
MENTAL HEALTH MONITORING APP

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STEP 1 : PROTOTYPE SELECTION

ABSTRACT

In recent years, the prevalence of mental health issues has highlighted the need for accessible and effective support systems. This project presents the development of a Mental Health Support App, leveraging machine learning to provide personalized mental health care. The app focuses on mood tracking, sentiment analysis, and personalized recommendations, aiming to empower users with tools to manage their mental well-being.

The project explores the feasibility, viability, and monetization potential of the proposed solution, ensuring that it can be developed in the short term, remain relevant in the long term, and be directly monetizable. A sentiment analysis model was implemented as a core component to validate the product idea, utilizing natural language processing (NLP) techniques to analyze user mood data. The model demonstrates promising accuracy in detecting user sentiment, forming the basis for personalized recommendations within the app.

This report details the development process, including data collection, model building, and a brief discussion on the potential for further scaling and deployment. The proposed solution aims to address the growing demand for mental health support, providing an innovative, scalable, and user-centric approach to mental wellness.

PROBLEM STATEMENT

The increasing prevalence of mental health issues worldwide has created a significant demand for accessible and personalized mental health support. Traditional methods of mental health care, while effective, often lack scalability and personalization, leading to gaps in care for individuals who may not have immediate access to professional help. This project addresses the need for a scalable solution by developing a Mental Health Support App that leverages machine learning to provide personalized mood tracking, sentiment analysis, and tailored recommendations. The app aims to empower users to manage their mental well-being proactively while offering an innovative approach to mental health care that is both accessible and effective.

MARKET/ CUSTOMER/ BUSINESS NEED ASSESSMENT

- **MARKET OVERVIEW**

The global mental health market is experiencing significant growth, driven by increasing awareness of mental health issues and the rising prevalence of conditions such as anxiety, depression, and stress-related disorders. The market is expected to continue expanding, with a projected compound annual growth rate (CAGR) of around 6-7% over the next decade. Digital mental health solutions, including mobile apps and telehealth services, are a rapidly growing segment within this market, as they provide scalable and accessible care to individuals worldwide.

- **CUSTOMER NEED**

Modern consumers are increasingly seeking personalized and on-demand mental health support that fits seamlessly into their daily lives. Many individuals face barriers to traditional mental health care, such as stigma, cost, and lack of access to qualified professionals. There is a growing demand for tools that allow users to self-manage their mental health, track their emotional well-being, and receive timely, personalized recommendations. Younger generations, in particular, prefer digital solutions that offer privacy, convenience, and a sense of control over their mental health journey.

- **BUSINESS NEED**

Mental health professionals, employers, and healthcare providers recognize the need for innovative solutions that can alleviate the burden on traditional healthcare systems while improving outcomes for patients. Businesses in the mental health space require scalable, data-driven solutions that can cater to a diverse user base. The rise of telemedicine and digital health apps has opened new revenue streams, with potential for subscription models, in-app purchases, and partnerships with healthcare organizations. The need for an effective, monetizable mental health support app is clear, providing an opportunity to meet market demand while delivering a positive impact on public health.

The proposed Mental Health Support App is positioned to address these market, customer, and business needs by offering an accessible, scalable, and personalized mental health solution.

TARGET SPECIFICATIONS AND CHARACTERIZATION

The “Mental Health Support App” aims to provide users with a comprehensive and personalized mental wellness solution. It features mood tracking, sentiment analysis, and tailored recommendations to support mental health management. The app’s core functionalities focus on enabling users to log their moods, receive insights through

sentiment analysis, and get personalized self-care tips and exercises based on their emotional state.

From a technical perspective, the app is designed to be compatible with both iOS and Android platforms, ensuring a smooth user experience across various devices. It employs robust data privacy and security measures, including encryption and secure authentication, to protect user information. The backend infrastructure is scalable, capable of handling large numbers of concurrent users while maintaining high performance and reliability.

In terms of user engagement and monetization, the app incorporates intuitive design and gamification elements to enhance user interaction and retention. It operates on a freemium model, offering basic features for free and premium options through subscription and in-app purchases. This approach is designed to ensure the app's accessibility while generating revenue and sustaining long-term growth.

EXTERNAL SEARCH (INFORMATION AND DATA ANALYSIS)

Here are some resources and datasets from which I took references for the development of Mental Health Support App:

1. [Digital Mental Health Market Size, Share & Trends Analysis Report](#)
2. [Mental Health Apps Market Growth and Trends](#)
3. [Top Apps in Health & Fitness](#)

Dataset which I am going to use in this project is: [Mental Health in Tech Survey](#)

Dataset Description

The "Mental Health in Tech Survey" dataset consists of responses from professionals in the tech industry regarding their mental health experiences. The dataset includes various attributes such as:

- Survey Respondent Information: Includes demographics like age, gender, and job role.
- Mental Health Status: Information about mental health conditions, workplace stress, and access to mental health resources.
- Workplace Environment: Details about workplace support, stigma, and accommodation for mental health needs.
- Personal Insights: Self-reported data on work-life balance, job satisfaction, and mental health impacts on professional performance.

This dataset aims to provide insights into the mental health challenges faced by tech professionals and the effectiveness of support systems in the workplace.

Viewing Dataset

```
import pandas as pd
```

```
df=pd.read_csv('/kaggle/input/mental-health-in-tech-survey/survey.csv')
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)
pd.set_option('display.max_colwidth', None)
df.head()
```

	Timestamp	Age	Gender	Country	state	self_employed	family_history	treatment	work_interfere	no_employees	remote_work	tech_company
0	2014-08-27 11:29:31	37	Female	United States	IL	NaN	No	Yes	Often	6-25	No	Yes
1	2014-08-27 11:29:37	44	M	United States	IN	NaN	No	No	Rarely	More than 1000	No	No
2	2014-08-27 11:29:44	32	Male	Canada	NaN	NaN	No	No	Rarely	6-25	No	Yes
3	2014-08-27 11:29:46	31	Male	United Kingdom	NaN	NaN	Yes	Yes	Often	26-100	No	Yes
4	2014-08-27 11:30:22	31	Male	United States	TX	NaN	No	No	Never	100-500	Yes	Yes

benefits	care_options	wellness_program	seek_help	anonymity	leave	mental_health_consequence	phys_health_consequence	coworkers
Yes	Not sure	No	Yes	Yes	Somewhat easy	No	No	Some of them
Don't know	No	Don't know	Don't know	Don't know	Don't know	Maybe	No	No
No	No	No	No	Don't know	Somewhat difficult	No	No	Yes
No	Yes	No	No	No	Somewhat difficult	Yes	Yes	Some of them
Yes	No	Don't know	Don't know	Don't know	Don't know	No	No	Some of them

supervisor	mental_health_interview	phys_health_interview	mental_vs_physical	obs_consequence	comments
Yes	No	Maybe	Yes	No	NaN
No	No	No	Don't know	No	NaN
Yes	Yes	Yes	No	No	NaN
No	Maybe	Maybe	No	Yes	NaN
Yes	Yes	Yes	Don't know	No	NaN

BENCHMARKING

Benchmarking for the Mental Health Support App involves comparing its features, performance, and user experience against leading mental health apps like Headspace and Calm. This process highlights opportunities for differentiation, such as offering more personalized recommendations through sentiment analysis from the "Mental Health in Tech Survey" dataset. By ensuring that the app meets high standards in usability, performance, data security, and monetization, it aims to deliver a superior user experience and a competitive edge in the growing digital mental health market.

APPLICABLE PATENTS

- **Sentiment Analysis and Mood Tracking:** There are several patents related to algorithms and systems for sentiment analysis and mood tracking. For example, U.S. Patent No. 9,674,637 titled "Method and System for Sentiment Analysis" focuses on extracting sentiment from textual data, which may be relevant to the sentiment analysis feature of your app.
- **AI-Driven Recommendations:** Patents like U.S. Patent No. 10,171,123, "System and Method for Providing Personalized Recommendations," cover the use of machine learning models to provide personalized content or recommendations to users. This could apply to how your app delivers tailored mental health tips based on user data.
- **Health Data Privacy and Security:** Patents focused on secure data storage and transmission, such as U.S. Patent No. 10,660,496, "Systems and Methods for Secure Data Transmission in Healthcare," are relevant to ensuring that your app meets legal requirements for protecting user health data.

APPLICABLE REGULATIONS (GOVERNMENT AND ENVIRONMENT)

- The app must comply with regulations like GDPR in Europe and HIPAA in the U.S. to protect user health data and ensure secure data handling practices.
- Digital health apps may require certification or approval from government bodies, such as the FDA in the U.S. or the MHRA in the UK, before they can be marketed.
- The app's promotional activities must follow regulations that prevent misleading claims, particularly regarding mental health outcomes, as per FTC guidelines in the U.S.
- Consideration of the app's digital footprint, including server energy use and e-waste from mobile devices, should align with sustainability practices and government environmental policies.

APPLICABLE CONSTRAINTS

- Limited access to comprehensive real-time data for sentiment analysis may constrain the accuracy of mood predictions.
- Strict data privacy laws like GDPR and HIPAA may limit the scope of data collection and sharing.
- Resource constraints, such as budget and development time, may restrict the implementation of advanced features or scaling capabilities.

BUSINESS OPPORTUNITY

The Mental Health Support App presents a significant business opportunity in the rapidly growing digital health market, driven by increasing awareness and demand for accessible mental health resources. By offering personalized support through advanced sentiment analysis and AI-driven recommendations, the app can attract a wide user base, including individuals and corporate wellness programs. With a freemium model that transitions users to paid premium features, such as direct consultations with professionals, the app has strong revenue potential. Additionally, its scalability and data-driven insights provide opportunities for partnerships with healthcare providers and mental health organizations.

CONCEPT GENERATION

Concept generation for the Mental Health Support App involves brainstorming and developing innovative features that cater to users' mental well-being needs. Key concepts include a mood tracking system that utilizes sentiment analysis to provide real-time emotional insights, AI-driven personalized recommendations for self-care activities, and a virtual mental health assistant for on-demand support. Additionally, integrating a community feature for peer support and professional consultation options can enhance user engagement. These concepts focus on creating a holistic mental health platform that is user-friendly, effective, and scalable.

Cleaning data

```
missing_values = df.isnull().sum()  
print(missing_values)
```

Timestamp	0
Age	0
Gender	0
Country	0
state	515
self_employed	18
family_history	0
treatment	0
work_interfere	264
no_employees	0
remote_work	0
tech_company	0
benefits	0
care_options	0
wellness_program	0
seek_help	0
anonymity	0
leave	0
mental_health_consequence	0
phys_health_consequence	0
coworkers	0
supervisor	0
mental_health_interview	0
phys_health_interview	0
mental_vs_physical	0
obs_consequence	0
comments	1095
dtype: int64	

Analyzing Work Inference

```
# Count the occurrences of each value in 'work_interfere'
work_interfere_counts = df['work_interfere'].value_counts(dropna=False)

# Calculate the percentage of each value
work_interfere_percentage = work_interfere_counts / work_interfere_counts.sum() * 100

# Display the percentages
print(work_interfere_percentage)
```

```
work_interfere
Sometimes    36.934075
NaN          20.969023
Never        16.918189
Rarely       13.741064
Often        11.437649
Name: count, dtype: float64
```

Fixing Inconsistencies

```
# I make everything in lower case
df['Gender'] = df['Gender'].str.lower()
# remove trailing white spaces
df['Gender'] = df['Gender'].str.strip()
gender_unique = df['Gender'].unique()
gender_unique
```

```
array(['female', 'm', 'male', 'male-ish', 'maile', 'trans-female',
      'cis female', 'f', 'something kinda male?', 'cis male', 'woman',
      'mal', 'male (cis)', 'queer/she/they', 'non-binary', 'femake',
      'make', 'nah', 'all', 'enby', 'fluid', 'genderqueer', 'androgynous',
      'agender', 'cis-female/femme', 'guy (-ish) ^_^',
      'male leaning androgynous', 'man', 'trans woman', 'msle', 'neuter',
      'female (trans)', 'queer', 'female (cis)', 'mail',
      'a little about you', 'malr', 'p', 'femail', 'cis man',
      'ostensibly male, unsure what that really means'], dtype=object)
```

CONCEPT DEVELOPMENT

Concept development for the Mental Health Support App focuses on refining the initial ideas into a cohesive, user-centric product. This involves detailed planning of the mood tracking and sentiment analysis features, ensuring they are intuitive and provide actionable insights. The AI-driven recommendation system is designed to offer personalized mental health tips based on user data, while the virtual assistant provides timely support. The app will also integrate community support and professional consultation features, ensuring a comprehensive mental health resource. Prototypes and user feedback will guide iterations to enhance functionality, usability, and overall user experience.

STEP 2 : PROTOTYPE DEVELOPMENT

Filtering Dataframe

```
# Filter the DataFrame to keep only rows with ages between 18 and 47
df_filtered = df[(df['Age'] >= 18) & (df['Age'] <= 47)]

# Verify the changes
print(df_filtered['Age'].describe())
df=df_filtered
```

```
count      1209.000000
mean         31.328371
std           6.109286
min          18.000000
25%          27.000000
50%          31.000000
75%          35.000000
max          47.000000
Name: Age, dtype: float64
```

Now the data is clean and ready to use for data analysis. We don't have a clear answer whether each one in the survey suffers from a mental problem. So, we will count on the column 'treatment' which say if the person seeked for help or not. If yes, we assume he has a problem and vice versa.

```
#Let's see how many seeked for help
df['treatment'].value_counts()
```

```
treatment
Yes      609
No       600
Name: count, dtype: int64
```

```
#the same with family history
df['family_history'].value_counts()
```

```
family_history
No         733
Yes        476
Name: count, dtype: int64
```

Checking for Correlation

```
from scipy.stats import chi2_contingency

# Create a contingency table for two categorical columns
contingency_table = pd.crosstab(df['treatment'], df['family_history'])

# Calculate chi-square test statistic and p-value
chi2, p, _, _ = chi2_contingency(contingency_table)

# Calculate Cramer's V
n = contingency_table.sum().sum()
cramer_v = np.sqrt(chi2 / (n * (min(contingency_table.shape) - 1)))

print(f"Chi-Square Test Statistic: {chi2}")
print(f"P-value: {p}")
print(f"Cramer's V: {cramer_v}")
```

```
Chi-Square Test Statistic: 173.031717792747
P-value: 1.610803052396677e-39
Cramer's V: 0.37831164455719013
```

Now we want to see whether women have more mentally problems than men.

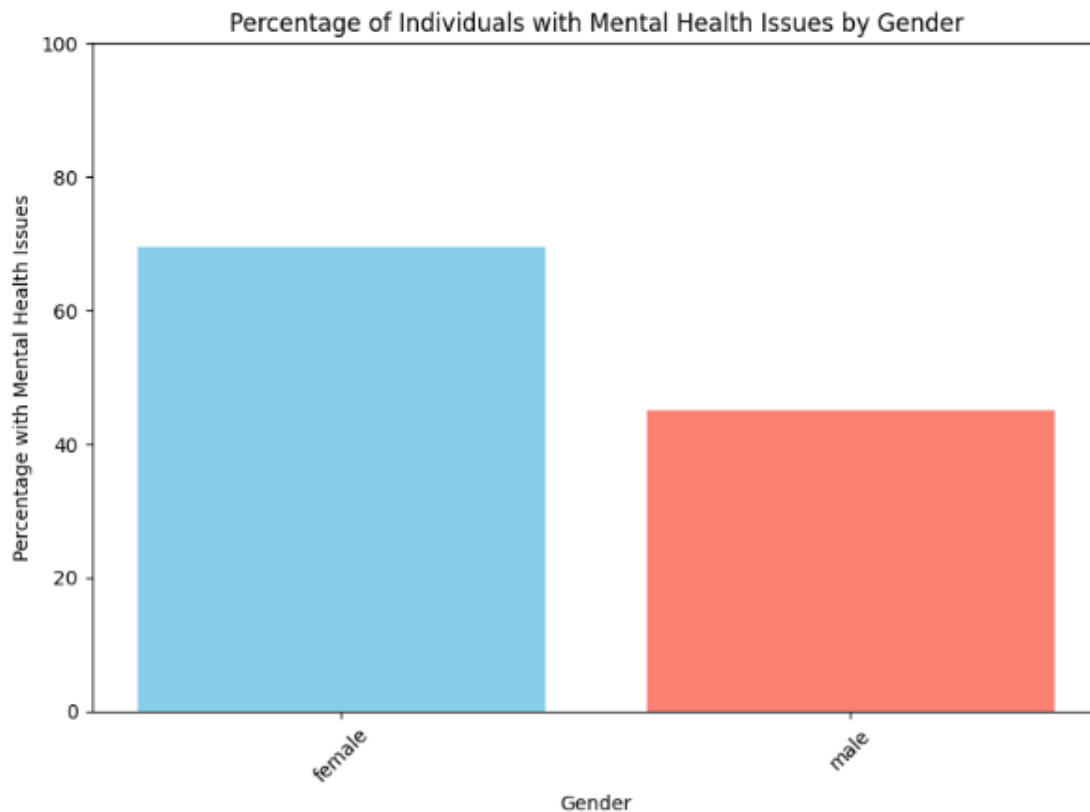
```
gender_filtered = df[df['Gender'].isin(['female', 'male'])]

# Count the number of rows for each gender where 'treatment' is 'Yes'
gender_mental_health_counts = gender_filtered[gender_filtered['treatment'] == 'Yes'].groupby('Gender').size()

# Calculate the percentage for each gender
total_gender_counts = gender_filtered.groupby('Gender').size()
percentage_mental_health = (gender_mental_health_counts / total_gender_counts) * 100

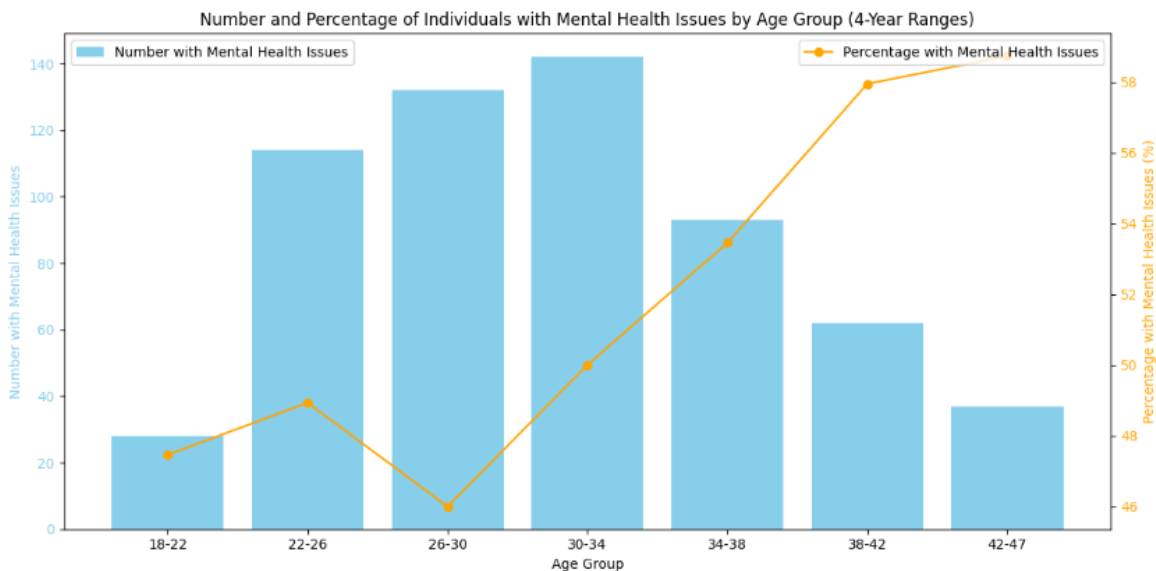
print("Percentage of individuals with mental health issues by gender:")
print(percentage_mental_health)
```

```
Percentage of individuals with mental health issues by gender:
Gender
female    69.583333
male      45.074946
dtype: float64
```



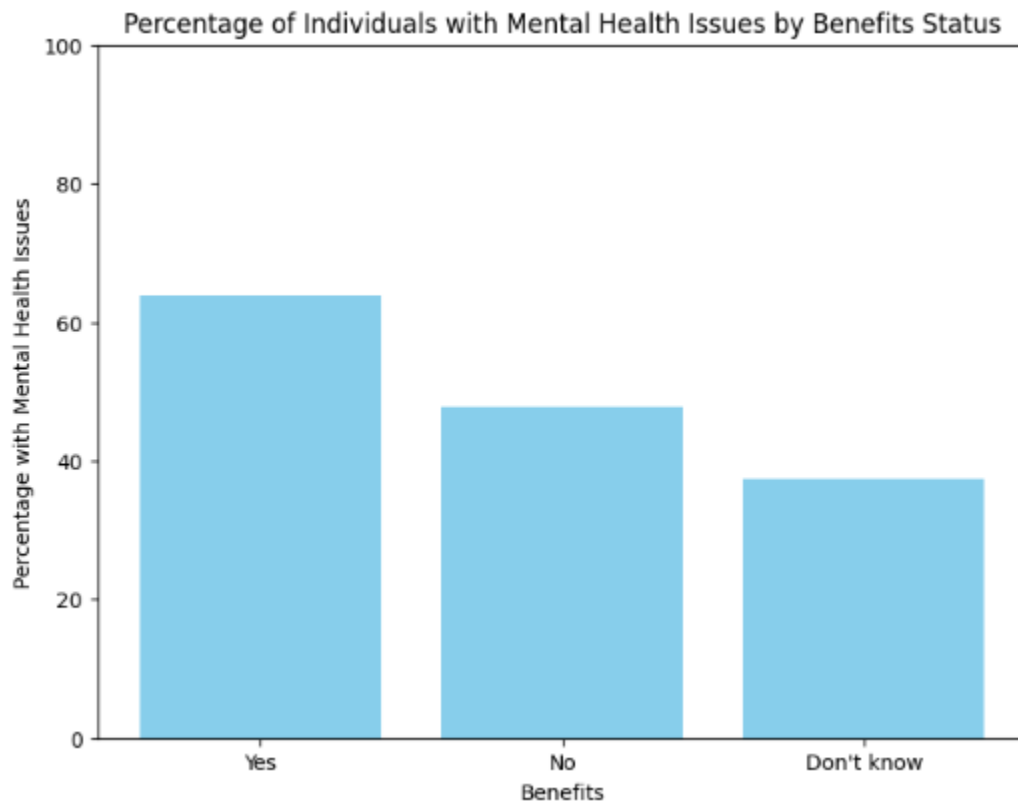
We can see that according to their relation in the population women have reported much more about mentally issues than men. Still, it doesn't say women have more problems because maybe they only share their problems more than men since they are less shy to reveal their feelings, they less try to be strong, etc.

Now we gonna see which ages tend to suffer more from mental health issues.



According to this plot we don't see much differences between the groups of age. They are all around 46-60 percents of seeking help so maybe we can say the older ages between 34 to 47 tend to seek help a little bit more than others but it's not so distinguished.

Now I want to test very interesting question about whether a supporting workplace has workers with less mentally problems. So first I'm going to check correlation between 'benefits' recieved from workplace for mentally issues to workers' condition in terms of mentally health.



We see apparently a surprising result. Where people get more help they tend to seek more for help. It's the opposite of what we could assume. To settle this we can think maybe people with mentally health issues tend to seek more supporting workplaces from the first place and maybe the workplace itself look for coping people and invite them to work with it as a good will.

FINAL PRODUCT PROTOTYPE/ PRODUCT DETAILS

The final product prototype for the Mental Health Support App includes several key features designed to support and enhance user mental well-being:

- **Mood Tracking:** Users can log their daily moods through a simple interface with predefined categories and free-text options, enabling effective mood monitoring over time.
- **Sentiment Analysis:** An advanced NLP model analyzes user inputs to detect emotions and provide insights into their mental state, offering a personalized understanding of their mood patterns.
- **Personalized Recommendations:** Based on mood and sentiment data, the app delivers tailored self-care tips, mental health exercises, and articles, helping users manage their mental health proactively.

- **Virtual Assistant:** An AI-driven chatbot offers real-time support, guides users through mental health exercises, and provides immediate responses to user queries.
- **Professional Consultation:** Users have the option to connect with licensed mental health professionals for virtual consultations, enhancing access to expert advice and support.
- **Community Support:** A feature allowing users to engage with a supportive community, share experiences, and gain encouragement from peers.

This prototype aims to deliver a comprehensive mental health support system that is user-friendly, effective, and scalable, with a focus on personalization and accessibility.

STEP 3 : BUSINESS MODELLING

The business model for the Mental Health Support App revolves around offering a freemium service with premium subscription options for advanced features and professional consultations. Revenue streams include monthly or annual subscriptions, in-app purchases for additional resources, and partnerships with corporations for employee wellness programs. The app targets individual users seeking personalized mental health management, corporate clients looking to enhance employee well-being, and healthcare providers integrating the app into their practice. Key activities involve continuous product development, strategic marketing, and robust customer support, supported by a skilled team and effective resource management.

STEP 4 : FINANCIAL MODELLING (EQUATION) WITH MACHINE LEARNING & DATA ANALYSIS

a. Market Identification

The product will be launched into the digital mental health market, targeting both individual consumers and corporate clients. This market has seen significant growth in recent years due to increased awareness of mental health issues and the rising demand for accessible mental health services.

b. Market Data Collection

Based on available data, the digital mental health market is projected to grow from approximately \$5.7 billion in 2021 to over \$17 billion by 2030, reflecting a compound annual growth rate (CAGR) of around 13%. The key drivers include increased demand

for mental health apps, corporate wellness programs, and the integration of AI in healthcare.

c. Forecasting and Predictions

Given the market's CAGR of 13%, we can model the market's growth using an exponential growth function. However, for simplicity and based on linear growth assumptions over shorter periods, we might apply a linear regression model to predict sales and profits.

- **Linear Growth Model:** Assuming the market grows linearly in the short term, we can model sales over time as:

$$x(t) = a + bt$$

where $x(t)$ is the total sales at time t , a is the initial sales volume, and b is the sales growth rate.

- **Profit Prediction Equation:** The financial model for predicting profit $y(t)$ can be expressed as:

$$y(t) = m \cdot x(t) - c$$

Financial Equation Based on Market Trend

Given the market trend, the financial equation might look like:

$$y(t) = m \cdot (a + bt) - c$$

If the app is priced at \$20 per user per month, with an initial user base of 10,000 users and an expected growth of 500 users per month, and fixed costs are \$100,000 per month:

$$y(t) = 20 \cdot (10,000 + 500t) - 100,000$$

This equation predicts the monthly profit based on time t in months.

CONCLUSION

This financial model helps in forecasting potential profits as the app scales in the digital mental health market, allowing for adjustments in pricing, cost management, and strategic growth planning.