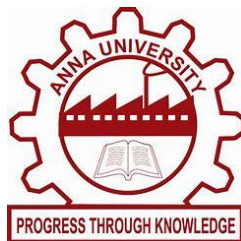


NAAN MUDHALVAN

PROJECT REPORT
HEART RISK Q&A CHATBOT

SUBMITTED BY
ABIRAAME A.J – 2022116043

DEPARTMENT OF BIOMEDICAL ENGINEERING



COLLEGE OF ENGINEERING, GUINDY

CHENNAI – 600025

APRIL – 2025

HEART RISK Q&A CHATBOT

1. Introduction

1.1 Project Overview:

- This project implements a command-line chatbot designed to answer user questions about heart disease and related risks.
- The chatbot leverages the Gemini 1.5 Pro language model to provide information.

1.2 Background and Motivation:

- Heart disease is a major global health concern.
- This chatbot aims to provide a readily accessible tool for users to get quick information about heart health.

1.3 Project Goals and Objectives:

- The primary goal is to create a chatbot that can accurately and informatively respond to user inquiries about heart disease.
- Objectives include:
 - Integrating the Gemini 1.5 Pro model.
 - Defining a system instruction to guide the model's responses.
 - Implementing a basic command-line interface for user interaction.

1.4 Scope:

- The chatbot focuses on providing information about heart disease.
- It is designed for informational purposes and does not provide medical diagnoses or treatment advice.

2. Methodology

2.1 Technology Stack:

- Python (programming language)
- google-generativeai library (for accessing the Gemini model)
- Google Gemini 1.5 Pro latest (language model)

2.2 Data Source and Knowledge Base:

- The chatbot's knowledge is derived from the Gemini 1.5 Pro model, which has been trained on a large dataset of text and code.

- The system instruction provided to the model guides it to provide accurate and concise medical information.

2.3 Model Selection and Configuration:

- The Gemini 1.5 Pro latest model was selected for its strong natural language processing capabilities.
- The model is configured with a system instruction to act as a helpful and knowledgeable AI assistant for heart disease information.

2.4 Development Process:

- The development process involved:
 - Installing the google-generativeai library.
 - Configuring the Gemini API key.
 - Initializing the Gemini 1.5 Pro model with a system instruction.
 - Creating a function (ask_medical_bot) to handle user input and chatbot responses.
 - Implementing a loop to maintain the chat session until the user exits.

3. Chatbot Functionality

3.1 User Interface:

- The chatbot uses a simple command-line interface.
- Users type their questions, and the chatbot displays the responses in the terminal.

3.2 Chatbot Capabilities:

- The chatbot can answer a range of questions related to heart disease, such as:
 - Symptoms of heart conditions
 - Risk factors
 - Prevention methods
 - General information about heart health

3.3 Limitations:

- The chatbot is limited to providing informational responses.
- It cannot provide medical diagnoses, treatment plans, or personalized medical advice.

- Users are advised to consult with a healthcare professional for specific medical concerns.

4. Evaluation

4.1 Testing and Validation:

- Testing was primarily done through manual interaction with the chatbot.
- Users provided various questions about heart disease to assess the chatbot's accuracy, relevance, and clarity of responses.

4.2 Results and Discussion:

- The chatbot demonstrated the ability to provide generally informative answers to common questions about heart disease.
- The Gemini 1.5 Pro model's system instruction effectively guided the chatbot to stay within its intended role.
- Further testing and refinement could improve the chatbot's ability to handle more complex or nuanced questions.

Potential improvements include:

- Expanding the knowledge base with more specific medical information.
- Implementing a more user-friendly interface (e.g., a web-based interface using Streamlit).
- Adding features to provide links to reliable sources of medical information.
- Improving error handling and robustness.

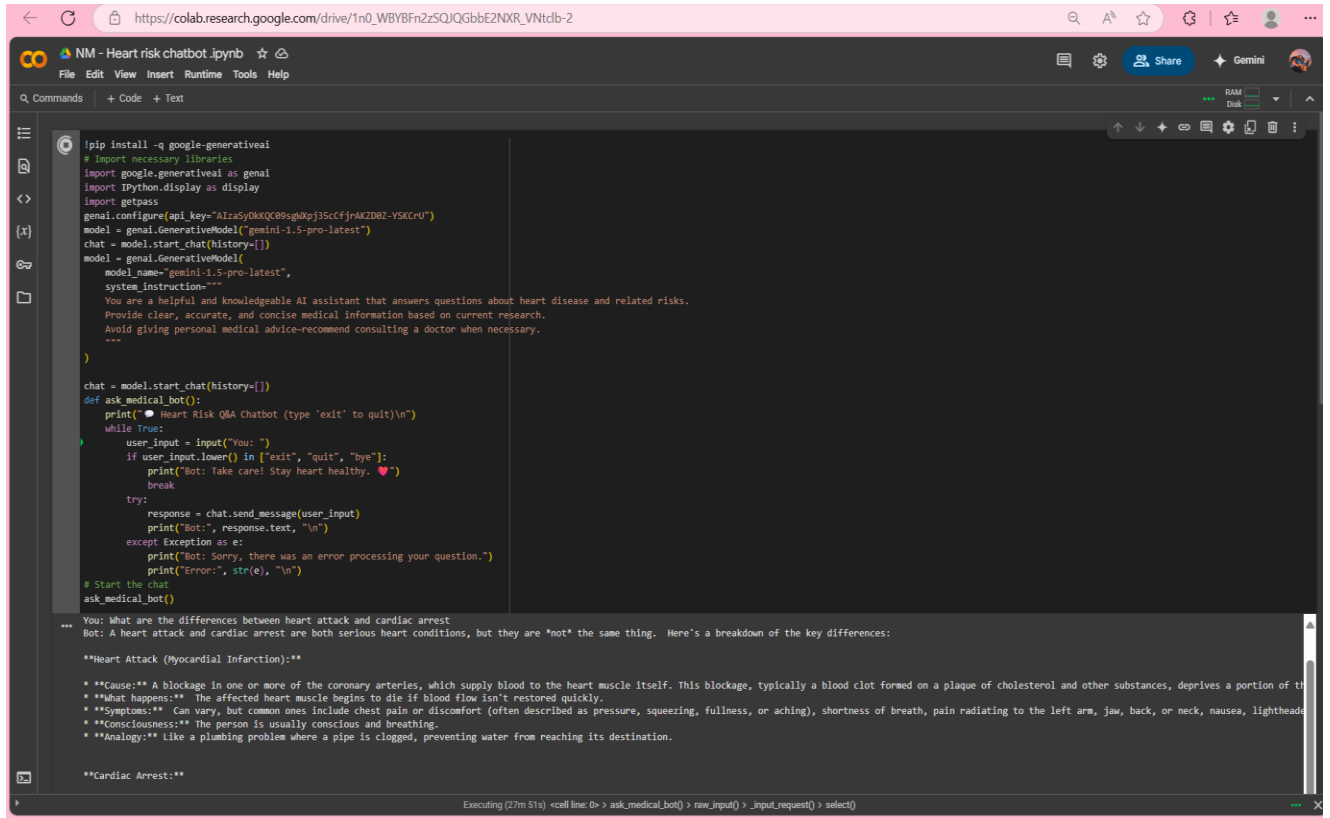
5.3 Overall Impact:

- The chatbot has the potential to serve as a helpful tool for individuals seeking basic information about heart disease.
- It can contribute to raising awareness about heart health and promoting preventive measures.

This report provides a structured overview of the heart disease chatbot implemented in the provided Colab notebook.

Google colab link :

https://colab.research.google.com/drive/1n0_WBYBFn2zSQJQGbbE2NXR_VNtclb-2?usp=sharing



```
[ip] Install -g google-generativeai
# Import necessary libraries
import google.generativeai as genai
import IPython.display as display
import getpass

genai.configure(api_key="AIzaSyDkQ09sgd0p3ScCfjrAKZD02-Y5KcrU")
model = genai.GenerativeModel("gemini-1.5-pro-latest")
chat = model.start_chat(history=[])
model = genai.GenerativeModel(
    model_name="gemini-1.5-pro-latest",
    system_instruction="""
You are a helpful and knowledgeable AI assistant that answers questions about heart disease and related risks.
Provide clear, accurate, and concise medical information based on current research.
Avoid giving personal medical advice-recommend consulting a doctor when necessary.
"""
)

chat = model.start_chat(history=[])
def ask_medical_bot():
    print("👉 Heart Risk Q&A Chatbot (type 'exit' to quit)\n")
    while True:
        user_input = input("You: ")
        if user_input.lower() in ["exit", "quit", "bye"]:
            print("Bot: Take care! Stay heart healthy. ❤️")
            break
        try:
            response = chat.send_message(user_input)
            print("Bot:", response.text, "\n")
        except Exception as e:
            print("Bot: Sorry, there was an error processing your question.")
            print("Error:", str(e), "\n")
# Start the chat
ask_medical_bot()

You: What are the differences between heart attack and cardiac arrest
Bot: A heart attack and cardiac arrest are both serious heart conditions, but they are *not* the same thing. Here's a breakdown of the key differences:

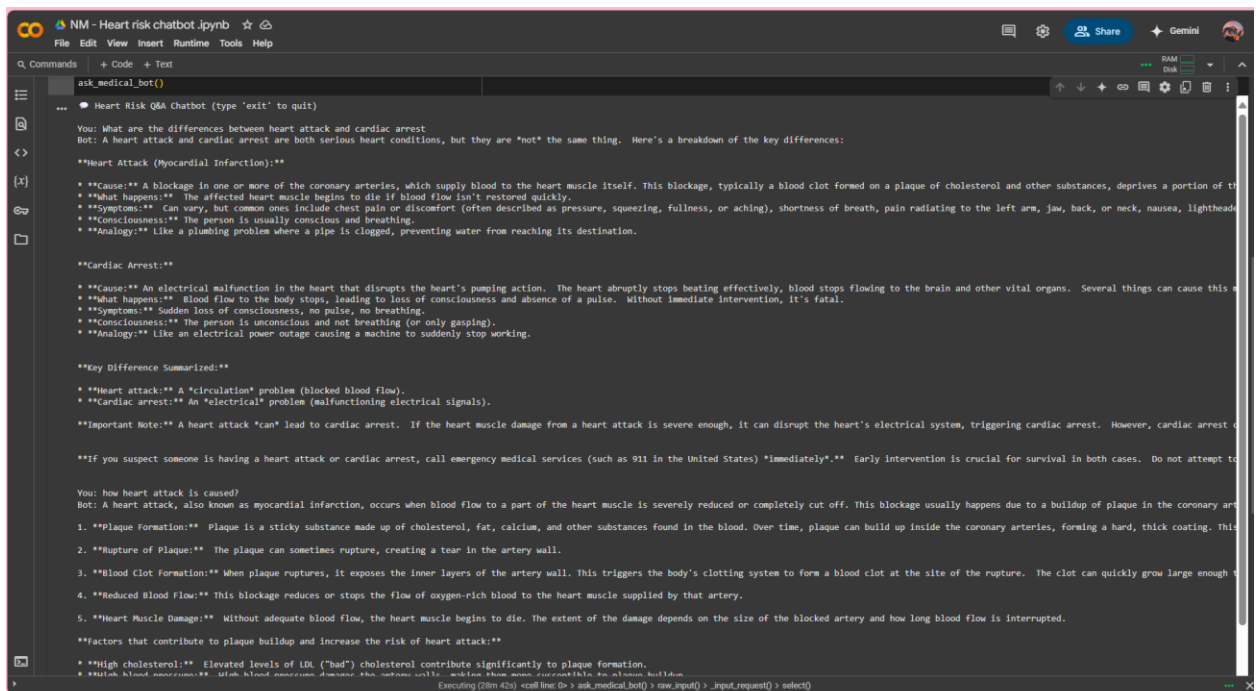
**Heart Attack (Myocardial Infarction):**
* **Cause:** A blockage in one or more of the coronary arteries, which supply blood to the heart muscle itself. This blockage, typically a blood clot formed on a plaque of cholesterol and other substances, deprives a portion of the heart muscle of oxygen-rich blood.
* **What happens:** The affected heart muscle begins to die if blood flow isn't restored quickly.
* **Symptoms:** Can vary, but common ones include chest pain or discomfort (often described as pressure, squeezing, fullness, or aching), shortness of breath, pain radiating to the left arm, jaw, back, or neck, nausea, lightheadedness, and sweating.
* **Consciousness:** The person is usually conscious and breathing.
* **Analogy:** Like a plumbing problem where a pipe is clogged, preventing water from reaching its destination.

**Cardiac Arrest:**
* **Cause:** An electrical malfunction in the heart that disrupts the heart's pumping action. The heart abruptly stops beating effectively, blood stops flowing to the brain and other vital organs. Several things can cause this, including a heart attack, but they are not always directly related.
* **What happens:** Blood flow to the body stops, leading to loss of consciousness and absence of a pulse. Without immediate intervention, it's fatal.
* **Symptoms:** Sudden loss of consciousness, no pulse, no breathing.
* **Consciousness:** The person is unconscious and not breathing (or only gasping).
* **Analogy:** Like an electrical power outage causing a machine to suddenly stop working.

**Key Difference Summarized:**
* **Heart attack:** A "circulation" problem (blocked blood flow).
* **Cardiac arrest:** An "electrical" problem (malfunctioning electrical signals).

**Important Note:** A heart attack *can* lead to cardiac arrest. If the heart muscle damage from a heart attack is severe enough, it can disrupt the heart's electrical system, triggering cardiac arrest. However, cardiac arrest can also occur without a heart attack.

**If you suspect someone is having a heart attack or cardiac arrest, call emergency medical services (such as 911 in the United States) *immediately*! Early intervention is crucial for survival in both cases. Do not attempt to perform CPR or first aid unless you are trained and authorized to do so.
```



```
ask_medical_bot()

...
You: What are the differences between heart attack and cardiac arrest
Bot: A heart attack and cardiac arrest are both serious heart conditions, but they are *not* the same thing. Here's a breakdown of the key differences:

**Heart Attack (Myocardial Infarction):**
* **Cause:** A blockage in one or more of the coronary arteries, which supply blood to the heart muscle itself. This blockage, typically a blood clot formed on a plaque of cholesterol and other substances, deprives a portion of the heart muscle of oxygen-rich blood.
* **What happens:** The affected heart muscle begins to die if blood flow isn't restored quickly.
* **Symptoms:** Can vary, but common ones include chest pain or discomfort (often described as pressure, squeezing, fullness, or aching), shortness of breath, pain radiating to the left arm, jaw, back, or neck, nausea, lightheadedness, and sweating.
* **Consciousness:** The person is usually conscious and breathing.
* **Analogy:** Like a plumbing problem where a pipe is clogged, preventing water from reaching its destination.

**Cardiac Arrest:**
* **Cause:** An electrical malfunction in the heart that disrupts the heart's pumping action. The heart abruptly stops beating effectively, blood stops flowing to the brain and other vital organs. Several things can cause this, including a heart attack, but they are not always directly related.
* **What happens:** Blood flow to the body stops, leading to loss of consciousness and absence of a pulse. Without immediate intervention, it's fatal.
* **Symptoms:** Sudden loss of consciousness, no pulse, no breathing.
* **Consciousness:** The person is unconscious and not breathing (or only gasping).
* **Analogy:** Like an electrical power outage causing a machine to suddenly stop working.

**Key Difference Summarized:**
* **Heart attack:** A "circulation" problem (blocked blood flow).
* **Cardiac arrest:** An "electrical" problem (malfunctioning electrical signals).

**Important Note:** A heart attack *can* lead to cardiac arrest. If the heart muscle damage from a heart attack is severe enough, it can disrupt the heart's electrical system, triggering cardiac arrest. However, cardiac arrest can also occur without a heart attack.

**If you suspect someone is having a heart attack or cardiac arrest, call emergency medical services (such as 911 in the United States) *immediately*! Early intervention is crucial for survival in both cases. Do not attempt to perform CPR or first aid unless you are trained and authorized to do so.

You: how heart attack is caused?
Bot: A heart attack, also known as myocardial infarction, occurs when blood flow to a part of the heart muscle is severely reduced or completely cut off. This blockage usually happens due to a buildup of plaque in the coronary arteries.

1. **Plaque Formation:** Plaque is a sticky substance made up of cholesterol, fat, calcium, and other substances found in the blood. Over time, plaque can build up inside the coronary arteries, forming a hard, thick coating. This narrows the arteries and restricts blood flow.
2. **Rupture of Plaque:** The plaque can sometimes rupture, creating a tear in the artery wall.
3. **Blood Clot Formation:** When plaque ruptures, it exposes the inner layers of the artery wall. This triggers the body's clotting system to form a blood clot at the site of the rupture. The clot can quickly grow large enough to completely block the artery.
4. **Reduced Blood Flow:** This blockage reduces or stops the flow of oxygen-rich blood to the heart muscle supplied by that artery.
5. **Heart Muscle Damage:** Without adequate blood flow, the heart muscle begins to die. The extent of the damage depends on the size of the blocked artery and how long blood flow is interrupted.

**Factors that contribute to plaque buildup and increase the risk of heart attack:**
* **High cholesterol:** Elevated levels of LDL ("bad") cholesterol contribute significantly to plaque formation.
* **High blood pressure:** High blood pressure damages the artery walls, making them more susceptible to plaque buildup.
* **Smoking:** Smoking damages the arteries and increases the risk of blood clot formation.
* **Diabetes:** Diabetes can lead to the hardening and narrowing of the arteries.
* **Obesity:** Excess weight is often associated with high cholesterol, high blood pressure, and insulin resistance, all of which increase the risk of heart disease.
* **Sedentary lifestyle:** Lack of physical activity contributes to obesity, high cholesterol, and high blood pressure.
* **Unhealthy diet:** A diet high in saturated fats, trans fats, and sodium can lead to high cholesterol and high blood pressure.
* **Stress:** Chronic stress can contribute to high blood pressure and unhealthy lifestyle choices.
* **Family history:** Having a family history of heart disease increases the risk of developing it.
* **Age and sex:** The risk of heart disease increases with age and is higher for men than for women.


```

IMPROVEMENTS DONE:

Deploying this as app in streamlit through github repository:

Methodology:

Technology Stack:

- List the programming languages, libraries, and tools used:
 - Python
 - Streamlit (for the user interface)
 - Google Generative AI (for the language model)
- Explain why these technologies were chosen.

Data Source and Knowledge Base:

- Describe the sources of information used to train or inform the chatbot's responses.
 - Reliable medical websites (e.g., World Health Organization, CDC, Mayo Clinic)
 - Peer-reviewed research articles
 - Medical textbooks
- Emphasize the importance of using credible and up-to-date sources.

Model Selection and Configuration:

- Specify the Gemini model used (e.g., Gemini 1.5 Pro latest).
- Explain the rationale for choosing this model (e.g., its capabilities in natural language understanding and generation).
- Describe any specific configurations or prompt engineering techniques used to optimize the model's performance.

Development Process:

- Outline the steps involved in developing the chatbot:
 - Data gathering and preparation
 - Model integration
 - User interface design (using Streamlit)

- Testing and refinement

Chatbot Functionality

User Interface:

- Describe the Streamlit application's layout and features.
 - Input area for user questions
 - Display area for chatbot responses
 - Chat history feature (if implemented)
 - Any other relevant UI elements
- Include screenshots of the application.

Chatbot Capabilities:

- Provide examples of the types of questions the chatbot can answer:
 - "What are the symptoms of a heart attack?"
 - "What are the risk factors for heart disease?"
 - "What are some healthy lifestyle changes to prevent heart disease?"
- Demonstrate the chatbot's ability to provide informative and relevant responses.

Github repository link: [Abiraame03/Heart-risk-chatbot: It is the app which has a chatbot which can answer about the cardiac problems](https://github.com/Abiraame03/Heart-risk-chatbot)

Streamlit app developed: <https://heart-risk-chatbot-ezuqrpdkxmkgwhsjpwcwv.streamlit.app/>

RESULT:

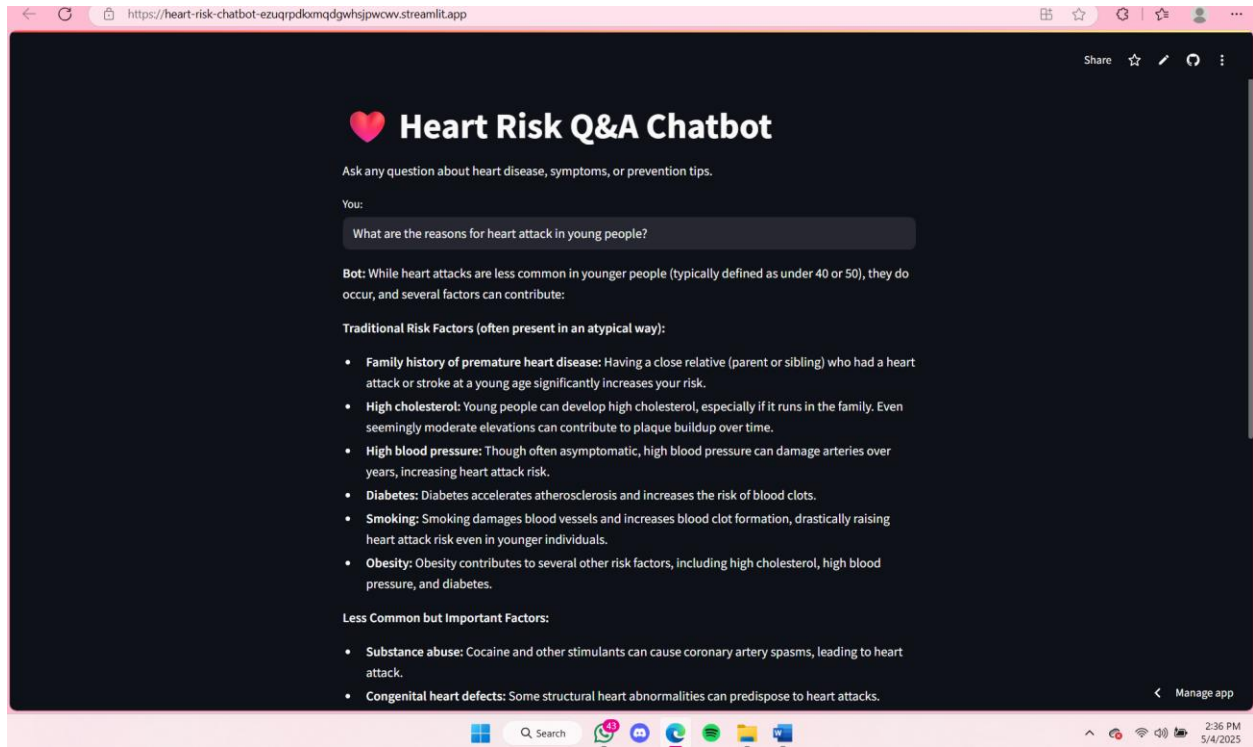


Figure showing the app developed through streamlit from the github repository

Thank you!