

VAAL UNIVERSITY OF TECHNOLOGY



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OF TECHNOLOGY**

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FACULTY: Applied and Computer Sciences
DEPARTMENT: Information and Communications Technology
SUBJECT: Business Analysis 3.2
SUBJECT CODE: AIBUY3A_2_2024
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YEAR: 2024

ASSESSMENT NAME:	AI Solution Documentation
ASSESSMENT DATE:	21 October 2024

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declare that the contents of this project represent our unaided work and that the project has not previously been submitted for academic examination towards any qualification. Furthermore, it represents our own opinions and not necessarily those of the Vaal University of Technology.

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Table of Contents

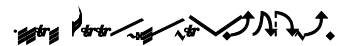
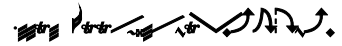
DECLARATION



1-AI Solution

1

- AI Chatbot:
- Machine Learning Approaches:
- Data Utilization:



2- Business Objectives

1

Objectives

1

Business Success Criteria

1

Business Background

1

Requirements

2

Constraints

2

Risks

2

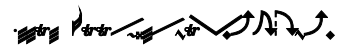
Tools and Techniques

2

3- Problem definition

2

Relevance to Theme:



Benefits:

3

4. Poster

4



1-AI Solution

In today's university environment, balancing academics, social life, and mental well-being can be a real struggle, for every students starting nor graduating. The demands of campus life can be overwhelming, and maintaining mental health is often a noticeable challenge. To support VUT students in managing such matters, we are developing an AI chat-bot tailored specifically for their needs. This chat-bot is designed to help students navigate university life with confidence, providing them with the tools they need to succeed not just academically, but also personally and socially.

This project aligns with the theme of "AI Solution for Industries" by applying AI to the education sector, an area where technology can make a significant positive impact on mental health.

2- Business Objectives

Objectives

- strengthen VUT students through an AI that provides improved mental health tips.
- To display information about student groups, clubs, and activities for socializing.
- To promote healthy lifestyle living tips.
- Mental well-being ensured through access to counselling services and real-time assistance with the help of an AI chat-bot.

Business Success Criteria

- **User Adoption Rate:** The application should reach high adherence and user rates within the VUT community.
- **Improved Student Outcomes:** Students' engagement in social, and academic wellness activities should increase.
- **Positive Feedback:** High rating of user satisfaction from feedback surveys about the usability, usefulness, and relevance of the chat-bot.
- **Retention and Academic Performance:** The actual improvement in student retention and academic performance based on the use of the app.

Business Background

Chick-script started when a group of VUT students, realized we weren't alone in struggling with mental health challenges. After surveying students we noticed that it's hard to find the right mental health resources, there's no easy way to access support when it's needed most, and figuring out where to go for help can be confusing. We knew something had to change.

we came together to create a solution that would make a real difference for students. We wanted to develop an AI chat-bot designed just for VUT students a tool that's easy to use, available 24/7, and focused on mental health.

Requirements

- **Instant Mental Health Support:** The chat-bot should be there whenever students need it, offering quick and helpful responses to mental health questions. Whether they're feeling stressed, anxious, or overwhelmed, the chat-bot will provide immediate support and suggest ways to cope. If students need further help, it will guide them to appropriate resources.
- **Empathetic and Personal Conversations:** The chat-bot should be understanding and kind, responding in a way that feels personal and reassuring. It will use natural language to make each interaction feel genuine, offering advice and support tailored to the student's situation, without needing any personal information.
- **Always Available and Fast:** The chat-bot must work smoothly and quickly, making sure students can get the help they need at any time, without delays. It should be reliable, ready to assist when stress or worries hit, offering a calm, supportive presence whenever needed.

Constraints

- **Budget:** R10 000 initial budget for marketing and creating the AI.
- **Technology:** The application should run on windows and mac-OS operating systems.
- **Time of Launch:** The application should go online at the start of the next academic year to ensure it achieves maximum impact.

Risks

- **Adoption Risk:** If students are not aware of this app or the app does not meet the requirements, then it will lead to low adoption.
- **Regulatory Risk:** Non-compliance with AI regulations could expose the project to lawsuits if the chat-bot's advice is perceived as inadequate
- **Technical Risk:** The model may unintentionally provide biased responses, failing to accommodate diverse student needs.

Tools and Techniques

Tools

- **Flask:** Web framework for API creation and handling requests.
- **Flask-CORS:** Manages Cross-Origin Resource Sharing (CORS).
- **Google Generative AI (Gemini):** Provides NLP capabilities for generating chat-bot responses.
-

Techniques:

- **API Development:** Flask creates an endpoint
- (`/api/mental_health_resources_info`) to handle POST requests and return AI-generated answers.

- **NLP:** Gemini AI uses NLP to process and respond based on mental health content (mental_health_resources.txt).
- **-File Handling:** Reads mental_health_resources.txt to extract information for AI responses.
- **Generative AI:** Uses genai to interact with Gemini, adjusting parameters like temperature and output length.
- **Session Management:** Maintains context through an ongoing chat session with the AI.

3- Problem definition

University students, whether they're just starting or nearing graduation, often struggle with mental health challenges like stress, anxiety, and balancing academic pressures. Many students also find it difficult to navigate available mental health resources, leaving them feeling unsupported.

Relevance to Theme:

The problem aligns with the AI theme in these ways:

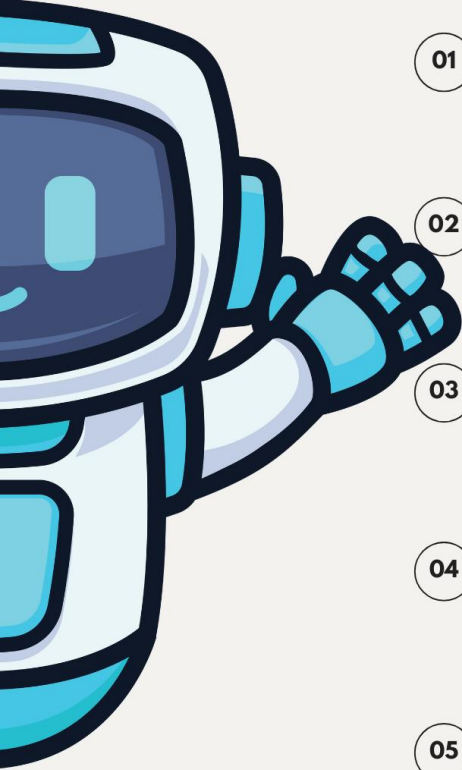
- **AI-Powered Support:** Using AI chat-bots to provide immediate, accessible mental health help when students need it most.
- **Personalized Guidance:** Leveraging AI to offer tailored advice and resources based on individual student needs.
- **Streamlining Resources:** AI can automate tasks, making it easier for students to connect with the mental health resources they need.
- **Connecting Support Services:** Developing AI systems to integrate various mental health services, making them more accessible and efficient for students.

Benefits:

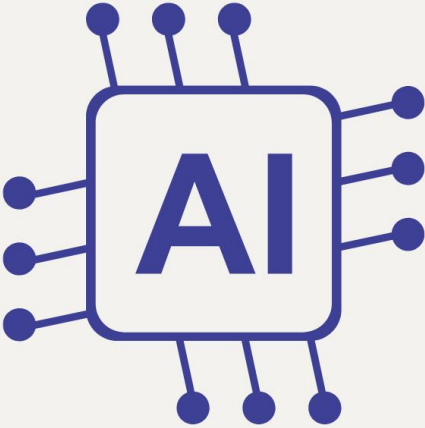
The proposed AI-powered mental health chat-bot will:

- **Easy Access to Mental Health Resources:** Help students quickly find mental health services and wellness tips.
- **24/7 Support:** Provide immediate emotional support anytime, day or night.
- **Better Mental Well-being:** Offer personalized advice to help students manage stress, anxiety, and other challenges.
- **Reduced Mental Health Struggles:** Alleviate stress and anxiety, supporting better emotional balance.
- **Increased Student Engagement:** Encourage students to engage with mental health resources through a supportive, non-judgmental platform.

4. Poster



VUT AI CHATBOT



01 Overview

An AI-powered chatbot designed to provide 24/7 mental health support for VUT students, offering personalized guidance, resources, and coping strategies.

02 Project Highlights

- Empathetic AI chatbot for mental health.
- Instant access to resources and support.
- Personalization based on individual needs.

03 Business Objectives

- Improve student mental well-being.
- Provide accessible mental health resources.
- Reduce barriers to mental health support.

04 Success Criteria

- Positive student engagement.
- Increased usage of mental health resources.
- Continuous improvement of AI responses.

05 Challenges

- Ensuring accurate and relevant mental health advice.
- Handling diverse student needs and queries.
- Maintaining a user-friendly interface.

06 Technical Aspects

- Python, Github
- Flask for API development.
- Google Generative AI (Gemini) for chatbot responses.
- Natural Language Processing (NLP) for personalized interactions.
- Machine Learning to adapt responses based on past interactions.

07 Benefits

- Easy Access to Resources: Instant connection to mental health support.
- 24/7 Emotional Support: Available anytime for students.
- Improved Well-being: Helps students manage stress and anxiety.

Join Us in Transforming Student Life at VUT!

For more information, visit our website or contact us!
<https://github.com/ChickScript/AI>

Machine Learning Approach

The solution uses a Large Language Model trained using the widespread supervised machine learning approach and thereafter reinforcement learning to finetune the model getting rid of unsafe responses like foul language or providing information that could be used to harm the user or others. Our of choice LLM is the Gemini 1.5 model produced by Google(parent company Alphabet), a transformer-based architecture that excels in natural language processing, crucial for generating empathetic and accurate mental health responses.

Data:

The Gemini LLM was trained on a robust, multi-modal, and multilingual data-set having diverse content types, such as web documents, books, code, images, audio, and video. This data enables Gemini to operate effectively across modalities, allowing it to tackle complex tasks like cross-modal reasoning and manage long-context inputs with up to 1 million tokens. For this chatbot application, additional structured text data from mental health and wellness resources (e.g., `mental_health_resources.txt`) and anonymized interaction data from students has been integrated. This curated content provides a specialized foundation for Gemini, ensuring that it can deliver contextually relevant, well-informed responses to students' mental health inquiries.

Model Evaluation:

The Gemini LLM's effectiveness for mental health support is confirmed through its high performance on challenging benchmarks. 59.1% on GPQA a challenging dataset designed to evaluate the capabilities of Large Language Models (LLMs), for expert-level reasoning. These metrics reflect the model's high generalization capacity, essential for accurately responding to diverse mental health topics.

The chat-bot's performance will be evaluated through metrics like response relevance and accuracy. Regular updates will be made based on internal assessments and feedback to ensure that the model continues to provide reliable and effective mental health support.

Time Series Analysis on Data:

Time series is not implemented, but if time series analysis could be applied, it would track seasonal trends in mental health inquiries, such as increased stress during exams. This enables the chat-bot to provide anticipatory support, making it more responsive and proactive.

Solution Techniques:

This solution applies transformer-based LLMs like Gemini with prompt engineering the process of designing and optimizing instructions, or prompts, to guide artificial intelligence (AI) models to generate desired outputs, making it particularly accurate in handling sensitive mental health queries. Continuous improvement is ensured by tracking user interactions to refine the model's responses.

Natural Language Processing (NLP), Speech Recognition, or Speech Synthesis:

NLP is essential to this solution, allowing the chat-bot to respond naturally and empathetically to mental health questions. While speech recognition/synthesis isn't included initially, these features could enhance accessibility in future updates.

Deep Learning:

Using deep learning, specifically the Gemini model's transformer-based architecture a type of neural network architecture that transforms or changes an input sequence into an output sequence, enables the chat-bot to process complex queries and respond with relevant mental health advice. Prompt engineering/fine-tuning ensures responses remain contextually appropriate and supportive.

Techniques Implemented:

Transformer Networks:

Transformers are architectures used for processing sequential data that help the chat-bot understand the order of words in a sentence and their connections. They allow the chat-bot to pay attention to the most important parts of what a user says, making its responses coherent and relevant.

Mixture-of-Experts (MoE):

MoE is a machine learning technique where multiple specialized models work together, with a gating network selecting the best expert for each input, divides the chat-bot into smaller sections, each focused on different topics or types of questions. When the chat-bot gets a query, it can call on the right “expert” to answer it, making responses quicker and more accurate for the specific question asked.

Long-Context Reasoning:

This refers to the background information and conversation history the model can remember while responding. Handling up to 2 million tokens which is approximately 1.5 million words. This means the chat-bot can remember and connect information across a very long conversation, so it doesn't lose track of previous messages, even if the conversation is detailed or complex.

Other Features (Chatbot/Softbot):

The chat-bot is highly relevant to the solution as it directly supports students mental health needs by offering real-time, accessible guidance. It aligns well with the project's goal to improve student well-being by using AI to provide mental health support tailored to their specific concerns.