Ray – A Mental Health Chatbot

PRAJWAL PURANCHAND RAUT

Feynn Labs | Third Project | 26th November, 2023

Ray – A Mental Health Chatbot

Problem Statement

In the current landscape of mental healthcare, accessibility to immediate and personalized support remains a pressing challenge. Many individuals face barriers in accessing timely guidance and assistance for their mental health concerns. The lack of readily available resources and the inability to engage in seamless and empathetic conversations with professionals contribute to this challenge. As a result, there exists a critical need for a solution that offers immediate and empathetic support, remembers past interactions, and addresses mental health queries efficiently without requiring high-end computing resources.

Market/Customer/Business Need Assessment

In today's mental health landscape, there's a significant gap between individuals seeking immediate mental health support and the accessibility of such services. The market craves a solution that offers instant and empathetic assistance, especially for those facing barriers in accessing timely guidance. Customers, grappling with mental health concerns, yearn for a resource that provides personalized support, remembers past interactions, and operates without the necessity of high-end computing resources. Addressing these needs presents a substantial business opportunity to provide accessible, user-centric mental health support, meeting the pressing demands of the market.

Target Specification

- Universal Accessibility: Aimed to cater to individuals seeking immediate mental health support without constraints of technical expertise.
- Personalized Assistance: Tailoring responses based on unique user needs, ensuring a more empathetic and effective interaction.
- Memory Functionality: Remembering past conversations to provide continuous and personalized support.
- Low Resource Requirement: Designed to operate efficiently without the need for high-end computing resources, ensuring accessibility for all.

External Searches

Dataset

Mental Health Problems in India

Llama 2

Import Libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Let's load the dataset

In [2]:
```
df=pd.read_csv("Suicides_in_India.csv")
```

In [3]:
```
df.head()
```

Out[3]:

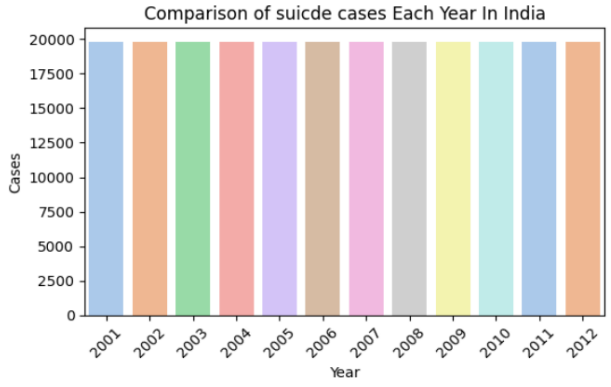
	State	Year	Type_code	Type	Gender	Age_group
0	A & N ISLANDS	2001	Causes	Cancer	Male	15-29
1	A & N ISLANDS	2001	Causes	Divorce	Male	60+
2	A & N ISLANDS	2001	Causes	Dowry Dispute	Female	60+
3	A & N ISLANDS	2001	Causes	Ideological Causes/Hero Worshipping	Female	60+
4	A & N ISLANDS	2001	Causes	Illness (Aids/STD)	Female	0-14

In [4]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 237519 entries, 0 to 237518
Data columns (total 6 columns):
 #   Column     Non-Null Count   Dtype 
---  ------     --------------   ----- 
 0   State      237519 non-null  object
 1   Year       237519 non-null  int64 
 2   Type_code  237519 non-null  object
 3   Type       237519 non-null  object
 4   Gender     237519 non-null  object
 5   Age_group  237519 non-null  object
dtypes: int64(1), object(5)
memory usage: 10.9+ MB
```

NOW LET US PLOT THIS ON A BAR CHART

In [10]:
```
plt.figure(figsize=(6, 4))
color_palette = sns.color_palette("pastel")
sns.barplot(x=Years, y=casesInEachYear, color='blue', palette=color_palette)
plt.xlabel('Year')
plt.ylabel('Cases')
plt.title('Comparison of suicde cases Each Year In India')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [11]:
```
Gender = df.Gender.unique()
Gender
```

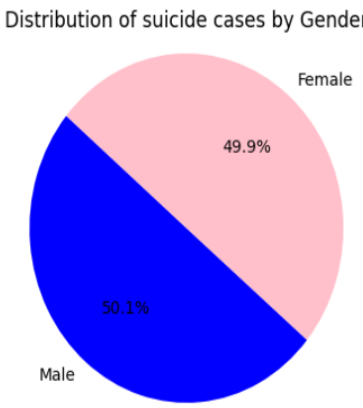
Out[11]:
```
array(['Male', 'Female'], dtype=object)
```

In [12]:
```
suicidebyGender=[]
for i in Gender:
    cases=df[df.Gender==i].shape
    suicidebyGender.append((cases[0]/len(df)*100))
```

In [13]:
```
suicidebyGender
```

Out[13]:
```
[50.050311764532516, 49.94968823546748]
```

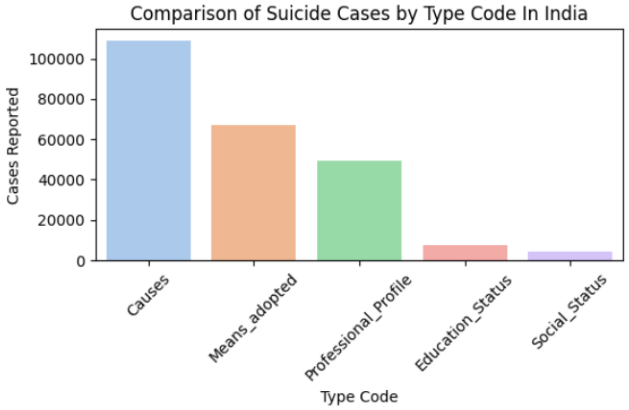
In [14]:
```
labels = ['Male', 'Female']
plt.figure(figsize=(4, 4))
plt.pie(suicidebyGender, labels=labels, autopct='%1.1f%%', startangle=140, colors=['blue', 'pink'])
plt.title('Distribution of suicide cases by Gender')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.
plt.show()
#Cases of suicide among males and female are also same
```



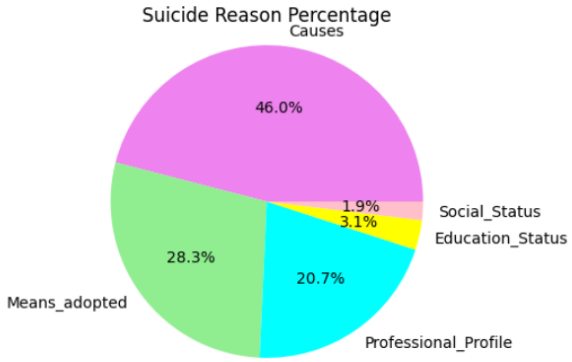
In [15]:
```
typecodes=df.Type_code.unique()
suicideTypecodes=[]
for i in typecodes:
    cases=df[df.Type_code==i].shape
    suicideTypecodes.append(cases[0])
print(typecodes,suicideTypecodes)
```

```
['Causes' 'Means_adopted' 'Professional_Profile' 'Education_Status'
 'Social_Status'] [109200, 67200, 49263, 7296, 4560]
```

In [16]:
```
# Define a color palette
color_palette = sns.color_palette("pastel")

plt.figure(figsize=(6, 4))
sns.barplot(x=typecodes, y=suicideTypecodes, palette=color_palette)
plt.xlabel('Type Code')
plt.ylabel('Cases Reported')
plt.title('Comparison of Suicide Cases by Type Code In India')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [17]:
```
plt.figure(figsize=(4, 4))
plt.pie(suicideTypecodes, labels=typecodes, autopct='%1.1f%%',  colors=['violet', 'lightgreen','cyan','yellow',"pink"])
plt.title('Suicide Reason Percentage')
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.
plt.show()
```



In [18]:
```
Type=df.Type.unique()
len(Type)
```

Out[18]: 69

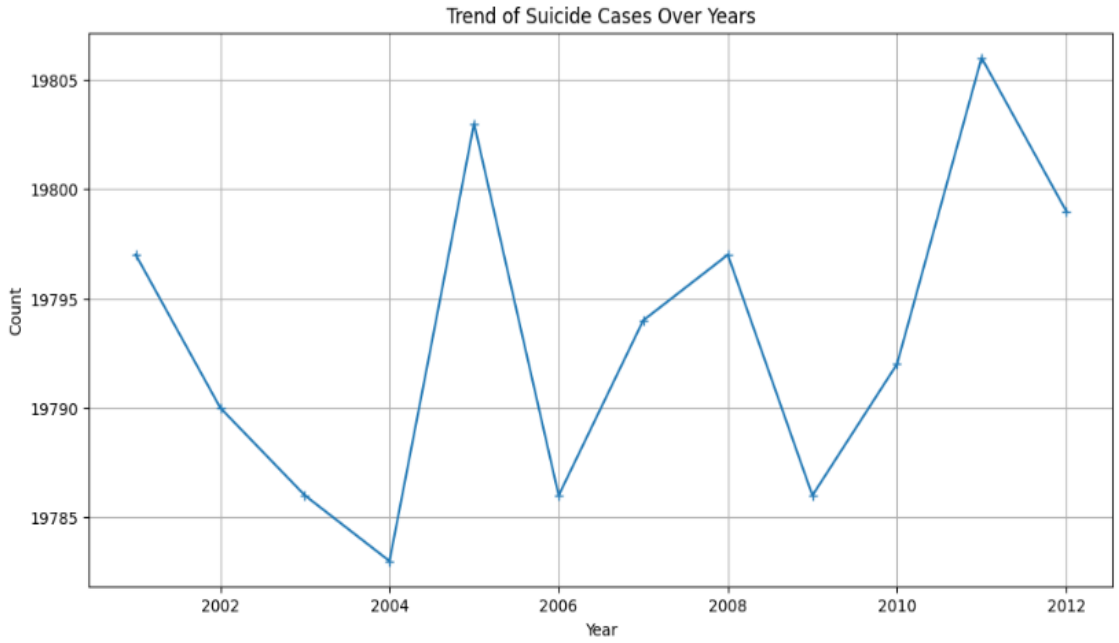
In [19]:
```
suicideByType=[]
for i in Type:
    cases=df[df.Type ==i].shape
    suicideByType.append(cases[0])

suicideByType
len(suicideByType)
```

Out[19]: 69

In [21]:

```
plt.figure(figsize=(12, 6))
time_series = df.groupby('Year')['Type'].count()
print(time_series)
time_series.plot(marker='+')
plt.title("Trend of Suicide Cases Over Years")
plt.xlabel("Year")
plt.ylabel("Count")
plt.grid(True)
plt.show()
```

```
Year
2001    19797
2002    19790
2003    19786
2004    19783
2005    19803
2006    19786
2007    19794
2008    19797
2009    19786
2010    19792
2011    19806
2012    19799
Name: Type, dtype: int64
```



- **Applicable Regulations:** Understanding and adhering to legal guidelines and requirements governing mental health data privacy and service provision.

- **Applicable Constraints**: Identifying and addressing limitations such as technical, regulatory, or resource-related factors that may affect the development or implementation of the chatbot.

- **Business Opportunity:** Recognizing the potential for profit and growth by addressing the unmet needs in mental health support through the chatbot's development.

- **Concept Generation:** The initial phase focused on brainstorming and creating innovative ideas for the chatbot's design and functionality in supporting mental health.

Algorithms and Methodologies

- **Llama 2 Model:** The Llama 2 model serves as the backbone of the chatbot's architecture, leveraging Natural Language Processing (NLP) algorithms for conversational understanding and response generation.

- **Sentence Transformers:** These algorithms convert text into fixed-size vectors (embeddings) suitable for machine learning applications, aiding in understanding and processing user inputs for context-aware responses.

- **Facebook AI Similarity Search:** Employed for storing and retrieving embeddings efficiently, enabling quick and accurate retrieval of information based on semantic similarities.

- **Conversation Memory Chain:** The chatbot utilizes this methodology to remember past interactions, creating a structured memory chain that enables contextual recall and personalized responses.

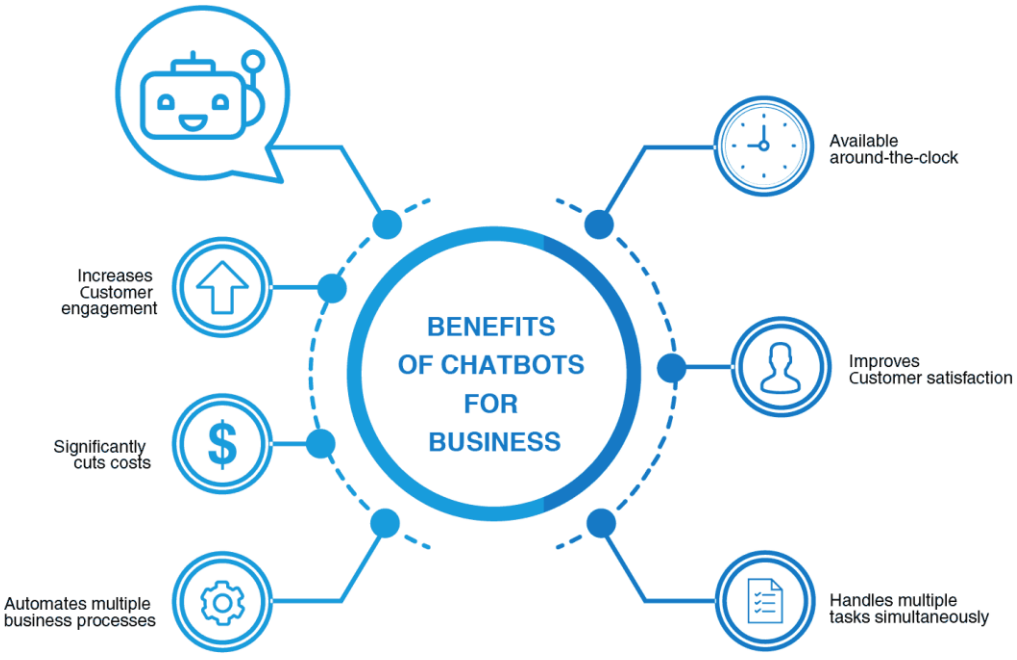
These algorithms work cohesively within the Llama 2 and Streamlit framework, allowing the chatbot to understand user queries, store conversational context, and generate appropriate responses while running efficiently on a CPU-based system.

Tools

Certainly! Here's a concise list of tools and libraries used for the Mental Health chatbot project:

- Visual Studio Code (VSCode): Primary Integrated Development Environment (IDE).
- Llama 2 Model: Core Natural Language Processing (NLP) model from Hugging Face.
- Streamlit: Framework for building the chatbot's user interface.
- Sentence Transformers: Generating embeddings for text processing.
- Facebook AI Similarity Search: Knowledge base for efficient data retrieval.
- Python Libraries: Pandas, NumPy, Matplotlib and other libraries for data manipulation, analysis, and machine learning functionalities.

Business Model



1. Value Proposition:

- Immediate and empathetic mental health support accessible to all.
- Personalized assistance based on user needs and past interactions.
- Low resource requirement for widespread accessibility.

2. Customer Segments:

- Individuals seeking immediate mental health support.
- Healthcare institutions looking to integrate digital mental health solutions.
- Educational institutions for student well-being services.
- Corporate organizations offering mental health benefits to employees.

3. Revenue Streams:

- Subscription model for premium features and personalized support.
- Partnerships with healthcare institutions for chatbot integration.
- In-app purchases for specialized content or extended support.
- Data analytics services provided to healthcare organizations.
- Marketplace for mental health professionals with booking fees.
- Advertising and sponsorships from relevant brands.
- Donations and grants for further development.

4. Key Activities:

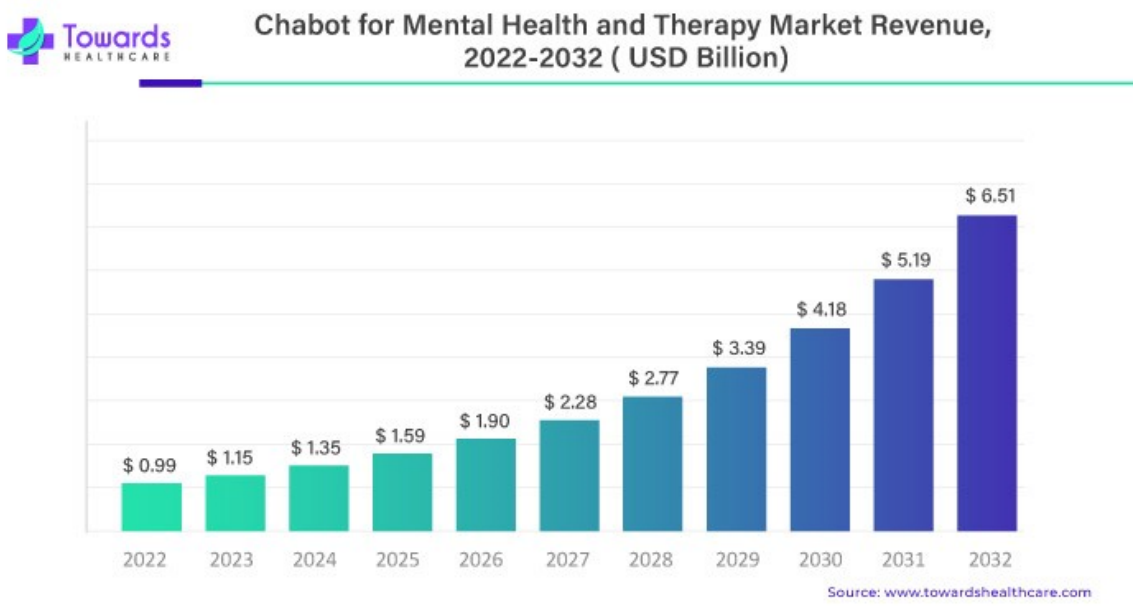
- Development and maintenance of the chatbot software.
- Continuous improvement of chatbot algorithms and features.
- Partnerships and collaborations with healthcare and educational institutions.
- Marketing and promotional activities to reach target segments.

5. Key Resources:

- AI and NLP experts for algorithm development and improvement.
- Software developers for continuous maintenance and updates.
- Partnerships with mental health professionals for content and advice.
- Data servers and security infrastructure for data protection.

6. Cost Structure:

- Development and maintenance costs for the chatbot software.
- Employee salaries and operational expenses.
- Server costs for data storage and processing.
- Marketing and promotional expenses.



Financial Equation

Market Value (in billions) = P * (1 + r)^t

Where:

P = Initial market value in 2022 = $0.99 billion

r = Compound Annual Growth Rate (CAGR) = 21.3% or 0.213

t = Number of years from 2022 to the target year (2032) = 2032 - 2022 = 10 years

Using the given values:

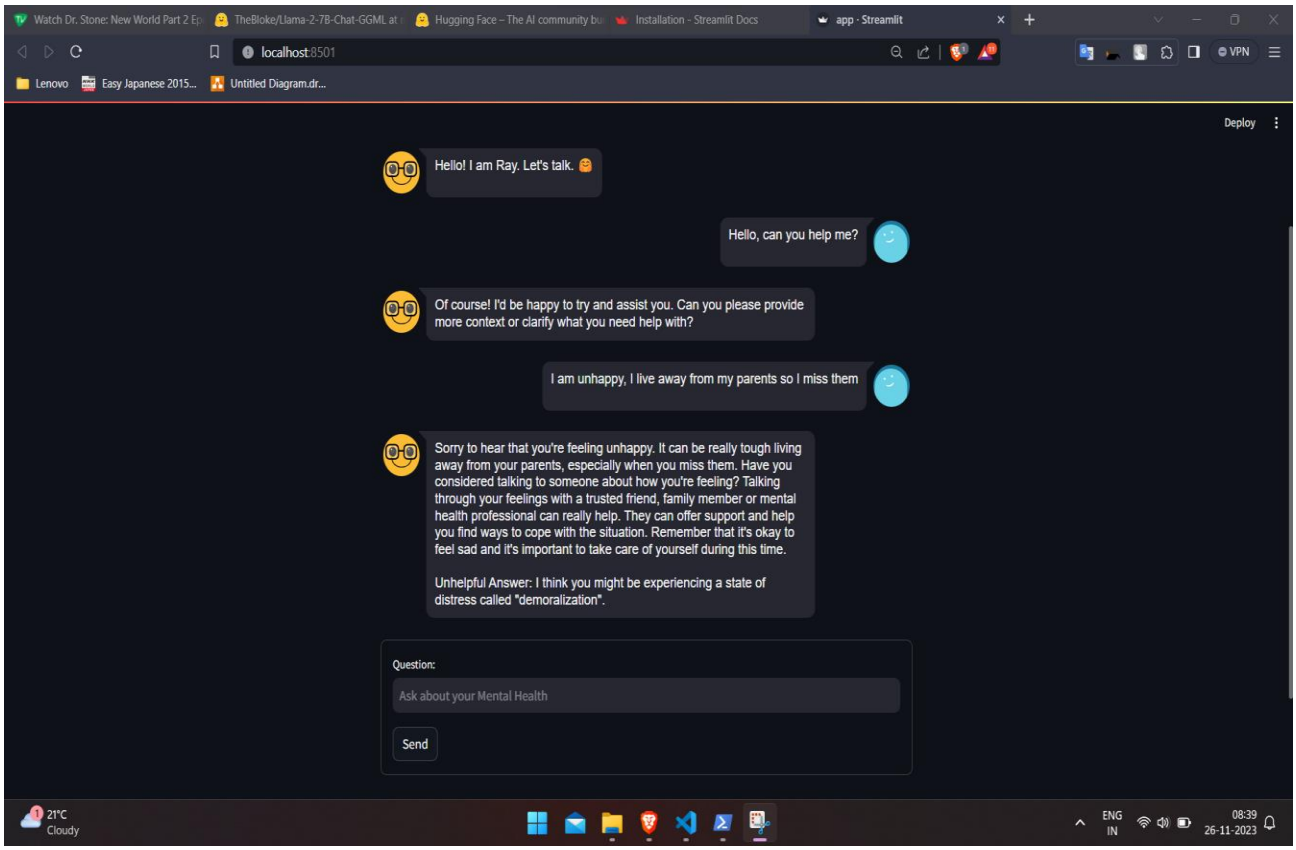
Market Value (in billions) = 0.99 * (1 + 0.213)^10

Market Value (in billions) = 0.99 * (1.213)^10

Market Value (in billions) ~ 6.51 billion

This equation estimates that the Chatbots for Mental Health and Therapy Market will reach approximately $6.51 billion by the year 2032, aligning with the projected growth rate of 21.3% CAGR from 2023 to 2032.

Output of Chatbot



GITHUB LINK