responsive frontend with validations
- Documented architecture and design decisions

9. Submission Instructions

- **Codebase**: Provided with comments and clear modular structure
- **Documentation**: Included above as part of the case study

Run Instructions:
pip install -r requirements.txt

python app.py

Visit http://127.0.0.1:5000/

- **Credentials:** Use /register route to create your own account
- **Demo:** Walkthrough from registration to PDF download & AI advice