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1. ABSTRACT

Cancer remains one of the leading global health concerns, affecting millions of individuals and families annually. Public awareness, early detection, and education play a crucial role in combating this disease. The "Cancer Chatbot" project is designed as an educational tool to provide general information about cancer in a user-friendly and interactive format.

This chatbot employs a structured, predefined response system to answer commonly asked questions about cancer, including its causes, symptoms, treatments, and preventive measures. The chatbot is built using Python and incorporates a simple question-response framework, making it accessible for users with no prior technical knowledge. For queries like "What is cancer?" or "What are the symptoms of cancer?", the chatbot delivers accurate and concise responses, ensuring users gain basic knowledge about the disease. Additionally, the chatbot includes an engaging feature where it provides random facts about cancer, keeping the interaction informative and captivating.

One of the unique features of this chatbot is its ability to maintain a conversational tone, simulating real-time interactions. When users input queries that are beyond the chatbot's knowledge base, it responsibly responds with a disclaimer, encouraging users to consult medical professionals for specific advice. This ensures that the chatbot remains a reliable educational tool without overstepping its scope.

The project demonstrates the potential of chatbot technology in the healthcare sector, particularly in promoting health literacy and awareness. While the chatbot is limited to predefined responses, it highlights how even a simple system can contribute to raising awareness about critical health issues like cancer.

This chatbot can be utilized in various settings, such as schools, awareness campaigns, or online platforms, to spread knowledge about cancer. Future iterations of the chatbot could integrate advanced natural language processing (NLP) techniques to enable dynamic and personalized responses. Moreover, expanding the knowledge base and incorporating multilingual support could make the tool more inclusive and widely accessible.

2. INTRODUCTION

Cancer is a significant global health challenge, with millions of cases reported annually. It is a group of diseases characterized by the uncontrolled growth and spread of abnormal cells, which, if left untreated, can lead to severe health complications and death. According to the World Health Organization (WHO), cancer is one of the leading causes of death worldwide, with lung, breast, and colorectal cancers being the most common types. Despite advancements in medical research, a large portion of the population remains unaware of cancer's symptoms, risk factors, and prevention methods. This lack of awareness often leads to delayed diagnosis and treatment, which can have life-threatening consequences.

In an era where technology plays an integral role in education and healthcare, chatbots have emerged as an innovative tool for spreading knowledge and improving accessibility to information. Chatbots are computer programs designed to simulate human conversation, providing users with instant responses to their queries. They are particularly effective in creating an engaging and interactive platform for learning. The "Cancer Chatbot" project leverages this technology to bridge the gap in public awareness by offering a simple, user-friendly solution for accessing general information about cancer.

The Cancer Chatbot is programmed to address common questions such as "What are the symptoms of cancer?" or "How can cancer be prevented?" It operates using a predefined knowledge base, ensuring accurate and concise responses. Unlike complex AI models, this chatbot uses a straightforward question-response system, making it accessible to users with minimal technical expertise. Additionally, the chatbot enhances user engagement by providing random, interesting facts about cancer, fostering curiosity and learning in a conversational format.

This project emphasizes the importance of health education and the role of digital tools in promoting awareness. While the chatbot does not replace professional medical consultation, it serves as a starting point for users to gain basic knowledge about cancer. By encouraging users to adopt healthy habits, undergo regular screenings, and seek professional advice, the chatbot contributes to the broader goal of reducing the global cancer burden.

In this report, the development, functionality, and potential applications of the Cancer Chatbot are explored in detail.

3. REQUIREMENTS

Python: Version 3.6 or higher

The chatbot is developed using Python, which is an easy-to-learn, versatile programming language with a robust library ecosystem.

Integrated Development Environment (IDE):

Visual Studio Code, PyCharm, Jupyter Notebook, or any Python-compatible editor for coding and debugging the chatbot.

Operating System Support:

Windows 10/11, macOS, or any Linux distribution with Python support.

Python Libraries and Dependencies

random: A standard Python library used for selecting random facts about cancer from a predefined list.

No external installation is required as it is included in the Python Standard Library.

Functional Requirements

Predefined Responses: The chatbot must have a comprehensive and accurate knowledge base with predefined responses to user queries.

User Interaction: Ability to accept user inputs and provide corresponding responses in real time.

Error Handling: If a user's query is outside the chatbot's knowledge base, it should provide a disclaimer and guide the user to consult medical professionals.

Exit Functionality: The chatbot must terminate gracefully when the user types "goodbye."

Reliability: The chatbot must respond consistently to predefined queries without crashing or lagging.

Usability: The user interface must be simple and easy to navigate for non-technical users.

Performance: The chatbot should provide instant responses to user inputs without noticeable delay.

Scalability: While currently limited to predefined responses, the architecture should allow future upgrades, such as adding dynamic features or integrating advanced AI models.

4. WORKING METHODOLOGY

The "Cancer Chatbot" is a rule-based system designed to provide users with general information about cancer. It follows a straightforward methodology to deliver accurate and predefined responses to user queries. The chatbot's operation can be divided into the following key steps:

1. User Interaction

The chatbot starts by greeting the user and introducing its purpose—to provide general information about cancer. Users interact with the chatbot by typing their queries in natural language, such as "What are the symptoms of cancer?" or "How is cancer treated?"

2. Query Matching

The chatbot processes the user's input and compares it against its predefined knowledge base, which is stored as key-value pairs in a Python dictionary. Each key represents a possible user query, while the corresponding value contains the chatbot's response.

Direct Matches: If the user query matches a predefined key, the chatbot retrieves and delivers the associated response.

Fact Selection: For specific queries like "Tell me a fact about cancer," the chatbot uses Python's random library to select and display a random fact from a list.

Default Response: If the user input does not match any predefined key, the chatbot provides a default message, such as: "I'm sorry, I don't have information on that. Please consult a medical professional for specific advice."

3. Response Generation

Once a match is found, the chatbot generates a response and displays it to the user in a conversational format. This ensures the interaction feels natural and engaging.

4. Conversation Management

The chatbot operates in a loop, allowing users to ask multiple questions during a session. The loop continues until the user types "goodbye," signaling the end of the conversation. At this point, the chatbot terminates gracefully with a farewell message, such as: "Thank you for chatting! Remember to consult a healthcare provider for any medical advice."

5. Error Handling

The chatbot is designed to handle unexpected inputs gracefully. For example:

If the user enters a query outside the chatbot's knowledge base, it responds with a disclaimer encouraging users to seek professional advice.

If the user input is invalid or contains typos, the chatbot prompts the user to rephrase their query.

6. Lightweight Implementation

The chatbot uses a simple text-based interface and is implemented entirely in Python. It does not rely on external databases or APIs, making it lightweight and easy to run on basic hardware and software configurations.

7. Future Scalability

The modular design of the chatbot allows for easy future enhancements. Additional questions and responses can be added to the knowledge base, and advanced features such as natural language processing (NLP) can be integrated for more dynamic interactions.

This working methodology demonstrates how the Cancer Chatbot efficiently combines simplicity, accuracy, and accessibility to educate users about cancer-related topics.

5. IMPLEMENTATION CODE

Backend code:

```
from flask import Flask, render_template, request

import random


app = Flask(__name__)


# Predefined responses for a simple cancer chatbot

responses = {

    "What is cancer?": "Cancer is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body.",

    "What are the symptoms of cancer?": "Symptoms can vary depending on the type of cancer but often include unusual lumps, unexplained weight loss, fatigue, skin changes, and persistent cough.",

    "What are the causes of cancer?": "Cancer is caused by genetic mutations, which can result from factors such as smoking, radiation, viruses, cancer-causing chemicals, obesity, and lack of exercise.",

    "How is cancer treated?": "Cancer treatment options include surgery, chemotherapy, radiation therapy, immunotherapy, and targeted therapy. The choice of treatment depends on the type and stage of cancer.",

    "Can cancer be prevented?": "While not all cancers can be prevented, a healthy lifestyle can lower the risk. Avoiding tobacco, eating a balanced diet, maintaining a healthy weight, and regular screenings can help reduce the risk.",

    "Tell me a fact about cancer.": [

        "Over 9.6 million people die from cancer each year.",

        "More than 70% of cancer deaths occur in low- and middle-income countries.",

        "Lung, breast, and colorectal cancers are among the most common types of cancer."

    ],

    "goodbye": "Thank you for chatting! Remember to consult a healthcare provider for any medical advice.",

    "What is chemotherapy?": "Chemotherapy is a treatment that uses drugs to kill cancer cells or stop their growth.",
```

"What is immunotherapy?": "Immunotherapy is a treatment that uses the body's immune system to fight cancer by enhancing or stimulating the immune response.",

"What are the stages of cancer?": "Cancer stages describe the extent of cancer in the body. They are usually classified as Stage 0 (early) to Stage IV (advanced).",

"What is radiation therapy?": "Radiation therapy uses high-energy radiation to kill or damage cancer cells.",

"Can cancer be cured?": "Some types of cancer can be cured with early detection and treatment. However, other types may be managed as chronic conditions.",

"What is targeted therapy?": "Targeted therapy is a treatment that uses drugs to target specific genes or proteins that are involved in the growth and survival of cancer cells.",

"What is a biopsy?": "A biopsy is a procedure where a small sample of tissue is taken from the body to check for cancer cells.",

"Can genetics play a role in cancer?": "Yes, some cancers are hereditary, meaning they can run in families due to inherited gene mutations.",

"What is a tumor?": "A tumor is an abnormal mass of tissue that may or may not be cancerous. Benign tumors are non-cancerous, while malignant tumors are cancerous.",

"What is breast cancer?": "Breast cancer is a cancer that starts in the cells of the breast. It is one of the most common cancers in women.",

"What is lung cancer?": "Lung cancer is cancer that starts in the lungs, often due to smoking, although non-smokers can also develop lung cancer.",

"What is colon cancer?": "Colon cancer is cancer that starts in the colon (large intestine) or rectum, and is often associated with changes in bowel habits.",

"What is prostate cancer?": "Prostate cancer is cancer that starts in the prostate, a small gland that produces semen in men.",

"What is skin cancer?": "Skin cancer is cancer that begins in the skin cells, often caused by UV radiation exposure.",

"What are the risk factors for cancer?": "Risk factors include smoking, excessive alcohol consumption, obesity, family history, exposure to carcinogens, and lack of physical activity.",

"What are common cancer treatments?": "Common cancer treatments include surgery, chemotherapy, radiation therapy, immunotherapy, and targeted therapies.",

"What is cancer screening?": "Cancer screening involves tests and exams to detect cancer in people who do not yet have symptoms, with the aim of finding it early.",

"What is a cancer survivor?": "A cancer survivor is someone who has been diagnosed with cancer and is living with or after treatment.",

"What is a palliative care?": "Palliative care is specialized care aimed at relieving symptoms and improving quality of life for patients with serious illnesses like cancer.",

"How does smoking contribute to cancer?": "Smoking introduces carcinogens into the lungs and other parts of the body, significantly increasing the risk of lung and other cancers.",

"What foods should be avoided to prevent cancer?": "Processed foods, excessive red meat, and foods high in sugar or salt should be limited as they can increase cancer risk.",

"What foods are good for cancer prevention?": "A diet rich in fruits, vegetables, whole grains, and healthy fats is beneficial in reducing cancer risk.",

"Can exercise reduce cancer risk?": "Regular physical activity helps maintain a healthy weight and lowers the risk of various types of cancer, such as breast and colon cancer.",

"What is a clinical trial?": "A clinical trial is a research study to test new treatments or drugs for cancer.",

"What is a cancer vaccine?": "Cancer vaccines help the immune system recognize and destroy cancer cells. Examples include the HPV vaccine for cervical cancer.",

"How is cancer related to age?": "The risk of developing cancer increases with age, as the body accumulates mutations over time.",

"What is the survival rate for cancer?": "The survival rate depends on the type of cancer, its stage at diagnosis, and the treatment options available.",

"What is a cancer remission?": "Remission refers to the period when cancer signs and symptoms are reduced or disappear following treatment.",

"Can cancer spread to other parts of the body?": "Yes, cancer cells can spread from their original site to other parts of the body, a process known as metastasis.",

"What is an oncologist?": "An oncologist is a doctor who specializes in diagnosing and treating cancer.",

"What is a PET scan?": "A PET scan is a type of imaging test that can detect cancerous cells in the body.",

"What is a CT scan?": "A CT scan is a type of X-ray that provides detailed images of the body's organs and tissues and is often used to detect cancer.",

"What is a mammogram?": "A mammogram is an X-ray of the breast used to detect early signs of breast cancer.",

"What is HPV?": "Human papillomavirus (HPV) is a virus that can cause various cancers, including cervical cancer.",

"What is ovarian cancer?": "Ovarian cancer starts in the ovaries and is often diagnosed in later stages due to subtle symptoms.",

"What is liver cancer?": "Liver cancer starts in the liver, often due to chronic liver diseases like cirrhosis or hepatitis.",

"What is kidney cancer?": "Kidney cancer starts in the kidneys and may cause symptoms like blood in the urine or pain in the side.",

"What are the survival rates for breast cancer?": "Breast cancer survival rates vary depending on the stage, type, and treatment, with early detection improving outcomes.",

"Can cancer be treated with diet?": "While diet alone cannot cure cancer, a healthy diet can support overall health and may improve treatment outcomes.",

```
    "What is a cancer recurrence?": "Cancer recurrence occurs when cancer comes back after treatment, either in the same location or elsewhere in the body.",

    "What are the stages of breast cancer?": "Breast cancer stages range from Stage 0 (early) to Stage IV (advanced), depending on tumor size, lymph node involvement, and spread.",

    "What is leukemia?": "Leukemia is a type of blood cancer that affects the bone marrow and blood cells.",

    "What is the role of chemotherapy in cancer treatment?": "Chemotherapy kills cancer cells by interfering with their ability to divide and grow, but it can also affect healthy cells.",

    "What is the importance of early detection in cancer?": "Early detection of cancer often leads to more effective treatments and higher survival rates.",

    "What is the role of the immune system in fighting cancer?": "The immune system can recognize and attack cancer cells, and treatments like immunotherapy boost this natural defense.",

    "How do environmental factors affect cancer risk?": "Exposure to environmental factors like air pollution, radiation, and chemicals can increase the risk of cancer."

}


def get_response(user_input):

    # Check if input matches a key in the predefined responses

    if user_input in responses:

        response = responses[user_input]

        # If the response is a list, choose a random fact

        if isinstance(response, list):

            return random.choice(response)

        return response

    else:

        return "I'm sorry, I don't have information on that. Please consult a medical professional for specific advice."


@app.route("/")

def home():

    return render_template("chat.html")


@app.route("/get_response", methods=["POST"])

def chat():

    user_message = request.form["user_input"]
```

```
    bot_response = get_response(user_message)
    return {"response": bot_response}


if __name__ == "__main__":
    app.run(debug=True)
```

Frontend code:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
      <title>Yuki - Cancer Chatbot</title>
    <link
href="https://fonts.googleapis.com/css2?family=Poppins:wght@300;400;600&display=swap"
rel="stylesheet">
    <style>
        body {
            font-family: 'Poppins', sans-serif;
            background: linear-gradient(to bottom, #9eecf2, #a2c2f1, #c0bdf2);
            margin: 0;
            padding: 0;
            color: #333;
        }

        .chat-container {
            max-width: 700px;
            margin: 50px auto;
            background: #ffffff;
            border-radius: 15px;
            box-shadow: 0 4px 20px rgba(0, 0, 0, 0.1);
            overflow: hidden;
```

```
}

.header {
    background: #4a90e2;
    color: white;
    text-align: center;
    padding: 20px;
    font-size: 22px;
    font-weight: 600;
}

.messages {
    padding: 20px;
    height: 500px;
    overflow-y: auto;
    background: #f8f9fa;
    position: relative;
}

.input-box {
    display: flex;
    padding: 15px;
    background: #e0f7fa;
    border-top: 1px solid #b2ebf2;
}

.input-box input {
    flex: 1;
    padding: 15px;
    border: 1px solid #b2ebf2;
    border-radius: 10px;
    font-size: 16px;
```

```
    font-family: 'Poppins', sans-serif;
    background: #ffffff;
}

.input-box button {
    background: #4a90e2;
    color: white;
    border: none;
    padding: 12px 20px;
    margin-left: 10px;
    border-radius: 10px;
    cursor: pointer;
    font-size: 16px;
    font-weight: 500;
}

.input-box button:hover {
    background: #0069d9;
}

.clear-chat {
    margin-top: 10px;
    text-align: center;
}

.clear-chat button {
    background: #80b3f2;
    color: white;
    border: none;
    padding: 10px 20px;
    border-radius: 10px;
    cursor: pointer;
```

```
    font-size: 14px;
    font-weight: 500;
}

.clear-chat button:hover {
    background: #0069d9;
}

.message {
    margin: 10px 0;
    font-size: 16px;
    animation: fadeIn 0.5s ease-in-out;
    max-width: 70%;
}

.user-message {
    text-align: right;
    background: #e9f5ff;
    display: inline-block;
    padding: 10px 15px;
    border-radius: 15px;
    margin-left: auto;
}

.bot-message {
    text-align: left;
    background: #f0faff;
    display: inline-block;
    padding: 10px 15px;
    border-radius: 15px;
    margin-right: auto;
}
```

```
        .typing-indicator {
            display: none;
            text-align: left;
            font-style: italic;
            color: #888;
            margin-top: 5px;
            font-size: 14px;
        }

        .error-message {
            color: #ff4d4f;
            font-style: italic;
            text-align: center;
            margin-top: 10px;
        }

        @keyframes fadeIn {
            from { opacity: 0; transform: translateY(10px); }
            to { opacity: 1; transform: translateY(0); }
        }

        ::-webkit-scrollbar {
            width: 6px;
        }

        ::-webkit-scrollbar-thumb {
            background: #80b3f2;
            border-radius: 10px;
        }
    </style>
</head>
```

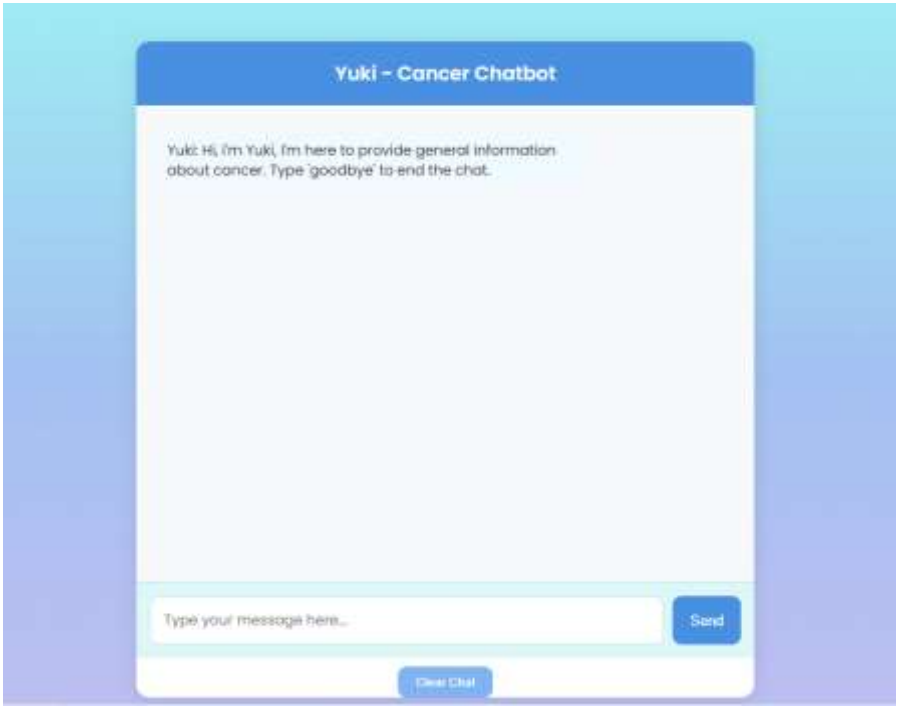
```
<body>
    <div class="chat-container">
        <div class="header">
            Yuki - Cancer Chatbot
        </div>
        <div class="messages" id="chat-messages">
            <div class="message bot-message">
                Yuki: Hi, I'm Yuki, I'm here to provide general information about cancer. Type 'goodbye' to end the chat.
            </div>
        </div>
        <div class="typing-indicator" id="typing-indicator">Yuki is typing...</div>
        <div class="input-box">
            <input type="text" id="user-input" placeholder="Type your message here...">
            <button onclick="sendMessage()">Send</button>
        </div>
        <div class="clear-chat">
            <button onclick="clearChat()">Clear Chat</button>
        </div>
    </div>

    <script>
        const chatMessages = document.getElementById("chat-messages");
        const typingIndicator = document.getElementById("typing-indicator");

        // Load chat history from localStorage
        window.onload = () => {
            const savedChat = localStorage.getItem("chatHistory");
            if (savedChat) {
                chatMessages.innerHTML = savedChat;
            }
        };
```

```
function sendMessage() {
    const userInput = document.getElementById("user-input").value;
    if (!userInput) return;

    // Add user message to chat
    const userMessageDiv = document.createElement("div");
    userMessageDiv.className = "message user-message";
    userMessageDiv.textContent = userInput;
    chatMessages.appendChild(userMessageDiv);
    chatMessages.scrollTop = chatMessages.scrollHeight;

    // Show typing indicator
    typingIndicator.style.display = "block";

    // Send message to the backend
    fetch("/get_response", {
        method: "POST",
        headers: {
            "Content-Type": "application/x-www-form-urlencoded"
        },
        body: "user_input=" + encodeURIComponent(userInput)
    })
    .then(response => response.json())
    .then(data => {
        typingIndicator.style.display = "none"; // Hide typing indicator

        const botMessageDiv = document.createElement("div");
        botMessageDiv.className = "message bot-message";
        botMessageDiv.textContent = "Yuki: " + data.response;
        chatMessages.appendChild(botMessageDiv);
        chatMessages.scrollTop = chatMessages.scrollHeight;
```

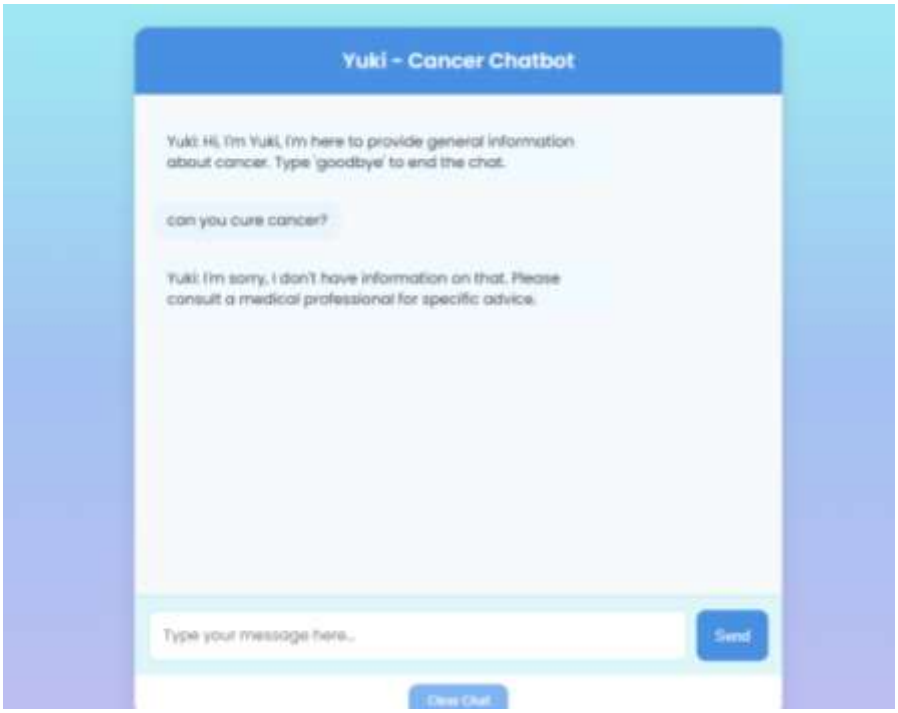
```
            // Save chat history to localStorage
            localStorage.setItem("chatHistory", chatMessages.innerHTML);
        })
        .catch(() => {
            typingIndicator.style.display = "none"; // Hide typing indicator
            const errorDiv = document.createElement("div");
            errorDiv.className = "error-message";
            errorDiv.textContent = "An error occurred. Please try again.";
            chatMessages.appendChild(errorDiv);
        });

        // Clear input field
        document.getElementById("user-input").value = "";
    }

    function clearChat() {
        chatMessages.innerHTML = `
            <div class="message bot-message">
                Yuki: Hi, I'm Yuki, I'm here to provide general information about cancer. Type 'goodbye' to end the chat.
            </div>`;
        localStorage.removeItem("chatHistory");
    }
  </script>
</body>
</html>
```

6. RESULTS

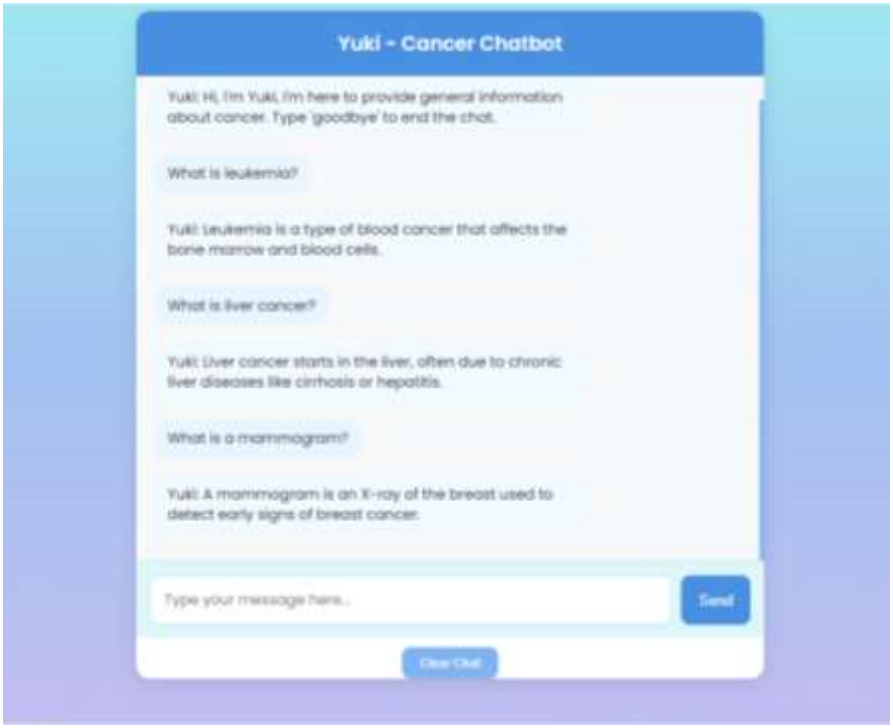
When we run our chatbot_app.py in terminal using the command ‘python chaybot_app.py’ the below web page is displayed as output, we can enter any messages related to cancer that are already predefined in our backend code.



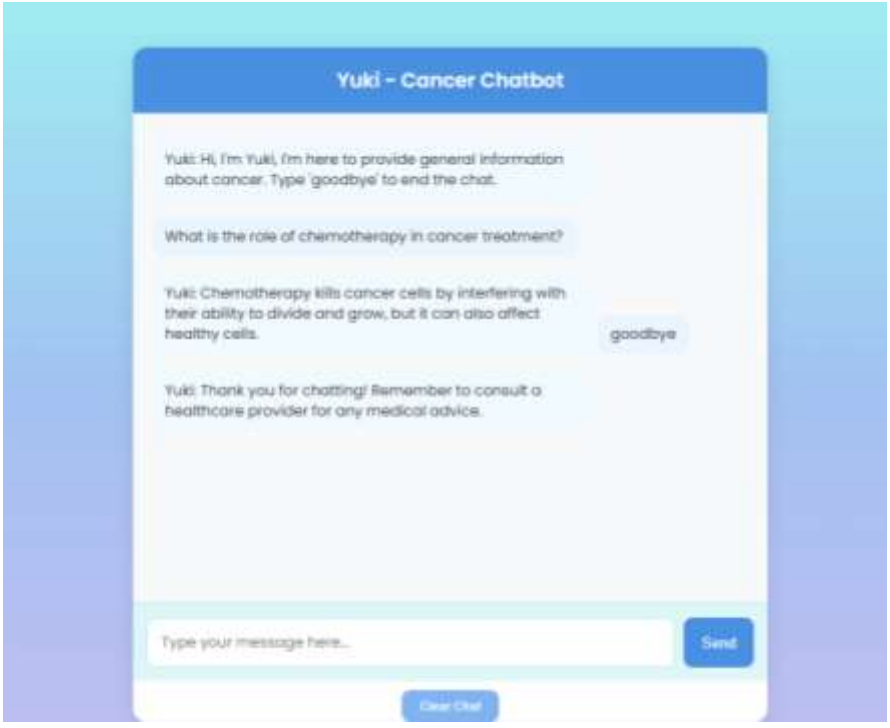
When we enter a message that not in the predefined responses then the chatbot displays the below output.



This chatbot have a option called as ‘clear chat’ that clears the previous chats and you can start a new chat.



If you want to end the chat the type ‘goodbye’ to end chat



7. CONCLUSION

The "Cancer Chatbot" serves as an innovative, user-friendly tool designed to spread awareness about cancer. By leveraging a simple rule-based architecture, the chatbot provides accurate and concise responses to common questions about cancer, such as its causes, symptoms, treatment methods, and preventive measures. It also offers interesting facts to engage users while encouraging them to adopt healthier lifestyles and seek medical advice when needed.

This project highlights the potential of chatbot technology in healthcare education. Despite being a basic implementation, it demonstrates how digital tools can make vital information more accessible and empower users to take an active role in understanding complex health topics. The chatbot's lightweight design, combined with its ease of use, makes it a valuable prototype for awareness campaigns, educational purposes, and public health initiatives.

While the current version is limited to predefined responses, the chatbot’s architecture allows for future enhancements. Integrating natural language processing (NLP), expanding the knowledge base, and incorporating multilingual support could significantly broaden its functionality and reach.

In conclusion, the "Cancer Chatbot" is a practical and impactful example of using technology to address critical global health issues. It serves as a starting point for further exploration and development of AI-driven solutions in the healthcare domain, fostering greater awareness and empowering communities worldwide.

8. REFERENCES

https://jamanetwork.com/journals/jamaoncology/article-abstract/2808731

https://cancer.jmir.org/2021/4/e27850/