LAB N0. 15

Build a RAG-Based Chatbot Using Ollama and LangChain, and Streamlit

Lab Objective

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

- Set up Ollama locally and run LLAMA2
- Build a basic LangChain chatbot using Ollama
- Implement document ingestion and vector storage
- Enable Retrieval-Augmented Generation (RAG)
- Deploy the chatbot using Streamlit

Tools & Technologies

- Python 3.9+
- VS Code
- Ollama (LLAMA2)
- LangChain
- Streamlit
- FAISS (Vector Store)
- Dotenv

File code 1

Localama.py

```
from langchain_openai import ChatOpenAI
from langchain_core.prompts import ChatPromptTemplate
from langchain_core.output_parsers import StrOutputParser
from langchain_community.llms import Ollama
import streamlit as st
import os
from dotenv import load_dotenv

load_dotenv()

os.environ["LANGCHAIN_TRACING_V2"]="true"
os.environ["LANGCHAIN_API_KEY"]=os.getenv("LANGCHAIN_API_KEY")

## Prompt Template

prompt=ChatPromptTemplate.from_messages(
```

```
  [
    ("system","You are a helpful assistant. Please response to the user queries"),
    ("user","Question:{question}")
  ]
)
## streamlit framework

st.title('Langchain Demo With LLAMA2 API')
input_text=st.text_input("Search the topic u want")

# ollama LLAma2 LLm
llm=Ollama(model="llama2")
output_parser=StrOutputParser()
chain=prompt|llm|output_parser

if input_text:
  st.write(chain.invoke({"question":input_text}))
```

Code File 2

App.py

```
from langchain_openai import ChatOpenAI
from langchain_core.prompts import ChatPromptTemplate
from langchain_core.output_parsers import StrOutputParser

import streamlit as st
import os
from dotenv import load_dotenv

os.environ["OPENAI_API_KEY"]=os.getenv("OPENAI_API_KEY")
## Langmith tracking
os.environ["LANGCHAIN_TRACING_V2"]="true"
os.environ["LANGCHAIN_API_KEY"]=os.getenv("LANGCHAIN_API_KEY")

## Prompt Template

prompt=ChatPromptTemplate.from_messages(
  [
    ("system","You are a helpful assistant. Please response to the user queries"),
    ("user","Question:{question}")
  ]
)

## streamlit framework

st.title('Langchain Demo With OPENAI API')
input_text=st.text_input("Search the topic u want")

# openAI LLm
```

```
llm=ChatOpenAI(model="gpt-3.5-turbo")
output_parser=StrOutputParser()
chain=prompt|llm|output_parser

if input_text:
   st.write(chain.invoke({'question':input_text}))
```

Step 1: Create Project Structure

Open **VS Code** and create the following folder structure:

```
rag-ollama-chatbot/
│
├── app.py
├── requirements.txt
├── .env
├── data/
│   └── sample_docs.txt
```

Step 2: Install and Verify Ollama

2.1 Install Ollama

Download and install Ollama from:

```
https://ollama.com
```

2.2 Pull LLAMA2 Model

Open terminal and run:

```bash
ollama pull llama2
```

2.3 Verify Ollama

```bash
ollama run llama2
```

If the model responds, Ollama is working correctly.

Step 3: Create Virtual Environment

```bash
python -m venv myenv
myenv\Scripts\activate   # Windows
```

Step 4: Install Required Libraries

Create **requirements.txt**:

```txt
langchain
langchain-community
langchain-core
langchain-openai
streamlit
faiss-cpu
python-dotenv
```

Install dependencies:

```bash
pip install -r requirements.txt
```

Step 5: Add Sample Knowledge Base

Create **data/sample_docs.txt** and add:

```pgsql
LangChain is a framework for developing applications powered by large language mo
RAG stands for Retrieval-Augmented Generation.
Ollama allows running LLMs locally without cloud APIs.
FAISS is a vector database for similarity search.
```

Step 6: Environment Configuration

Create **.env** file:

```env
LANGCHAIN_API_KEY=your_langchain_api_key
```

> Note: Even with Ollama, LangChain tracing may require this key.

Step 7: Understand the Base Chatbot Code (Given Code)

The provided code:

- Uses **Ollama LLAMA2**
- Accepts user input via Streamlit
- Sends query directly to the LLM
- ❌ Does NOT use retrieval (no RAG)

We will **extend this code** to add:

- Document loading
- Text splitting
- Embeddings
- Vector database
- Retriever

Step 8: Add RAG Components

8.1 Import Additional Modules

Update **app.py**:

python

```
from langchain_community.document_loaders import TextLoader
from langchain.text_splitter import RecursiveCharacterTextSplitter
from langchain_community.embeddings import OllamaEmbeddings
from langchain_community.vectorstores import FAISS
from langchain_core.runnables import RunnablePassthrough
```

Step 9: Load and Process Documents

Add below `.env` loading:

python

```
# Load documents
loader = TextLoader("data/sample_docs.txt")
documents = loader.load()

# Split documents
text_splitter = RecursiveCharacterTextSplitter(
    chunk_size=500,
    chunk_overlap=50
)
docs = text_splitter.split_documents(documents)
```

Step 10: Create Embeddings and Vector Store

```
# Create embeddings
embeddings = OllamaEmbeddings(model="llama2")

# Create FAISS vector store
vectorstore = FAISS.from_documents(docs, embeddings)

# Create retriever
retriever = vectorstore.as_retriever()
```

Step 11: Modify Prompt for RAG

Replace your prompt template with:

```
prompt = ChatPromptTemplate.from_messages(
  [
    ("system", "Answer the question using the provided context only."),
    ("user", "Context:\n{context}\n\nQuestion:\n{question}")
  ]
)
```

Step 12: Build the RAG Chain

```
llm = Ollama(model="llama2")
output_parser = StrOutputParser()

rag_chain = (
  {
    "context": retriever,
    "question": RunnablePassthrough()
  }
  | prompt
  | llm
  | output_parser
)
```

Step 13: Update Streamlit UI

```
st.title("RAG Chatbot with Ollama & LangChain")

input_text = st.text_input("Ask a question based on the documents")

if input_text:
  response = rag_chain.invoke(input_text)
  st.write(response)
```

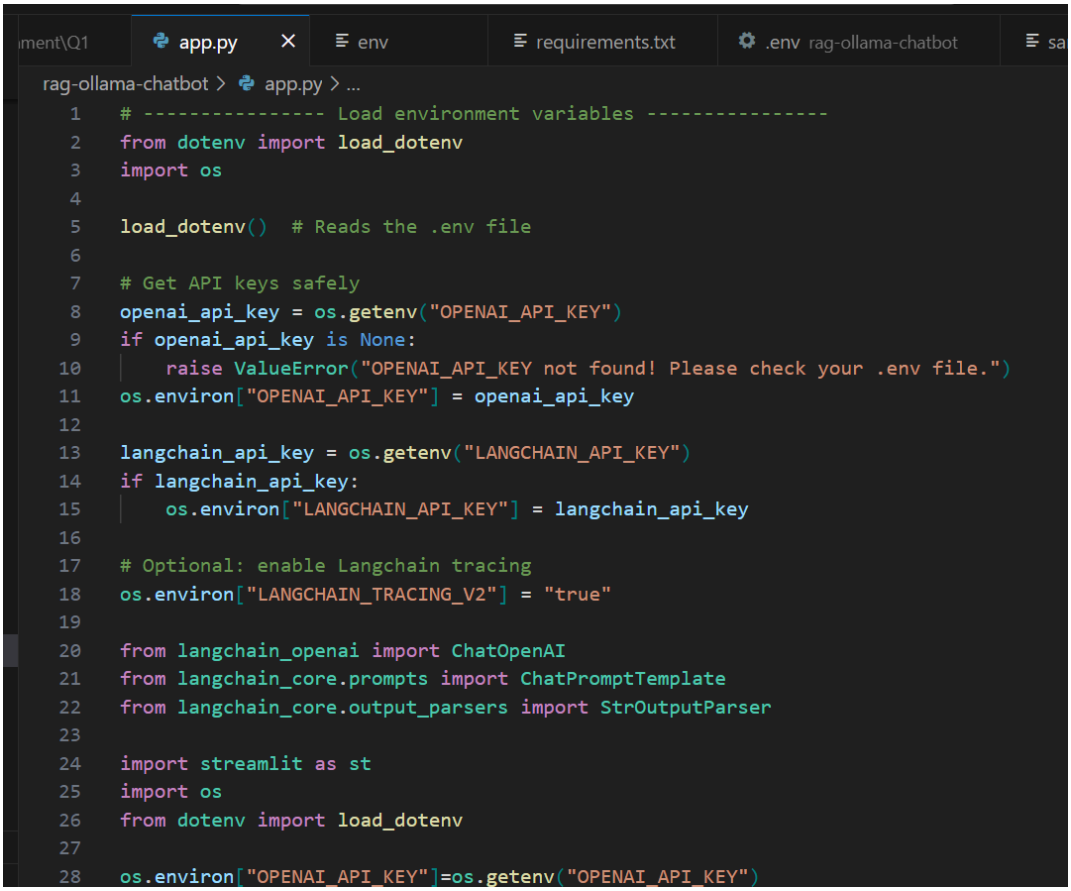
Step 14: Run the Application

```
streamlit run app.py
```

Open browser at:

```
arduino

http://localhost:8501
```



app.py | env | requirements.txt | .env rag-ollama-chatbot | sample_d

rag-ollama-chatbot > app.py > ...

```python
## Langmith tracking
os.environ["LANGCHAIN_TRACING_V2"]="true"
os.environ["LANGCHAIN_API_KEY"]=os.getenv("LANGCHAIN_API_KEY")
## Prompt Template

prompt=ChatPromptTemplate.from_messages(
    [
        ("system","You are a helpful assistant. Please response to the user queries"),
        ("user","Question:{question}")
    ]
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## streamlit framework

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llm=ChatOpenAI(model="gpt-3.5-turbo")
output_parser=StrOutputParser()
chain=prompt|llm|output_parser

if input_text:
    st.write(chain.invoke({'question':input_text}))
```

localama.py rag-ollama-chatbot | .env rag-ollama-chatbot | sample_docs.txt | localama.py ...\data

rag-ollama-chatbot > localama.py > ...

```python
from langchain_openai import ChatOpenAI
from langchain_core.prompts import ChatPromptTemplate
from langchain_core.output_parsers import StrOutputParser
from langchain_community.llms import Ollama
import streamlit as st
import os
from dotenv import load_dotenv
load_dotenv()

os.environ["LANGCHAIN_TRACING_V2"]="true"
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## Prompt Template

prompt=ChatPromptTemplate.from_messages(
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# ollama LLAma2 LLm
llm=Ollama(model="llama2")
output_parser=StrOutputParser()
chain=prompt|llm|output_parser
```

env | requirements.txt

rag-ollama-chatbot > requirements.txt

```
langchain
langchain-community
langchain-core
langchain-openai
streamlit
faiss-cpu
python-dotenv
ollama
```

sample_docs.txt | localama.py ...\data | q2.ipynb practice | ludo.ipynb | text_loader.py M | .env langcha

rag-ollama-chatbot > data > sample_docs.txt

```
LangChain is a framework for developing applications powered by large language models.
RAG stands for Retrieval-Augmented Generation. Ollama allows running LLMs locally without cloud APIs.
FAISS is a vector database for similarity search.
```

env | requirements.txt | localama.py rag-ollama-chatbot | .env rag-ollama-chatbot | sample_docs.txt | localam

rag-ollama-chatbot > env

```
OPENAI_API_KEY=sk-proj-cnRUNSfAA6h_XNPR8cHFFqW2PbMJIzlOsj-QaDCgzKWeWwDPrLuKn3J07pCksjpRri9LhBVMHHT3BlbkFJs3OqJFP
LANGCHAIN_API_KEY=your_langchain_key_here
```

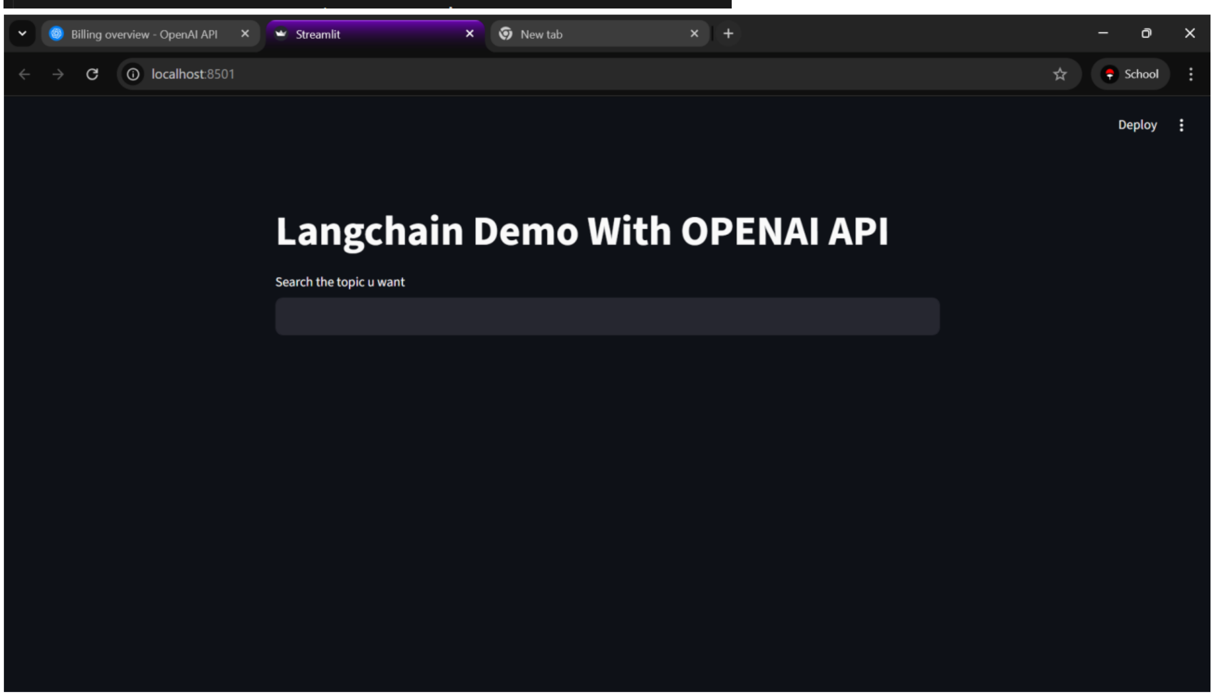
```
PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot>
 *  History restored

PS C:\Users\Administrator\Documents\AI> python -m venv .venv

 *  History restored

PS C:\Users\Administrator\Documents\AI> cd rag-ollama-chatbot
PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> python -m venv .venv
PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> .\.venv\Scripts\Activate
(.venv) PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> python -m pip install --upgrade pip
Requirement already satisfied: pip in c:\users\administrator\documents\ai\rag-ollama-chatbot\.venv\lib\site-packages (25.0.1)
Collecting pip
  Using cached pip-25.3-py3-none-any.whl.metadata (4.7 kB)
Using cached pip-25.3-py3-none-any.whl (1.8 MB)
Installing collected packages: pip
  Attempting uninstall: pip
    Found existing installation: pip 25.0.1
    Uninstalling pip-25.0.1:
      Successfully uninstalled pip-25.0.1
Successfully installed pip-25.3
(.venv) PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> pip install -r requirements.txt
Collecting langchain (from -r requirements.txt (line 1))
  Downloading langchain-1.2.3-py3-none-any.whl.metadata (4.9 kB)
Collecting langchain-community (from -r requirements.txt (line 2))
  Using cached langchain_community-0.4.1-py3-none-any.whl.metadata (3.0 kB)
Collecting langchain-core (from -r requirements.txt (line 3))
  Using cached langchain_core-1.2.6-py3-none-any.whl.metadata (3.7 kB)
Collecting langchain-openai (from -r requirements.txt (line 4))
  Downloading langchain_openai-1.1.7-py3-none-any.whl.metadata (2.6 kB)
Collecting streamlit (from -r requirements.txt (line 5))
  Downloading streamlit-1.52.2-py3-none-any.whl.metadata (9.8 kB)
```

```
Collecting faiss-cpu (from -r requirements.txt (line 6))
  Downloading faiss_cpu-1.13.2-cp313-cp313-win_amd64.whl.metadata (7.6 kB)
Collecting python-dotenv (from -r requirements.txt (line 7))
  Using cached python_dotenv-1.2.1-py3-none-any.whl.metadata (25 kB)
Collecting ollama (from -r requirements.txt (line 8))
  Downloading ollama-0.6.1-py3-none-any.whl.metadata (4.3 kB)
Collecting langgraph<1.1.0,>=1.0.2 (from langchain->-r requirements.txt (line 1))
  Using cached langgraph-1.0.5-py3-none-any.whl.metadata (7.4 kB)
Collecting pydantic<3.0.0,>=2.7.4 (from langchain->-r requirements.txt (line 1))
  Using cached pydantic-2.12.5-py3-none-any.whl.metadata (90 kB)
Collecting jsonpatch<2.0.0,>=1.33.0 (from langchain-core->-r requirements.txt (line 3))
  Using cached jsonpatch-1.33-py2.py3-none-any.whl.metadata (3.0 kB)
Collecting langsmith<1.0.0,>=0.3.45 (from langchain-core->-r requirements.txt (line 3))
  Downloading langsmith-0.6.2-py3-none-any.whl.metadata (15 kB)
Collecting packaging<26.0.0,>=23.2.0 (from langchain-core->-r requirements.txt (line 3))
  Using cached packaging-25.0-py3-none-any.whl.metadata (3.3 kB)
Collecting pyyaml<7.0.0,>=5.3.0 (from langchain-core->-r requirements.txt (line 3))
  Using cached pyyaml-6.0.3-cp313-cp313-win_amd64.whl.metadata (2.4 kB)
Collecting tenacity!=8.4.0,<10.0.0,>=8.1.0 (from langchain-core->-r requirements.txt (line 3))
  Using cached tenacity-9.1.2-py3-none-any.whl.metadata (1.2 kB)
Collecting typing-extensions<5.0.0,>=4.7.0 (from langchain-core->-r requirements.txt (line 3))
  Using cached typing_extensions-4.15.0-py3-none-any.whl.metadata (3.3 kB)
Collecting uuid-utils<1.0,>=0.12.0 (from langchain-core->-r requirements.txt (line 3))
  Downloading uuid_utils-0.13.0-cp39-abi3-win_amd64.whl.metadata (5.5 kB)
Collecting jsonpointer>=1.9 (from jsonpatch<2.0.0,>=1.33.0->langchain-core->-r requirements.txt (line 3))
  Using cached jsonpointer-3.0.0-py2.py3-none-any.whl.metadata (2.3 kB)
Collecting langgraph-checkpoint<4.0.0,>=2.1.0 (from langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Using cached langgraph_checkpoint-3.0.1-py3-none-any.whl.metadata (4.7 kB)
Collecting langgraph-prebuilt<1.1.0,>=1.0.2 (from langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Using cached langgraph_prebuilt-1.0.5-py3-none-any.whl.metadata (5.2 kB)
Collecting langgraph-sdk<0.4.0,>=0.3.0 (from langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Using cached langgraph_sdk-0.3.1-py3-none-any.whl.metadata (1.6 kB)
Collecting xxhash>=3.5.0 (from langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
```

```
))
  Using cached ormsgpack-1.12.1-cp313-cp313-win_amd64.whl.metadata (3.3 kB)
Collecting httpx>=0.25.2 (from langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Using cached httpx-0.28.1-py3-none-any.whl.metadata (7.1 kB)
Collecting orjson>=3.10.1 (from langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Using cached orjson-3.11.5-cp313-cp313-win_amd64.whl.metadata (42 kB)
Collecting requests-toolbelt>=1.0.0 (from langsmith<1.0.0,>=0.3.45->langchain-core->-r requirements.txt (line 3))
  Using cached requests_toolbelt-1.0.0-py2.py3-none-any.whl.metadata (14 kB)
Collecting requests>=2.0.0 (from langsmith<1.0.0,>=0.3.45->langchain-core->-r requirements.txt (line 3))
  Using cached requests-2.32.5-py3-none-any.whl.metadata (4.9 kB)
Collecting zstandard>=0.23.0 (from langsmith<1.0.0,>=0.3.45->langchain-core->-r requirements.txt (line 3))
  Using cached zstandard-0.25.0-cp313-cp313-win_amd64.whl.metadata (3.3 kB)
Collecting anyio (from httpx>=0.25.2->langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Downloading anyio-4.12.1-py3-none-any.whl.metadata (4.3 kB)
Collecting certifi (from httpx>=0.25.2->langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Downloading certifi-2026.1.4-py3-none-any.whl.metadata (2.5 kB)
Collecting httpcore==1.* (from httpx>=0.25.2->langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (li
ne 1))
  Using cached httpcore-1.0.9-py3-none-any.whl.metadata (21 kB)
Collecting idna (from httpx>=0.25.2->langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requirements.txt (line 1))
  Using cached idna-3.11-py3-none-any.whl.metadata (8.4 kB)
Collecting h11>=0.16 (from httpcore==1.*->httpx>=0.25.2->langgraph-sdk<0.4.0,>=0.3.0->langgraph<1.1.0,>=1.0.2->langchain->-r requireme
nts.txt (line 1))
  Using cached h11-0.16.0-py3-none-any.whl.metadata (8.3 kB)
Collecting annotated-types>=0.6.0 (from pydantic<3.0.0,>=2.7.4->langchain->-r requirements.txt (line 1))
  Using cached annotated_types-0.7.0-py3-none-any.whl.metadata (15 kB)
Collecting pydantic-core==2.41.5 (from pydantic<3.0.0,>=2.7.4->langchain->-r requirements.txt (line 1))
  Using cached pydantic_core-2.41.5-cp313-cp313-win_amd64.whl.metadata (7.4 kB)
Collecting typing-inspection>=0.4.2 (from pydantic<3.0.0,>=2.7.4->langchain->-r requirements.txt (line 1))
  Using cached typing_inspection-0.4.2-py3-none-any.whl.metadata (2.6 kB)
Collecting langchain-classic<2.0.0,>=1.0.0 (from langchain-community->-r requirements.txt (line 2))
  Using cached langchain_classic-1.0.1-py3-none-any.whl.metadata (4.2 kB)
Collecting SQLAlchemy<3.0.0,>=1.4.0 (from langchain-community->-r requirements.txt (line 2))
```

```
zdata-2025.3 urllib3-2.6.3 uuid-utils-0.13.0 watchdog-6.0.0 xxhash-3.6.0 yarl-1.22.0 zstandard-0.25.0
(.venv) PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> ollama pull llama2
pulling manifest
pulling 8934d96d3f08: 100%                                  3.8 GB
pulling 8c17c2ebb0ea: 100%                                  7.0 KB
pulling 7c23fb36d801: 100%                                  4.8 KB
pulling 2e0493f67d0c: 100%                                   59 B
pulling fa304d675061: 100%                                   91 B
pulling 42ba7f8a01dd: 100%                                  557 B
verifying sha256 digest
writing manifest
success
(.venv) PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> ollama --version
ollama version is 0.13.5
(.venv) PS C:\Users\Administrator\Documents\AI\rag-ollama-chatbot> streamlit run app.py

      Welcome to Streamlit!

      If you'd like to receive helpful onboarding emails, news, offers, promotions,
      and the occasional swag, please enter your email address below. Otherwise,
      leave this field blank.

      Email:

  You can find our privacy policy at https://streamlit.io/privacy-policy

  Summary:
  - This open source library collects usage statistics.
  - We cannot see and do not store information contained inside Streamlit apps,
    such as text, charts, images, etc.
  - Telemetry data is stored in servers in the United States.
  - If you'd like to opt out, add the following to %userprofile%/.streamlit/config.toml,
    creating that file if necessary:
```

```
    [browser]
    gatherUsageStats = false


  You can now view your Streamlit app in your browser.

  Local URL: http://localhost:8501
  Network URL: http://192.168.0.113:8501
```



LAB Assessment

Student Name		**LAB Rubrics**	**CLO3 , P5, PLO5**
		Total Marks	**10**
Registration No		**Obtained Marks**	
		Teacher Name	**Dr. Syed M Hamedoon**
Date		**Signature**	

Laboratory Work Assessment Rubrics

Sr. No.	Performance Indicator	Excellent (5)	Good (4)	Average (3)	Fair (2)	Poor (1)
1	**Theoretical knowledge 10%**	Student knows all the related concepts about the theoretical background of the experiment and rephrase those concepts in written and oral assessments	Student knows most of the related concepts about the theoretical background of the experiment and partially rephrase those concepts in written and oral assessments	Student knows few of the related concepts about the theoretical background of the experiment and partially rephrase those concepts in written and oral assessments	Student knows very little about the related concepts about the theoretical background of the experiment and poorly rephrase those concepts in written and oral assessments	Student has poor understanding of the related concepts about the theoretical background of the experiment and unable to rephrase those concepts in written and oral assessments
2	**Application Functionality 10%**	Application runs smoothly and operation of the application runs efficiently	Application compiles with no warnings. Robust operation of the application, with good recovery.	Application compiles with few or no warnings. Consideration given to unusual conditions with reasonable	Application compiles and runs without crashing. Some attempt at detecting and correcting errors.	Application does not compile or compiles but crashes. Confusing. Little or no error detection or correction.
3	**Specifications 10%**	The program works very efficiently and meets all of the required specifications.	The program works and meets some of the specifications.	The program works and produces the correct results and displays them correctly. It also meets most of the other specifications.	The program produces correct results but does not display them correctly.	The program is producing incorrect results.
4	**Level of understanding of the learned skill 10%**	Provide complete and logical answers based upon accurate technical content to the questions asked by examiner	Provide complete and logical answers based upon accurate technical content to the questions asked by examiner with few errors	Provide partially correct and logical answers based upon minimum technical content to the questions asked by examiner	Provide very few and illogical answers to the questions asked by examiner.	Provide no answer to the questions asked by examiner.
5	**Readability and Reusability 10%**	The code is exceptionally well organized and very easy to follow and reused	The code is fairly easy to read. The code could be reused as a whole or each class could be reused.	Most of the code could be reused in other programs.	Some parts of the code require change before they could be reused in other programs.	The code is poorly organized and very difficult to read and not organized for reusability.

6	**AI System Design 10%**	Well-designed AI models. Code is highly maintainable	Good designed AI models and Little code duplications	Some attempt to make AI models. Code can be maintained with significant effort	Little attempt to design AI models and less understanding of code	Very poor attempt to design AI models and its code
7	**Responsiveness to Questions/ Accuracy 10%**	1. Responds well, quick and very accurate all the time. 2. Effectively uses eye contact, speaks clearly, effectively and confidently using suitable volume	1. Generally Responsive and accurate most of the times. 2. Maintains eye contact, speaks clearly with suitable volume and pace.	1. Generally Responsive and accurate few times. 2. Some eye contact, speaks clearly and unclearly in different portions.	1. Not much Responsive and accurate most of the times. 2. Uses eye contact ineffectively and fails to speak clearly and audibly	. 1. Non Responsive and inaccurate all the times. 2. No eye contact and unable to speak 3. Dresses inappropriately
8	**Efficiency** **10%**	The code is extremely efficient without sacrificing readability and understanding	The code is fairly efficient without sacrificing readability and understanding	Some part of the code is efficient and other part of the code is not understandable and work properly	The code is brute force and unnecessarily long	The code is huge and appears to be patched together
9	**Delivery** **10%**	The program was delivered in time during lab.	The program was delivered in Lab before the end time.	The program was delivered within the due date.	The code was delivered within a day after the due date.	The code was delivered more than 2 days overdue.
10	**Awareness of Safety Guidelines 10%**	Student has sufficient knowledge of the laboratory safety SOPs and protocol and is fully compliant to the guidelines	Student has sufficient knowledge of the laboratory safety SOPs and protocol and is Partially compliant to the guidelines	Student has little knowledge of the laboratory safety SOPs and protocol and is Partially compliant to the guidelines	Student has little knowledge of the laboratory safety SOPs and protocol and is non-compliant to the guidelines	Student has no knowledge of the laboratory safety SOPs and protocol and is non-compliant to the guidelines