APP-SOLUTELY FABULOUS

A Data Scientist's Guide to Choosing Python Web Tools Wisely

Alan Feder

WHO AM I?

- Alan Feder
- Staff LLM Data Scientist at Magnifi / TIFIN
- Freelance Consultant
- NYC Expat I ♥ NY → 
- R Expat → 

DATA SCIENTISTS IN R LOVE SHINY

- How do I show interactive analysis?
- Am I stuck with copying and pasting my graphs to PowerPoint?

THE ZEN OF PYTHON

Abstract

Long time Pythoneer Tim Peters succinctly channels the BDFL's guiding principles for Python's design into 20 aphorisms, only 19 of which have been written down.

The Zen of Python

```
Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.
Readability counts.
Special cases aren't special enough to break the rules.
Although practicality beats purity.
Errors should never pass silently.
Unless explicitly silenced.
In the face of ambiguity, refuse the temptation to guess.
There should be one-- and preferably only one --obvious way to do it.
Although that way may not be obvious at first unless you're Dutch.
Now is better than never.
Although never is often better than *right* now.
If the implementation is hard to explain, it's a bad idea.
If the implementation is easy to explain, it may be a good idea.
Namespaces are one honking great idea -- let's do more of those!
```

ONLY ONE??

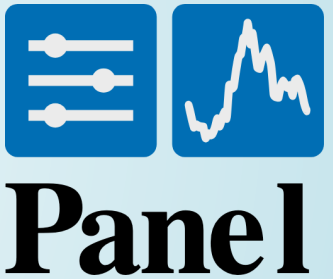

Streamlit


gradio


Shiny


plotly


Flask
web development,
one drop at a time

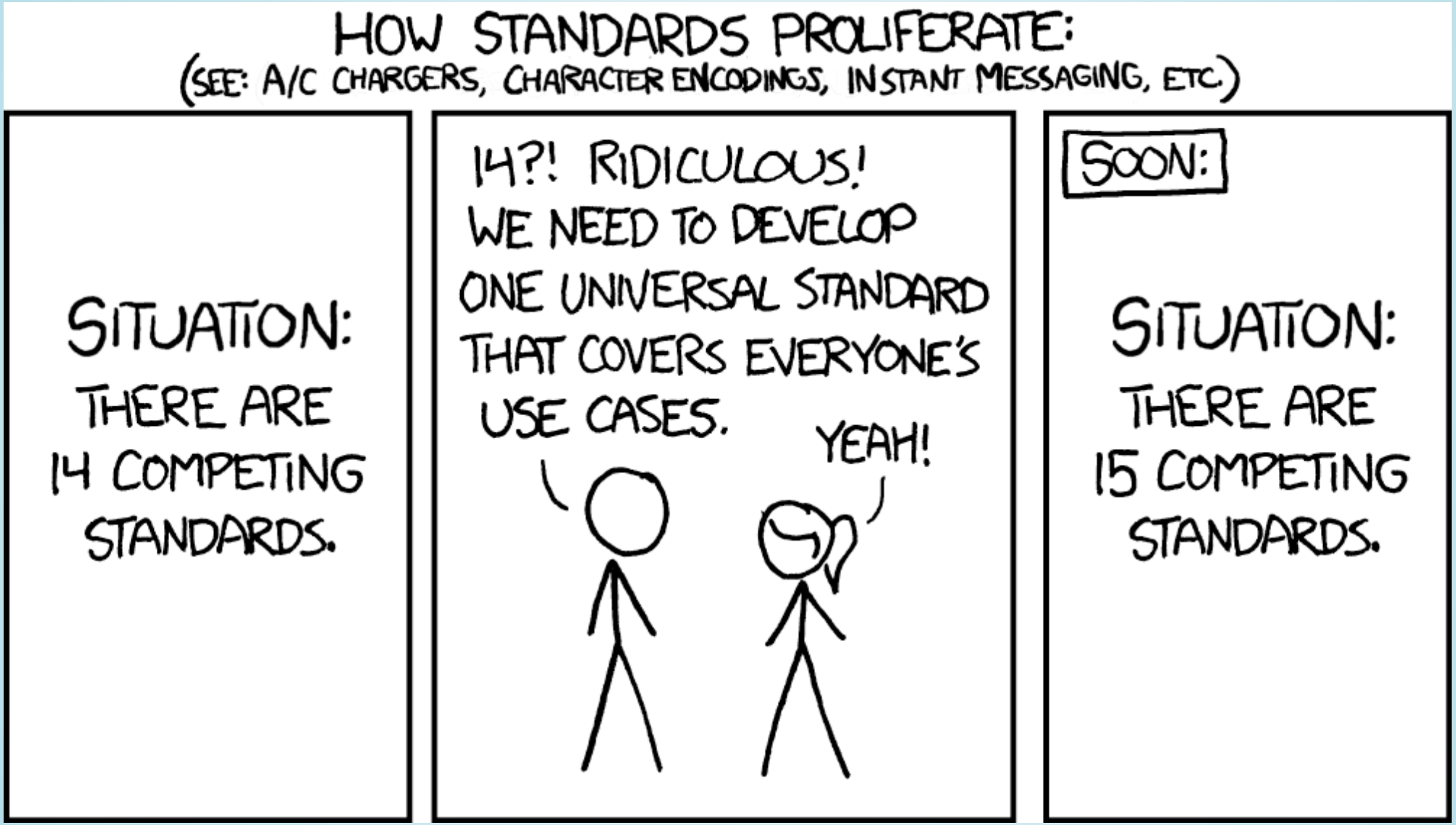

Panel


jupyter


django


FastHTML

TOO MANY OPTIONS



TRY (SOME OF) THEM!

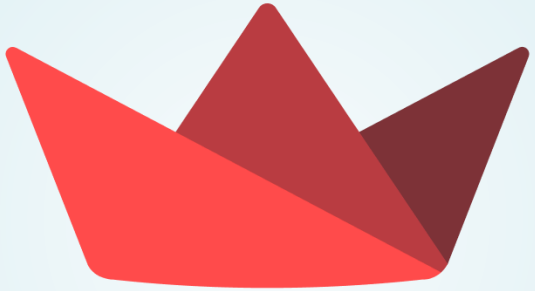
Streamlit

- Let’s try to make one app with three different methods
- RAG Chatbot referencing a specific data set
  - Previous RGov Talks

SERVER VS. SERVERLESS

- The computations need to happen *somewhere*
- `localhost:8000` - doesn't help with sharing
  - Setting up servers can be difficult without software experience
- In-browser versions can be helpful
  - Not all Python packages work
  - BE CAREFUL ABOUT YOUR PASSWORDS AND API KEYS

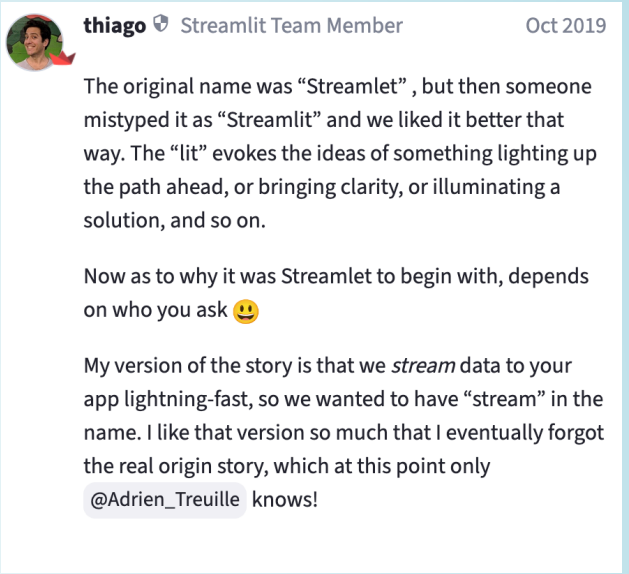
STREAMLIT



Streamlit

STREAMLIT

- Launched in 2019
- Purchased by Snowflake in 2022 for $800m ❄
- I've been using it a lot for the past 2 years - and even used in a (NY) R Conference talk!



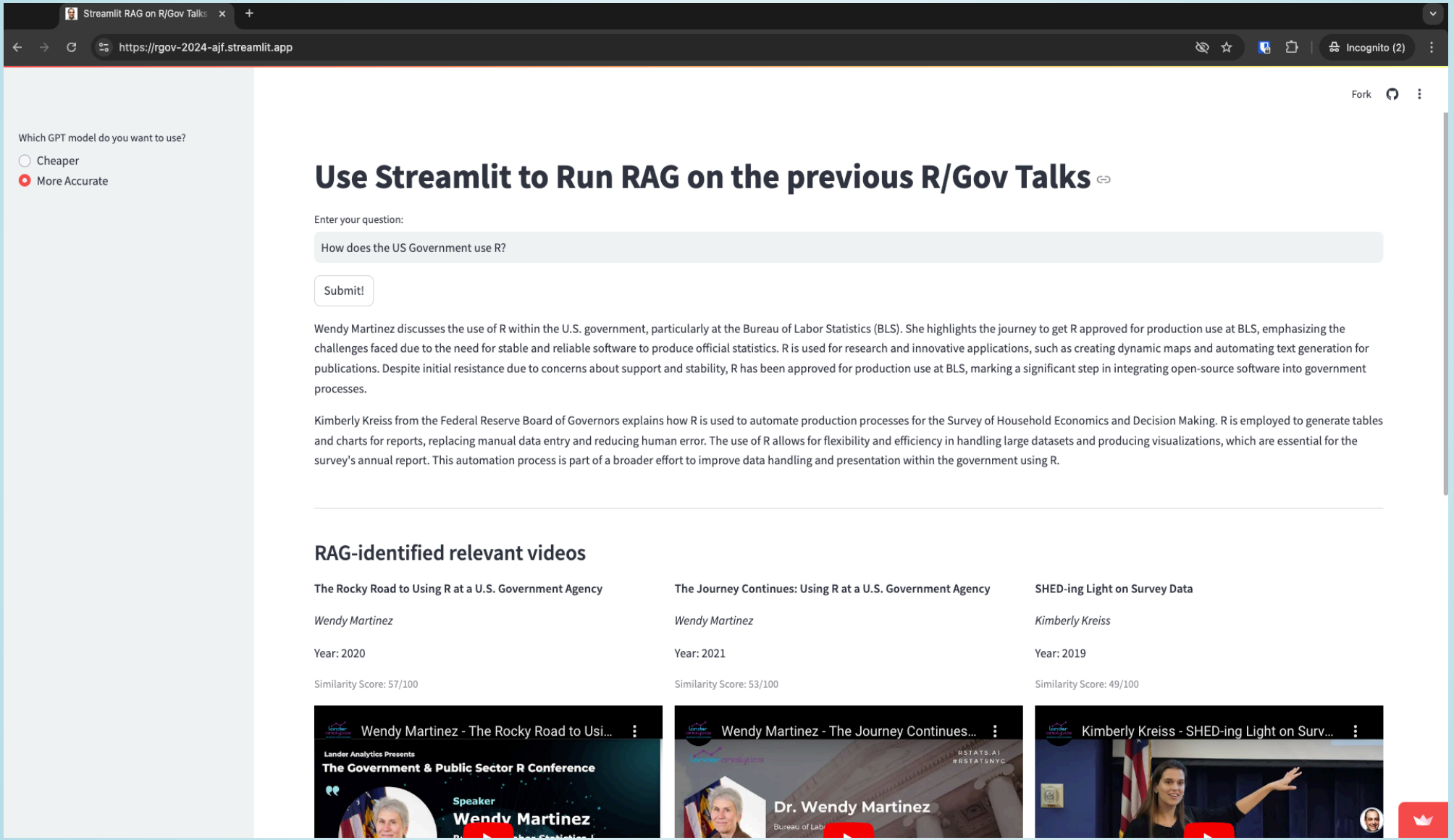
thiago Streamlit Team Member Oct 2019

The original name was "Streamlet" , but then someone mistyped it as "Streamlit" and we liked it better that way. The "lit" evokes the ideas of something lighting up the path ahead, or bringing clarity, or illuminating a solution, and so on.

Now as to why it was Streamlet to begin with, depends on who you ask 😃

My version of the story is that we *stream* data to your app lightning-fast, so we wanted to have "stream" in the name. I like that version so much that I eventually forgot the real origin story, which at this point only @Adrien_Treuille knows!

STREAMLIT EXAMPLE



STREAMLIT - 😀

- Lots of elements to use
  - New ones all the time
- Very Pythonic
  - Simple to transition from script

STREAMLIT - 😕

- Runs top to bottom - not at all reactive
- Can get very slow if it gets big
  - Has caching, `session_state`
- All Streamlit apps kinda look the same
  - Hard to tweak UI

STREAMLIT-LITE

- Stlite
  - Not officially supported by Streamlit
- Pretty easy interface to copy your Streamlit apps
- I couldn’t figure out how to do streaming
- Slower to load, slower to run

GRADIO

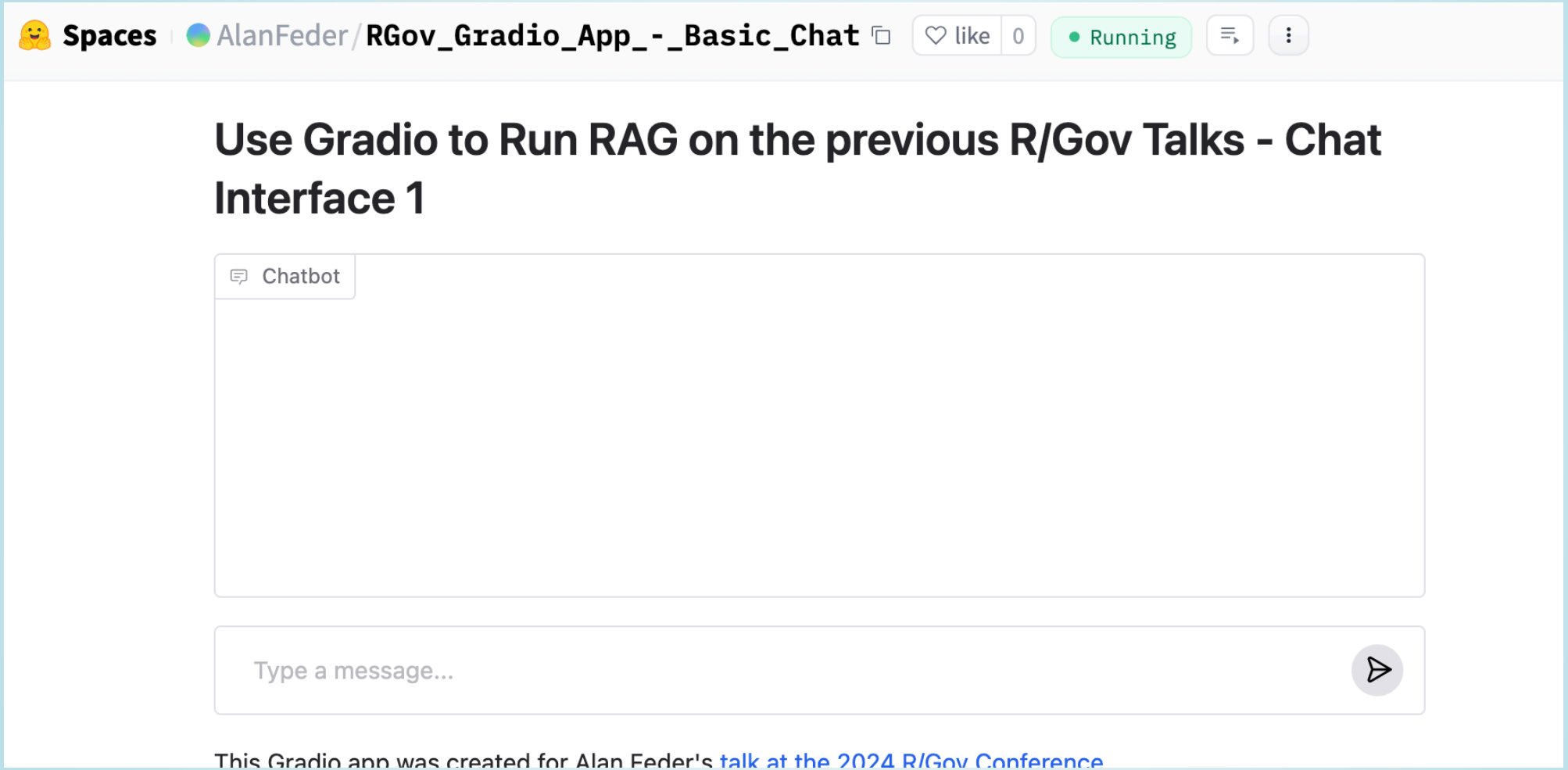
gradio

GRADIO

- Started by Stanford PhD Students in 2019
- Purchased by Hugging Face 🤗 in December 2021
- Powers most Huggingface Spaces

> The name “Gradio” comes from a combination of the words “Graphical” and “Audio”, which reflects the library’s original focus on building interfaces for audio and speech processing models. However, the library has since expanded to support a wide range of input and output types, including text, images, and video, and the name “Gradio” has come to represent a more general-purpose interface builder for data processing functions.

GRADIO - SIMPLEST



GRADIO - MORE COMPLEX

RAG on R/Gov Talks

Use Gradio to Run RAG on the previous R/Gov Talks

Model

Choose the model to use

○ Cheaper ◉ More Accurate

Enter your question:

How does the US Government use R?

Response

Wendy Martinez discusses the use of R within the U.S. government, particularly at the Bureau of Labor Statistics (BLS). She highlights her efforts to get R approved for production use at BLS, emphasizing the importance of using R for producing official statistics. Martinez notes that R is favored for its cost-effectiveness and the ability to implement new methodologies quickly, which are often first available in R before commercial software. She also mentions the challenges faced, such as security concerns, the need for stability, and the preference for commercial support. Despite these challenges, R has been officially approved for production use at BLS, marking a significant achievement in integrating open-source software into government operations.

Kimberly Kreiss from the Federal Reserve Board of Governors explains how R is used to automate production processes for the Survey of Household Economics and Decision Making (SHED). R is utilized to generate tables and charts for the survey report, replacing manual data entry and reducing human error. Kreiss highlights the efficiency and flexibility of using R, which allows for easy updates and changes to the report's visuals. The use of R has significantly improved their workflow, and there are plans to develop a public package to facilitate data access and analysis.

The Rocky Road to Using R at a U.S. Government Agency

Wendy Martinez

Year: 2020

Similarity Score: 57/100

▶ Transcript

The Journey Continues: Using R at a U.S. Government Agency

Wendy Martinez

Year: 2021

Similarity Score: 53/100

▶ Transcript

SHED-ing Light on Survey Data

Kimberly Kreiss

Year: 2019

Similarity Score: 49/100

▶ Transcript

GRADIO - 😃

- Very focused on AI
- Even simpler than Streamlit
- Built in interfaces for Chat
  - Easy to add in features like chat history, Thumbs Up/ Thumbs Down
- Has reactivity

GRADIO - 😕

- Less flexible than Streamlit
  - Complicated to do multiple things at once
- Fewer components available
  - Sometimes need to use HTML to do what you want
- All Gradio apps look the same – at least as much as Streamlit

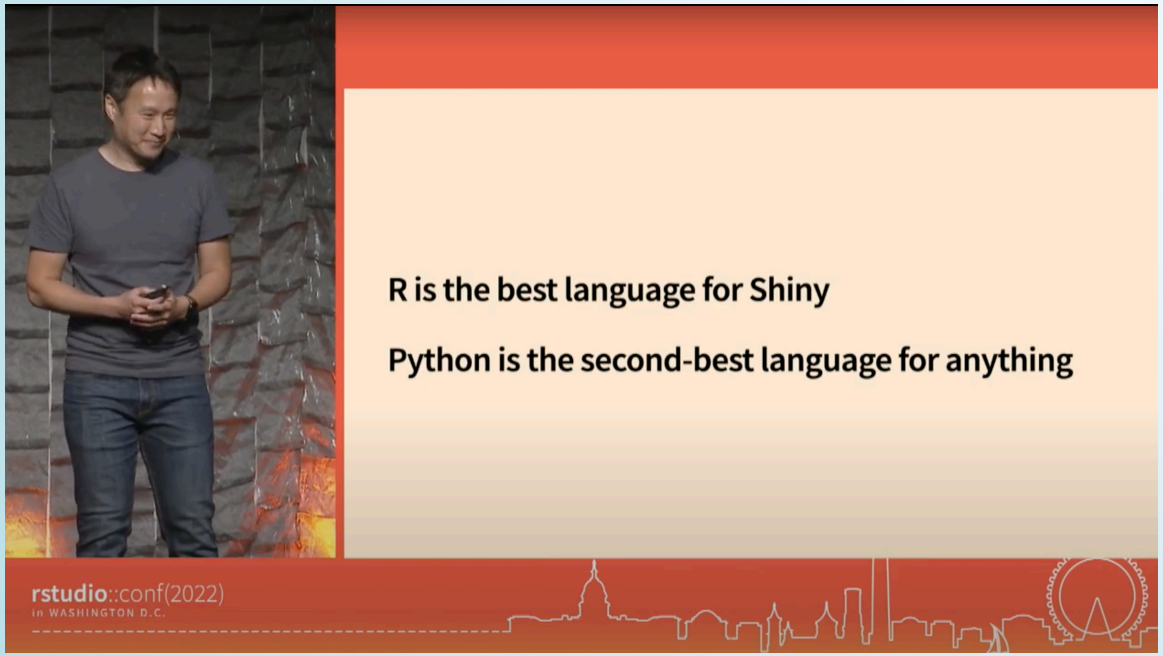
GRADIO - DEPLOYMENT POSSIBILITIES

- Local / Self-hosted
- Public Link, local compute (`share=True`)
- Through Huggingface Spaces (free with basic CPU)
- In-browser (Gradio Lite)
  - I couldn’t figure it out for complex app

SHINY

SHINY

- 2012: Developed for R by the company formerly known as RStudio
- 2022:



TWO TYPES OF SHINY

SHINY CORE

- More similar to RShiny
- Split Server vs. UI sections
  - Only one file
- Nested Functions

SHINY EXPRESS

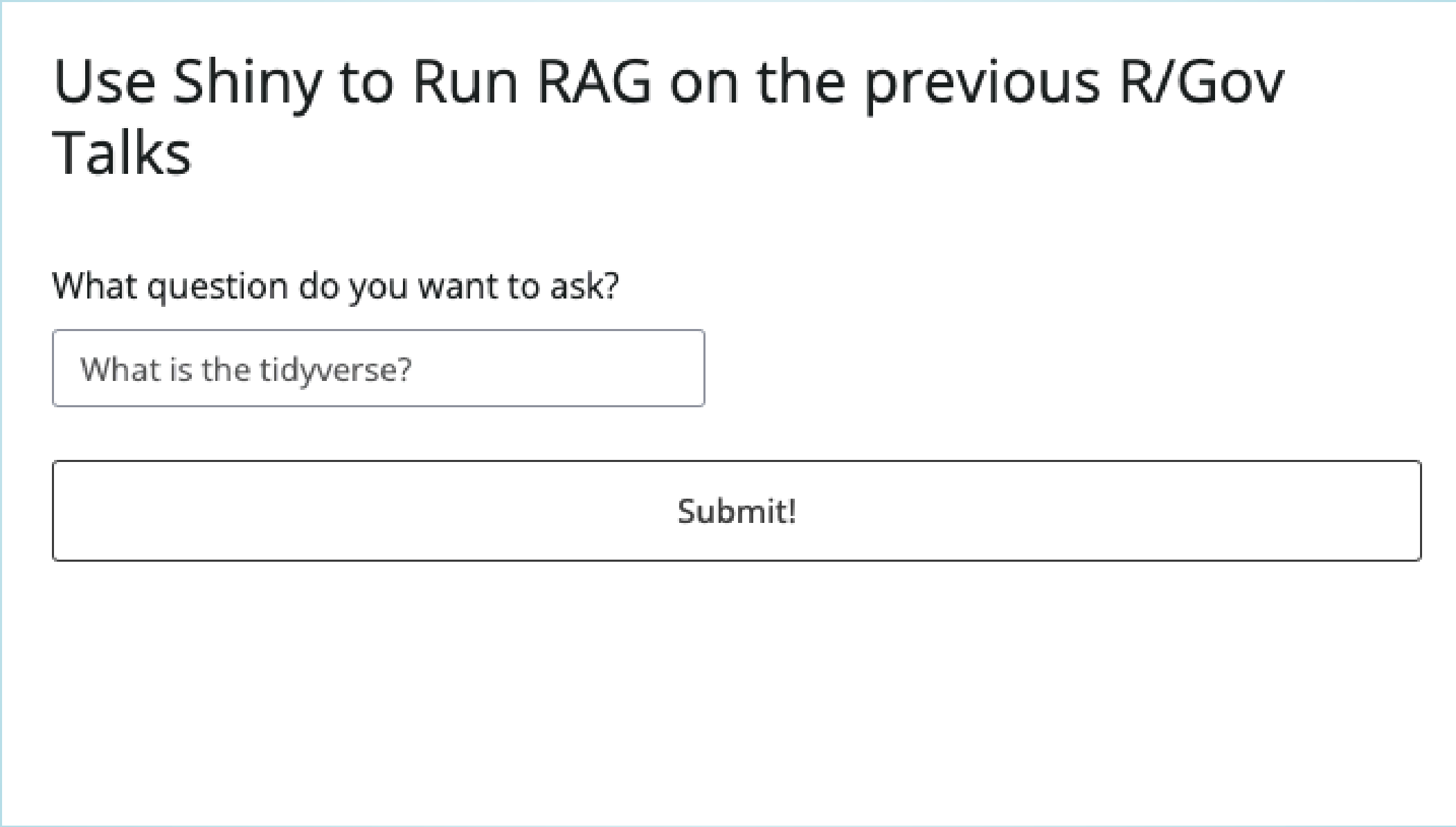
- Kinda Streamlit-ish
- No Split between Server and UI sections
- Heavy use of context managers

```
1 with ui.row():
2   XXXX
```

- Use of decorators

```
1 @reactive.text
2 def function():
3     ...
```

SHINY EXAMPLE



SHINY - 😃

- All Shiny is reactive - great for complex Apps
- Very flexible, can make almost any change you want
- Lots of components
- Documentation gives really good background/philosophy on how it works

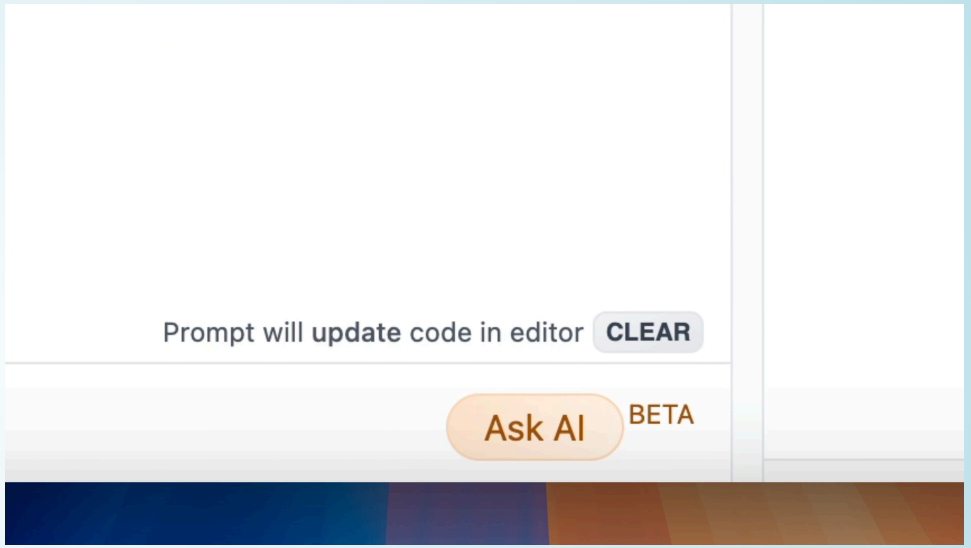
SHINY - 😕

- I found it confusing, not as intuitive/“Pythonic”
- Default UI is pretty bland
- Not as many components as Streamlit
- You kinda need to learn the philosophy of Shiny before you can do much complicated

HELP IS ON THE WAY!

SHINY

GRADIO



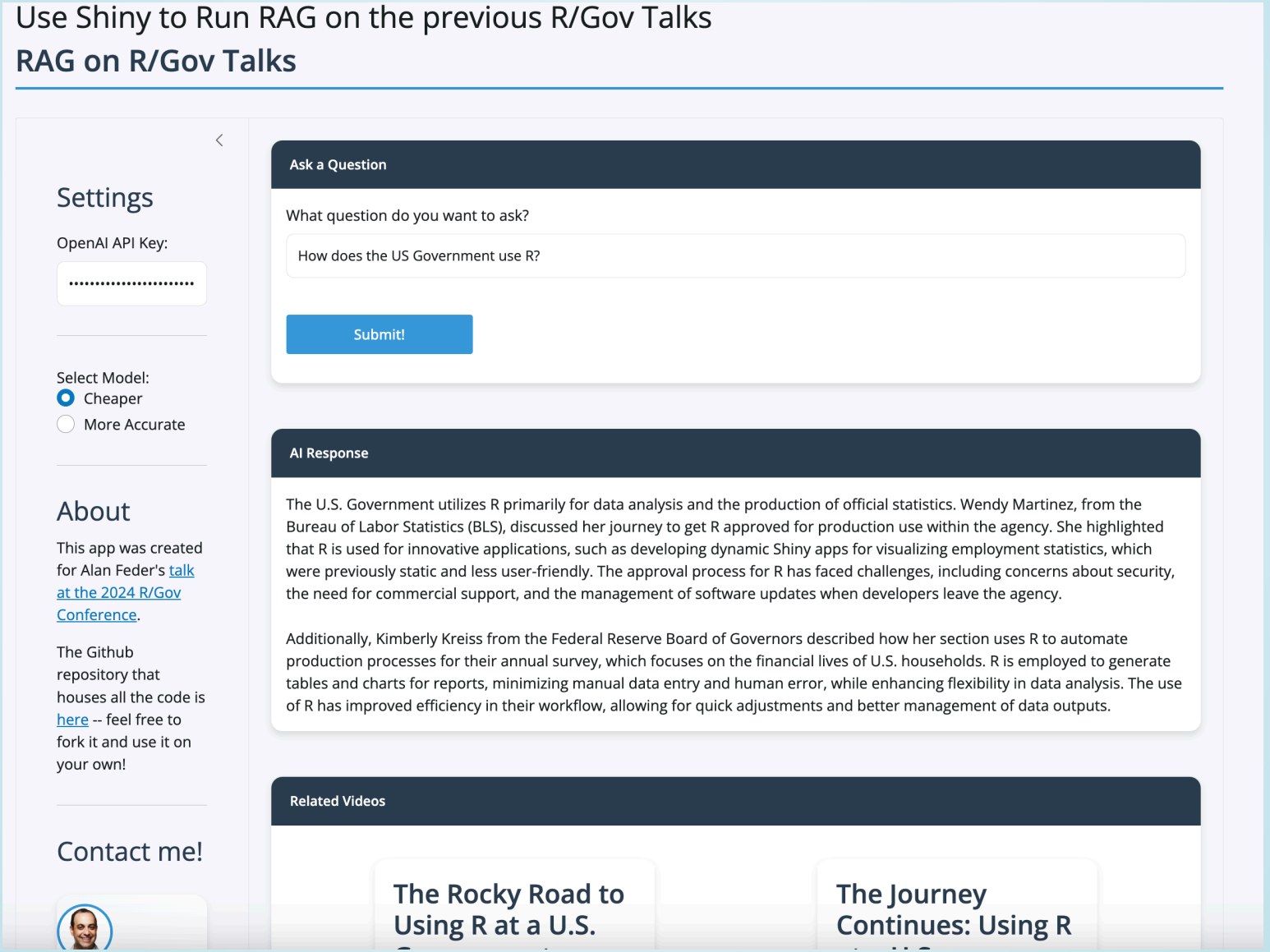
SHINYLIVE

SHINYLIVE IS SO EASY

shinylive is an extension to the Quarto open-source scientific and technical publishing system. It enables shiny applications to run locally, without a shiny server using WebAssembly. I'll show examples and discuss the limitations of using shinylive.

Slides

SHINYLIVE REALLY IS EASY!

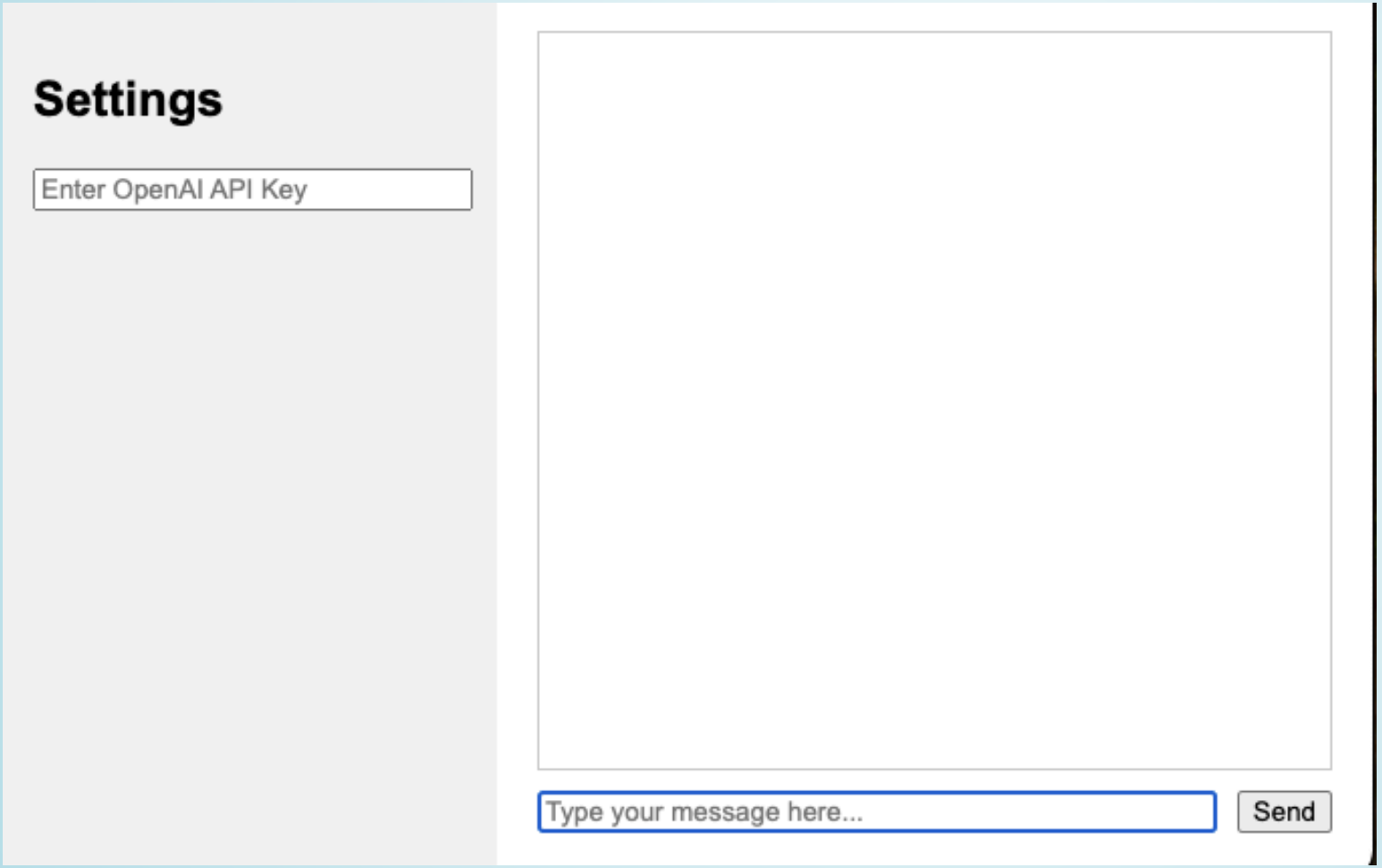


ONE OTHER OPTION...

If you're going to go in-browser, and what you're doing isn't that complex...

... AI might be able to build it for you without any of these apps

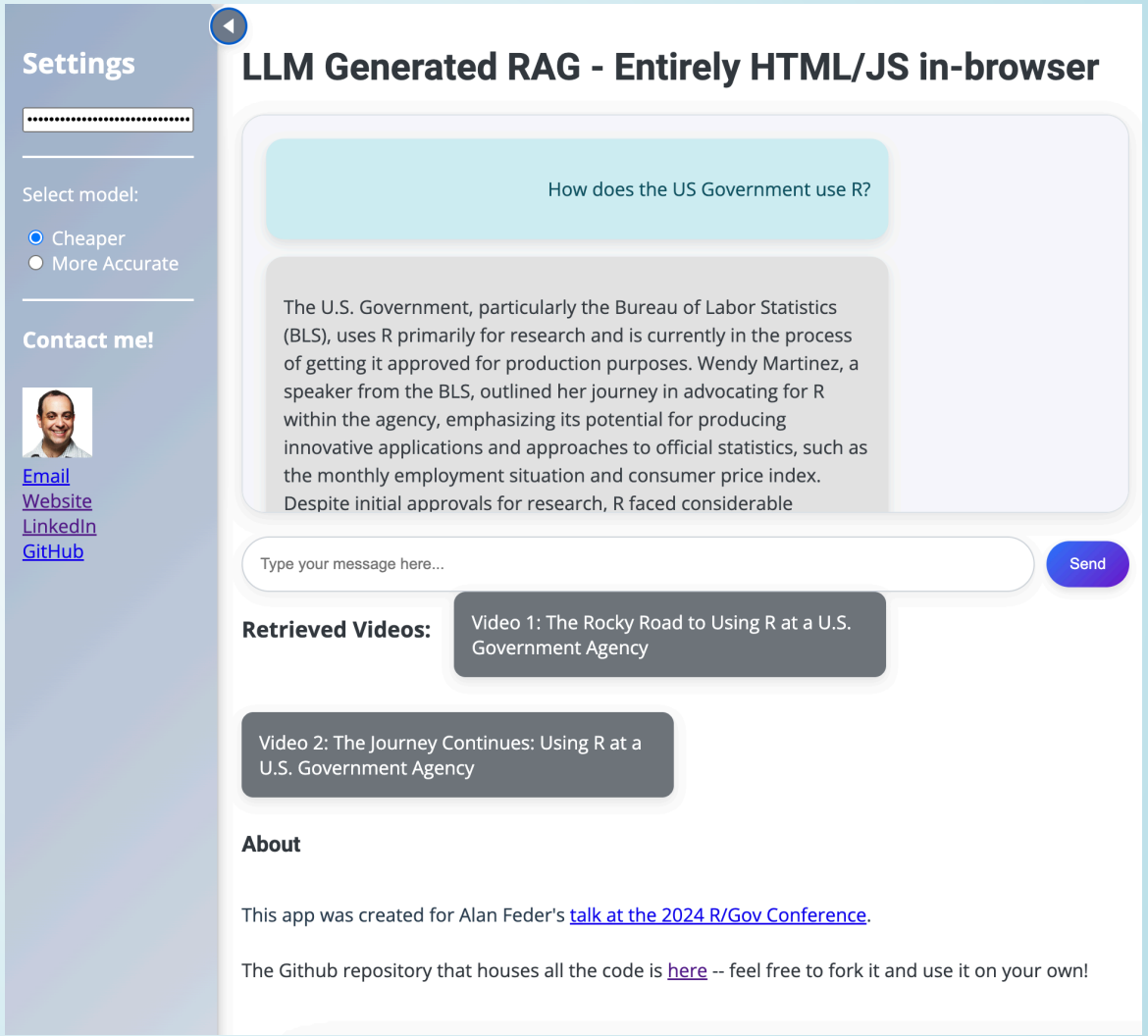
ASK CLAUDE/CHATGPT TO BUILD YOU AN IN-BROWSER TOOL



IT WILL THEN IMPROVE IT NICELY

Ive got an HTML based RAG app. IT works entirely in-browser successfully. Can you make it prettier?

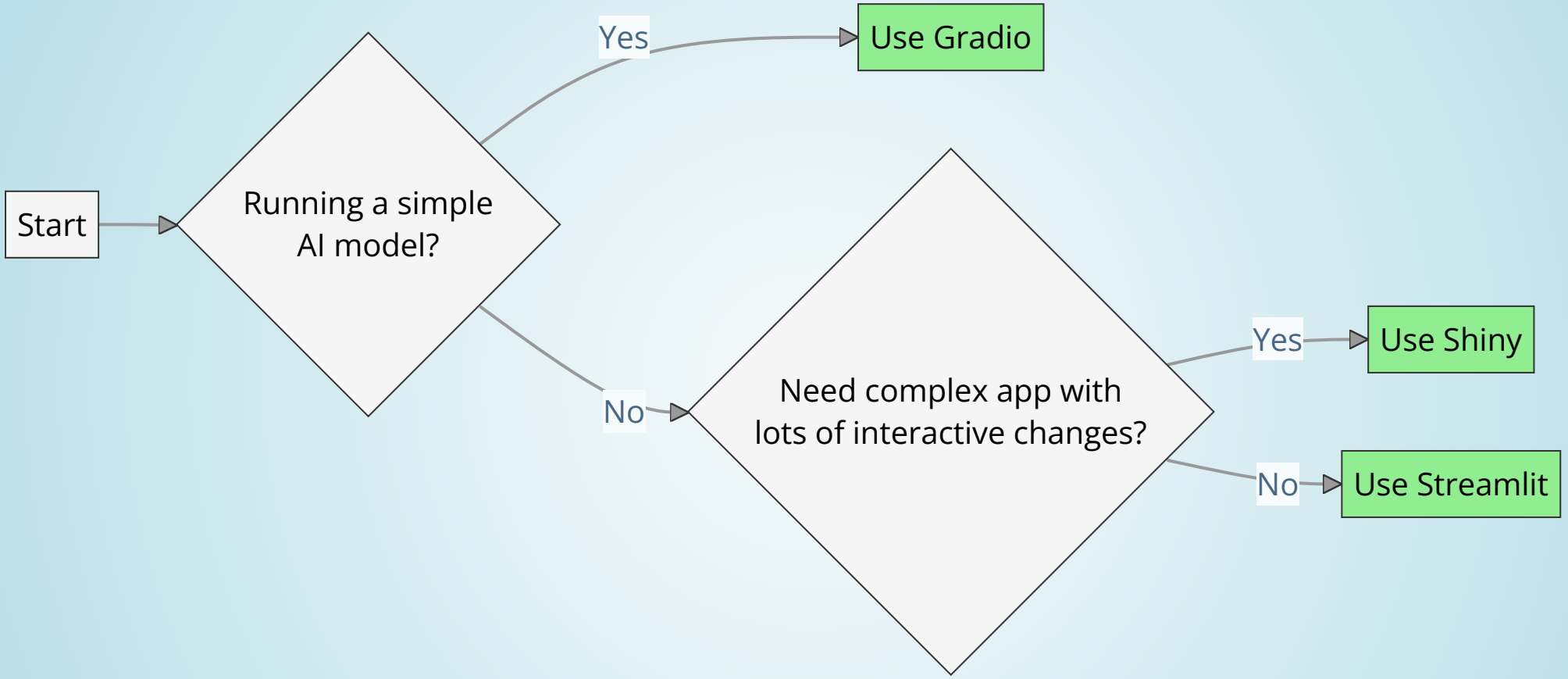
great! now make it even prettier



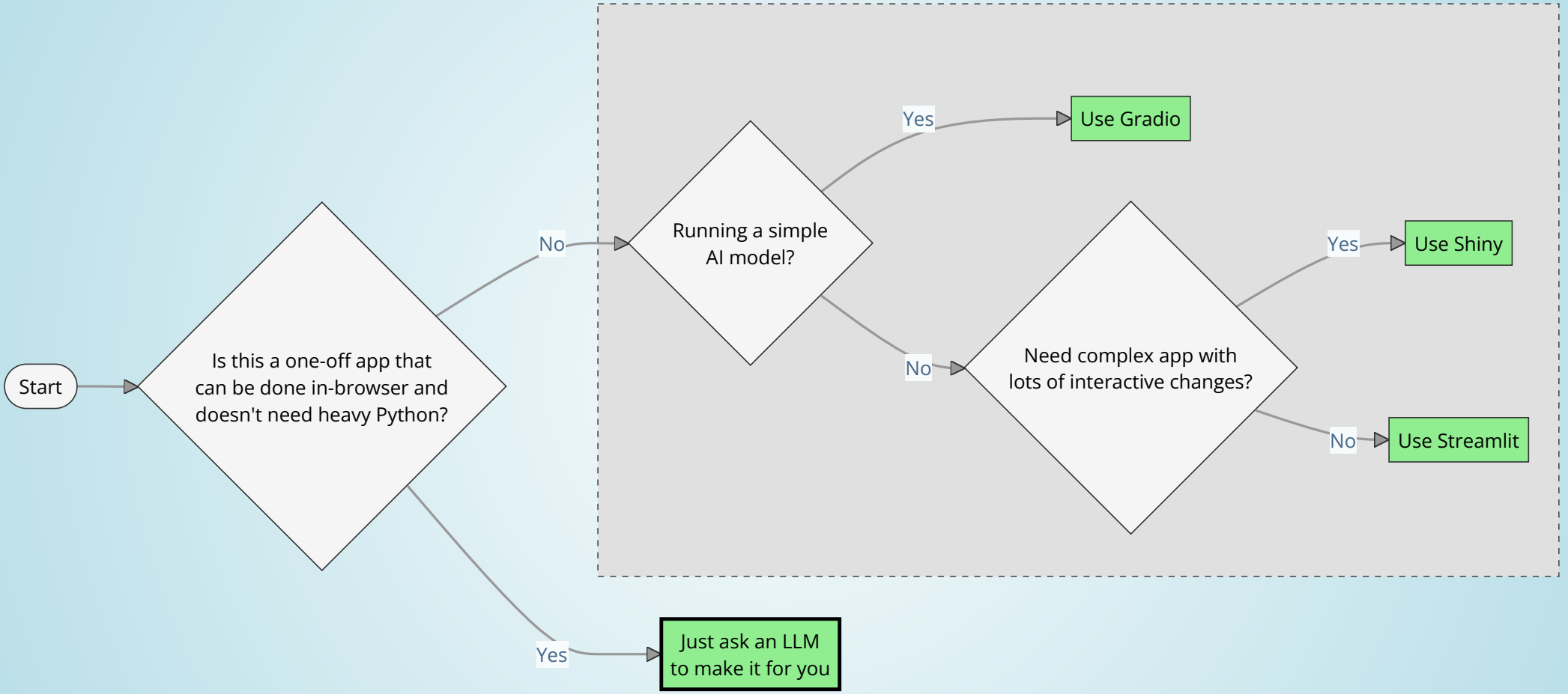
SO WHAT SHOULD I DO?

If you know one tool well, you can use it for most things - they overlap a lot.

REALLY, WHAT SHOULD I DO?



BUT ...


Start
Is this a one-off app that can be done in-browser and doesn't need heavy Python?
Yes
Just ask an LLM to make it for you
No
Running a simple AI model?
Yes
Use Gradio
No
Need complex app with lots of interactive changes?
Yes
Use Shiny
No
Use Streamlit

ALAN FEDER

- Code AlanFeder/rgov-2024
- Slides https://www.alanfeder.com/dcr_rag/

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Tool	Basic	Complex	Lite
Streamlit		Link	Link
Gradio	Link	Link	
Shiny		Link	Link
LLM/HTML			Link